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Environmental Effects of Conservation Practices on Grazing Lands

A Conservation Effects Assessment Project (CEAP) Bibliography



Environmental Effects of Conservation Practices on Grazing Lands

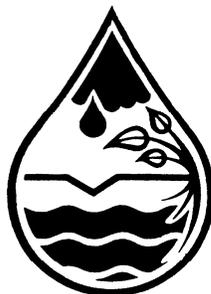
A Conservation Effects Assessment Project (CEAP) Bibliography

Special Reference Briefs Series no. SRB 2006-02

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Abstract

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This bibliography is one in a multi-volume set developed by the Water Quality Information Center at the National Agricultural Library in support of the U.S. Department of Agriculture's Conservation Effects Assessment Project (CEAP). This bibliography is a guide to recent scientific literature covering environmental effects of conservation practices on grazing lands. This information is useful in designing both policies and on-the-land conservation systems that foster practical and environmentally sound grazing practices.

Keywords: grazing, conservation practices, environmental management, pastures, rangelands, pasture plants, soil quality, land use, fish, wildlife, biodiversity, plant ecology

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September 2006

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Preface

This is one in a series of bibliographies developed by the Water Quality Information Center at the National Agricultural Library in support of the U.S. Department of Agriculture's Conservation Effects Assessment Project (CEAP).

The purpose of CEAP is to study the environmental effects of conservation practices implemented through various U.S. Department of Agriculture conservation programs. A national assessment covers cropland, wetlands, wildlife and grazing lands. Conservation practices that will be assessed include conservation buffers; erosion control; wetlands conservation and restoration; establishment of wildlife habitat; and management of nutrients, irrigation, tillage, pests, and grazing on rangeland and pastureland. More information about this and other components of CEAP is available at www.nrcs.usda.gov/technical/nri/ceap/.

The current titles in this series are

- *Environmental Effects of U.S. Department of Agriculture Conservation Programs*
Special Reference Briefs 2004-01
- *Implementing Agricultural Conservation Practices: Barriers and Incentives*
Special Reference Briefs 2004-02
- *Data and Modeling for Environmental Credit Trading*
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- *Agricultural Conservation Practices and Related Issues: Reviews of the State of the Art and Research Needs*
Special Reference Briefs 2004-04
- *Wetlands in Agricultural Landscapes*
Special Reference Briefs 2006-01
- *Environmental Effects of Conservation Practices on Grazing Lands*
Special Reference Briefs 2006-02

Each of the documents, as well as bibliographies on similar topics, is accessible online from the Water Quality Information Center at www.nal.usda.gov/wqic/.

Acknowledgments

The center gratefully acknowledges these organizations who granted permission to use their citations and abstracts.

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- Thomson Corporation/Thomson Scientific
scientific.thomson.com

The following databases were used to develop this bibliography:

- **AGRICOLA** (National Agricultural Library)
- **Aquatic Science and Fisheries Abstracts** (CSA)
- **BIOSIS Previews** (Thomson Scientific)
- **CAB Abstracts** (CABI Publishing)
- **Fish and Fisheries Worldwide** (NISC)
- **Scopus** (Elsevier)
- **Treesearch** (USDA Forest Service)
- **Water Resources Abstracts** (CSA)
- **Wildlife and Ecology Studies Worldwide** (NISC)
- **Zoological Record** (Thomson Scientific)

In addition, support from the Natural Resources Conservation Service (NRCS) for the development of these bibliographies is greatly appreciated. Special thanks to Leonard Jolley, NRCS, for his valuable assistance with this volume. Helpful guidance was also provided by Jim Dobrowolski, Lisa Duriancik, Bruce Menzel, Matt Sanderson, and Mark Weltz.

About This Bibliography

This bibliography is a guide to recent scientific literature covering environmental effects of conservation practices on grazing lands. This information is useful in designing both policies and on-the-land conservation systems that foster practical and environmentally sound grazing practices.

Most citations are categorized as relating to either pastureland or rangeland. However, due to the limited information available and the difficulty of distinguishing documents covering pastureland from those covering rangeland, assignment to either group is not precise. A third category, "Other Relevant Studies," contains citations that cover both pastureland and rangeland issues or other related topics.

The Society for Range Management¹ defines pastureland as "grazing lands, planted primarily to introduced or domesticated native forage species, which receive periodic renovation and/or cultural treatments such as tillage, fertilization, mowing, weed control and irrigation." Rangeland is "land on which the indigenous vegetation (climax or natural potential) is predominantly grasses, grass-like plants, forbs, or shrubs and is managed as a natural ecosystem. If plants are introduced, they are managed similarly. Rangeland include natural grasslands, savannas, shrublands, many deserts, tundras, alpine communities, marshes and meadows."

Citations are further categorized by effects on soil and water, fish and wildlife, and plant ecology and biodiversity. This last grouping also includes a few citations covering other environmental effects, such as carbon sequestration, and documents addressing multiple effects.

There are 1,303 citations with abstracts (when available) in this bibliography. Citations were found through literature searches of the AGRICOLA database, produced by the National Agricultural Library, and several commercial bibliographic databases. In addition, Water Quality Information Center staff created citations for documents that were located by other means. Documents cited were published from 1980 through early 2006. URLs are provided for online documents that are freely available. The inclusion or omission of a particular citation does not imply endorsement or disapproval.

Within sections, citations are arranged alphabetically by title. To locate information on a specific topic, for example, "fencing," use the subject index beginning on page 341. To ensure that you see all the relevant citations for a particular topic, be sure to also look up related terms in the subject index, such as "exclosure experiments, fences, exclosure," etc., from the example above. An author index is also available beginning on page 375.

To obtain a specific document, please contact your local library. Information on how to obtain documents from the National Agricultural Library can be found at www.nal.usda.gov/services/request.shtml.

¹ Bedell, T.E. (Chairman). 1998. *Glossary of Terms Used in Range Management: A Definition of Terms Commonly Used in Range Management*. 4th Edition. Glossary Update Task Group, Society for Range Management. Denver, Colorado: The Society.

Pastureland Conservation Practices

Soil and Water Effects

1. A 6-year comparison of nitrate leaching from grass/clover and N-fertilized grass pastures grazed by sheep.

Cuttle, S. P.; Scurlock, R. V.; and Davies, B. M. S.
Journal of Agricultural Science 131(1): 39-50. (1998)
NAL Call #: 10 J822; ISSN: 0021-8596

Descriptors: grazing/ pastures

Abstract: Nitrate leaching was measured over a 3-year period from rotationally grazed perennial ryegrass (*Lolium perenne* L.) pasture receiving 200 kg fertilizer-N/ha and from similarly grazed ryegrass/white clover (*Trifolium repens* L.) pasture that received no N fertilizer. The results are discussed together with those from the same plots in the preceding 3 years when they were stocked continuously. Under both managements, the numbers of grazing sheep were adjusted on the basis of the quantity of herbage available on the plots. During the whole 6 years, mean nitrate concentrations in soil water collected by porous cup samplers remained below the European Union limit of 11.3 mg N/l except for the fertilized grass plots in year 5 of the study. Quantities of nitrate leached ranged from 6 to 34 kg/ha per year from the grass/clover plots and 2-46 kg/ha from the fertilized plots. Leaching losses from both types of pasture were positively correlated with the numbers of lamb grazing days in the later part of the grazing season. This relationship and the high spatial variability associated with the measurements indicated that N derived from excreta was the main source of leached nitrate. It was concluded that, where pastures of equal productivity are compared, similar quantities of N are likely to be leached from grass/clover swards as from grass swards receiving N fertilizer.

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2. Acidification under grazed annual and perennial grass based pastures.

Ridley, A. M.; Slattery, W. J.; Helyar, K. R.; and Cowling, A.
Australian Journal of Experimental Agriculture 30(4): 539-544. (1990)

NAL Call #: 23 Au792; ISSN: 0816-1089

Descriptors: *Phalaris tuberosa*/ plant/ nitrate leaching/ aluminum sensitive species/ soil management/ crop industry/ agriculture/ Australia

Abstract: Soil samples to a depth of 60 cm were collected from adjacent, 39-year-old, phalaris-*[Phalaris tuberosa]* based and annual pasture fields on an acid soil at Rutherglen, north-eastern Victoria [Australia]. The fields had similar histories of fertiliser application and stock enterprise. Minimum net acid addition rates were determined under both pasture types, and the soil under annual pasture showed greater acidification. Carbon cycle acid addition contributed 1.31 and 1.36 kmol H⁺/ha.year to net acid addition on annual and phalaris pastures, respectively. Because slow alkaline soil reactions in the field contribute to buffering capacity on an acid soil and lead to underestimation of net acid addition rate and nitrate leaching, estimates of such reactions were made for both pasture types. If correct assumptions were used nitrate leaching was substantial under both pasture types but was reduced by 1.01 kmol H⁺/ha.year under phalaris pasture. This suggests that perennial grass based pastures can be used to reduce acidification on pastoral soils. Alkali addition

to counteract net acidification may be necessary on acid soils to maintain management options for growing aluminium-sensitive species.

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3. Agricultural impacts on bacterial water quality in karst groundwater.

Pasquarell, G. C. and Boyer, D. G.

Journal of Environmental Quality 24(5): 959-969. (1995)
NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: water quality/ karst/ groundwater pollution/ agricultural practices/ cattle/ bacterial coliforms/ feces/ seasonal variations/ soil water/ springs/ karstic environments/ ground water/ fecal coliforms/ agricultural pollution/ USA, West Virginia/ karstic environments/ ground water/ fecal coliforms/ agricultural pollution/ karst/ cattle/ soil water/ agricultural practices/ feces/ springs
Abstract: A 2-yr study (1991-1992) was conducted in a karst region in southeast West Virginia to determine the impact of agriculture on groundwater quality. The primary agriculture is characterized by seasonal cattle grazing. Fecal coliform densities were measured weekly in the resurgences of three karst basins possessing different degrees of agricultural intensity (79, 51, and 16% land use in agriculture). Fecal coliforms were also measured in a creek at sites upstream and downstream of the known resurgences from the most agriculturally intensive (79%) basin. The fecal coliform densities in the resurgences peaked in the summer and declined in the fall, with a recovery in late winter before the introduction of new cattle. The timing of the recovery indicated that significant storage of fecal material had taken place, which was transported to the groundwater when soil water conditions permitted. For most of each year, soil water effects appeared to have a greater bearing on the fecal coliform densities than did the presence or absence of cattle. The data did not generally support a strong relationship with percent land use in agriculture. This was attributed to the high variability in the data and to low soil moisture during periods of recession that inhibited the transport of fecal material to the groundwater. The karst resurgence springs of the most intensively agricultural basin were contaminated with fecal bacteria. Fecal bacteria concentrations were observed to significantly increase, in the receiving surface stream, from a point upstream of the resurgence springs to a point downstream of the resurgence springs.

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4. Agricultural land-use effects on the indicator bacterial quality of an upland stream in the Derbyshire Peak District in the U.K.

Hunter, Colin; Perkins, Joy; Tranter, Jamie; and Gunn, John

Water Research 33(17): 3577-3586. (1999)

NAL Call #: TD420.W3; ISSN: 0043-1354

Descriptors: agricultural land use intensification/ bacterial contamination/ catchment soils/ ecotoxicology/ health risk/ hydrological transport/ limestone karst system/ precipitation related output/ recreational caving/ seasonal variation/

sheep grazing/ spatial changes/ stream channel/
streamwater quality/ survival/ upland stream/ water inflow
sampling sites

Abstract: Concentrations of indicator bacteria - faecal coliforms (FC) and faecal streptococci (FS) - were monitored at stream and water inflow sampling sites over a 21 month period within a small upland catchment in north Derbyshire, England. Agricultural land-use within the catchment included rough, semi-improved and improved pastures for sheep grazing. During its passage through the catchment, the stream became significantly contaminated by faecal bacteria, suggesting the existence of a semi-permanent store of faecal bacteria in catchment soils, combined with hydrological transport mechanisms capable of moving bacteria from the land to the stream channel. Spatial changes in the bacterial quality of streamwater could be explained by the influence of a number of monitored water inflows to the stream, although a clear and consistent relationship between the bacterial quality of catchment waters and the intensity of adjacent agricultural land-use was not apparent. This is explained in terms of a trade-off between practices which allow land-use intensification and a consequent reduction in the potential for bacterial survival in soils and efficient hydrological transport via surface-water flows. A consistent seasonal pattern of bacterial concentration change was observed, with the highest concentrations occurring during summer months as stocking density increased and the bacterial load store recovered from high precipitation-related outputs during the winter. The extent of faecal bacterial contamination of the stream, particularly during summer months, may constitute a real health risk to recreational users using parts of the limestone karst system into which the stream drains.

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5. An analysis of environmental and economic implications of nil and restricted grazing systems designed to reduce nitrate leaching from New Zealand dairy farms: Pasture production and cost/benefit analysis.

De Klein, C. A. M. and Ledgard, S. F.

New Zealand Journal of Agricultural Research 44(2-3): 217-235. (2001)

NAL Call #: 23 N4892; ISSN: 0028-8233

Descriptors: cost/ benefit analysis/ grazing systems: dairy farms, economic aspects, environmental aspects/ nitrogen loss/ pasture production

Abstract: Nitrate leaching from animal urine is perceived to be a serious consequence of dairy farming. Previous results suggested that nil and restricted grazing systems could reduce nitrate leaching by up to 50%. It is likely that such systems may also increase pasture production. However, potential disadvantages include reduction in the clover content of pastures and increase in capital and/or operating costs. This paper examines the economic implications of nil and restricted grazing systems based on data from an average New Zealand dairy farm and from a long-term farmlet study. The analyses suggested that pasture production increased by about 20% and 2-8%, respectively, compared with a conventional grazing system. Based on the average New Zealand dairy farm, the cost/benefit analysis of the nil grazing system suggested a negative return on capital of about -10%. For the restricted grazing system, the average return on capital was about

9% (range: -4 to 25%) and depended largely on the efficiency of animal excreta use. On farms where an effluent application system is already in place, the average return on capital was 17% (range: 2 to 50%). Based on the farmlet study, the cost/benefit analysis of both grazing systems suggested a small negative return on capital, except when the costs of an effluent application system were excluded. It is concluded that a restricted grazing system for the average New Zealand dairy farm is likely to be economically viable, on farms where an effluent application system or a feed pad is already in place.
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6. An analysis of the physical condition of two intensively grazed Southland soils.

Greenwood, P. B. and McNamara, R. M.

Proceedings of the New Zealand Grassland Association 54: 71-75. (1992)

NAL Call #: 60.19 N48; ISSN: 0369-3902

Descriptors: bulk density/ porosity/ macropores/ hydraulic conductivity/ permeability/ resistance to penetration/ grazing/ physical properties/ soil compaction/ trampling/ soil degradation/ silt loam soils/ soil physical properties/ soil physics

Abstract: The physical properties of two Southland, New Zealand silt loam soils (a yellow-grey earth and a yellow-brown earth) with histories of high and low winter stocking densities of sheep were compared. Assessments were made of mechanical impedance, bulk density, porosity, air permeability and hydraulic conductivity. Results showed that winter treading by sheep on all-grass wintering systems (800-2000 sheep/ha) caused significant soil physical degradation by reducing hydraulically effective soil macroporosity, restricting the transmission of water through the topsoil. This led to waterlogging and root-zone oxygen deficiencies after rain. Soil compaction occurred to nearly the full depth of the A horizon probably as a result of damage over several winters. Measurements of mechanical impedance and bulk density were insensitive to small changes in soil porosity. Air permeability and hydraulic conductivity were good indicators of the relative degree of compactness and both were sensitive to small changes in effective macroporosity.

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7. Animal trampling effects on soil physical properties of two Southeastern U.S. Ultisols.

Tollner, E. W.; Calvert, G. V.; and Langdale, G.

Agriculture, Ecosystems & Environment 33(1): 75-87. (1990)

NAL Call #: S601 .A34; ISSN: 0167-8809

Descriptors: soil physics/ physical properties/ grazing/ animal husbandry/ soil/ soil fertility/ productivity

Abstract: Several selected soil physical properties and plant growth indicators thought to be affected by animal trampling were measured in three experiments ranging over 8 years. Crops studied included lucerne (*Medicago sativa*), Bermudagrass (*Cynodon dactylon*), and soybeans (*Glycine max*) following wheat (*Triticum aestivum*) or rye (*Secale cereale*). Stocking rates for the experiments ranged from 5 to 18 animals/ha. Cone penetrometer measurements were consistently higher in grazed areas than in areas protected from grazing. Other physical parameters (infiltration rate, bulk density, water release curve) measurements were sometimes significantly

influenced by trampling. Natural densification explained increased bulk densities within protected areas. Trampling altered surface soil structure; however, productivity (root biomass, forage growth) was not significantly reduced.
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8. Assessing the effect of management intensive grazing on water quality in the Northeast US.

Stout, W. L.; Fales, S. L.; Muller, L. D.; Schnabel, R. R.; Elwinger, G. F.; and Weaver, S. R.

Journal of Soil and Water Conservation 55(2): 238-243. (2000)

NAL Call #: 56.8 J822; ISSN: 0022-4561

Descriptors: grazing/ animal husbandry/ water quality/ environmental impact/ stocking rate/ dairy farming/ profitability/ nitrates/ leaching/ pastures/ excretion/ soil erosion/ groundwater/ leachates/ Pennsylvania
This citation is from AGRICOLA.

9. Cattle and sheep grazing effects on soil organisms, fertility and compaction in a smooth-stalked meadowgrass-dominant white clover sward.

Murphy, W. M.; Mena Barreto, A. D.; Silman, J. P.; and Dindal, D. L.

Grass and Forage Science 50(3): 191-194. (1995)

NAL Call #: 60.19 B773; ISSN: 0142-5242

Descriptors: *Poa pratensis*/ *Trifolium repens*/ cattle/ sheep/ rotational grazing/ pastures/ range management/ forbs/ soil fertility/ soil compaction/ free-living nematodes/ Rotifera/ earthworms/ nitrogen/ potassium/ phosphorus/ topping/ Vermont
This citation is from AGRICOLA.

10. Cattle grazing impact on surface water quality in a Colorado front range stream.

Gary, H. L.; Johnson, S. R.; and Ponce, S. L.

Journal of Soil and Water Conservation 38(2): 124-126. (1983)

NAL Call #: 56.8 J822; ISSN: 0022-4561

Descriptors: grazing/ environmental impact/ surface water/ water quality/ streams/ microbial pollution/ freshwater pollution/ agriculture/ microbial contamination/ USA, Colorado/ cattle/ microbial contamination/ streams/ microbial pollution

Abstract: Cattle grazing in pastures bisected by a small perennial in central Colorado had only minor effects on water quality during two years of study. Suspended solids and nitrate nitrogen did not increase significantly, and ammonia nitrogen increased significantly only once under moderate rates of grazing. Indicator bacteria densities in the stream water significantly higher when at least 150 cattle were grazing. After removal of cattle or when 40 head of cattle were grazing, bacterial counts dropped to levels similar to those in an adjacent, ungrazed pasture. About 5 percent of the total manure produced by cattle contributed to pollution and/or enrichment of the stream.
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11. Cattle grazing influences on percentage corn residue cover.

Shelton, D. P.; Schroeder, M. A.; Kachman, S. D.; Gosey, J. A.; and Jasa, P. J.

Journal of Soil and Water Conservation 52(3): 203-206. (1997)

NAL Call #: 56.8 J822; ISSN: 0022-4561

Descriptors: soil conservation/ erosion control/ *Zea mays*/ crop residues/ surface layers/ cattle/ grazing/ no-tillage/ fertilizers/ application methods/ sowing/ planters/ crop residue management/ Nebraska
This citation is from AGRICOLA.

12. Cattle treading and phosphorus and sediment loss in overland flow from grazed cropland.

Mcdowell, R. W.; Drewry, J. J.; Muirhead, R. W.; and Paton, R. J.

Australian Journal of Soil Research 41(8): 1521-1532. (2003)

NAL Call #: 56.8 Au7; ISSN: 0004-9573

Descriptors: cattle dung/ cattle treading/ cultivated paddocks/ cultivated soil/ dairy cow treading/ grazed cropland/ overland flow: events, mean suspended sediment concentration/ overland flow volume/ pasture/ sediment loss/ slope positions/ soil disturbance/ soil macroporosity/ soil physical properties

Abstract: This 1-year study investigated the effect of dairy cow treading on soil physical properties and sediment and phosphorus (P) loss via overland flow from pasture and cultivated soil used for wintering dairy cows in southern New Zealand. Treading decreased soil macroporosity and Ksat, and increased overland flow volumes. Treading increased mean suspended sediment concentration in overland flow in the cultivated + trodden treatment (2.6 g/L) compared with ungrazed pasture (0.44 g/L) and ungrazed cultivated (0.98 g/L) treatments over 2 slope positions. Following grazing in the cultivated + trodden treatment, only 25% more sediment was lost in subsequent overland flow events (2.09 and 2.63 g before and after grazing, respectively), and mean total P (TP) losses increased by >250% (from 0.7 to 2.5 mg P). Meanwhile in the cultivated but ungrazed treatment, sediment and TP loss decreased. The increased loss of sediment and P following grazing in the cultivated + trodden treatment was attributed to P from cattle dung, and soil disturbance. Consequently, wintering of animals on cultivated paddocks with forage crops increases the risk of losing much P, especially in particulate form.
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13. Change in the balance of ammonium-N and nitrate-N content in soil under grazed grass swards over 7 years.

Watson, C. J. and Poland, P.

Grass and Forage Science 54(3): 248-254. (1999)

NAL Call #: 60.19 B773; ISSN: 0142-5242

Descriptors: sward/ ammonium nitrogen/ nitrate nitrogen/ soil fertility/ grazing/ range management/ nitrification/ *Lolium perenne*/ *Trifolium repens*/ calcium ammonium nitrate/ steers/ soil microorganisms/ microorganisms/ grassland soils/ application rate/ Northern Ireland

Abstract: The pool of nitrate-N (NO₃(-)-N) in the soil is more prone to losses than that of ammonium-N (NH₄⁺ -N) so any shift towards NO₃(-)-N dominance in the soil pools, caused by management intensity, could have environmental implications. The change in the balance of soil NH₄⁺ -N and NO₃(-)-N content with time was studied using grazed grass swards receiving different fertilizer N inputs. In addition, the effects of past management on net nitrification of 400 microgram NH₄⁺ -N g⁻¹ was investigated in a soil incubation study. Mineral N was determined at frequent intervals (at least every 2 weeks) throughout the

year in the top 5 or 7.5 cm of a sandy clay-loam soil at the Agricultural Research Institute of Northern Ireland at Hillsborough, County Down, for a 7-year period (1989-90 to 1995-96). The treatments were a perennial ryegrass-white clover sward receiving no fertilizer N, together with perennial ryegrass swards receiving 100, 200, 300, 400 or 500 kg N ha⁻¹ year⁻¹ as calcium ammonium nitrate. The plots were continuously grazed by beef steers from April to October to maintain a constant sward height of 7 cm. There was little or no change in average soil NO₃(-)-N and NH₄⁺-N content from 1989-90 to 1995-96 on the grass-clover sward and plots receiving 100 and 200 kg N ha⁻¹ year⁻¹. However, with the plots receiving 300, 400 and 500 kg N ha⁻¹ year⁻¹ NO₃(-)-N became progressively more dominant with time. The incubation study confirmed that this was due to an increase in net nitrification rate. There was evidence that rapid microbial assimilation of NO₃(-)-N occurred during the soil incubations. Past management history can play an important role in determining soil NO₃(-)-N content and hence potential losses of N to the environment. This citation is from AGRICOLA.

14. Changes in a stream's physical and biological conditions following livestock exclusion.

Line, D. E.

Transactions of the ASAE 46(2): 287-293. (2003)
NAL Call #: 290.9 Am32T; ISSN: 0001-2351

Descriptors: BMP/ fecal coliform/ livestock exclusion/ water quality

Abstract: Runoff from dairy cow pastures can degrade the quality of surface waters. Weekly grab samples were collected for 7.5 years from a small stream draining a 56.7-ha, mostly dairy cow pasture and analyzed for fecal coliform and enterococci (streptococci). In situ measurements of pH, dissolved oxygen, temperature, conductivity, and turbidity were made during most grab sampling events. Fecal coliform and enterococci levels for samples collected during the 2.25 years prior to the installation of livestock exclusion fencing were more than 300% greater at the downstream monitoring station compared to the upstream station. After fencing, fecal coliform and enterococci levels decreased 65.9% and 57.0%, respectively. The decreased bacteria levels were significantly different, indicating that livestock exclusion fencing was effective at reducing bacteria levels in the stream. While the levels of dissolved oxygen, pH, temperature, and specific conductivity downstream relative to upstream following fencing generally documented improved water quality, the changes were not statistically significant. Conversely, decreases in turbidity and suspended sediment levels following fencing were significantly different. Levels of most of the physical parameters and bacteria were not significantly different at the upstream monitoring site following the installation of the alternate water supply in the pasture upstream. Thus, the alternate water supply, without fencing, was not effective at improving water quality in the upper pasture.

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15. Changes in soil fungal:bacterial biomass ratios following reductions in the intensity of management of an upland grassland.

Bardgett, R. D.; Hobbs, P. J.; and Frostegard, A.
Biology and Fertility of Soils 22(3): 261-264. (1996)
NAL Call #: QH84.8.B46; ISSN: 0178-2762

Descriptors: soil fungi/ soil bacteria/ biomass/ grassland soils/ upland soils/ range management/ soil management/ sheep/ grazing/ NPK fertilizers/ liming/ soil pH/ community ecology/ biological activity in soil/ estimation/ methodology/ community structure

Abstract: In this study we examined the effect on soil fungal:bacterial biomass ratios of withholding fertiliser, lime, and sheep-grazing from reseeded upland grassland. The cessation of fertiliser applications on limed and grazed grassland resulted in a reduction in soil pH from 5.4 to 5.1. The cessation of fertiliser applications and liming on grazed grassland resulted in a fall in pH from 5.4 to 4.7, whereas withholding fertiliser and lime and the removal of grazing resulted in a further reduction to pH 4.5. Substrate-induced respiration was reduced in the unfertilised grazed (21%; P<0.01) and unfertilised ungrazed (36%; P<0.001) treatments. Bacterial substrate-induced respiration and bacterial fatty acids were unaffected by the treatments. The relative abundance of the fungal fatty acid 18:2 omega 6 increased by 39 and 72% (P<0.05) in the limed grazed and unfertilised grazed treatments, respectively. Fungal substrate-induced respiration increased in the limed grazed (18%) and unfertilised grazed (65%; P<0.05) treatments. The ratio of 18:2 omega 6: bacterial fatty acids was correlated with the ratio of fungal:bacterial substrate-induced respiration (r=0.69; P<0.001).

This citation is from AGRICOLA.

16. Changes of surface soil nutrients and sustainability of pastoralism on grazed hilly and steep land, South Island, New Zealand.

McIntosh, P. D.; Ogle, G. I.; Patterson, R. G.; Aubrey, B.; Morriss, J.; and Giddens, K.

Journal of Range Management 49(4): 361-367. (1996)
NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/1996/494/361-367_mcintosh.pdf

Descriptors: sheep/ grazing/ upland soils/ cation exchange capacity/ topsoil/ pH/ highlands/ New Zealand
Abstract: Soil nutrients in topsoils (0-7.5 cm) on grazed hilly and steep land on 2 high country sheep farms with contrasting climate in the upper Waitaki district, South Island, New Zealand, were compared before and after a 14-15 year period. In addition, effects on soils of 2 farm management systems were compared by sampling similar soils on adjacent farms. On a farm with mean annual rainfall of 700-1,000 mm (study area A) that had been fertilised and oversown, and grazed with about 1.6 ewe equivalents per hectare for 14 years, levels of exchangeable cations (Ca, K, Mg) increased in topsoils on sunny slopes, but there was little change on shady slopes. The Ca increase on sunny slopes was the increase to be expected from the amount of Ca contained in the superphosphate applied but increases of exchangeable K and Mg could not be explained by fertiliser additions. There was an overall 29% increase of CEC, 7.5% decline of base saturation, and decline of soil pH by 0.4 units over the 14 year period. On a farm with mean annual rainfall of 500-600 mm (study area B) that had been grazed for 15 years with about 0.6 ewe equivalents per hectare but not fertilised or oversown, levels of exchangeable cations in topsoils declined. Base saturation values declined from 98% to 73% and pH declined by 0.4 units. Losses of Ca and Mg were greater than could be explained by direct effects of sheep grazing and we conclude that processes such as erosion or

removal of vegetation and nutrients by rabbits are important loss pathways. In the spatial comparison on land with mean annual rainfall of approximately 1,000 mm, oversown and fertilised soils (grazed with about 1.6 ewe equivalents per hectare) had higher levels of exchangeable cations, organic C and total N than soils that had neither been oversown or fertilised (grazed with about 0.6 ewe equivalents per hectare). Questions of ecological and economic sustainability arise both on the moister and drier high country. On moister land like area A, if lime can be applied economically, and fertiliser can continue to be applied with positive financial returns, oversowing and fertilising may be sustainable on sunny slopes. The sustainability of pastoralism on shady slopes is more problematical. If on drier land losses of topsoil nutrients such as those measured on area B are widespread, they are considered to be unsustainable. Although the nutrients lost could be readily replenished using modest amounts of fertiliser and lime, the changes have occurred concurrently with declines of organic C and total N. Restoration of organic matter levels is likely to require either reduced grazing, or oversowing and application of fertiliser. Because oversowing and fertilising the drier high country is not financially viable except during periods of high commodity prices, both these options would require major changes in farm management and/or financial assistance with soil conservation measures.

This citation is from AGRICOLA.

17. Changes to soil physical properties after grazing exclusion.

Greenwood, K. L.; MacLeod, D. A.; Scott, J. M.; and Hutchinson, K. J.

Soil Use and Management 14(1): 19-24. (1998)

NAL Call #: S590.S68; ISSN: 0266-0032

Descriptors: pastures/ soil degradation/ bulk density/ unsaturated hydraulic conductivity/ sheep/ grazing/ stocking rate/ rain/ evaporation/ New South Wales

Abstract: The potential for degraded physical properties of soil to regenerate naturally after exclusion of grazing animals was examined at a long-term stocking rate trial near Armidale, New South Wales, Australia. Unsaturated hydraulic conductivity was measured before grazing was excluded, and after 7 months and 2.5 years' grazing exclusion. These data were compared with controls grazed at 10,15 and 20 sheep/ha. After 2.5 years, there were significant increases in unsaturated hydraulic conductivity at 5 and 15 mm tension in the ungrazed treatments compared with the grazed controls. The unsaturated hydraulic conductivities and bulk density of surface soils under pasture which had been ungrazed for 2.5 years were comparable to those where the pasture had been ungrazed for 27 years. We speculate that the natural amelioration of soil physical properties in these soils was due to biological activity and wetting and drying cycles, in the absence of the compactive effect of animal treading.

This citation is from AGRICOLA.

18. Channel changes over 12 years on grazed and ungrazed reaches of Wickiup Creek in eastern Oregon.

Nagle, G. N. and Clifton, C. F.

Physical Geography 24(1): 77-95. (2003); ISSN: 0272-3646

Descriptors: channels/ streams/ grazing/ pastures/ geography/ reach/ livestock

Abstract: Stream channel cross sections were first

compared in 1986 in grazed reaches and inside a 47-yr.-old grazing enclosure along Wickiup Creek in eastern Oregon. Significant differences between grazed and ungrazed channels were found at that time. In 1998, we measured 49 cross sections placed at a similar spacing inside the enclosure and in three grazed reaches in order to examine changes over 12 yr. Although the grazed channels were still significantly different than the ungrazed, in two out of three grazed reaches, the channels showed improvement in all parameters since 1985 although not all of these were statistically significant at the 90% level. Since 1990, the Wickiup riparian pasture has been managed more cautiously than many other streamside pastures in eastern Oregon and our results indicate that under careful grazing management, stream channels may show improvement from destructive past grazing without complete exclusion of livestock. As an alternative to the intensive method of measuring channel cross sections that was used in this study, we propose a rapid method of measuring stream channels that might be more useful in future studies of riparian grazing impacts.

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19. Chemical water quality of runoff from grazing land in Nebraska: Contributing factors.

Schepers, J. S.; Hackes, B. L.; and Francis, D. D.

Journal of Environmental Quality 11(3): 355-359. (1982)

NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: farm management/ livestock/ pastures/ precipitation/ runoff/ agricultural runoff/ water quality/ animal wastes/ manure/ vegetation/ wildlife/ nutrients/ organic matter/ nitrates/ phosphorus/ chlorides/ ammonium/ water pollution sources/ fate of pollutants/ grazing/ farm wastes/ nonpoint pollution sources/ Nebraska

Abstract: The effects of climatic factors, hydrologic factors, and management practices on the chemical quality of runoff from a 32.5 ha cow and calf pasture in Nebraska were studied in 1976-78. Precipitation and hydrologic characteristics, stocking rates, and sediment contents in the runoff were used to predict the average concentrations of ammonium-N, nitrate-N, Kjeldahl N, soluble P, total P, total organic carbon, COD, and chloride. Animal stocking density significantly influenced the predicted concentrations of ammonium-N, nitrate-N, total P, total organic carbon, and COD in the runoff. However, dilution was the dominant process. Likely sources of pollutants were standing plant material and manure. Chloride appeared to be an indicator of wildlife activity.

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20. Chemical water quality of runoff from grazing land in Nebraska: Influence of grazing livestock.

Schepers, J. S. and Francis, D. D.

Journal of Environmental Quality 11(3): 351-354. (1982)

NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: pastures/ runoff/ water quality/ farm management/ animal wastes/ manure/ vegetation/ wildlife/ nutrients/ organic matter/ nitrates/ phosphorus/ chlorides/ ammonium/ water pollution sources/ fate of pollutants/ livestock/ grazing/ farm wastes/ nonpoint pollution sources/ Nebraska

Abstract: The quality of runoff water from a 32.5 ha cow and calf pasture in Nebraska was studied for three years, 1976-78. Three types of pastures were included: ungrazed pasture (control), grazed pasture with livestock actively

grazing, and grazed pasture with livestock absent. The runoff water from pasture with actively grazing livestock had higher concentrations of all water quality parameters with respect to the grazed pasture with no livestock present, with the exception of Kjeldahl N, which decreased by 19%. The increases were: total solids, 52%; total organic carbon, 11%; COD, 7%, ammonium-N, 6%, nitrate-N, 45%; total P, 37%; soluble P, 48% and chloride, 78%. Runoff from the control area was tea-colored and had the poorest quality, with 1.94 to 10.8 times greater concentrations of pollutants. This was attributed to wildlife activity and leaching of nutrients and organic matter from vegetation.

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21. A comparison between continuous and controlled grazing on a red duplex soil: Effects on soil physical characteristics.

Proffitt, A. P. B.; Bendotti, S.; and MCGarry, D.
Soil and Tillage Research 35(4): 199-210. (1995)

NAL Call #: S590.S48; ISSN: 0167-1987

Descriptors: controlled grazing/ hardsetting/ no grazing/ plastic limit/ set stocking/ structural deterioration/ trampling

Abstract: The effect of sheep trampling and grazing management practice on soil physical characteristics was examined over one pasture season. The soil studied was a fragile sandy clay loam (red duplex soil) located in a dryland agricultural area (307 mm average annual rainfall) of Western Australia. The pasture was predominantly *Serena medic* (*Medicago polymorpha*). The three grazing management practices investigated were: (i) traditional set-stocking (where sheep were grazed continuously for 17 weeks, beginning soon after the start of the early winter rains); (ii) controlled grazing (where sheep were temporarily removed from the enclosure when the topsoil was close to its plastic limit); (iii) no grazing (where the pasture was mown to simulate grazing without trampling). Topsoil structure was assessed in several ways: dry bulk density, infiltration rate and tensile strength measurements, and image analysis of resin-impregnated soil blocks. At the end of the grazing period, all soil structure attributes measured showed that topsoil structure under the controlled grazing practice was not only superior to that found under the traditional set-stocking practice, but similar to that found in the ungrazed treatment. Soil remoulding appeared to be a significant process contributing to the deterioration in topsoil structure. The plastic limit was used diagnostically and found to be an important soil property which should be routinely determined in order to aid management decisions. Continuous (or set-stocking) grazing practices in the pasture phase of wheat (*Triticum aestivum*): pasture rotations can exacerbate the susceptibility of red duplex soils to structure deterioration and hardsetting. However, the degree of structure deterioration inflicted by stock can be minimized by removing stock for brief periods when the soil is close to its plastic limit.

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22. Curtailing grazing-induced erosion in a small catchment and its environs, the Peak District, Central England.

Evans, R.

Applied Geography 25(1): 81-95. (2005); ISSN: 0143-6228

Descriptors: erosion/ grazing/ peat/ sheep/ vegetation colonisation

Abstract: Eroding slopes within a small catchment in the Peak District, Central England, and its environs have been monitored since 1966. A reduction in sheep grazing pressure in the late 1960s, due to a harsh winter and a poor crop of lambs, led to colonisation of bare soil on lower slopes, but not on higher exposed slopes. Sheep grazing pressure was permanently reduced in the 1980s as part of a new grazing regime. Many formerly eroding sheep scars in the small catchment have over time become completely colonised by vegetation and only those scars still actively used by sheep remain. It took two decades before vegetation began to invade the bare soil on the higher slopes. There, it was not until all the peat and the underlying leached (Ea) soil horizon was stripped off that vegetation was re-established. Colonisation is a rapid process and c.80% of the bare soil is covered within 5-10 years. Factors other than sheep grazing pressure that exacerbated erosion were a cooling climate in the 1960s and the presence of cattle on the slopes. Temperatures have risen since then and cattle no longer graze the slopes.

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23. Dissolved organic carbon losses from grazed grasslands under different management regimes.

Mctiernan, K. B.; Jarvis, S. C.; Scholefield, D.; and Hayes, M. H. B.

Water Research 35(10): 2565-2569. (2001)

NAL Call #: TD420.W3; ISSN: 0043-1354

Descriptors: grasslands/ grazing/ fertilizers/ drainage/ watershed management/ organic carbon/ on-site investigations/ dissolved organic matter/ dissolved organic carbon/ soils/ drainage water/ nitrogen/ resource management/ waterlogged/ land (grass and pasture)/ land/ organic matter/ biogeochemistry/ soil/ grazed grassland

Abstract: Dissolved organic matter (DOM) is fundamental to many biogeochemical processes in soils and natural waters. Despite the large number of studies reporting on DOM losses from forest soils and in surface waters there is little published data on exports from managed grasslands. The objective of our study was to determine the extent of short-term exports of dissolved organic carbon (DOC) from managed grazed grasslands and to evaluate the influence of fertilizer management and drainage regime. DOC discharged from grazed grassland plots, with a range of management strategies, was determined over 2 months. Total export varied from 42 to 118 kg C ha⁻¹ super(-1), and was greater from some plots than literature estimates for annual losses from all catchment types. There was a significant ($P = 0.048$) positive correlation between DOC export and rates of nitrogen application for treatments with no artificial drainage. Increased dry matter production arising from increased fertilizer-N inputs is suggested as an important factor in this relationship. DOC export was significantly ($P = 0.032$) reduced by artificial drainage and adsorption of DOC to soil surfaces and the restriction of decomposition due to waterlogging are suggested as two possible explanations.

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24. A drained plot study of the impact of cutting and/or grazing management and N fertilization on nitrate leaching under grassland.

Decau, M. L. and Le Corre, L.

In: Grassland and Society: 15th General Meeting of the European Grassland Federation. (Held 6 Jun 1994-9 Jun 1994 at Wageningen, Netherlands.)

Wageningen, Netherlands: Wageningen Pers; pp. 382-386; 1994.

NAL Call #: QK938.P7E97 1994; ISBN: 9074134157

Descriptors: book chapter/ meeting poster/ nitrogen/ pollution/ soil

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25. Economic and environmental impacts of pasture nutrient management.

Osei, E.; Gassman, P. W.; Hauck, L. M.; Neitsch, S.; Jones, R. D.; McNitt, J.; and Jones, H.

Journal of Range Management 56(3): 218-226. (2003)

NAL Call #: 60.18 J82; ISSN: 0022-409X

Descriptors: dairy cows/ grazing/ stocking rate/ soil nutrient balance/ nutrient management/ nitrogen/ phosphorus/ simulation models/ dairy farm management/ production costs/ farm size/ fertilizer application/ application rate/ agricultural runoff/ costs and returns/ pollution control/ Texas

Abstract: Highly intensive stocking of dairy cattle on continuously grazed pasture coupled with liberal applications of commercial fertilizer can lead to increased losses of agricultural nutrients, which is a concern for water quality of receiving lakes and surface water resources. Integrated economic-environmental model simulations performed for the Lake Fork Reservoir Watershed in northeast Texas indicate that appropriate pasture nutrient management including stocking density adjustments and more efficient commercial fertilizer use could lead to significant reductions in nutrient losses. Soluble and organic P losses were predicted to decline by 54 and 13% relative to baseline conditions when manure P was assumed totally plant available (Low P scenario). The soluble and organic P loss reductions declined to 33 and 7% when only inorganic P was assumed plant available (High P scenario). Simulation of an N-based manure management plan resulted in the smallest predicted soluble and organic P loss reductions of 18 and 3%. Nitrogen loss predictions ranged from a 7% decline to a 1% increase for the 3 scenarios as compared to the baseline. The High P and Low P scenarios resulted in estimated aggregate profit reductions of 6 and 18% relative to the baseline. These profit declines occurred because the dairies had to acquire additional pasture land to accommodate the expanded area required for the P-based scenarios. In contrast, the N-based stocking density and nutrient management scenario resulted in an aggregate profit increase of 3% across all dairies. Variations in economic impacts were also predicted across farm sizes.

This citation is from AGRICOLA.

26. Effect of cattle and sheep treading on surface configuration of a sedimentary hill soil.

Betteridge, K.; Mackay, A. D.; Shepherd, T. G.; Barker, D. J.; Budding, P. J.; Devantier, B. P.; and Costall, D. A.

Australian Journal of Soil Research 37(4): 743-760. (1999)

NAL Call #: 56.8 Au7; ISSN: 0004-9573

Descriptors: downward movement/ grazing/ pastures/

disturbed soils/ grassland soils/ soil types/ soil compaction/ soil physical properties/ upland soils/ livestock/ soil mechanics/ trampling/ surface roughness

Abstract: Pastures with a 6-year history of grazing by cattle (cattle pasture) and sheep (sheep pasture) in New Zealand were used to measure the effects on soil disturbance of a single severe grazing/treading event by sheep (S), one by cattle (C1), or 2 events within 3 weeks by cattle (C2).

Treatments were stocked at 35 500 kg LW [liveweight]0.9/ha (? 200 cattle/ha) for 48 h when the soil was wetter than the plastic limit. A control plot (untrodden, U) was grazed only lightly by sheep to control pasture cover while causing minimal observable surface damage. Change in surface contour, random roughness, soil surface damage, and pasture cover were determined with a 'contometer'. The construction and use of the contometer to measure change in microtopography and to describe the soil surface and vegetative state by grazing is described. Disturbance was calculated as the change in height (mm) of soil level at fixed positions along transects within treatment plots. Both sheep and cattle pastures were affected similarly ($P > 0.05$) in relation to absolute and net disturbance of soils. Averaged across both pasture types, very little absolute surface soil disturbance was measured on S, whereas cattle-treading caused significant upward and downward movement of soil. Mean (+or-s.d.) absolute surface disturbance (sum of upward and downward movement on a transect) was greater by cattle (C1, 11.2 +or-8.1; C2, 9.9 +or-5.0 mm) than by sheep (5.1 +or-1.8 mm) ($P < 0.01$) after the single treading and 9.0 +or-4.1 mm for C2 after the second treading. Net disturbance (average of upward and downward movement on a transect) was 1.9 +or-4.0, 1.8 +or-4.0, and 3.0 +or-1.8 mm for C1, C2, and S ($P > 0.05$), respectively, after the first treading and 4.1 +or-3.7 mm for C2 after the second treading. Cumulative net disturbance resulting from C2 on sheep pasture was greater than cattle pasture ($P < 0.05$), especially after the first treading, which suggested sheep pasture was more susceptible to compaction than the previously damaged cattle pasture. Random roughness and percentage of surface soil penetrated by hooves, based on observation, was greater with cattle than sheep treading. Random roughness increased ($P < 0.07$) following treading of sheep than of cattle pastures. It was concluded that the effect on soil surface configuration of severe short-term treading events on wet soils was greater by cattle than by sheep stocked at the same metabolic liveweight per hectare and that this occurred irrespective of the previous grazing history. Although absolute disturbance in each of the 2 cattle treadings in C2 was similar, net disturbance (compaction) on sheep pasture was more than twice that on cattle pasture ($P < 0.05$).

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27. Effect of grassland management on nitrogen mineralization potential, microbial biomass and nitrogen yield in the following year.

Hassink, J.

Netherlands Journal of Agricultural Science 40(2): 173-185. (1992)

NAL Call #: 12 N3892; ISSN: 0028-2928

Descriptors: fertilizer/ grazing/ herbage dry matter production/ mowing

Abstract: The effect of mowing or grazing and mineral fertilizer level on N mineralization potential and microbial

biomass N (N flush) was studied in 1988 on a sandy soil and a sedimentary calcareous silty loam (loam). On the loam the residual effect of the treatments on N yield and herbage dry matter accumulation in the following year was also studied. The different management practices were started in 1985 on the sandy soil and in 1986 on the loam. The amount of microbial biomass N was larger under grazing than under mowing. The increase in the amount of microbial biomass N due to grazing was larger for the loam than for the sandy soil. The N-mineralization rate was higher under grazing than under mowing. The difference in N-mineralization rates between grazed and mown fields was 20-30% in April for both soils, but increased considerably in the sandy soil during the growing season. It was estimated that the difference in N-mineralization between mown and grazed plots under field conditions was 110 and 40 kg N ha⁻¹ year⁻¹ in the sandy soil and the loam, respectively. Thus the optimum N fertilizer application rate should be considerably lower under grazing conditions than under mowing conditions, especially on sandy soil. Fertilizer level had no effect on the amount of microbial biomass and rates of N-mineralization. Both grazing compared to mowing and increasing N fertilizer levels above 550 kg N ha⁻¹ year⁻¹ affected the N yield and dry matter accumulation in the following year (= residual effects) on the loam. These effects were greater for N yield than for dry matter accumulation. The residual effect of previous fertilizer input was probably caused by the presence of different amounts of N in roots and stubble. The residual effect on N yield under grazing exceeded that under mowing by 28%.

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28. Effect of grassland management on the amounts of soil organic nitrogen and carbon.

Hassink, J. and Neeteson, J. J.

Netherlands Journal of Agricultural Science 39(4): 225-236. (1991)

NAL Call #: 12 N3892; ISSN: 0028-2928

Descriptors: grazing/ mowing/ fertilizer

Abstract: In the period 1985-1990 field trials with N fertilization, grazing and mowing were conducted on a sandy soil and a loamy soil to investigate the accumulation of organic N and C in intensively managed grassland systems. Annual fertilizer rates of N varied from 250 to 700 kg ha⁻¹ under grazing and from 0 to 700 kg ha⁻¹ under mowing. On the grazed plots no significant accumulation of soil organic N occurred in the sandy soil, whereas in the loamy soil an average N accumulation of 245 kg ha⁻¹ yr⁻¹ was found. The accumulation in the loamy soil was probably caused by the marine history of the soil and the fact that the soil was recently plowed and resown. The accumulation was independent of the level of fertilizer N applied, indicating that increased biomass production does not necessarily increase the return of dead organic material to the soil. These results confirm the suggestion that the surplus of fertilizer N is largely lost to the environment. About four years after the start of the experiment the amounts of soil N and C were considerably higher under grazing than under mowing. In spite of the higher amount of soil N under grazing compared to mowing, approximately 71% and 57% of the extra amount of N returned to the soil by grazing is lost to the environment on the sandy and the loamy soil, respectively. The C/N ratio of the soil organic matter was lower in plots with fertilizer N application than in

plots without fertilizer N. This difference was probably caused by a difference in C/N ratio of dead grass and roots that were returned to the soil.

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29. The effect of grazing on soil microbial biomass and community on alpin pastures.

Insam, H.; Rangger, A.; Henrich, M.; and Hitzl, W.

Phyton (Horn) 36(3): 205-216. (1996)

NAL Call #: 450 P565; ISSN: 0079-2047

Descriptors: agronomy/ alpine pasture/ animal husbandry/ ecophysiology/ grazing/ litter quality/ respiration/ soil microbial biomass/ soil conditions/ terrestrial ecology

Abstract: Within in a multidisciplinary project the effect of termination of cattle grazing on grassland and forest on soil microbial properties was investigated. The changes of microbial biomass (C-mic), basal respiration and the ecophysiological parameters (metabolic quotient and the C-mic:C-org ratio) were small. Mainly in the dry summer of 1993 an increase of basal respiration, microbial biomass and the C-mic:C-org ratio was observed for the fenced in sites. The effects were not observed in the moist summer of 1995. For the pasture site, a substrate utilization assay employing 95 different C sources (Biolog) indicated some changes in the functional abilities of the bacterial communities after 9 years of protecting the site from grazing. The changes were attributed to a change of litter quality.

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30. The effect of improved pastures and grazing management on soil water storage on a basaltic plains site in south-west Victoria.

Bird, P. R.; Jackson, T. T.; Kearney, G. A.; Saul, G. R.; Waller, R. A.; and Whipp, G.

Australian Journal of Experimental Agriculture 44(6): 559-569. (2004)

NAL Call #: 23 Au792; ISSN: 0816-1089

Descriptors: rotational grazing/ applied and field techniques/ basalt/ grazing management/ groundwater recharge/ pasture/ rainfall/ soil salinity

Abstract: Soil salinity of non-irrigated farmlands in Australia has been largely attributed to tree clearing and their replacement by annual pasture and crop species. This paper deals with the effects of sowing perennial ryegrass and greater inputs of fertiliser, and the effect of grazing management, on water use and the potential to improve recharge control on a gravelly soil derived from basalt. In 1991, neutron access tubes were inserted into plots on a project established in 1989 to examine the impact of upgrading the pasture on sheep productivity. These plots were subdivided in 1996 to examine the impact of grazing management (tactical v. set-stocking) and pasture type (pastures dominated by annual species v. upgraded pastures) on productivity. Neutron probe readings were taken periodically from tubes in each plot, at depth intervals of 25 cm (December 1991-March 1995) or 20 cm (August 1995-April 1999) to 170 cm. There was no effect of treatment on soil moisture. Data for 2 wet years (1995 and 1996) indicate that the effective soil water storage capacity to 170 cm depth for these pastures was a mean of 125 mm of water. This represents the potential buffer before winter rainfall exceeds the water use by the pasture, fills the soil profile to capacity and then either runs off or allows deep drainage to occur. We did not achieve a significant

reduction in soil water storage, and therefore potential recharge of groundwater, by re-sowing the pasture with perennial ryegrass and applying more fertiliser, or by altering the grazing management to a form of rotational grazing. Compared with set-stocked annual pasture, the impact of such treatments was to reduce soil water storage to a depth of 170 cm in autumn by less than 20 mm/year. There was no association between total herbage production and soil water storage, however, an increased percentage of perennial ryegrass in the pasture was associated with a small reduction in soil water storage in 1 year. Greater use of soil water may depend upon using deeper-rooted perennials or maintaining a higher proportion of perennial species in the sward (the perennial ryegrass in the re-sown pastures declined from 53% in October 1996 to 4% in October 1998).

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31. The effect of livestock grazing on surface runoff and soil erosion from sloping pasture lands in the Ethiopian highlands.

Mwendera, E. J.; Saleem, M. A. Mohamed; and Dibabe, A. *Australian Journal of Experimental Agriculture* 37(4): 421-430. (1997)

NAL Call #: 23 Au792; ISSN: 0816-1089

Descriptors: livestock industry/ animal husbandry/ biobusiness/ grazing/ pasture land/ slope/ soil erosion/ soil science/ surface runoff

Abstract: Effects of livestock grazing on surface runoff and soil erosion at varying slopes were studied in pasture lands within Ginchi watershed, Ethiopia. The results showed that livestock grazing in the watershed followed distinct seasonal and spatial patterns. During the rainy season, grazing pressure was greatest on the upper slopes (gt 5% slope) while the pressure shifted to the lower slopes during part of the dry season. Seasonal grazing pressure in different parts of the watershed was further complicated by the fact that during the rainy season and immediately after the rains, grazing was limited to individually designated pasture lands while during most part of the dry season, the entire watershed became a common grazing resource for livestock of watershed residents as well as those farmers outside the watershed. It was observed that, on pastures above 4.2% slope, there is the risk of erosion rates exceeding the estimated soil loss tolerable limit under the current grazing pressures (heavy grazing), while slopes exceeding 5.8% are likely to suffer soil erosion under moderate grazing pressure at the current level of biomass productivity. Since livestock are mobile, farmers tend to take advantage of this attribute by seasonally moving the livestock to different parts of the watershed. This study has demonstrated the need for better understanding of the resource use patterns beyond the individual farmlands, most preferably at watershed level, so that on-site and off-site effects of seasonal concentration of livestock can be incorporated into developing feed production and management strategies for improving the system productivity and environmental protection.

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32. Effect of retention of run-off water and grazing on soil and on vegetation of a temperate humid grassland.

Alconada, M.; Ansin, O. E.; Lavado, R. S.; Deregibus, V. A.; Rubio, G.; and Gutierrez Boem, F. H.

Agricultural Water Management 23(3): 233-246. (1993)

NAL Call #: S494.5.W3A3; ISSN: 0378-3774

Descriptors: temperate zones/ grasslands/ runoff farming/ grazing/ water management/ animal husbandry/ temperate grasslands/ water relations/ trampling

Abstract: A 4-year field trial was carried out on a Typic Natraqualf to modify surface runoff, to change the soil water regime and improve forage productivity. Water was retained by earth banks which were built along contour lines. The area was grazed by cattle at a density of six animal units per hectare during five or six occupation periods per year. To study the effect of cattle trampling, 1 ha within the water retention area was excluded from grazing. It was found that surface accumulation of water led to higher soil water contents and prevented salt rising by capillarity from the water table (electrical conductivity of A1 horizon, 1.4 dS/m against 3.4 dS/m in the control area). Soil salinization in the control area was associated with soil water evaporative losses and a water table depth <1.5 m. Soil alkalinity (pH and SAR) showed variations closely related to salinity. The already impaired soil physical properties were not significantly affected by livestock trampling in the water retention area. A marked change in plant community composition was observed. Most halophytic species disappeared and the area was covered by hydrophilous grasses. This contributed to the fourfold increase forage. Runoff water retention proved to be a promising way to change temporarily the status of the soil and to cause a large change in grassland characteristics and productivity.

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33. Effect of rotational grazing on selected physical properties of a gleyed brunisolic gray luvisol loam in Nova Scotia.

Rodd, A. V.; Papadopoulos, Y. A.; Laflamme, L. F.; Mcrae, K. B.; Fillmore, S. A. E.; and Wilson, R. W.

Canadian Journal of Soil Science 79(1): 117-125. (1999)

NAL Call #: 56.8 C162; ISSN: 0008-4271

Descriptors: bulk density/ hydraulic conductivity/ penetration resistance/ physical properties/ rotational grazing/ gleyed brunisolic gray luvisol loam

Abstract: Low organic matter content and weak soil structure, combined with high annual precipitation, make the soils of the Maritime Provinces extremely susceptible to compaction. Although many pasture studies have been conducted in the Maritime Provinces, none has investigated the impact of pasturing cattle on soil physical properties. Soil properties such as resistance to penetration, bulk density and hydraulic conductivity were monitored on pasture swards receiving various rotational-grazing intensities. These parameters were measured concomitantly on traffic-free areas that had been harvested as conserved forage. Resistance to penetration measurements indicate that a significant amount of compaction by cattle occurred during the 1990, 1991 and 1992 grazing seasons. Penetration resistance was generally greatest in the top 6 cm of soil, but was alleviated by frost action during the subsequent winter and spring. The other soil parameters measured were either more variable (surface and subsurface saturated hydraulic conductivity) or less sensitive (bulk density) to compaction. Although more variable, surface hydraulic conductivity was significantly higher in the traffic-free conserved forage areas than in the pasture paddocks. Rest intervals between grazings had no significant effect on saturated hydraulic conductivity. Seasonal change in resistance to penetration

generally increased as rest interval decreased. The timothy/alfalfa swards (little alfalfa was left in the pastures by 1992) had the least seasonal change in resistance to penetration.

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34. Effect of short term pastures on soil nitrogen status under contrasting management practices.

Williams, P. H. and Wright, C. E.

Proceedings Annual Conference Agronomy Society of New Zealand 27: 139-143. (1997)

NAL Call #: S3.A37; ISSN: 0110-6589

Descriptors: nitrogen fertilizers/ application rates/ grazing/ mineral uptake/ nutrient uptake/ seed production/ straw/ wheat/ nitrogen fixation/ residual effects

Abstract: In a field trial in 1993-95 at Lincoln, New Zealand, mixtures of *Lolium perenne* cv. Grasslands Supernui and *Trifolium repens* cv. Grasslands Tahora were grazed by sheep or managed for seed production. Under grazing, *T. repens* fixed 55 kg N ha⁻¹ year⁻¹, and the net input to the soil was 84 kg N ha⁻¹ over the two years. In the first year under seed production when *L. perenne* seed was harvested, *T. repens* fixed only 21 kg N ha⁻¹, but 100 kg N ha⁻¹ was applied in fertilizer. In the second year, when *L. perenne* was killed by herbicide and *T. repens* seed harvested, 134 kg N ha⁻¹ was fixed and 25 kg N ha⁻¹ fertilizer was applied. However, N was removed in harvested seed (15 kg N ha⁻¹ in *L. perenne* seed and 30 kg N ha⁻¹ in *T. repens* seed) and *L. perenne* straw (65 kg N ha⁻¹). Overall, the net input of N to the soil under seed production (157 kg N ha⁻¹) was greater than under grazing (84 kg N ha⁻¹). Despite the higher net N input to the soil under seed production, there was no evidence that this had a beneficial effect on wheat cv. Sapphire in a subsequent greenhouse pot trial, and there was a higher dry matter yield and N uptake from the wheat following grazing than seed production. The carryover effect of the two management practices on the wheat appeared to be linked to the form of N added to the soil, rather than the total amount of N added.

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35. Effect of two different grazing intensities on the rotational methods with dairy cattle: Nutrients recycling in the soil from the dairy cattle feces.

Reyes, J.; Vidal, Ibis; Gonzalez, Maria R.; Gonzalez, Rosa M.; and Fonte, Damaris

Cuban Journal of Agricultural Science 37(2): 161-166. (2003)

NAL Call #: S1.R4; ISSN: 0864-0408

Descriptors: grazing rotation method: applied and field techniques/ dung patches/ red ferrallic soil

Abstract: For determining the contribution of cattle feces to the soil in each grazing intensity with low inputs, a study was conducted for four years on a red ferrallic soil planted with star grass (*Cynodon nlemfuensis*) and submitted to two grazing intensities (high (HI), 184.4 LAU/ha and low intensity (LI), 101.2 LAU/ha, as average). High stocking rates, 3.7 and 3.2 LAU/ha/year, for HI and LI, respectively, were used. The statistical analysis used was a linear model of fixed effect. Treatment, season, year and their interaction were controlled. The results showed that the number of dung patches deposited in the paddocks (dung patches/animal/d) did not differ between treatments; while the highest ($P < 0.05$) number of dung patches was reported

in the rainy season. The deposition of total dung patches (dung patches/ha/year) was higher ($P < 0.01$) in the four years with HI, in 37.2, 30.4, 18.3 and 15.0%, respectively, compared to LI. The percentage of the area covered by the dung patches did not surpass 10.5% in any case. However, the method of HI surpassed ($P < 0.001$) to that of LI in all the years (2.7, 1.4, 1.2 and 1.2 more from the first to the fourth year, respectively). The contribution of organic matter was higher in the four years ($P < 0.01$) in the HI method (868.2, 698.3, 692.9 and 1104.9 kg of organic matter/ha/year), while the contribution of nitrogen, phosphorus and potassium by total feces (dung patches and urine) was higher ($P < 0.001$) in HI, which represented 29.1, 40.9 and 24.6% for nitrogen, phosphorous and potassium, respectively, as average. The results confirmed that the contribution of nutrients to the soil is higher by using higher grazing intensities. However, further studies are suggested to prove that there is a balance in the system, in general, and in the soil, in particular, with thees intensities.

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36. Effect of urine volume on nitrate leaching in the northeast USA.

Stout, W. L.

Nutrient Cycling in Agroecosystems 67(2): 197-203. (2003)

NAL Call #: S631 .F422; ISSN: 1385-1314

Descriptors: field experiment: applied and field techniques/ large drainage lysimeter: field equipment/ Hagerstown silt loam soil: fine, mesic typic hapludalf, mixed/ grazing/ nitrate leaching: urine volume effects/ water quality

Abstract: To investigate how the urine volume (i.e. size of cow) affects how much NO₃-N is leached from a urine deposition in the climatic conditions of the northeast USA, a field study using large drainage lysimeters to measure NO₃-N leaching loss from synthetic urine applied in spring, summer and fall in 1-, 2-, and 3-1 volumes to an orchardgrass (*Dactylis glomerata* L., c.v. 'Pennlate') sward was conducted from April 1997 to March 1999. The study site was located in central Pennsylvania on a Hagerstown silt loam soil (fine, mixed, mesic Typic Hapludalf). It was found that increasing urine volume increased the amount of urine N leached but had no significant effect on the apparent percent of urine N leached. The apparent percent of urine N leached was 25% averaged over all treatment times and volumes and was 21% for spring and summer applied urine and 32% for fall applied urine.

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37. The effects of agricultural management on the soil biota of some upland grasslands.

Bardgett, R. D.; Frankland, J. C.; and Whittaker, J. B.

Agriculture, Ecosystems & Environment 45(1-2): 25-45. (1993)

NAL Call #: S601 .A34; ISSN: 0167-8809

Abstract: Soil Collembola, in particular the fungal-feeding *Onychiurus procampatus*, were selected for further study. Field sampling revealed simultaneous trends of decreasing Collembola numbers and increasing total hyphal length and biomass of fungi in the surface soil, together with differences in chemical and physical soil properties, along a gradient of reduced sheep management intensity. Similar changes occurred when sheep grazing was removed by

fenced enclosures. The relative abundance of the seven most commonly isolated species of litter fungi varied along the same gradient of sheep management. -from Authors © 2006 Elsevier B.V. All rights reserved.

38. Effects of animal traffic on soil compaction in wheat pastures.

Krenzer, E. G.; Chee, C. F.; and Stone, J. F. *Journal of Production Agriculture* 2(3): 246-249. (1989)
 NAL Call #: S539.5.J68; ISSN: 0890-8524
Descriptors: Triticum aestivum/ Bos taurus/ conservation tillage/ grazing seasons/ agriculture/ agribusiness/ crop industry/ yield growth/ Great Plains, USA/ bulk density/ gravimetric soil moisture/ soil strength
Abstract: Grazing of hard red winter wheat (*Triticum aestivum* L.) in the U.S. southern Great Plains during the fall and winter, followed in the summer by the harvesting of grain, has been of great economic importance. With the increase in conservation tillage, however, there is growing concern that the compaction effects grazing has on the soil may not be eliminated by subsequent tillage. This study was conducted to quantify the extent to which soil compaction occurs as a result of animal traffic on wheat pasture. Of the three locations that were evaluated in the 1986-1987 growing season, two were on a silt loam soil and the third a sandy loam. Cattle (*Bos taurus*) grazed wheat until the early joint stage of growth, and measurements of soil strength, soil moisture, and bulk density were taken before initiation of grazing and immediately after grazing termination. Bulk density measurements and gravimetric soil moisture evaluations were made at 1.2 in. increments through the soil profile to a depth of 16.5 in. Data for soil strength evaluation, using a mechanical cone penetrometer, were collected at 0.8 in. increments also to a depth of 16.5 in. Increases in both the bulk density and the soil strength of the grazed areas were found in all three sites, although the depth to which the differences were measured varied from site to site. Animal traffic increased bulk density by as much as 16% and soil strength by 270% in surface zones. In the sandy loam soil, the bulk density was increased to a depth of 8 in. and the soil strength to 12 in.; while in the silt loam soils, the bulk density was increased only 5 in. These data indicate that compaction does result from grazing wheat pasture and may extend to a depth where some tillage practices may not eliminate it. The possible effects that this compaction may have on wheat growth and its yield, and the tillage practices necessary to alleviate this compaction require further study.

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39. Effects of cattle grazing and BMPs on stream water quality.

Agouridis, C. T.; Edwards, D. R.; Workman, S. R.; Bicudo, J. R.; Taraba, J. L.; Vanzant, E. S.; and Gates, R. S. In: 2004 ASAE Annual International Meeting. (Held 1 Aug 2004-4 Aug 2004 at Ottawa, Ontario, Canada.); pp. 2251-2277; 2004.
 NAL Call #: S671.3 .A54
Descriptors: bacteria/ best management practices/ nutrients/ stream
Abstract: Cattle production is a major component of Kentucky's agricultural economy, accounting for approximately 15% of the total agricultural sales in 2000. There are over 2.2 million beef cattle and calves in the state

making Kentucky the number one beef producer east of the Mississippi River. Research into the effects of cattle grazing on stream water quality has been well documented in the western portion of the United States with some estimates indicating that 80% of the damage to riparian areas was caused by grazing livestock. However, the impacts of grazing cattle in a humid environment may differ significantly from those witnessed in the arid West. Furthermore, relatively little information exists regarding the effectiveness of grazing best management practices (BMPs), such as alternate water sources, alternate shade sources, supplemental feeding, and riparian buffers, for improving the water quality of streams in grazed watersheds of the humid region. As part of a larger research endeavor into cattle production practices in the humid region, water samples were collected over a two year period at the project site located on the University of Kentucky's Animal Research Center. The project sites consisted of two replications of three treatments: control, selected BMPs with free access to the stream, and selected BMPs with limited access to the stream. Grab samples were collected at the upstream and downstream pasture edges. Samples were analyzed for nitrate-nitrogen, ammonium-nitrogen, total Kjeldahl nitrogen, dissolved orthophosphate, total phosphorus, total suspended solids, pH, chemical oxygen demand, five-day biochemical oxygen demand, fecal coliforms, and fecal streptococci. Results indicated that minimal water quality benefits were incurred by implementing the BMP systems (i.e. treatments). One of the most substantial understandings gleaned from the project was the importance of upstream land use, and to some degree soils, when attempting to identify significant treatment effects within a small reach. Additionally, the karst geology, which is characteristic of the Bluegrass Region of Kentucky, influenced the rate of transport (i.e. flashy system with quick response time to rainfall) of nutrients from upland areas (i.e. row crops), especially along Pin Oak. These external factors may have resulted in the lack of uniformity in significant constituent concentration differences between the two streams when cattle were present. Furthermore, the background constituent concentration levels may have prohibited the identification of treatment effects. Results from this project indicated that minimal water quality benefits were incurred by implementing a BMP system (with or without a partially excluded riparian zone). However, these results may differ if cattle were completely excluded from the stream or if the BMP system was implemented at a site with larger pastures, different geology (nonkarst), soils (low in phosphorus), or stream morphology (nonbedrock bottom channel).

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40. Effects of cattle treading and natural amelioration on soil physical properties and pasture under dairy farming in Southland, New Zealand.

Drewry, J. J. and Paton, R. J. *New Zealand Journal of Agricultural Research* 43(3): 377-386. (2000)
 NAL Call #: 23 N4892; ISSN: 0028-8233
Descriptors: air permeability/ cattle/ compaction/ hydraulic conductivity/ macropores/ pugging/ treading
Abstract: The effects of current dairy cow grazing practice, reduced levels of grazing, and stock exclusion on soil physical properties and pasture dry matter production were

investigated under dairy farming in Southland. Current grazing practice involves rotational grazing with dairy cows from September to May each year, with no grazing during winter. For the reduced grazing treatments, cattle were excluded during the 3rd, or combined 3rd, 4th, and 5th grazing cycles, or for half-day grazing intervals to reduce grazing intensity. Macroporosity increased by 70% in the ungrazed treatment compared with current grazing practice (control) within four months of dairy cow exclusion. Air permeability was increased by over two orders of magnitude 18 months after trial commencement, and saturated hydraulic conductivity increased by 200% to the 10-cm soil depth. Macroporosity, air permeability, and hydraulic conductivity for the reduced grazing treatments were intermediate between the control and ungrazed treatments. Relationships between macroporosity and pasture relative yield are presented. At 97% relative pasture yield, the level of macroporosity was 11.5-11.7% (v/v) in three silt loams.

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41. Effects of exclosure and management on biomass and soil nutrient pools in seasonally dry high country, New Zealand.

McIntosh, Peter D.; Allen, Ralph B.; and Scott, Neal
Journal of Environmental Management 51(2): 169-186. (1997)

NAL Call #: HC75.E5J6; ISSN: 0301-4797

Descriptors: benmore range/ calcium/ carbon/ conservation/ fertilization/ grazing/ magnesium/ nitrogen/ nutrient/ nutrient pools/ phosphorus/ potassium/ rainfall/ root biomass/ soil acidification/ soil quality/ South Island/ sustainable pastoral use/ tussock grasslands

Abstract: We examined the effects of grazing and three exclosure treatments (no grazing, no-grazing plus oversowing, and no grazing plus oversowing plus fertilizer) on soils (Ustochrepts) and biomass of tussock grasslands on hill country under a mean annual rainfall of about 500-600 mm in the Benmore Range, South Island, New Zealand. Excluding grazing by sheep and rabbits for 15 years, with no oversowing or fertilizer, resulted in a two- to three-fold increase in the total biomass (roots+litter+herbage) relative to the grazed treatment. On all three exclosure treatments root biomass was approximately doubled in relation to root biomass on the grazed treatment. With the exception of Mg, total nutrient pools in biomass plus soil were lowest in the grazed treatment. Oversowing alone, without added fertilizer, maintained soil pH at pre-exclosure values and prevented exchangeable Ca, Mg and K decline, but had no significant effect on soil C, N or P. In contrast, oversowing and fertilizing had the effect of increasing soil C and N by 5.7 t/ha and 0.6 t/ha respectively, relative to the ungrazed treatment, and by 8.7 t/ha and 0.87 t/ha respectively, relative to the grazed treatment. Under ungrazed, grazed, and the oversown +fertilizer treatments pH declined relative to pre-exclosure values and values on the oversown treatment. The lower pH under the oversown +fertilizer treatment was attributed to the direct and indirect acidifying effects of elemental S fertilizer, while the lower pH of the ungrazed treatment was attributed, in part, to the acidifying effect of *Hieracium pilosella*, with both cation removal by animals and *Hieracium* effects likely to have lowered pH in the grazed treatment. A positive balance of 425 kg/ha of Ca, 680 kg/ha of K and 1900 kg/ha of N remained in total

biomass plus soil on the oversown +fertilizer treatment, after fertilizer additions and previous herbage removals were taken into account. The positive Ca and K balance was attributed to release of nutrients by soil weathering, and the N balance to N fixation by legumes. Grazing of seasonally dry South Island tussock grasslands on hilly land, even at the present low levels, without fertilizing, appears incompatible with the maintenance of soil pH and carbon and total soil and biomass nutrients.

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42. Effects of grassland management practices and environmental conditions on nutrient concentrations in overland flow.

Kurz, I.; Coxon, C.; Tunney, H.; and Ryan, D.

Journal of Hydrology 304(1-4): 35-50. (2005)

NAL Call #: 292.8 J82; ISSN: 0022-1694

Descriptors: grasslands/ grassland soils/ overland flow/ nitrogen/ phosphorus/ losses from soil/ nonpoint source pollution/ agricultural runoff/ soil fertility/ grazing/ nitrogen fertilizers/ fertilizer application/ Irish Republic

Abstract: The loss of nutrients from agricultural land to water bodies is a serious concern in river basin management in many countries. To gain information on the contributions of agricultural grassland to the eutrophication of water bodies, this study set out to assess phosphorus (P) loss from grassland areas on poorly drained soils. A second aim was to look at the impact of grassland management practices on nutrient concentrations in overland flow. Edge-of-field measurements of overland flow quantity and of P and nitrogen (N) concentrations in overland flow were carried out at three study sites with different soil P levels. The amounts of overland flow and the P concentrations in overland flow varied considerably during events, and among sites and events. Despite this variability, there was a clear increase in P loss in overland flow from the low to the medium and high soil P sites. The inter-site variability of the P concentrations in overland flow greatly exceeded the variability of the amounts of overland flow from the different sites. Thus, P concentrations had a larger impact than the volume of overland flow on the differences in P exports from the three sites. Management practices which, at times, influenced the P and N concentrations in overland flow were grazing and N fertilisation.

This citation is from AGRICOLA.

43. Effects of riparian grazing and channelisation on streams in Southland, New Zealand: Channel form and stability.

Williamson, R. B.; Smith, R. K.; and Quinn, J. M.

New Zealand Journal of Marine and Freshwater Research 26(2): 241-258. (1992)

NAL Call #: QH91.57.A1N4; ISSN: 0028-8330

Descriptors: river banks/ grazing/ erosion/ agriculture/ channels/ vegetation cover/ riparian environments/ geomorphology/ streams/ New Zealand, South I., Southland/ New Zealand/ sheep and cattle grazing/ channelisation/ streams/ vegetation cover

Abstract: The effects of mixed sheep and cattle grazing of stream margins, channelisation, and the benefits of riparian retirement were assessed through a survey of five streams in Southland, New Zealand. There is no evidence that grazing streambanks in floodplain streams of northern Southland will lead to rapid and severe deterioration of channel form, except in small streams (< 2 m wide) under

intensive grazing of wet streamside soils. Generally, the dominant erosion mechanism—the undercutting of banks—is largely unaffected by grazing stream margins. In contrast, channelisation has led to severe streambank and streambed erosion in two of the three streams examined. The major factor in this degradation appears to be straightening and deepening the channel so that underlying uncohesive shingle is exposed to high flows. Riparian retirement had variable effects depending on the stability of the stream channel. On smaller, relatively inactive channels, it reduced localised bank erosion from livestock trampling, especially at cattle crossings. However, this damage (which sometimes can be quite visible) did not lead to significant change in average channel form or width in the 7-15 years since the land has been converted to intensive agriculture from extensively grazed tussock.

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44. Effects of sheep grazing episodes on sediment and nutrient loss in overland flow.

Elliott, A. H. and Carlson, W. T.

Australian Journal of Soil Research 42(2): 213-220. (2004)
NAL Call #: 56.8 Au7; ISSN: 0004-9573

Descriptors: runoff/ sediments/ nutrient loading/ rainfall/ infiltration/ phosphorus/ particulates/ nutrient loss/ growth/ agriculture/ nitrogen/ grasses/ grazing/ nutrients/ overland flow/ infiltration rate/ rainfall simulators/ sheep/ risk/ growth rates/ farms/ pollution load/ baseline studies/ sediment load/ nitrogen compounds/ New Zealand, North I., Waikato/ grazing

Abstract: The effect of sheep grazing on the loss of sediment and nutrients in overland flow was investigated on a hill-country farm in the Waikato, New Zealand. The losses were measured in runoff produced artificially with small (0.5 m super(2)) and large (1050 m super(2)) rainfall simulators. Immediately after intensive winter grazing, rainfall applied at high intensity increased concentrations by a factor of 13-16 for sediment and particulate nutrients, 33-76 for dissolved reactive phosphorus and ammonium-nitrogen, and 5-7 for dissolved organic nitrogen and phosphorus. During summer, when there was less removal of vegetative cover, there was a smaller effect of grazing. The concentrations of sediment and particulate nutrients in overland flow were strongly correlated with the percentage of bare ground. The concentrations returned to background levels within 6 weeks after grazing, and the infiltration rate and ground cover also recovered from grazing in this time. The small rainfall simulator experiments showed that the infiltration rate decreases with grazing, which results in greater runoff after grazing. The greater runoff combines with the increased concentrations to give higher loads after grazing. In late winter, the infiltration rates were approximately half the summer values and the soil erodibility was approximately double, so the risk of high sediment and nutrient loads is greatest in winter, especially considering the higher rainfall and lower grass growth. The management implications are that exposure of bare ground associated with intensive grazing should be avoided, especially in winter.

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45. Effects of soil texture and grassland management on soil organic C and N and rates of C and N mineralization.

Hassink, J.

Soil Biology and Biochemistry 26(9): 1221-1231. (1994)
NAL Call #: S592.7.A1S6; ISSN: 0038-0717

Descriptors: grassland soils/ soil organic matter/ carbon/ nitrogen/ mineralization/ soil texture/ range management/ age/ nitrogen fertilizers/ mowing/ grazing/ carbon nitrogen ratio/ application rate

Abstract: The effects of soil texture and grassland management, i.e. rate of fertilizer N input, mowing vs grazing, and the number of years the site is under grass, on the amounts of soil organic C and N and on the rates of C and N mineralization were investigated. A positive relationship was found between the amount of organic N in the soil and the clay + silt content. The relationship was affected by the groundwater table. There was a negative relationship between the percentage of soil N mineralizing during incubation and the clay + silt content of the soil. The amount of organic C was only positively correlated with soil texture in the soils with a high water table, but the relationship was less clear. Except for the groundwater table, differences in the C-to-N ratio of the soil organic matter in sandy soils confused the relationship of soil organic C with soil texture. Organic matter in podzol soils had C-to-N ratios between 15 and 20 while in other sandy soils the C-to-N ratio ranged from 10 to 18; in loams and clays the C-to-N ratio was ca 10. The percentage of soil C mineralizing in sandy soils was negatively correlated with the C-to-N ratio of the soil organic matter. The sandy soils with a C-to-N ratio > 16 that were used for incubation contained black humus including small charcoal particles; both other sandy soils with a lower C-to-N ratio contained brown humus without visible charcoal particles. So we hypothesize that sandy soils with a high C-to-N ratio contained more inert C than sandy soils with a low C-to-N ratio. The rate of N fertilization had no effect on soil organic C and N nor on the rates of C and N mineralization. Differences between the effects of grazing and mowing on soil organic C and N and the rate of C and N mineralization were very small and not very consistent. Both the amounts of soil organic C and N found and the rates of C and N mineralization were significantly higher in old grassland (10 yr) than in young grassland (1-3 yr). The increases in the mineralization rates were larger than the increases in soil organic C and N.

This citation is from AGRICOLA.

46. Effects of the nitrification inhibitor dicyandiamide on potassium, magnesium and calcium leaching in grazed grassland.

Di, H. J. and Cameron, K. C.

Soil Use and Management 20(1): 2-7. (Mar. 2004)
NAL Call #: S590.S68; ISSN: 0266-0032

This citation is from AGRICOLA.

47. Effects of trampling by cattle on the hydraulic and mechanical properties of soil.

Pietola, L.; Horn, R.; and Yli Halla, M.

Soil and Tillage Research 82(1): 99-108. (2005)
NAL Call #: S590.S48; ISSN: 0167-1987

Descriptors: clay/ deformation/ Entisols/ environmental impact/ grassland soils/ grazing/ hydraulics/ Inceptisols/ infiltration/ macropores/ pastures/ porosity/ runoff/ runoff

water/ sandy loam soils/ soil compaction/ soil mechanics/
soil structure/ soil types/ trampling

Abstract: Destroyed soil structure can increase surface runoff water, with adverse environmental impacts. The effects of trampling by cattle on physical parameters of a heavy clay (a Typic Cryaquept) were studied at the followings four Site types of a pasture after grazing for three seasons: (1) grass with no visible trampling; (2) pasture with some trampling; (3) vicinity of a drinking site with some signs of penetrated hooves, and; (4) a drinking site with totally homogenized surface soil and destroyed vegetation. Additionally, Site types 1 and 4 were studied on sandy loam (an Aquic Cryothent) derived from glacial till after one grazing season. Steady state infiltration rates were reached after 15-35 min of infiltration, depending on the degree of trampling and soil texture. On the sandy loam the infiltration rate at the drinking site was only 20% of that under natural pasture with no visible trampling. When the trampling occurred for longer periods in a soil with higher clay content, the infiltration rate of drinking site was only 10-15% of that in non-trampled pastures. These findings could be explained by a reduced porosity for both soils. In heavy clay at the depth of 10-15 cm, macropores ($O > 30$ micro m) decreased from 5 to 1.5% (v/v) by the most severe trampling and mechanical strength was lost near the soil surface (cohesion ~ 1 kPa). Deeper at 10-13 cm, cohesion (at water potential of -6 kPa) was near 30 kPa at the drinking site but around 20 kPa in non-trampled sites. At the 20-23 cm depth of Site 4, the angle of internal friction value (35) for smaller stresses (< 150 kPa) was reduced to smaller values (9) at greater strengths (150-300 kPa) due to a stress dependent aggregate strength and the conversion of a structured soil system to a mostly texture dependent one. The data showed that even a low intensity of grazing will reduce infiltration and hence increase susceptibility to erosion at the drinking sites.

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48. The efficacy of controlling phosphorus loading: The case of management-intensive grazing.

Winsten, J. R. and Stokes, J. R.

Agricultural Systems 79(3): 283-303. (Mar. 2004)

NAL Call #: HD1.A3; ISSN: 0308-521X

Abstract: Consolidation in US agriculture has led to fewer, larger farms. In the case of dairy in the Northeastern US, higher concentrations of animals near large population centers pose water quality problems that can be attributed to excessive soil nutrient levels. While new environmental policies and regulations are being developed and implemented to help manage such problems, research to determine the efficacy of alternative dairy production systems is needed. The research reported in this paper makes use of stochastic dynamic programming to determine optimal stocking densities, milk production levels, and feed rations for a hypothetical dairy farm using management-intensive grazing. A key feature of the model is that financial disincentives are placed on excessive accumulation of phosphorus in the farm's soils. The results show that under optimal management the cost of reducing soil phosphorus to acceptable levels across all states of nature modeled is approximately \$524 per hectare per year. The optimal farm management strategy is to rapidly

reduce the size of the dairy herd (as opposed to feeding for a lower level of milk production per cow) until soil phosphorus levels are under control.

This citation is from AGRICOLA.

49. Emission of nitrous oxide from some grazed pasture soils in New Zealand.

Carran, R. A.; Theobald, P. W.; and Evans, J. P.

Australian Journal of Soil Research 33(2): 341-352. (1995)

NAL Call #: 56.8 Au7; ISSN: 0004-9573

Descriptors: grazing/ grassland soils/ trampling/ nitrogen/ nitrous oxide/ emission/ soil/ grasslands/ pastures

Abstract: Nitrous oxide emissions from grazed pastures were measured at four sites in North Island, New Zealand, for a 2 year period. Sites differed in drainage class and N cycle characteristics. At two intensively farmed sites on Kairanga silt loam, which is poorly drained, daily emissions ranged from 0 to 100 g N/ha per day and annual emission was in the range 3-5 kg N₂O-N/ha. Emissions occurred when the soil was near or above field capacity indicating denitrification was the probable source of N₂O. Multiple regression analysis, using soil water content, NO₃⁻, NH₄⁺ and temperature, gave $r^2 = 0.44$ and 0.57 at sites 1 and 2 respectively. Soil water content and NH₄⁺ were significant variables. Emissions at a low fertility hillside site were low and an annual emission of 0.5 kg/N₂O-N per yr, or less, was indicated. The highly fertile hillside site showed low emission values. It is suggested that grazing animals may have a significant impact on emissions through hoof damage on wet soils.

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50. The environmental impact of nitrogen fertiliser use on dairy pastures.

Eckard, R. J.; Chapman, D. F.; White, R. E.; and Chen, D.

Australian Journal of Dairy Technology 59(2):

145-148. (2004)

NAL Call #: 44.8 Au74; ISSN: 0004-9433

Descriptors: nitrogen abatement management: applied and field techniques/ climatic factors/ denitrification/ grazed dairy pasture/ seasonal variation/ volatilisation loss

Abstract: The use of fertiliser nitrogen (N) on dairy pastures in southeastern Australia has increased exponentially over the past 20 years, with more than 60% of dairy farmers applying between 25 and 50 kg N/ha at least once a year (Eckard and Franks 1998; Eckard et al. 2000). This increase in N use is of environmental concern due to the gaseous losses of NH₃ and N₂O and the leaching of NO₃. Over the past 10 years, there has been an estimated 140% increase in N₂O emissions from agricultural systems in Australia (AGO 2003). The application of both N fertiliser and urinary N to intensively grazed pasture can contribute to significant losses of NO₃ during periods of high rainfall and drainage (Cameron and Scotter 1987). Few data are available quantifying N losses from intensive pasture-based dairy production systems in south-eastern Australia (Eckard 1998). This paper reviews the recent data of Eckard et al. (2003) and Eckard et al. (2004) reporting N losses through gaseous and leaching pathways from grazed dairy pastures, respectively, and proposes abatement management practices.

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51. Erosional effects of cattle on streambanks in Tennessee, U.S.A.

Trimble, S. W.

Earth Surface Processes and Landforms 19(5): 451-464. (1994)

NAL Call #: GB400.E2; ISSN: 0197-9337

Descriptors: bank erosion/ streams/ geomorphology/ livestock/ watershed management/ riparian vegetation/ agriculture/ grazing/ soil erosion/ river banks/ environmental impact/ vegetation cover/ ecosystem disturbance/ USA, Tennessee

Abstract: The geomorphological effects of cattle on streambanks in a humid region, which have consequent potential effects on water quality, are examined. Field observations suggest that cattle are important agents in causing streambanks to erode, but so many variables are involved that it is difficult to isolate the role of cattle. Instead, an empirical approach based on long-term controlled experiment was adopted along a small perennial stream in the central basin of Tennessee. The results showed that uncontrolled grazing caused about six times as much gross bank erosion as occurred on the protected control stretch. However, most of this difference was due to breakdown of banks by trampling and consequent erosion, rather than by bank scour caused by removal of bank vegetation by grazing. That is, bank vegetation alone did not appear to be a primary control. A relatively inexpensive grade-control structure reduced the gross bank erosion by about 50 per cent. The rapid destruction of streambanks observed in this study suggests that reduction of geomorphic resistance by uncontrolled stock access to streambanks has been an important factor in the stream widening that has taken place during historical time in the eastern United States.

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52. Evaluation of soil compaction in an irrigated short-duration grazing system.

Silva, A. P.; Imhoff, S.; and Corsi, M.

Soil and Tillage Research 70(1): 83-90. (2003)

NAL Call #: S590.S48; ISSN: 0167-1987

Descriptors: grazing/ grazing intensity/ grazing systems/ irrigation/ pastures/ resistance to penetration/ rotational grazing/ soil compaction/ soil degradation/ soil fertility/ soil physical properties/ soil water content/ stocking rate/ trampling

Abstract: Reduction in pasture productivity is generally attributed to alterations in soil quality. Soil compaction due to animal trampling is one of the factors responsible for the degradation of the physical quality of soils under pasture. The objective of the study was to evaluate penetrometer resistance (PR) in an irrigated short-duration grazing system at three post-graze residue levels. PR and moisture were simultaneously measured in plots containing three different post-graze residue levels (1000, 2500 and 4000 kg dry material ha⁻¹). The influence of soil moisture on PR was taken into account using regression analysis techniques. PR was significantly higher for the treatments characterized by a small amount of post-graze residue, while similar values were obtained for the other two treatments. From a management perspective, adopting an irrigated short-duration grazing system with high stocking rate may adversely affect the soil physical quality.

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53. Faecal contamination over flood events in a pastoral agricultural stream in New Zealand.

Nagels, J. W.; Davies-Colley, R. J.; Donnison, A. M.; and Muirhead, R. W.

Water Science and Technology 45(12): 45-52. (2002)

NAL Call #: TD420.A1P7; ISSN: 0273-1223.

Notes: Conference: 5. International Symposium on Waste Management Problems in Agro-Industries, Shiga [Japan], 16-18 Nov 2001

ISBN: 1843394197

Descriptors: water pollution sources/ nonpoint pollution sources/ agricultural watersheds/ livestock/ flood flow/ bacterial analysis/ *Escherichia coli*/ experimental data/ data collections/ model studies/ streams/ fecal coliforms/ floods/ pollution (water)/ pollution (nonpoint sources)/ catchment areas/ livestock (see also individual animals)/ floods and flooding/ microbiological analysis/ bacteria (*Enterobacteriaceae*) (*Escherichia*)/ *Escherichia coli*/ New Zealand/ New Zealand, Morrinsville/ cattle

Abstract: Faecal bacterial dynamics during flood events were studied in the Topehaehae Stream near Morrinsville, New Zealand, in a catchment used for grazing dairy and beef cattle. During the rising limb of a natural flood event, *E. coli* bacterial concentration rose by more than 2 orders of magnitude and peaked at 41,000 cfu/100 mL. *E. coli* correlated closely with turbidity over the flood event, and both variables peaked close to the time of maximum flow acceleration rather than peak flow. An artificial flood on the same stream, created by releasing water from a supply reservoir during fine weather with no wash-in from the catchment, produced a broadly similar pattern of faecal contamination (peak *E. coli* = 12,500 cfu/100 mL). This and other evidence suggests that direct deposition of faecal matter by cattle in the stream channel may be of similar or greater importance than wash-in from land. The flood experiments have been useful for constructing a model of faecal bacterial yields, and they imply that exclusion of livestock from stream channels may appreciably improve water quality.

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54. Faecal bacteria in agricultural waters of the bluegrass region of Kentucky.

Howell, J. M.; Coyne, M. S.; and Cornelius, P.

Journal of Environmental Quality 24(3): 411-419. (1995)

NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: karst/ cattle/ groundwater pollution/ coliforms/ feces/ *Streptococcus*/ agricultural runoff/ sampling/ nonpoint pollution sources/ surface-groundwater relations/ animal wastes/ livestock/ water pollution/ water supply/ fecal microflora/ fecal coliforms/ ground water/ agricultural pollution/ microbial contamination/ hazard assessment/ *Enterococcus*/ USA, Kentucky/ FC/ FS/ USEPA

Abstract: Agricultural runoff influenced by nonpoint pollution frequently exceeds the USEPA standards for bacterial contamination of primary contact water (200 fecal coliforms/100 mL). Few studies have evaluated the effect of cattle (*Bos taurus*) grazing on fecal contamination of groundwater in the karst topography of central Kentucky. Our objectives were to: (i) observe the extent and pattern of fecal bacteria in agricultural waters from two central Kentucky watersheds; (ii) determine if monthly sampling accurately assessed the extent and variability of fecal contamination; and (iii) assess the fecal coliform/fecal streptococci ratio (FC/FS) as an indicator of fecal bacteria

source. Springs, streams, and wells in two agricultural watersheds typical of central Kentucky were monitored for fecal coliform and fecal streptococci from December 1991 to January 1993. Springs and wells exceeded primary contact water standards, between 28 and 74% of the time; streams exceeded water quality standards between 87 and 100% of the time. When fecal bacteria were present, rainfall rapidly moved them from the soil surface into spring and well water. At two springs in Fleming county, only 29% of samples exceeded primary contact standards before cattle were present; 80% exceeded standards after cattle began grazing the surrounding pasture. Monthly sampling adequately reflected the extent of fecal contamination in our study, which had relatively continuous cattle grazing. Although the FC/FS ratio identified domestic animal contamination sources, it did not distinguish between domestic animal and human sources of contamination.
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55. Fecal coliform and streptococcus concentrations in runoff from grazed pastures in northwest Arkansas.

Edwards, D. R.; Coyne, M. S.; Vendrell, P. F.; Daniel, T. C.; Moore, P. A.; and Murdoch, J. F.

Water Resources Bulletin 33(2): 413-422. (1997)

NAL Call #: 292.9 Am34; ISSN: 0043-1370

Descriptors: agricultural runoff/ cattle/ coliforms/ Streptococcus/ pastures/ manure/ water quality standards/ grazing/ seasonal variations/ agricultural practices/ fecal coliforms/ fecal microflora/ pasture/ USA, Arkansas, Northwest

Abstract: Agricultural practices such as cattle grazing and animal manure application can contribute to relatively high runoff concentrations of fecal coliform (FC) and fecal streptococcus (FS). Available information, however, is inconsistent with respect to the effects of such practices as well as to measures that can discriminate among candidate sources of FC and FS. The objective of this study was to assess the effects of grazing, time of year, and runoff amounts on FC and FS concentrations and to evaluate whether FC/FS concentration ratios are consistent with earlier values reported as characteristic of animal sources. Runoff from four Northwest Arkansas fields was sampled and analyzed for fecal coliform (FC) and fecal streptococcus (FS) for nearly three years (1991-1994). Each field was grazed and fertilized, with two fields receiving inorganic fertilizer and two receiving animal manure. Runoff amount had no effect on runoff concentrations of FC or FS. There were no consistent relationships between the presence of cattle and FC and FS runoff concentrations. Both FC and FS concentrations were affected by the season during which the runoff occurred. Higher concentrations were observed during warmer months. Runoff FC concentrations exceeded the primary contact standard of 200 cfu/100 mL during at least 89 percent of all runoff events and the secondary contact standard of 1000 cfu/100 mL during at least 70 percent of the events. Ratios of FC to FS concentrations varied widely (from near zero to more than 100), confirming earlier findings that FC/FS ratios are not a reliable indicator of the source of FC and FS.
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56. Fecal contamination of pastoral wetlands.

Collins, R.

Journal of Environmental Quality 33(5): 1912-1918. (2004)

NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: wetlands/ cattle/ solar radiation/ contamination/ bacterial/ grazing/ bacteria (enterobacteriaceae) (escherichia)/ catchment areas/ storms/ temperature/ rainfall/ high flow/ excretion/ statistical models/ storm seepage/ feces/ survival/ water quality control/ livestock/ water quality/ catchments/ seasonal variations/ mathematical models/ environmental quality/ Escherichia coli/ New Zealand

Abstract: Near-channel hill-country wetlands draining steep pastoral land in New Zealand exhibit high levels of fecal contamination at a range of flows. This contamination is attributed to both the transport of bacteria into a wetland from the surrounding catchment and the direct excretion of fecal material onto wetlands by grazing cattle. E. coli concentrations observed at low to moderate flow at 20 sites varied between 0.5×10^1 and 2×10^4 most probable number (MPN) 100 mL⁻¹. High flow concentrations measured at two wetlands ranged up to 6×10^6 MPN 100 mL⁻¹ and yielded storm period bacterial loads of between 1×10^6 and 3×10^{10} MPN per event. Given the disproportionately large fraction of surface and subsurface flow from the catchment that passes through the wetlands, these yields represent a large proportion of the total loss of bacteria from steep grazed hillsides, across a range of storm events. Cattle are attracted to the smaller, shallower wetlands for grazing in both summer and winter. Excluding stock from shallow wetlands may therefore yield improvements in bacterial water quality, although accurately quantifying this improvement is difficult without long-term studies. Cattle are not attracted to larger, deeper wetlands, presumably for fear of entrapment, and fencing them is unlikely to realize significant improvements in bacterial water quality. A statistical model incorporating solar radiation and flow explains 87% of the variance in E. coli concentrations across five monitored rainfall events. A positive correlation was found between solar radiation and E. coli concentration. The study was conducted in winter when clear, sunny days are relatively cold. Solar radiation on these days appears to be too weak to promote die-off but the colder temperatures aid survival.
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57. Fertilisers and phosphorus loss from productive grazing systems.

Nash, David M. and Halliwell, David J.

Australian Journal of Soil Research 37(3): 403-429. (1999)

NAL Call #: 56.8 Au7; ISSN: 0004-9573

Descriptors: fertilizer management/ productive grazing systems

Abstract: This paper reviews phosphorus loss from productive high rainfall grazing systems. In particular it describes the processes occurring when phosphatic fertilisers are added to soil, the different pathways through which fertiliser and other nutrient sources may contribute to phosphorus losses, and an evaluation of the management strategies aimed at minimising phosphorus loss. It is now generally accepted that soil is not an endless sink for phosphorus uptake and that at the landscape scale the highest concentrations of phosphorus loss occur in surface runoff, followed by macropore flow and vertical matrix flow.

However, loads of phosphorus lost through these pathways are unknown. The development of an understanding of the transport mechanisms and phosphorus species being transported is fundamental to developing management strategies that are effective in decreasing phosphorus losses from grazing systems.

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58. Grassland management effects on soil surface properties in the Ozark Highlands.

Brye, K. R. and West, C. P.

Soil Science 170(1): 63-73. (Jan. 2005)

NAL Call #: 56.8 So3; ISSN: 0038-075X

Descriptors: grassland soils/ grasslands/ silt loam soils/ grazing/ mowing/ bulk density/ soil pH/ soil chemistry/ exchangeable cations/ prairies/ pastures/ surface layers/ soil fertility/ soil nutrients/ Arkansas

This citation is from AGRICOLA.

59. Grazing management affects soil phosphorus and potassium levels.

Gerrish, J. R.; Peterson, P. R.; and Brown, J. R.

American Forage and Grassland Council Proceedings 4: 175-179. (1995)

NAL Call #: SB193.F59

This citation is from AGRICOLA.

60. Grazing systems to maximize forage and minimize P, N, and sediment pollution of streams.

Russell, Jim; Haan, Matthew M.; Powers, Wendy; Schultz, Richard; Mickelson, Steve; Ahmed, S.; and Kovar, John.

In: *Proceedings: Agriculture and the Environment: The Challenge of Change*. (Held 4 Mar 2002-6 Mar 2002 at Ames, Iowa.)

http://www.ans.iastate.edu/faculty/wpowers/acc/pub/Systems_to_maximize_forage_and_minimize.pdf

Descriptors: sediments/ agricultural runoff/ phosphorus/ pastures/ grazing management

61. Headwater stream response to grassland agricultural development in New Zealand.

Riley, R. H.; Townsend, C. R.; Niyogi, D. K.; Arbuttle, C. A.; and Peacock, K. A.

New Zealand Journal of Marine and Freshwater Research 37(2): 389-403. (2003)

NAL Call #: QH91.57.A1N4; ISSN: 0028-8330

Descriptors: biological diversity/ community composition/ food webs/ streams/ agricultural land/ land use/ grasslands/ man-induced effects/ agriculture/ agricultural runoff/ nutrients (mineral)/ environmental impact/ rivers/ chemical limnology/ ecosystem disturbance/ aquatic organisms/ zoobenthos/ aquatic plants/ vegetation cover/ grain size/ sediments/ Invertebrata/ New Zealand

Abstract: Agricultural development of native grasslands may change stream physico-chemistry in ways that provide both subsidies and stresses to the system. The aims of this study were to determine: (1) which physico-chemical parameters respond most strongly to agricultural development; (2) how biodiversity, community composition, and food-web structure responded to these changes; and (3) to determine the balance between negative and positive impacts of these subsidies and stresses based on the analysis of 18 headwater streams. Developed pasture streams had increased nutrient loading, alterations to streamside vegetation, increased fine sediment

composition, and lower moss coverage of streambeds than undeveloped or lightly grazed native grassland catchments (which could not be distinguished from one another). These differences were associated with higher numbers of macroinvertebrate taxa and higher numbers of macroinvertebrates indicating that the net effects of these subsidies and stresses associated with agricultural development were positive within these headwater stream reaches.

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62. Hydrology and soil loss from a high fertility rotational pasture program.

Owens, L. B.; Van Keuren, R. W.; and Edwards, W. M.

Journal of Environmental Quality 12(3): 341-346. (1983)

NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: Dactylis glomerata/ Festuca arundinacea/ beef management program/ Ohio/ USA/ watershed/ grazing/ feeding/ hay/ surface runoff/ H flume/ Coshocton wheel

Abstract: Five small watersheds (0.25-3.1 ha) on sloping uplands in eastern Ohio [USA] were used to evaluate environmental effects of a beef management program of rotational summer grazing on one area, and rotational winter grazing/feeding with stored hay on another area. During the 5-yr study, annual precipitation was 1080 mm, which was 8-15% greater than the long-term average. The surface runoff was measured by precalibrated H-flumes, and automatically sampled using Coshocton wheels. Surface runoff from watersheds with beef cattle management increased, compared with the long-term averages when hay was grown on the watersheds. Greater precipitation was the primary factor causing more runoff during the growing season (May-Oct), and the cattle management was a major contributing influence on the runoff increase during the dormant season (Nov.-April). Maintenance of good vegetative cover [Dactylis glomerata, Festuca Arundinacea] on the study areas was a major factor in limiting annual average surface runoff to < 110 mm, which was a relatively small amount. The large runoff events, although a small percentage of the total number of events, produced most of the runoff volume. Soil loss from these pastures was minimal.

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63. Hydromorphological and biological factors influencing sediment and phosphorus loss via bank erosion in small lowland rural streams in Denmark.

Laubel, A.; Kronvang, B.; Hald, A. B.; and Jensen, C.

Hydrological Processes 17(17): 3443-3463. (2003)

NAL Call #: GB651.H93; ISSN: 0885-6087

Descriptors: bank erosion/ suspended sediments/ streams/ phosphorus/ catchment areas/ topsoil/ vegetation/ hydrologic models/ stream banks/ soil erosion/ catchment area/ spatial variations/ resuspended sediments/ agricultural runoff/ vegetation cover/ sediments/ agriculture/ river banks/ Denmark

Abstract: Bank erosion was measured at 91 stream banks located in 15 Danish rural 1st and 2nd order streams over a 2-year period. Our aims were firstly to examine factors controlling spatial variation in bank erosion, secondly to estimate sediment and phosphorus (P) loss via bank erosion. The overall mean bank erosion rate was 11 mm year super(-1). Bank erosion rate over the 2-year period was significantly related to a number of site-specific

characteristics, including bank angle, bank vegetation cover, overhanging bank and estimated stream power. An empirical model for bank erosion based on these descriptive variables yielded a 55% explanation of the observed spatial variation in bank erosion rate. Bank erosion was higher at the lower 50-cm bank section (20 mm year super(-1)) than at the upper bank (6 mm year super(-1)). Cattle fencing in grazed areas and buffer zones with riparian woodland lowered bank erosion rates. We found that total P content of bank material was high (0.64 g P kg super(-1)) and at the same level as found in agricultural topsoil along the streams. The overall annual catchment loss of bank-derived clay-silt sediment and total P to streams amounted to 58-72 kg sediment ha super(-1) and 0.23-0.28 kg P ha super(-1), respectively. In comparison, the mean annual suspended sediment (SS) and total P losses from 14 similar sized Danish agricultural catchments were 122 kg SS ha super(-1) and 0.58 kg P ha super(-1) over the 2-year study period. Thus, bank erosion seems to be a major contributor of suspended sediment and P in this type of small channelized lowland stream.

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64. Impact of cattle treading on hill land: Soil damage patterns and pasture status.

Sheath, G. W. and Carlson, W. T.

New Zealand Journal of Agricultural Research 41(2): 271-278. (1998)

NAL Call #: 23 N4892; ISSN: 0028-8233

Descriptors: cattle/ grazing management/ hill land/ sustainability/ treading

Abstract: An experiment was conducted on steep hill land in New Zealand to describe the pattern of cattle treading that occurred from a single damage event during winter. The experiment also measured some of the consequences of treading and sought to define the subsequent grazing management which promoted the most rapid recovery of pasture. In hill paddocks of mixed topography, damage of the soil surface was greatest on animal tracks/camps and easy contoured areas (<25°) where cattle prefer to walk. Evidence of this initial winter impact disappeared over spring, most rapidly on easy contoured areas and under continuous sheep grazing. To promote rapid recovery of damaged paddocks continued grazing of cattle during spring should be avoided. At high levels of damage (>50% soil surface), puddling on tracks/camps and skid damage on steep inter-tracks became frequent. These processes are significant because animal tracks/camps act as important channels for surface water flow in hill lands; and disturbed, inter-track areas are an important source of sediment runoff. During spring, pasture growth rates were reduced by treading damage. From a systems context this could represent losses of 5-10 kg DM ha⁻¹ d⁻¹ during early-mid spring. Pasture cover and growth rates had fully recovered by early December.

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65. Impact of cattle treading on hill land: Soil physical properties and contaminant runoff.

Nguyen, M. L.; Sheath, G. W.; Smith, C. M.; and Cooper, A. B.

New Zealand Journal of Agricultural Research 41(2): 279-290. (1998)

NAL Call #: 23 N4892; ISSN: 0028-8233

Descriptors: cattle/ livestock/ soil erosion/ infiltration/

density/ soil porosity/ contamination/ soil physical properties/ runoff/ rainfall/ agriculture/ soil/ physicochemical properties/ simulation

Abstract: A simulated rainfall study carried out as part of a larger grazing experiment was conducted to investigate the effects of a 2-3 day cattle-treading event in winter on soil physical properties and contaminant (sediment and nutrient) runoff in topographically variable hill land. Measurements were made on two land zones: easy contoured ridges and gullies (15-24 degree slope) and steep inter-track land (28-39 degree slope). Simulated rainfall was applied to 16 plots (0.5 m super(2)) with a range of treading damage for each land zone within 14 days of the treading event. Simulated rainfall was repeated on the same plots in the following summer and winter to assess the recovery of soil from treading damage. Treading damage reduced water infiltration rate, particularly in the steep zone. It also caused a significant increase in the transport of suspended solids (SS), total Kjeldahl nitrogen (TKN), and total phosphorus (TP) from the plots during simulated runoff. On the steep inter-track zone, damaged areas had a 46% lower infiltration rate, and runoff from these areas contained on average 87% more sediment, and 89% more N and 94% more P compared with undamaged areas. These effects had disappeared six months later. The rainfall simulation and soil physical studies show that a 2-3 day winter treading event may increase soil bulk density, reduce soil macroporosity and total porosity, and lead to a decrease in the water infiltration rate and an increase in contaminant runoff.

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66. Impact of excreted nitrogen by grazing cattle on nitrate leaching.

Hack-ten Broeke, M. J. D.; Groot, W. J. M. de.; and Dijkstra, J. P.

Soil Use and Management 12(4): 190-198. (1996)

NAL Call #: S590.S68; ISSN: 0266-0032

Descriptors: cattle/ grazing/ excreta/ nitrogen/ losses from soil/ nitrates/ leaching/ nitrate nitrogen/ nitrogen content/ spatial distribution/ soil water/ simulation models/ grassland soils/ sandy soils/ soil water content/ soil heterogeneity/ unsaturated flow/ water pollution/ drinking water/ health hazards/ Netherlands

Abstract: At De Marke experimental farm, data on water and nitrogen flows in the unsaturated zone were gathered on two grazed pastures on sandy soils during the years 1991 to 1994. These provided a basis for calibration and validation of simulation models. The different levels of nitrate-N concentrations of the two plots could largely be explained by differences in crop uptake and simulated denitrification as influenced by different groundwater levels. The irregular distribution of excreta was taken into account by a simulation study quantifying the variability of nitrate-N concentrations under a grazed field. The resulting distribution of simulated nitrate-N concentrations explained the average and peak values of the measured concentrations. Temporal variability of weather was used to assess the nitrate leaching risk under urine patches deposited in either July or September. At site A the probability of exceeding the EC-directive by drinking water (11.3 mg/l nitrate-N) under a urination deposited in either July or September was respectively 10 and 25%. The average field concentration at this site will hardly ever be a high risk for the environment under the current farm

management. At site B the EC-directive will be exceeded under any urine patch in almost 100% of the years, affecting the field average concentration. In field B careful grazing management would result in less nitrate leaching, but the environmental goals would not be reached. This citation is from AGRICOLA.

67. Impact of grazing management on soil nitrogen, phosphorus, potassium, and sulfur distribution.

Mathews, B. W.; Sollenberger, L. E.; Nair, V. D.; and Staples, C. R.
Journal of Environmental Quality 23(5): 1006-1013. (1994)
NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: range management/ Cynodon dactylon/ rotational grazing/ soil fertility/ nitrogen/ phosphorus/ potassium/ sulfur/ soil pH/ drainage water/ water quality/ soil horizons

Abstract: Little information is available directly comparing soil nutrient distribution under different defoliation managements. During 1990 (116 d) and 1991 (141 d), 'Callie' bermudagrass (*Cynodon dactylon* var. *aridus* Harlan et de Wet) pastures grazed by Holstein heifers (*Bos taurus*) were used to determine the effects of two rotational stocking methods and continuous stocking on lateral and vertical distribution of extractable N, P, K, and S. A hay management also was included to compare soil responses under grazing and clipping. Nutrient distribution and concentration in the Ap1 horizon (0- to 15-cm soil depth) did not differ among grazing methods, but N, P, and K accumulated in the third of the pastures closest to shade, water sources, and supplement feeders (lounging areas where cattle tend to congregate or rest). Similar observations were made with K in the Ap2 horizon (15- to 30 cm soil depth). Nutrient concentrations were lower or tended to be lower in the Ap1 horizon of the hay management than in grazed pastures because of nutrient removal in harvested herbage. Across defoliation managements, greater extractable N, P, and K concentrations were observed in the Ap1 horizon in 1991 than in 1990. For N and K, this was attributed to fertilizer inputs in all managements and partially to supplemental feed inputs in d pastures. Increases in extractable P appeared to be associated primarily with flooding of the experimental site in late 1991. This study suggests that grazing method of well-managed pastures may have little effect on short-term (2 yr) soil nutrient distribution, especially when grazing occurs during months when temperatures are high.

This citation is from AGRICOLA.

68. The impact of increasing the length of the cattle grazing season on emissions of ammonia and nitrous oxide and on nitrate leaching in England and Wales.

Webb, J.; Anthony, S. G.; Brown, L.; Lyons Visser, H.; Ross, C.; Cottrill, B.; and Scholefield, D.
Agriculture, Ecosystems & Environment 105(1-2): 307-321. (2005)

NAL Call #: S601 .A34; ISSN: 0167-8809
Descriptors: ngauge model: mathematical and computer techniques/ ammonia emission model: mathematical and computer techniques/ grazing season extension model: mathematical and computer techniques/ manure nitrogen evaluation routine model: manner model, mathematical and computer techniques/ cattle grazing season

Abstract: Ammonia (NH₃) emissions from cattle are much

less when they are grazing than when they are housed. The urine excreted during grazing may rapidly infiltrate soil whereas it remains on the surface of impermeable floors and yards. If the average grazing season for the UK herd could be extended from 6 to 8 months, NH₃ emissions from cattle could potentially be reduced by ca. 15% (of the total for all livestock) if the cattle spend all of the extra grazing days outdoors. The main objective of this desk study was to assess the potential of extended season grazing to reduce NH₃ emissions from UK cattle farming. The impacts on nitrate (NO₃⁻) leaching and nitrous oxide (N₂O) emissions were also estimated. A simple process-based model was developed to quantify the potential for extending the grazing season. A farm-scale model of NH₃ emissions at the farm-scale, based on published emission factors for UK agriculture, was used to estimate NH₃ emissions. Losses of NO₃⁻ following slurry spreading were estimated using the MANNER model, while NO₃⁻ leaching and denitrification losses during grazing were taken from output by the NGAUGE model. We conclude that one month's extra grazing (based on the animals being outside for all of that month, day and night) may reduce NH₃ emissions from slurry-based systems by ca. 9% and for FYM-based systems by ca. 7% compared with losses from the current ca. 180-day winter housing period. However, in practice cattle are not outdoors all day during the extended grazing period. If it is assumed that cattle graze for an average of 4 h per day over the extended period, then the monthly reduction in NH₃ emissions may be only ca. 1-2%. At all sites most of this conserved N was predicted to be lost as NO₃⁻. For slurry-based systems this could be at least 80%. For FYM-based leaching was always greater than the NH₃ systems. For which there was less potential to conserve NH₃, the increase in NO₃⁻ conserved. The effects on direct emissions of N₂O were estimated to be negligible, if grazing began earlier in spring or perhaps some reduction when grazing continues for longer in autumn. We conclude that extending the grazing season will increase - leaching and that further studies are needed to fully evaluate the potential for reducing emissions of NH₃. Copyright 2004 Elsevier B.V. All rights reserved.

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69. Impact of land use on the faecal microbial quality of hill-country streams.

Donnison, A.; Ross, C.; and Thorrold, B.
New Zealand Journal of Marine and Freshwater Research 38(5): 845-855. (2004)

NAL Call #: QH91.57.A1N4; ISSN: 0028-8330
Descriptors: streams/ forests/ land use/ water pollution/ pollution indicators/ seasonal variations/ recreation/ freshwater environments/ sampling/ public health/ biological pollutants/ microbial contamination/ pathogenic bacteria/ environment management/ stream flow/ agriculture/ recreational waters/ rivers/ *Escherichia coli*/ *Pinus radiata*/ New Zealand, North I., Waikato, Whatawhata

Abstract: Faecal contamination of rural streams is of increasing concern in New Zealand. This study assessed hill-country streams in the Whatawhata district that were impacted by pastoral farming, indigenous forest, or *Pinus radiata* forest; by measuring *Escherichia coli* bacteria at 14 sampling sites fortnightly for 2 years. *E. coli* concentrations were highest in streams flowing through grazed pasture. In both years there was a noticeable seasonal pattern in all streams irrespective of land use, with highest bacterial

concentrations in summer and autumn and lowest in winter and early spring. There was no obvious correlation between *E. coli* concentration and rainfall or stream flow. In those streams impacted by a change in land use from pastoral to pines during the study, *E. coli* concentration fell rapidly and remained at levels lower than those in streams impacted by either indigenous or 7-year pine forests. As *E. coli* was detected in all but two samples, the water in these streams is not suitable for human consumption. The pastoral streams consistently failed to meet stock drinking-water guidelines (median concentration not greater than 100 *E. coli* 100 ml super(-1)) and the forest streams failed to do so in summer. Twenty-eight percent of pastoral samples, 25% of indigenous forest samples, 14% of 7-year pine forest samples, and 5% in New Pines stream samples (after planting) had *E. coli* concentrations associated with a high level of risk for contact recreation (>500 *E. coli* 100 ml super(-1)) and the high concentrations usually occurred in summer.

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70. The impact of sheep trampling and stocking rate on the physical properties of a red duplex soil with two initially different structures.

Proffitt, A. P. B.; Jarvis, R. J.; and Bendotti, S.
Australian Journal of Agricultural Research 46(4): 733-747. (1995)

NAL Call #: 23 Au783; ISSN: 0004-9409

Descriptors: livestock industry/ grazing/ hydraulic conductivity/ seasonality

Abstract: The effect of sheep trampling and stocking rate on the physical properties of a red duplex soil with two initially different structures was examined over an 8 week period when the soil was wet following winter rains. The experimental site was located at Merredin in Western Australia where the average annual rainfall is 307 mm. A previous long-term tillage and gypsum trial at the experimental site had resulted in the development of contrasting topsoil structures. Three grazing treatments were imposed at the trial site: grazing at the normal high stocking rate (8 DSE ha⁻¹), grazing at half the normal stocking rate (4 DSE ha⁻¹), and no grazing (where pasture was mown to simulate grazing without trampling). Topsoil structure was assessed by measuring water-stable aggregation (gt 2 mm diameter aggregates), the relative contribution of dispersion and staking to structural instability (measured as soil strength on lt 2 mm fine earth soil fractions), steady-state infiltration rates (at 10 mm tension), and in situ soil strength characteristics (measured as penetration resistance). At the end of the grazing period, all structure attributes measured showed that topsoil structure had been damaged as a result of sheep trampling. The magnitude of such structure damage was affected by the initial physical condition of the soil and stocking rate. When compared with ungrazed pasture, there was a greater decline in structural condition as a consequence of grazing on less well-structured soil than on better-structured soil. Halving the normal stocking rate reduced the degree of structure damage on both soils. Within-season variability in soil hydraulic properties was large. The temporal changes in infiltration rates were attributed to changes in drainage pore volume brought about by the growth and decay of pasture roots, the formation and disruption of a surface crust, and the processes of soil compaction and remoulding resulting from animal trampling (no direct measurements

were made). The variability in hydraulic behaviour found in this study emphasizes the need to maintain consistent sampling dates and soil water contents at sampling in long-term studies on soil structure changes.

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71. Impact of tree clearing on soil pH and nutrient availability in grazing systems of central Queensland, Australia.

Sangha, K. K.; Jalota, R. K.; and Midmore, D. J.
Australian Journal of Soil Research 43(1): 51-60. (2005)
NAL Call #: 56.8 Au7; ISSN: 0004-9573

Descriptors: ammonium/ calcium/ copper/ deforestation/ electrical conductivity/ exchangeable calcium/ exchangeable magnesium/ exchangeable potassium/ exchangeable sodium/ grazing systems/ iron/ land clearance/ land productivity/ magnesium/ manganese/ nitrate/ nitrogen/ nutrient availability/ pastures/ phosphorus/ plant communities/ potassium/ sodium/ soil degradation/ soil depth/ soil fertility/ soil pH/ soil properties/ zinc

Abstract: In Queensland, Australia, land is cleared at high rates to develop pastures for enhanced production and the associated monetary gains. However, pasture production declines over time in cleared pastures until a new equilibrium is reached. The present study focused on elucidating the reasons for decline in pasture production and finding the key soil properties that are affected due to clearing. Paired sites for cleared and uncleared pastures were selected to represent 3 dominant tree communities of the semiarid tropics in central Queensland, i.e. *Eucalyptus populnea*, *E. melanophloia*, and *Acacia harpophylla*. The cleared pastures were chosen to represent 3 different durations of time since clearing (5, 11-13, and 33 years) to evaluate the temporal impact of clearing on soil properties. Various soil parameters were studied: macronutrients - available N (NH₄⁺ and NO₃⁻), total N, and available P; micronutrients - Cu, Fe, Zn, and Mn; exchangeable cations - Ca, Mg, Na, and K (also macronutrients); pHw; and electrical conductivity. Of these, pHw showed a significant response to time of clearing for all 3 tree communities. Soil pHw increased significantly at cleared sites relative to uncleared (native woodland) pastures, and the increase was highly correlated with concentrations of exchangeable Ca, Mg, and Na. The change in soil pHw and exchangeable cations was more evident at >0.30 m soil depth. The increase in soil pHw in cleared pastures decreased the availability of soil nutrients for plant growth and, hence, pasture productivity. The interactions of different soil properties down the profile as a result of changes caused by clearing are important when interpreting the effects of clearing on soil properties.

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72. Impacts of intensive rotational grazing on stream ecology and water quality.

Undersander, D. J. and Paine, L.
Sustainable Agriculture Research and Education (Sare) Research Projects North Central Region: 1 portfolio. (1998)
NAL Call #: S441.S8553

Descriptors: rotational grazing/ streams/ water quality/ environmental impact/ dairy farming/ livestock production/ Wisconsin

This citation is from AGRICOLA.

73. The impacts of nitrogen fertilisation and increased stocking rate on pasture yield, soil physical condition and nutrient losses in drainage from a cattle-grazed pasture.

Monaghan, R. M.; Paton, R. J.; Smith, L. C.; Drewry, J. J.; and Littlejohn, R. P.

New Zealand Journal of Agricultural Research 48(2): 227-240. (2005)

NAL Call #: 23 N4892; ISSN: 0028-8233

Descriptors: fertilization: applied and field techniques/ land management: applied and field techniques/ pasture yield/ soil physical condition

Abstract: The effects of increasing nitrogen (N) fertiliser inputs, and associated cattle stocking rates, on pasture yield and composition, soil physical quality and nutrient losses in drainage were measured in an experiment on permanent white clover/ryegrass pastures in eastern Southland, New Zealand. Treatments were established on hydrologically-isolated replicate plots (900 m²) where pastures received annual fertiliser N inputs of 0, 100, 200 or 400 kg ha⁻¹ and were grazed throughout spring, summer, and autumn of each year by non-lactating dairy cattle. Our aim was to determine if N fertilisation of cattle pastures led to the deterioration of pasture or soil quality, or to the excessive loss of nutrients in drainage over the 3-4 years after such land management started. Pasture and soil monitoring showed that N fertilisation and increased stocking rate resulted in large, but variable, increases in pasture yield, with little discernible effect on soil physical condition, as evidenced by twice-yearly measurements of soil bulk density, percentage of soil pores >300 µm, soil macroporosity (volumetric percentage of pores >30 µm), hydraulic conductivity, and air permeability. A cyclical pattern of spring soil compaction followed by recovery over summer, autumn, and winter was evident in the 0-5 cm soil layer within all treatments. Mean annual pasture responses to applied fertiliser N were 14.8, 12.9, and 9.1 kg DM kg⁻¹ N applied in the 100, 200, and 400 N treatments, respectively, with greater responses observed in spring than in autumn in 3 out of 4 years. N fertilisation significantly increased losses of nitrate-N and Ca in drainage but had no significant effect on K, Mg, Na, sulphate-S, Cl, and P drainage losses. Within the context of the potential for enriching groundwater supplies of domestic drinking water, these losses suggest that annual fertiliser N inputs should not exceed approx. 17C kg N ha⁻¹ yr⁻¹ at this site. Considered from the perspective of potential surface water enrichment with P and N promoting nuisance weed and algal growth, losses of N and P in drainage water exceeded currently accepted guidelines, especially for N. The responses measured in this study represent a system that has recently undergone an improvement in soil fertility along with a change from sheep to cattle grazing. We thus caution that our findings pertain to short-term changes in soil and plant responses and may not accurately reflect those in a system that has been in long-term (>20 years) equilibrium.

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74. Impacts of rotational grazing and riparian buffers on physicochemical and biological characteristics of southeastern Minnesota, USA, streams.

Sovell, Laurie A.; Vondracek, Bruce; Frost, Julia A.; and Mumford, Karen G.

Environmental Management 26(6): 629-641. (2000)

NAL Call #: HC79.E5E5; ISSN: 0364-152X

Descriptors: principal component analysis: pca, mathematical method/ canopy cover/ grass buffers/ pastures: continuously grazed, rotationally grazed/ percent fines: streambed/ physical habitat: stream quality parameter/ riparian buffer management/ riparian management/ stream quality/ stream restoration/ turbidity/ water chemistry: stream quality parameter/ watershed/ wood buffer

Abstract: We assessed the relationship between riparian management and stream quality along five southeastern Minnesota streams in 1995 and 1996. Specifically, we examined the effect of rotationally and continuously grazed pastures and different types of riparian buffer strips on water chemistry, physical habitat, benthic macroinvertebrates, and fish as indicators of stream quality. We collected data at 17 sites under different combinations of grazing and riparian management, using a longitudinal design on three streams and a paired watershed design on two others. Continuous and rotational grazing were compared along one longitudinal study stream and at the paired watershed. Riparian buffer management, fenced trees (wood buffer), fenced grass, and unfenced rotationally grazed areas were the focus along the two remaining longitudinal streams. Principal components analysis (PCA) of water chemistry, physical habitat, and biotic data indicated a local management effect. The ordinations separated continuous grazing from sites with rotational grazing and sites with wood buffers from those with grass buffers or rotationally grazed areas. Fecal coliform and turbidity were consistently higher at continuously grazed than rotationally grazed sites. Percent fines in the streambed were significantly higher at sites with wood buffers than grass and rotationally grazed areas, and canopy cover was similar at sites with wood and grass buffers. Benthic macroinvertebrate metrics were significant but were not consistent across grazing and riparian buffer management types. Fish density and abundance were related to riparian buffer type, rather than grazing practices. Our study has potentially important implications for stream restoration programs in the midwestern United States. Our comparisons suggest further consideration and study of a combination of grass and wood riparian buffer strips as midwestern stream management options, rather than universally installing wood buffers in every instance.

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75. Implications of nitrogen fertilizer applications and extended grazing for the N economy of grassland.

Laidlaw, A. S.; Watson, C. J.; and Mayne, C. S.

Grass and Forage Science 55(1): 37-46. (Mar. 2000)

NAL Call #: 60.19 B773; ISSN: 0142-5242

Descriptors: sward/ grasslands/ nitrogen balance/ grazing/ range management/ urea/ soil fertility/ nutrient availability/ nitrogen/ dry matter accumulation/ application timing/ Northern Ireland

This citation is from AGRICOLA.

76. Influence of cattle trampling on preferential flow paths in alkaline soils.

Dreccer, M. F. and Lavado, R. S.

Soil Use and Management 9(4): 143-148. (1993)

NAL Call #: S590.S68; ISSN: 0266-0032

Descriptors: pampas soils/ Mollisols/ Alfisols/ alkaline soils/ cattle/ water flow/ soil water/ macropore flow/ soil pore

system/ soil texture/ soil organic matter/ soil pH/ textural soil types/ grazing/ flooded conditions/ Natraquolls/ Natraqualfs/ porosity/ Argentina

Abstract: Preferential flow paths (PFP) are important in water and solute movement through soils, especially in regions where vertical water movements predominate, such as the flooding Pampa (Argentina). The impact of grazing on PFP and its interactions with other properties were studied in three soils with natric horizons in the flooding Pampa using an iodide colouring technique. In the soil with a mollic horizon (Typic Natraquoll), % PFP was decreased by trampling but was later restored by shrink-swell. In the Typic Natraqualf, the most alkaline of the studied soils, % PFP was very small under both grazed and ungrazed conditions. In a coarser textured soil (Mollic Natraqualf) trampling did not affect % PFP. The % PFP of the Ah horizons increased with increasing organic carbon and sand contents and decreased as clay content, pH and sodium adsorption ratio (SAR) increased. The Bt horizons had small % PFPs and were not affected by cattle trampling.

This citation is from AGRICOLA.

77. Influence of cattle trampling on soil porosity under alternate dry and ponded conditions.

Taboada, M. A. and Lavado, R. S.

Soil Use and Management 9(4): 139-143. (1993)

NAL Call #: S590.S68; ISSN: 0266-0032

Descriptors: Mollisols/ pampas soils/ A horizons/ cattle/ soil pore system/ soil water content/ soil mechanics/ soil compaction/ dry environmental conditions/ seasonal variation/ shrinkage/ soil aggregates/ grazing/ flooded conditions/ Natraquolls/ porosity/ Argentina

Abstract: Abstract: The impact of cattle trampling on the porosity of a representative soil (Typic Natraquoll) of the flooding Pampa of Argentina was studied from 1984 to 1987. Water content, total porosity (TP), macroporosity (> 30 micrometer) and mean weight diameter of water-stable aggregates (MWD) were determined in undisturbed topsoil samples taken from adjacent continuously grazed (1.0 animal unit/ha/yr) and ungrazed (since 1976) areas. It was expected that trampling would decrease macroporosity when the soil was ponded, and that the damaged macropores would regenerate during the subsequent soil drying. This was only partly verified. The soil varied in TP from 58 to 64% in the ungrazed area, and from 53 to 78% in the grazed area. This variation resulted mainly from shrink-swell processes. Trampling decreased soil macroporosity (mainly > 60 micrometer) from 8 to 5% and decreased MWD from 5.35 to 4.58 mm under dry soil conditions. The damaged soil pores regenerated and aggregate stability recovered during the subsequent period of surface water ponding, when soil swelling increased macropores in the grazed area but not in the ungrazed area. There was no evidence of poaching damage in this soil.

This citation is from AGRICOLA.

78. The influence of cutting and grazing on phosphorus and nitrogen in irrigation runoff from perennial pasture.

Mundy, G. N.; Nexhip, K. J.; Austin, N. R.; and Collins, M. D.

Australian Journal of Soil Research 41(4): 675-685. (2003)

NAL Call #: 56.8 Au7; ISSN: 0004-9573

Descriptors: flood irrigation: applied and field techniques/

regression model: mathematical and computer techniques/ animal excreta/ cutting impacts/ grazing impacts/ perennial pasture: flood irrigated/ runoff: flow weighted nitrogen concentration, flow weighted phosphorus concentration, total kjeldahl nitrogen concentration/ severely defoliated pasture/ stocking intensities/ successive flood irrigation events

Abstract: Runoff from flood-irrigated perennial pastures generally contains higher phosphorus (P) and nitrogen (N) concentrations than the irrigation water applied to the pastures. We examined the sources of P and N that could contribute to these elevated nutrient concentrations in runoff. The first experiment compared P and N losses in runoff from pasture cut to different residual pasture masses. Flow-weighted P and N concentrations and loads were about 100% higher from pasture cut to 47 mm above ground than from pasture standing at 155 mm. These results indicated that severely defoliated pasture may be a significant source of nutrients when flood irrigated. In the second experiment, pastures were defoliated at a single grazing with different stocking intensities and the flow-weighted P and N concentrations in runoff were determined during 4 successive flood irrigation events. Nitrogen and P concentrations in runoff after the first irrigation following defoliation were higher at the highest stocking intensity. However, the effect of the grazing on nutrient concentrations in runoff declined in subsequent irrigation events. A regression model fitted to the P data indicated that there was a significant linear increase in P concentrations with stocking density and a significant non-linear decline in concentrations with successive irrigations. A similar relationship for TKN concentrations in runoff at each stocking density over the 4 irrigation events was not found. An inconsistency of the TKN concentrations of the supply water between irrigation events possibly helped to mask a similar relationship between N concentrations in runoff and stocking density over the 4 irrigation events. We postulate that both animal excreta and the pasture itself can contribute to elevated nutrient concentrations in flood-irrigation runoff.

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79. Influence of off-stream supplements on streambanks of riparian pastures.

McInnis, M. L. and McIver, J.

Journal of Range Management 54(6): 648-652. (2001)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/2001/546/648-652_mcinnis.pdf

Descriptors: grazing intensity/ beef cattle/ water erosion/ riverbank protection/ animal behavior/ dietary mineral supplements/ Oregon

Abstract: Accelerated erosion of streambanks in grazed riparian pastures is of concern to land managers. We tested the hypothesis that providing cattle free-choice off-stream water and trace mineralized salt would lessen negative impacts of grazing on cover and stability of streambanks compared to pastures lacking these amenities, and may therefore reduce the potential of accelerated erosion. The study was conducted on Milk Creek at the Hall Ranch Unit of the Eastern Oregon Agricultural Research Center near Union, Ore. Three replications each of 3 grazing treatments were examined: (1) non-grazed control; (2) grazed with supplemental water and trace mineralized salt provided ("supplemented"); and (3) grazed with no supplemental

water or salt ("nonsupplemented"). Each grazed pasture (approximately 12 ha) was stocked with cow-calf pairs for a mean stocking rate of 0.8 ha per AUM to achieve moderate grazing intensity of approximately 50% utilization of key forages. Pastures were grazed for 42 consecutive days during each of 2 years (1996-1997) beginning mid-July. Estimates of streambank cover ("covered" or "uncovered") and stability ("stable" or "unstable") were taken before (June) and after (September) grazing by examining 0.5 X 0.3 m plots placed on the greenline. Additionally, frequency of cattle hoof prints (number of plots with hoof prints/total number of plots) was measured as an indication of cattle presence in the greenline. Treatment effects were compared using one-way ANOVA. Streambank effects were consistent with observations of cattle distribution, with 26% of the streambank in supplemented pastures showing cattle presence (hoof prints), versus 31% for non-supplemented pastures. Off-stream water and salt attracted cattle into the uplands enough to significantly (p less than or equal to 0.05) reduce development of uncovered and unstable streambanks from 9% in non-supplemented pastures to 3% in supplemented pastures. An "erosion index" indicated no significant ($p < 0.05$) difference in potential accelerated streambank erosion between supplemented and non-supplemented pastures. This citation is from AGRICOLA.

80. Influence of pasture management on soil biological quality.

Banerjee, M. R.; Burton, D. L.; McCaughey, W. P.; and Grant, C. A.

Journal of Range Management 53(1): 127-133. (2000)
 NAL Call #: 60.18 J82; ISSN: 0022-409X
http://jrm.library.arizona.edu/data/2000/531/127-132_banerjee.pdf

Descriptors: soil water/ stocking rate/ rotational grazing/ nitrogen content/ carbon/ microorganisms/ biomass/ arylsulfatase/ enzyme activity/ alkaline phosphatase/ acid phosphatase/ Manitoba

Abstract: The long-term sustainability of pasture management systems, whether related to structural stability or nutrient dynamics, is dependent upon maintaining soil biological properties. This study investigates the extent to which the microbiological and biochemical properties of soil can change with season and pasture management system, including their likely value as indicators of soil quality. The experiment was conducted on a 30-ha pasture near Brandon, Manitoba. Seasonal fluctuations were observed in the soil microbial and biochemical properties. In general, these fluctuations were mainly independent of the small variations in soil organic matter content but were more closely related to soil water content. The data also suggests an impact of stocking rate and grazing system on soil microbial biomass C and on N mineralization potential. However, because duration of the investigation, limited number of replications and the high soil variability encountered, it is not yet possible to recommend any particular grazing system and/or stocking rate favorable for the maintenance of soil biological quality. The trends suggest that light, continuous grazing systems had the largest microbial biomass and nutrient mineralizing activity. This citation is from AGRICOLA.

81. Inorganic nitrogen in drainage water from grazed grassland in Northern Ireland.

Watson, C. J.; Jordan, C.; Lennox, S. D.; Smith, R. V.; and Steen, R. W. J.

Journal of Environmental Quality 29(1): 225-232. (2000)
 NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: drainage water/ environmental quality/ grazed grassland/ river catchment/ surface water quality

Abstract: The loss of inorganic N in drainage water from grazed perennial ryegrass (*Lolium perenne* L. cv. Talbot) swards in Northern Ireland was studied for 9 yr. Plots (each 0.2-ha area) were hydrologically isolated and artificially drained to V-notch weirs with flow-proportional monitoring of drainage water. Nitrogen, as calcium ammonium nitrate, was applied at 100, 200, 300, 400, or 500 kg N ha⁻¹ yr⁻¹. The efficiency of flow interception by drains decreased on average by 39% during the 9 yr. Annual loss of NO₃⁻ in drain flow for the plot receiving 300 kg N ha⁻¹ yr⁻¹ ranged from 16 to 52 kg N ha⁻¹ and was highest after a dry summer. In individual years, NO₃⁻ in drainage water was linearly related to fertilizer N input with 5 to 23% of the added N input being lost. The shape of the NO₃⁻ dose-response curve did not change with time. Annual losses of NH₄⁺ and NO₂⁻ in drainage water were not related to fertilizer rate, and ranged from 0.2 to 4 kg N ha⁻¹ and 8 to 540 g N ha⁻¹, respectively. Annual flow-weighted mean NO₃⁻, NH₄⁺, and NO₂⁻ concentrations usually did not exceed the European Community maximum admissible limits for drinking water below a fertilizer N application rate of 300 kg N ha⁻¹ yr⁻¹. However, the European Community guideline NH₄⁺ and NO₂⁻ concentrations in salmonid and cyprinid waters were exceeded at application rates ≥ 100 kg N ha⁻¹ yr⁻¹.

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82. Land use effects on soil carbon fractions in the southeastern United States: Management-intensive versus extensive grazing.

Conant, Richard T.; Six, Johan; and Paustian, Keith

Biology and Fertility of Soils 38(6): 386-392. (2003)

NAL Call #: QH84.8.B46; ISSN: 0178-2762

Descriptors: land use effects/ management intensive

versus extensive grazing/ pasture conditions

Abstract: Changes in grassland management intended to increase productivity can lead to sequestration of substantial amounts of atmospheric C in soils. Management-intensive grazing (MiG) can increase forage production in mesic pastures, but potential impacts on soil C have not been evaluated. We sampled four pastures (to 50 cm depth) in Virginia, USA, under MiG and neighboring pastures that were extensively grazed or hayed to evaluate impacts of grazing management on total soil organic C and N pools, and soil C fractions. Total organic soil C averaged 8.4 Mg C ha⁻¹ (22% greater under MiG; differences were significant at three of the four sites examined while total soil N was greater for two sites. Surface (0-10 cm) particulate organic matter (POM) C increased at two sites; POM C for the entire depth increment (0-50 cm) did not differ significantly between grazing treatments at any of the sites. Mineral-associated C was related to silt plus clay content and tended to be greater under MiG. Neither soil C:N ratios, POM C, or POM C:total C ratios were accurate indicators of differences in total soil C between grazing treatments, though differences in total soil C between treatments attributable to changes in POM C (43%) were larger than

expected based on POM C as a percentage of total C (24.5%). Soil C sequestration rates, estimated by calculating total organic soil C differences between treatments (assuming they arose from changing grazing management and can be achieved elsewhere) and dividing by duration of treatment, averaged 0.41 Mg C ha⁻¹ year⁻¹ across the four sites.

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83. Land-use effects on water quality in an intensively managed catchment in the Australian humid tropics.

Bramley, R. G. V. and Roth, C. H.

Marine and Freshwater Research 53(5): 931-940. (2002)
NAL Call #: GC1.A85; ISSN: 1323-1650

Descriptors: agricultural production/ agricultural run off/ catchment management/ ecotoxicology/ environmental degradation/ forestry/ freshwater ecology/ grazing impact/ humid tropical environments/ land use effects/ riverine ecology/ sediment loads/ water quality

Abstract: The minimization of environmental degradation that might arise as a result of agricultural production requires a detailed knowledge of the off-site effects of rural land use. This paper reports the results of an assessment of the effect of land use on water quality in the lower part of the catchment of the Herbert River, an intensively managed part of the humid tropics in north Queensland, where the major land uses are sugarcane production, cattle grazing and forestry. Compared with grazing and forestry, sugarcane production was found to have a significant impact on riverine water quality as evidenced by higher concentrations of nitrogen (N), phosphorus (P) and total suspended solids (TSS) in stream-waters draining land under sugarcane, a finding that was unaffected by the inclusion of sampling sites dominated by upper-catchment grazing. However, land use had no significant effect on the partitioning of N and P between mineral, organic and particulate phases in stream-waters, although the proportion in particulate form tended to be least for sugarcane-dominated sites. Irrespective of land use, the concentrations of both total N and P were dominated by soluble fractions, particularly in organic combination. These results suggest that, irrespective of the ecological impact of these nutrient and sediment loadings on freshwaters and the near-shore zone, there is considerable room for improvement in land management in the Australian humid tropics in terms of minimizing off-site export of both nutrients and sediment.

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84. Leaching of nitrate and other nutrients from a grazed pasture.

Steele, K. W.; Judd, M. J.; and Shannon, P. W.

New Zealand Journal of Agricultural Research 27(1): 5-12. (1984)

NAL Call #: 23 N4892; ISSN: 0028-8233

Descriptors: *Lolium perenne*/ *Trifolium repens*/ *Paspalum dilatatum*/ cattle/ percolation/ calcium

Abstract: The amounts of NO₃⁻ and other nutrients leached from an intensively grazed pasture [*Lolium perenne*, *Trifolium repens*, *Paspalum dilatatum*] over 1 yr were determined. Concentrations of NH₄⁺, NO₃⁻, Ca²⁺, Mg²⁺, Na⁺, K⁺, SO₄²⁻, PO₄³⁻ and Cl⁻ were measured in samples of water percolating through soil (Ruatangata friable clay) under cattle grazed pastures receiving 0 or 172 kg N/ha per yr as urea. Elemental concentrations varied

greatly with both site and time of collection. The equivalent concentrations of NO₃⁻ and Ca²⁺ were highly correlated ($r^2 = 0.96$) and could be used for estimating the equivalent concentrations of the other ions. For each unit increase in the concentration of NO₃⁻, the equivalent concentration of cations increased in the order: Ca > Mg > Na > K. The amount of element leached was calculated as the product of measured concentration and estimated drainage volume. Leaching losses over 1 yr (kg/ha nil-N treatment; kg/ha + N treatment) were thus estimated as N (88; 193); Ca (154; 216); Mg (32; 44); Na (71; 86); and K (14; 21), respectively. Rainfall and estimated drainage were 1840 and 985 mm, respectively.

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85. Long-term effects of various conservation management treatments on selected soil properties of chalk grassland.

Rizand, A.; Marrs, R. H.; Gough, M. W.; and Wells, T. C. E.

Biological Conservation 49(2): 105-112. (1989)

NAL Call #: S900.B5; ISSN: 0006-3207

Descriptors: grazing/ succession/ nitrogen/ mineralization/ phosphorus/ sorption

Abstract: Soils were collected from a long-term (22-year) conservation management experiment on chalk grassland. This experiment was designed initially to compare different annual cutting frequencies (with and without the return of clippings) with untreated plots, where successional development was allowed, but in this study an adjacent grazed area was also included. Concentrations of inorganic N, rates of nitrogen mineralization and nitrification were estimated, and phosphate adsorption curves calculated. After 22 years' treatment, nitrogen mineralization was higher in the untreated plots than in some treated plots, but the most consistent result was a reduction in P sorption, and hence a greater availability of added P, in the plots where the clippings had been returned, implying a potential improvement in phosphorus availability. If this trend were to be continued over a much longer time period, there might be implications for species change.

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86. Long-term management impacts on soil carbon and nitrogen dynamics of grazed bermudagrass pastures.

Wright, A. L.; Hons, F. M.; and Rouquette, F. M.

Soil Biology and Biochemistry 36(11):

1809-1816. (Nov. 2004)

NAL Call #: S592.7.A1S6; ISSN: 0038-0717

Descriptors: soil organic matter/ carbon/ nitrogen/ soil nutrient dynamics/ cattle/ grazing intensity/ *Cynodon dactylon*/ pasture management/ carbon sequestration/ mineralization/ sandy loam soils/ mineral fertilizers/ sowing/ *Lolium multiflorum*/ *Trifolium*/ Texas

Abstract: Managed pastures have potential for C and N sequestration in addition to providing forage for livestock. Our objectives were to investigate changes in soil organic C (SOC) and soil organic N (SON) concentrations and mineralizable C and N in cattle (*Bos indicus*) grazed bermudagrass [*Cynodon dactylon* (L.) Pers.] pastures up to 32 y after establishment. Management included low- and high-grazing intensity, fertilization, and winter overseeding with annual ryegrass (*Lolium multiflorum* Lam.) and clover (*Trifolium* sp.). Soil (0-15 cm) was sampled 7, 15, 26, and 32 y after establishment of Coastal and common bermudagrass pastures. No significant differences in SOC

or SON concentrations were observed between Coastal and common bermudagrass pastures. Grazing strategies played important roles in C and N sequestration, as high-grazing intensity resulted in a lower increase in SOC and SON concentrations over time compared to low-grazing intensity. Increases in SOC were observed up to 26 y, while increases in SON were observed up to 32 y after establishment of bermudagrass pastures. Soil organic C increased 67 and 39% from 7 to 26 y at low-grazing intensity for bermudagrass+ryegrass and bermudagrass+clover pastures, respectively. SOC and SON concentrations did not increase beyond 15 y after bermudagrass establishment at high-grazing intensity. An exception was the Coastal bermudagrass+ryegrass pastures, which exhibited higher SON at 32 y than at 7 y at both grazing intensities. By 32 y, SON increased 83 and 45% in Coastal bermudagrass+ryegrass pastures at low- and high-grazing intensity, respectively, compared to 7 y. The introduction of clover to pastures decreased SOC and SON relative to ryegrass at high- but not at low-grazing intensity. Potentially mineralizable C increased from 7 to 15 y, while mineralizable N increased from 7 to 32 y. Potentially mineralizable N was also greater for bermudagrass+clover than bermudagrass+ryegrass pastures. Long-term increases in SOC and SON concentrations suggest that managed and grazed pastures have strong potential for C and N sequestration. This citation is from AGRICOLA.

87. Losses of nitrogen phosphorus and sediment in runoff from hill country under different fertilizer and grazing management regimes.

Lambert, M. G.; Devantier, B. P.; Nes, P.; and Penny, P. E. *New Zealand Journal of Agricultural Research* 28(3): 371-380. (1985)

NAL Call #: 23 N4892; ISSN: 0028-8233

Descriptors: sheep/ cattle/ erosion/ stocking rate/ eutrophication/ New Zealand

Abstract: Eight 0.1-1.5 ha catchments within a grazing trial in steep hill country near Woodville, New Zealand, were monitored for 19-53 months during 1975-79. Experimental treatments with 3 grazing managements [rotational grazing with sheep (RGS) or cattle (RGC), or set stocking with sheep (SSS)] and 2 fertiliser practices [low (LF) = 11 kg P ha⁻¹ year⁻¹, high (HF) = 64 kg P ha⁻¹ year⁻¹ + lime]. Stocking rates were 27% higher on HF than LF areas. Runoff, and nitrogen (N), phosphorus (P), and sediment concentrations in runoff, were measured. Average annual rainfall and runoff values were 1247 and 555 mm, respectively. Sediment losses were greater under RGC (2740 kg ha⁻¹ year⁻¹) than sheep grazing (average of RGS and SSS = 1220 kg ha⁻¹ year⁻¹). Total N and P losses in runoff from RGC catchments (12.1 kg N and 1.5 kg P ha⁻¹ year⁻¹) were higher than from sheep-grazed catchments (8.7 kg N and 0.7 kg P ha⁻¹ year⁻¹). No significant differences were found between RGS and SSS catchments. Although concentrations of N and P in runoff water were higher for HF than LF catchments, total N and P losses were similar because HF runoff volume was about 25% lower. The proportion of total N and P in dissolved inorganic form in runoff tended to be higher for HF than LF catchments. This study showed that increases in fertiliser application and stocking rate on hill country might not

increase total N and P losses, but can increase nutrient loading of runoff waters. This may result in accelerated eutrophication.

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88. Management options to limit nitrate leaching from grassland.

Cuttle, S. P. and Scholefield, D.

Journal of Contaminant Hydrology 20(3-4): 229-312. (1995)

NAL Call #: TD426.J68; ISSN: 0169-7722.

Notes: Conference: Integrated Nitrogen Management in Relation to Leaching and Groundwater Quality, 15. World Congress of Soil Science, Acapulco (Mexico), 10-16 Jul 1994

Descriptors: nitrates/ leaching/ grasslands/ grazing/ manure/ management planning/ economic aspects/ cycling nutrients

Abstract: Nitrate leaching can be reduced by the adoption of less intensive grassland systems which, though requiring a greater land area to achieve the same agricultural output, result in less nitrate leaching per unit of production than do intensively managed grasslands. The economic penalties associated with reductions in output can be partly offset by greater reliance on symbiotic nitrogen fixation and the use of clover-based swards in place of synthetic N fertilisers. Alternatively, specific measures can be adopted to improve the efficiency of nitrogen use in intensively managed systems in order to maintain high outputs but with reduced losses. Controls should take account of other forms of loss and flows of nitrogen between grassland and other components of the whole-farm system and, in most instances, should result in an overall reduction in nitrogen inputs. Removing stock from the fields earlier in the grazing season will reduce the accumulation of high concentrations of potentially leachable nitrate in the soil of grazed pastures but will increase the quantity of manure produced by housed animals and the need to recycle this effectively. Supplementing grass diets with low-nitrogen forages such as maize silage will reduce the quantity of nitrogen excreted by livestock but may increase the potential for nitrate leaching elsewhere on the farm if changes to cropping patterns involve more frequent cultivation of grassland. Improved utilisation by the sward of nitrogen in animal excreta and manures and released by mineralisation of soil organic matter will permit equivalent reductions to be made in fertiliser inputs, provided that adequate information is available about the supply of nitrogen from these non-fertiliser sources.

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89. Management practices for minimising nitrate leaching after ploughing temporary leguminous pastures in Canterbury, New Zealand.

Francis, G. S.

Journal of Contaminant Hydrology 20(3-4): 313-327. (1995)

NAL Call #: TD426.J68; ISSN: 0169-7722

Descriptors: ammonium/ dicyandiamide/ grazing/ nitrification inhibitor/ rainfall distribution/ seasonality/ urine

Abstract: Winter leaching losses of nitrate following the ploughing of temporary leguminous pastures in late summer or early autumn are a major concern in mixed cropping rotations on the Canterbury Plains of New Zealand. Field experiments showed that pastures ploughed in early autumn (March) and left fallow accumulated 107-142 kg ha⁻¹ N of mineral-N in the soil profile by the start of

winter, with 72-106 kg ha⁻¹ N lost through leaching in the first winter. Delaying the ploughing of pasture until late autumn (May) reduced the accumulation of mineral-N to 42-120 kg ha⁻¹ N and the leaching loss to 8-52 kg ha⁻¹ N. In situations where early cultivation cannot be avoided, growing winter cover crops or using the nitrification inhibitor dicyandiamide (DCD) both have the potential to reduce leaching compared with fallow soil. DCD increased the amount of mineral-N present in the soil as ammonium and reduced leaching losses by 25-50% without affecting the yield of the following spring wheat crop. Cover crops only reduced leaching losses (by up to 60%) when they were sown early in the autumn and they had taken up considerable amounts of soil mineral-N before drainage occurred. When cover crops were grazed before incorporation in spring, there was an increased risk of leaching from urine patch areas. If residues were incorporated without grazing, however, the yield of the following spring wheat crop was depressed by 20-30% due to extensive net N immobilization during decomposition of the residues. In Canterbury conditions, the most reliable way to minimise N leaching losses is to delay the ploughing of pasture for as long as possible in autumn or winter. Where pastures are ploughed early, the relative effectiveness of using DCD or growing winter cover crops varies mainly in relation to rainfall distribution.
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90. Managing phosphorus levels in Arkansas pastures.

Sandage, L. and Kratz, D.
Proceedings of the Forage and Grassland Conference 7: 129-132. (1998)
NAL Call #: SB193.F59; ISSN: 0886-6899
Descriptors: rotational grazing/ water quality/ environmental impact
This citation is from AGRICOLA.

91. Methods for monitoring the effects of grazing management on bank erosion and channel morphology, Fever River, Pioneer Farm, Wisconsin, 2004.

Peppler, Marie C. and Fitzpatrick, Faith A. U.S. Geological Survey, 2005. Fact Sheet.
<http://pubs.usgs.gov/fs/2005/3134/>
Descriptors: grazing management/ bank erosion
Abstract: "In May 2002, seven rotational-deferred paddocks were established in a riparian pasture along a 0.8-mile reach, or section, of the Fever River at the University of Wisconsin (UW)-Platteville Pioneer Agricultural Stewardship Farm in southwestern Wisconsin (fig. 1). From 1996 to 2002, this pasture had been used for rotational grazing in five paddocks. In 2002, the fences were changed to create the seven present (2004) paddocks. Four cattle crossings were installed by the end of winter 2003. In 2001, the U.S. Geological Survey (USGS) began monitoring runoff, solids, nutrients, bacteria, and selected pesticides from various upland fields with a variety of best management practices. Some of the sampling locations for this study are noted in figure 1. In June 2004, the USGS, in cooperation with the UW-Platteville Pioneer Farm, began monitoring bank and channel changes along the river through this reach. Channel and bank monitoring is designed to continue indefinitely. It is hoped that the methods used during this study can be applied in other grazing locations."

92. Modelling environmental impacts of deposition of excreted nitrogen by grazing dairy cows.

McGechan, M. B. and Topp, C. F. E.
Agriculture, Ecosystems & Environment 103(1): 149-164. (2004)
NAL Call #: S601.A34; ISSN: 0167-8809
Descriptors: dual porosity contaminant transport model macro: mathematical and computer techniques/ grass growth model: mathematical and computer techniques/ soil nitrogen and carbon dynamics model soiln: mathematical and computer techniques/ environmental pollution/ grazing conditions/ grazing dairy cow excreted nitrogen deposition: environmental impacts/ localized stocking rate/ overall stocking rate/ pollution loads/ silage/ soil macropores/ spatially non uniform excretion
Abstract: The soil nitrogen (N) and carbon dynamics model SOILN (which has interactive links to a grass growth model), and the dual-porosity contaminant transport model MACRO, have been used to study environmental pollution arising from grazing dairy cows. The models had been calibrated and tested in previous studies related to livestock agriculture. Information about N contents and other characteristics of urine and faeces excreted by dairy cows was assembled from literature sources. Watercourse pollution by nitrate and ammonium was the main environmental impact considered. Denitrified nitrogen losses were also estimated as an indicator of nitrous oxide pollution of air. Higher levels of nitrate pollution in tile drains (which feed into watercourses) were shown to arise under grazing compared to fields receiving slurry and cut for silage. Much of this raised nitrogenous pollution arises late in the grazing season. High levels of nitrate pollution could be attributed to various factors, including the fact that cows tend to congregate in certain areas of a field at a localised stocking rate much higher than the overall stocking rate, and due to deposition of N at times when grass cannot utilise it as a plant nutrient. The fact that urine and faeces patches are concentrated over a small proportion of the field area did not give an increase in overall loss when this was considered along with field areas receiving no excretions. Rapid transport through soil macropores of ammonium from urine led to high pollution loads during grazing on wet soil. In contrast to leaching, simulated N losses by denitrification were at a low level, and appeared to show little variation with factors which had a large effect on leaching losses. Overall, the forms of pollution most damaging to the environment due to spatially non-uniform excretion by grazing animals, appeared to be leached ammonium from urine transported by macropore flow, and leached nitrate exacerbated both due to cows congregating and due to deposition at times of low plant N uptake.
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93. Modelling phosphorus leaching to watercourses from extended autumn grazing by cattle.

McGechan, M. B.
Grass and Forage Science 58(2): 151-159. (June 2003)
NAL Call #: 60.19 B773; ISSN: 0142-5242
Descriptors: agricultural management models/ hydrologic models/ soil transport processes/ simulation models/ macropore flow/ phosphorus/ soil pore system/ dairy cows/ grazing/ cattle manure/ water pollution/ losses from soil/ drainage/ pasture management/ seasonal variation/ soil water regimes/ autumn/ soil water/ United Kingdom

Abstract: A modelling approach was undertaken to investigate the effect of grazing animals on phosphorus pollution of water draining from grazed fields. Following a similar study in relation to slurry spreading in winter, the dual-porosity hydrological and contaminant transport model, MACRO, was calibrated to represent transport of phosphorus from faeces through the soil to field drains. Rapid flows, through water-filled macropores in wet soil, of phosphorus sorbed onto colloidal particles in the faeces of cattle appeared to be the dominant transport mechanism. The outputs of the model supported experimental evidence that levels of phosphorus pollution of water draining from grazed fields can rise substantially if grazing is extended into late autumn, particularly if grazing is extended until soil has wetted up to around the field capacity water content. The critical housing date, to avoid phosphorus losses rising to an unacceptable level, varied considerably between years. The outputs of the model suggest that phosphorus pollution does not occur during grazing under dry conditions where soil macropores do not contain water, so that losses would remain low if animals are housed before soil substantially wets up in the autumn. This citation is from AGRICOLA.

94. Nitrate leaching affected by management options with respect to urine-affected areas and groundwater levels for grazed grassland.

Hack Ten Broeke, M. J. D. and Van Der Putten, A. H. J. *Agriculture, Ecosystems & Environment* 66(3): 197-210. (1997)

NAL Call #: S601 .A34; ISSN: 0167-8809

Descriptors: simulation modeling: modeling method/ grazed grassland/ groundwater levels/ management options/ management strategy/ nitrate leaching/ urine affected areas/ soil science

Abstract: Simulations were performed to quantify the effects of management options on nitrate leaching to the groundwater in grazed pastures. At the experimental farm for sustainable dairy farming 'De Marke', experimental data on soil water and nitrates were gathered for two fields during the years 1991-1995. These data were used for model validation. The simulations showed that a detailed type of precision agriculture, which can identify urine-affected areas in the field and then subsequently omit fertilizing such areas, resulted in considerable reductions of simulated nitrate concentrations in the soil water, especially on an intensively grazed and relatively dry site with groundwater levels between 0.5 and 2.8 m. On the wetter site, the maximum calculated reduction in nitrate concentrations was 11%, but for the relatively dry site the maximum calculated reduction was as high as 41%. The second simulated option involved the raising of groundwater levels, which usually also resulted in a decrease in simulated nitrate concentrations. Under wet conditions, the groundwater level increase ultimately lead to increased nitrate leaching. The combined effect of non-fertilization of urine patches and the raising of groundwater levels usually resulted in higher simulated reductions of nitrate concentrations than the single options. When the effect of within-field variability was also considered, the raising of groundwater levels was most effective in reducing nitrate concentrations on the wet site, while on the relatively dry and intensively used site, the non-fertilization of urine-

affected areas had the dominant effect. The study shows how simulation modelling can assist in identifying promising management strategies.

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95. Nitrate leaching from grazed grassland and after straw incorporation in arable soils.

Jarvis, S. C.; Barraclough, D.; Unwin, R. J.; and Royle, S. M.

In: Management systems to reduce impact of nitrates/ Germon, J. C. and Dupain, S. New York: Elsevier Applied Science, 1989; pp. 110-125.

Notes: ISBN: 1851664025

NAL Call #: TD427.N5M3

Descriptors: grazing/ grasslands/ nitrates/ leaching/ arable soils/ straw/ groundwater contamination/ fertilizer application/ nitrogen fertilizers/ United Kingdom This citation is from AGRICOLA.

96. Nitrate leaching from intensively grazed pastures.

Stout, W. L.; Elwinger, G. F.; Fales, S. L.; Muller, L. D.; Schnabel, R. R.; and Priddy, W. E.

American Forage and Grassland Council Proceedings 5: 216-220. (1996)

NAL Call #: SB193.F59

Descriptors: pastures/ range management/ grazing/ nitrogen/ fertilizers/ urea/ leaching/ dairy farming/ seasonal variation/ cattle manure/ Pennsylvania

This citation is from AGRICOLA.

97. Nitrate leaching from intensively grazed swards.

Lord, E. I.

In: Proceedings: The Fertiliser Society.; Vol. 327. London: Fertiliser Society; 29 p.; 1992.

Notes: ISSN 0369-9277

NAL Call #: 57.9 F41

Descriptors: pastures/ nitrates/ leaching/ cattle/ grazing intensity/ cutting/ nitrogen/ losses from soil/ range management

This citation is from AGRICOLA.

98. Nitrate leaching from sheep-grazed upland pastures in Wales.

Cuttle, S. P.; Hallard, M.; Gill, E. K.; and Scurlock, R. V. *Journal of Agricultural Science* 127(pt.3): 365-375. (1996)

NAL Call #: 10 J822; ISSN: 0021-8596

Descriptors: pastures/ nitrates/ leaching/ quantitative analysis/ sheep/ grazing intensity/ nitrogen/ losses from soil/ range management/ nitrogen fertilizers/ symbiosis/ nitrogen fixation/ streams/ water pollution/ application rate/ highlands/ Wales

Abstract: Ceramic cup samplers were used to measure nitrate leaching from grass/clover pasture in Wales to which no N fertilizer had been applied and from a predominantly grass pasture receiving 100 kg fertilizer-N/ha annually. Annual leaching losses at individual sampling points, measured over a 3-year period between 1988 and 1991, ranged from the equivalent of < 0.1 to 226 kg N/ha. All data sets were positively skewed and in four out of six cases conformed to a log-normal distribution. The marked spatial heterogeneity was attributed to the uneven deposition of N in the excrete of grazing stock but variations in soil depth and hydrology may also have contributed. Particularly large losses occurred from those areas of the plots where sheep congregated. As a result of this heterogeneity, there were

large standard errors associated with estimates of mean losses from the pastures as a whole. Overall losses ranged from 13 to 24 kg N/ha per year from grass/clover plots and from 10 to 13 kg/ha from fertilized grass plots. There was no consistent relationship between relative losses from the two types of pasture. The quantity of nitrate leached appeared to be independent of stocking rate, although there was a direct correspondence between the loss from grass/clover plots and the proportion of clover in the sward. Estimates of nitrate concentrations in drainage never exceeded 5.6 mg N/l for either sward. This citation is from AGRICOLA.

99. Nitrate leaching from temperate perennial pastures grazed by dairy cows in south-eastern Australia.

Eckard, R. J.; White, R. E.; Edis, R.; Smith, A.; and Chapman, D. F.
Australian Journal of Agricultural Research 55(9): 911-920. (2004)
 NAL Call #: 23 Au783; ISSN: 0004-9409
 Descriptors: drainage/ nitrates/ fertilizers/ leaching/ ammonium/ pasture/ dairies/ livestock/ grasses/ Australia
 Abstract: Nitrate (NO₃-N) leaching losses were measured over 3 years from a temperate grass/clover pasture with and without 200 kg N fertilizer/ha, applied as ammonium nitrate or urea, using a system of moles and tile drains. Fertiliser was applied in 4 split dressings of 50 kg N/ha in each of the 4 seasons of each year. Drainage was collected continuously and NO₃-N concentrations in drainage water were measured in subsamples collected using a flow-proportioned sampler. Pastures were rotationally grazed with dairy cows at stocking rates equivalent to 1.9 or 2.8 cows/ha for the unfertilised and fertilised treatments, respectively. Soil water deficit (SWD) varied markedly between seasons and years, with drainage occurring in the cooler, wetter months (April-October) and not at all through the summer. There were no significant differences between treatments in SWD, drainage events, or drainage volumes. Peak NO₃-N concentrations were 19, 50, and 17 mg/L for the control, ammonium nitrate, and urea treatments, respectively. Mean annual flow-weighted NO₃-N concentrations over the 3 years were 1.7 and 2.2 times higher from the ammonium nitrate treatment than from the urea and control treatments, respectively. Annual NO₃-N leaching loads (kg N/ha) were 3.7-14.6 from the control treatment, 6.2-22.0 from the urea treatment, and 4.3-37.6 from the ammonium nitrate treatment, for the lowest and highest drainage years, respectively. The experiment confirmed that the application of N fertiliser prior to periods of substantial drainage can result in high losses of NO₃-N through leaching. More efficient and environmentally sound use of N fertiliser can be achieved by not combining high N fertiliser rates, high stocking intensity, and nitrate-containing fertilisers prior to periods when there is a risk of substantial drainage occurring.
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100. Nitrate loss through leaching and surface runoff from grassland effects of water supply soil type and management.

Garwood, E. A. and Ryden, J. C.
 In: Nitrogen fluxes in intensive grassland systems. (Held 1983 at Wageningen, Netherlands.) Van der Meer, H. G.; Ryden, J. C.; and Ennik, G. C. (eds.)

Dordrecht, Netherlands: Kluwer Academic Publishers; 1986.

Notes: EEC (European Economic Community) Workshop; ISSN 0167-840X

NAL Call #: S596.7.D4 v.23; ISBN: 902473309X

Descriptors: sward/ fertilizer/ denitrification/ utilization/ grazing/ cutting/ urine

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101. Nitrogen loss from a high fertility rotational pasture program.

Owens, L. B.; Van Keuren, R. W.; and Edwards, W. M.
Journal of Environmental Quality 12(3): 346-350. (1983)
 NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: water pollution/ winter grazing/ nonpoint source pollution/ agricultural practice/ grazing system/ nitrate transport/ Ohio/ USA

Abstract: A beef cattle-pasturing system involving 4 rotationally grazed summer pastures (SG) and 4 pastures used rotationally for winter grazing/feeding (WGF) was studied on sloping upland watersheds in Ohio [USA] to determine effects of livestock management on N levels in water. Both summer and winter areas annually received 224 kg N/ha as NH₄NO₃ fertilizer. Surface runoff was collected automatically during runoff events, and subsurface flow was sampled from spring developments on a weekly basis. Although seasonal N concentration and transport in surface runoff tended to be greater in the area occupied by the cattle, N concentration and transport in runoff from the 2 areas were quite similar and did not significantly impair water quality, based on USA Public Health Standards. The NO₃-N concentration in the subsurface flow from the WGF area was higher than in the subsurface flow from the SG area. The NO₃-N concentration in the subsurface flow from both areas increased progressively throughout the study period, and reached levels as high as 18 mg/l. The subsurface flow provided the main pathway for N transport, with the surface transport being approximately 20 and 14% of the total N transport from the SG and WGF areas, respectively. The amount of sediment-N transported was very small because of low soil loss.

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102. Nonpoint-source pollutant load reductions associated with livestock exclusion.

Line, D. E.; Harman, W. A.; Jennings, G. D.; Thompson, E. J.; and Osmond, D. L.
Journal of Environmental Quality 29(6): 1882-1890. (2000)
 NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: grazing/ livestock exclusion/ nonpoint source pollutant load reduction/ riparian corridor/ sediment load/ streams/ tree planting

Abstract: Cattle (*Bos taurus*) grazing on unimproved pastures can be a significant, yet often overlooked, source of pollutants to surface waters, especially when the cattle have unlimited access to streams in the pastures. Livestock exclusion from streams has been demonstrated to reduce sediment and possibly nutrient yield from streams draining pastures. The purpose of this study was to evaluate the effects of excluding dairy cows from, and planting trees in, a 335-m-long and 10- to 16-m- wide riparian corridor along a small North Carolina stream. Analysis of 81 wk of pre-exclusion and 137 wk of post-exclusion fencing data documented 33,78,76, and 82% reductions in weekly

nitrate+nitrite, total Kjeldahl nitrogen (TKN), total phosphorus (TP), and sediment loads, respectively, from the 14.9-ha pasture area adjacent to the fenced section of stream. Statistical analyses by t-tests and analysis of variance suggested that the reductions in mean weekly loads post-fencing were significant ($P < 0.05$) for all pollutants except nitrate+nitrite. Thus, the results indicated that livestock exclusion and subsequent riparian vegetation establishment was effective at reducing pollutant export from an intensively grazed pasture.
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103. Nutrient losses from management intensive grazing dairy farms.

Weil, R. R. and Gilker, R. E.
Proceedings American Forage and Grassland Council 13: 302-306. (2004)
NAL Call #: SB193.F59
Descriptors: dairy farming/ grazing/ pastures/ best management practices/ Maryland
This citation is from AGRICOLA.

104. Off-stream water sources for grazing cattle as a stream bank stabilization and water quality BMP.

Sheffield, Ronald Erle
Blacksburg, Va.: Virginia Polytechnic Institute and State University, 1996.
Notes: Thesis (M.S.); Bibliography: leaves 147-153.
NAL Call #: ViBibV LD5655.V855-1996.S544
This citation is from AGRICOLA.

105. Off-stream water sources for grazing cattle as a stream bank stabilization and water quality BMP.

Sheffield, R. E.; Mostaghimi, S.; Vaughan, D. H.; Collins, E. R.; and Allen, V. G.
Transactions of the ASAE 40(3): 595-604. (1997)
NAL Call #: 290.9 Am32T; ISSN: 0001-2351
Descriptors: stream erosion/ range management/ beef cattle/ drinking/ water supply/ water troughs/ erosion control/ water quality/ rotational grazing/ best management practices/ Virginia
Abstract: A multi-disciplinary study was conducted to evaluate effectiveness of providing cattle with an off-stream water source (i.e., water trough) in reducing stream bank erosion and fostering water quality improvements. This study was conducted on two commercial cow-calf operations in southwest Virginia which used rotational stocking. When given the choice, cattle were observed to drink from a water trough 92% of the time, compared to the time which they spent drinking from the stream. Stream bank erosion was reduced by 77% due to installation of the alternative water source. Concentrations of total suspended solids, total nitrogen, and total phosphorus reduced by 90, 54, and 81%, respectively when an alternative water source was provided. Similar reductions were observed in concentrations of fecal coliform and fecal streptococcus. Concentrations of dissolved nutrients such as nitrate and orthophosphorus, however, were adversely affected by installation of the BMP. The study results clearly indicate that off-stream water sources for grazing cattle are effective BMPs for reducing the loss of sediment and sediment-bound pollutants to adjacent streams without resorting to stream bank fencing.
This citation is from AGRICOLA.

106. Offstream water and salt as management strategies for improved cattle distribution and subsequent riparian health.

Dickard, M. L.; Momont, P. A.; DelCurto, T.; Rimbey, N. R.; Tanaka, J. A.; and McInnis, M.
Eastern Oregon Agricultural Research Center: Annual Report: 65-72. (1998)
NAL Call #: 100 Or3M no.991
Descriptors: grazing/ water quality/ animal husbandry/ cattle/ Oregon
This citation is from AGRICOLA.

107. Pasture management influences on soil properties in the northern Great Plains.

Wienhold, B. J.; Hendrickson, J. R.; and Karn, J. F.
Journal of Soil and Water Conservation 56(1): 27-31. (2001)
NAL Call #: 56.8 J822; ISSN: 0022-4561
Descriptors: grazing management/ microbe numbers/ mixed grass prairie/ N mineralization/ North Dakota/ organic C/ soil quality
Abstract: The effect of management practices associated with livestock grazing on soil properties are largely unknown. Several physical, chemical, and biological soil properties were compared for soil from a native vegetation enclosure, a moderately grazed native vegetation pasture stocked at 2.6 ha (6.4 ac) steer-1, a heavily grazed native vegetation pasture stocked at 0.9 ha steer-1 and a fertilized crested wheatgrass (*Agropyron cristatum* L. Gaertn.) pasture stocked at 0.9 ha steer-1 near Mandan, North Dakota. The three native vegetation pastures were established in 1916 and the crested wheatgrass pasture was seeded in 1932. Soil properties varied in sensitivity to the management practices. Measures of vegetation and animal production, combined with assessment of soil properties suggest that moderate grazing and fertilization of crested wheatgrass are viable management options that appear to be sustainable while providing goods and services needed by society. Range and pasture assessment should include soil assessment to more completely determine management effects on pastoral ecosystems.
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108. Patterns and simulation of soil water under different grazing management systems in central Alberta.

Mapfumo, E.; Chanasyk, D. S.; and Baron, V. S.
Canadian Journal of Soil Science 83(5): 601-614. (2003)
NAL Call #: 56.8 C162; ISSN: 0008-4271
Descriptors: VB2000 model: mathematical and computer techniques/ versatile soil moisture budget model: mathematical and computer techniques/ neutron moisture probe: field equipment/ soil water measurement: applied and field techniques/ daily volumetric soil water content/ evapotranspiration rates/ forage systems/ grazing management systems/ grazing systems/ grazing treatments: rotational grazed, ungrazed/ input data errors/ model errors/ overall modeling efficiency/ paddock/ propagation errors/ soil water: content, patterns
Abstract: A study was conducted at the Lacombe Research Centre to quantify and simulate the impacts of forage and grazing systems on soil water content. Four forages used in the study were alfalfa (*Medicago sativa* L.), a mixture of meadow bromegrass (*Bromus riparius* L.) and

alfalfa, an annual pasture and an old grass pasture that was composed of mainly quackgrass (*Elytrigia repens* L.), smooth brome grass (*Bromus inermis* L.) and Kentucky bluegrass (*Poa pratensis* L.). Within each 1.2-ha paddock were two grazing treatments: rotational grazed and ungrazed. Soil water measurements to a 65-cm depth were conducted between May and October of 1999 and 2000 using a neutron moisture probe. Total soil water was affected by forage species more than grazing. Actual evapotranspiration rates were 3-4 mm d⁻¹ in both years. Simulation of daily volumetric soil water content (%) for each year was conducted using the Versatile Soil Moisture Budget (VB2000) model on grazed alfalfa, ungrazed alfalfa, grazed annual and ungrazed annual treatments. During calibration year of 1999, the overall modeling efficiency (EF) was 0.58 while, during the evaluation year it was 0.43. Further, simulations for alfalfa were better than those for annual treatments. These EF values are relatively low indicating substantial discrepancies between observed and simulated results, which could have been attributed to a combination of input data errors, model errors and propagation errors in output.
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109. Phosphorus, sediment, and E. coli loads in unfenced streams of the Georgia Piedmont, USA.

Byers, Harris L.; Cabrera, Miguel L.; Matthews, Monte K.; Franklin, Dorcas H.; Andrae, John G.; Radcliffe, David E.; Mccann, Mark A.; Kuykendall, Holli A.; Hoveland, Carl S.; and Calvert, Vaughn H.
In: Proceedings of the 2005 Georgia Water Resources Conference. Hatcher, K. J. (eds.)
Athens, GA: University of Georgia Institute of Ecology; 2005.
Notes: Conference: 2005 Georgia Water Resources Conf., Athens, GA (USA), 25-27 Apr 2005; ISBN: 0935835091
Descriptors: pathogenic bacteria/ microbial contamination/ biological pollutants/ sediment pollution/ water resources/ water quality/ water supply/ agricultural pollution/ sediment transport/ phosphorus/ environmental effects/ stream pollution/ water pollution sources/ bacteria (*Enterobacteriaceae*) (*Escherichia*)/ sediment contamination/ pastures/ cattle/ animal wastes/ agricultural runoff/ storm runoff/ grazing/ surface water/ sediment load/ pollution load/ *Escherichia coli*/ USA, Georgia
Abstract: Contamination of unfenced streams with phosphorus, sediments, and pathogenic bacteria from cattle activity may be affected by the availability of shade and alternative water sources. The objectives of this study were to evaluate water quality in two streams draining tall fescue/bermudagrass pastures with different shade distributions, and to quantify the effects of alternative water sources on stream water quality. Loads of DRP, TP, and TSS were measured during storm flow, and loads of DRP, TP, TSS, and *E.coli* were measured every 14 d during base flow in two streams located in the Piedmont region of Georgia. Our results showed that grazing cattle in pastures with unfenced streams contributed significant loads of DRP, TP, TSS, and *E. coli* to surface waters ($p < 0.01$). Although storm flow was similar in both streams, loads of DRP, TP, and TSS were larger ($p < 0.08$) in the pasture with the smaller amount of non-riparian shade. Water trough availability significantly decreased ($p < 0.08$) base flow loads of TSS and *E. coli* in both streams. Our results indicate that possible BMPs to reduce P, sediment, and *E.*

coli contamination from beef-cattle-grazed pastures may be to develop or encourage non-riparian shade and to provide cattle with an alternative water supply away from the stream.
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110. The potential of off-stream livestock watering to reduce water quality impacts.

Godwin, Derek C. and Miner, J. Ronald
Bioresource Technology 58(3): 285-290. (1996)
NAL Call #: TD930.A32; ISSN: 0960-8524
Descriptors: animal enterprises/ animal husbandry/ animal operated pasture pump/ biobusiness/ conventional watering systems/ livestock grazing/ manure management/ off stream livestock watering/ off stream watering device/ pollution/ water quality
Abstract: Small commercial and non-commercial animal enterprises (SCAEs) are often located in suburban watersheds. Such operations raise a small number of animals on a few acres and have potential water quality impacts from their manure management. A typical pollution abatement practice includes fencing livestock from streams and providing an off-stream watering area. However, if there is a large stream to land area ratio, this practice becomes very costly for implementation and maintenance. An alternative is to provide off-stream watering areas without fencing to lure animals from the stream. This project demonstrated that off-stream watering areas are an effective alternative to stream fencing. They reduce the time animals spend at the stream under small acreage grazing conditions. In addition, an animal-operated pasture pump was demonstrated to be a viable off-stream watering device. The animal-operated tested pump pulled water from the creek and held the water in a small basin accessible to the animals. It is a usable alternative where conventional watering systems are inconvenient or expensive.
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111. Quality of runoff from plots with simulated grazing.

Edwards, D. R.; Hutchens, T. K.; Rhodes, R. W.; Larson, B. T.; and Dunn, L.
Journal of the American Water Resources Association 36(5): 1063-1074. (2000)
NAL Call #: GB651.W315; ISSN: 1093-474X
Descriptors: runoff/ grazing/ livestock/ nonpoint pollution sources/ pastures/ nutrients/ agriculture/ nitrogen/ phosphorus/ livestock (see also individual animals)/ pollution (nonpoint sources)/ land (grass and pasture)/ USA, Kentucky
Abstract: Grazed pastures represent a potential source of nonpoint pollution. In comparison to other nonpoint sources (e.g., row-cropped lands), relatively little information exists regarding possible magnitudes of nutrient losses from grazed pasture, how those losses are affected by management variables, and how the losses can be minimized. The objective of this study was to measure concentrations of nitrogen (N), phosphorus (P), and solids in runoff from fescue plots and relate those measurements to simulated forage management strategy. The study was conducted at the University of Kentucky Maine Chance Agricultural Experiment Station north of Lexington. Plots (2.4 m wide by 6.1 m long) were constructed and established in Kentucky 31 fescue (*Festuca arundinacea* Schreb.) to represent pasture. The experimental treatments

applied to the plots varied in terms of forage height and material applied (none, manure, or manure and urine). Runoff was sampled for six simulated rainfall events applied over the summer of 1997 and analyzed for nitrate N (NO₃-N), ammonia N (NH₃-N), total Kjeldahl N (TKN), ortho-P (PO₄-P), total P (TP), and total suspended solids (TSS). All runoff constituents exhibited dependence on the date of simulated rainfall with generally higher concentrations measured when simulated rainfall followed relatively dry periods. The effects of forage height and manure addition were mixed. Highest runoff N concentrations were associated with the greatest forage heights, whereas highest P concentrations occurred for the least forage heights. Manure/urine addition increased runoff P concentrations relative to controls (no manure/urine) for both the greatest and least forage heights, but runoff N concentrations were increased only for the greatest forage heights. These findings indicate that runoff N and P is at least as sensitive to amount and proximity of preceding rainfall and suggest that managing forage to stimulate growth and plant uptake can reduce runoff of N.

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112. Quantification and simulation of surface runoff from fescue grassland watersheds.

Chanasyk, D. S.; Mapfumo, E.; and Willms, W. *Agricultural Water Management* 59(2): 137-153. (2003)
 NAL Call #: S494.5.W3A3; ISSN: 0378-3774
 Descriptors: erosion/ grasslands/ grazing intensity/ losses from soil/ meltwater/ precipitation/ runoff/ simulation models/ topography/ watersheds
 Abstract: The topographic features of the foothills fescue grasslands in southern Alberta predispose them to runoff and soil loss via erosion. A study was conducted at Stavely Research Station, Alberta to determine the runoff from small grassland watersheds under three grazing intensities, viz. ungrazed (or control), heavy (2.4 animal unit months per hectare (AUM ha⁻¹)) and very heavy (4.8 AUM ha⁻¹) grazing. Total annual precipitation in 1998, 1999 and 2000 was 648, 399 and 263 mm, respectively. Surface runoff hydrographs indicated large summer storm runoff rates from heavy grazed compared to other watersheds, but large snow melt-induced runoff from very heavy grazed compared to other watersheds. Surface runoff rates measured from May and August ranged between 0 and 2.3 mm per day in 1998, 0-0.2 mm per day in 1999, and 0-0.07 mm per day in 2000. In all the years, the average rainfall runoff was <10% of average daily precipitation on all three watersheds. In 2000, snow melt-induced runoff was measured in March. Total surface runoff for this month was 0.07, 8.5 and 3.7 mm for ungrazed, heavy and very heavy watersheds, respectively. These accounted for 78, 96 and 92% of total annual runoff from ungrazed, heavy and very heavy watersheds, respectively. Surface runoff for 1999 and 2000 was simulated using Soil Water Assessment Tool (SWAT), a continuous time distributed parameter model developed for ungaged basins. Model calibration was conducted using data of 1998 and parameters adjusted until the predicted and observed results were visibly close. Evaluation of the model was conducted using statistical criteria that included calculations of average error (AE), residual mean square (RMS), coefficient of residual mass (CRM) and modelling efficiency (EF), and comparing these

statistics against optimal values. The evaluation indicated that the model under-predicted surface runoff from the watersheds in both the years.

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113. Rapid intrinsic rates of amino acid biodegradation in soils are unaffected by agricultural management strategy.

Jones, D. L.; Kemmitt, S. J.; Wright, D.; Cuttle, S. P.; Bol, R.; and Edwards, A. C. *Soil Biology and Biochemistry* 37(7): 1267-1275. (July 2005)
 NAL Call #: S592.7.A1S6; ISSN: 0038-0717
 Descriptors: agricultural soils/ grassland soils/ arable soils/ amino acids/ biodegradation/ mineralization/ fertilizer application/ grazing/ soil pH/ liming/ soil types/ soil microorganisms/ microbial activity/ biodiversity/ community structure/ soil quality/ field experimentation/ England/ Scotland/ Wales
 Abstract: Amino acids represent one of the largest inputs of dissolved organic nitrogen to soil and consequently they constitute a major component of the organic N cycle. The effect of agricultural management on the rate of amino acid turnover in soil, however, remains largely unknown. The aim of this study was to evaluate in long-term field experiments the effect of fertilizer addition (N, P and K), grazing, pH manipulation (lime addition), vegetation cover and shifts (grassland versus arable) and drainage on the mineralization of ¹⁴C-labelled amino acids in agricultural topsoils. Our results showed that the intrinsic rate of amino acid mineralization was rapid for all management regimes, irrespective of the tested soil type. The average (+/-SEM) half-life of the amino acids in all soils (n=155) was calculated to be 2.3 +/- 0.5 h. The relative amount of amino acid-C partitioned into respiration (25% of total C) versus biomass production (75% of total C) was also unaffected by management strategy. The rate of amino acid mineralization was shown to be slightly sensitive to soil pH, peaking at around pH(CaCl₂) 5.0 with an approximate twofold reduction at the pH extremes (pH 3.8 and 6.4). We conclude that management regime has little effect on the intrinsic rate of amino acid mineralization in agricultural soils. We propose therefore that total microbial activity rather than microbial diversity or community structure is likely to be the key determinant governing amino acid turnover in agricultural soils.
 This citation is from AGRICOLA.

114. Reducing environmental impacts of agriculture by using a fine particle suspension nitrification inhibitor to decrease nitrate leaching from grazed pastures.

Di, H. J. and Cameron, K. C. *Agriculture, Ecosystems & Environment* 109(3-4): 202-212. (2005)
 NAL Call #: S601.A34; ISSN: 0167-8809
 Descriptors: soil monolith lysimeter: field equipment/ environmental impact/ grazed pasture/ agronomic benefit/ fine particle suspension
 Abstract: Nitrate (NO₃-) leaching from intensively grazed pasture systems, e.g. dairy farming, is of increasing environmental concern worldwide. The major source of the NO₃- leached in grazed pastures is the nitrogen (N) returned in the urine from the grazing animal. The objective of this study was to use undisturbed soil monolith lysimeters to quantify the effectiveness of treating a grazed

pasture soil with a fine particle suspension (FPS) nitrification inhibitor, dicyandiamide (DCD), in decreasing NO₃- leaching losses from a deep sandy soil with a mixture of perennial ryegrass (*Lolium perenne* L.) and white clover (*Trifolium repens* L.) pasture. The application of DCD as a FPS at 10 kg ha⁻¹ in autumn (May) and late winter (August) decreased NO₃-N leaching from 134 kg N ha⁻¹ year 1 to 43 kg N ha⁻¹ year 1 (equivalent to a 68% reduction) from the dairy cow urine N applied in the autumn (May) at the rate of 1000 kg N ha⁻¹. This reduced the annual average NO₃-N concentration under the urine patch from 43 mg NO₃-N L⁻¹ to 18 mg NO₃-N L⁻¹. The DCD FPS also reduced Ca²⁺ leaching by 51% and Mg²⁺ leaching by 31%. In addition, herbage dry matter yield in the urine patch areas was increased by 33%, from 15.3 t ha⁻¹ year⁻¹ without DCD to 20.3 t ha⁻¹ year⁻¹ when DCD was applied at 10 kg ha⁻¹. However, DCD applied at 5 kg ha⁻¹ (May and August) did not provide significant environmental and agronomic benefits under the experimental conditions. Results from this study when compared with those reported previously show that DCD, when applied as a FPS at 10 kg active ingredient ha⁻¹, is just as effective in reducing NO₃- leaching in grazed pasture soils, as when it is applied as a solution. (c) 2005 Elsevier B.V. All rights reserved.
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115. Reduction of nitrate leaching with haying or grazing and omission of nitrogen fertilizer.

Owens, L. B. and Bonta, J. V.
Journal of Environmental Quality 33(4): 1230-1237. (2004)
NAL Call #: QH540.J6; ISSN: 0047-2425
Descriptors: haying: applied and field techniques/ rotational grazing: applied and field techniques/ alternative management practices/ groundwater/ high fertility high stocking density grazing systems/ small watersheds
Abstract: In some high-fertility, high-stocking-density grazing systems, nitrate (NO₃) leaching can be great, and ground water NO₃-N concentrations can exceed maximum contaminant levels. To reduce high N leaching losses and concentrations, alternative management practices need to be used. At the North Appalachian Experimental Watershed near Coshocton, OH, two management practices were studied with regard to reducing NO₃-N concentrations in ground water. This was following a fertilized, rotational grazing management practice from which ground water NO₃-N concentrations exceeded maximum contaminant levels. Using four small watersheds (each approximately 1 ha), rotational grazing of a grass forage without N fertilizer being applied and unfertilized grass forage removed as hay were used as alternative management practices to the previous fertilized pastures. Ground water was sampled at spring developments, which drained the watershed areas, over a 7-yr period. Peak ground water NO₃-N concentrations before the 7-yr study period ranged from 13 to 25.5 mg L⁻¹. Ground water NO₃-N concentrations progressively decreased under each watershed and both management practices. Following five years of the alternative management practices, ground water NO₃-N concentrations ranged from 2.1 to 3.9 mg L⁻¹. Both grazing and haying, without N fertilizer being applied to the forage, were similarly effective in reducing the NO₃-N levels in ground water. This research shows two management practices that can be effective in reducing high NO₃-N

concentrations resulting from high-fertility, high-stocking density grazing systems, including an option to continue grazing.

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116. Responses of fecal coliform in streamwater to four grazing strategies.

Tiedemann, A. R.; Higgins, D.; Quigley, T. M.; Sanderson, H. R.; and Marx, D. B.
Journal of Range Management 40(4): 322-329. (1987)
NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1987/404/9tied.pdf>
Descriptors: bacterial/ water/ contamination/ livestock distribution/ pastures/ watersheds/ pollution
Abstract: Concentration and loadings (output, number day⁻¹ km⁻²) of fecal coliform (FC) indicator bacteria were measured from 1979 through 1984 in streamflow from 13 forested watersheds under the following range management strategies: (A) no grazing; (B) grazing without management for livestock distribution; (C) grazing with management to obtain livestock distribution, and (D) grazing with management to obtain livestock distribution and cultural practices to increase forage. Both FC concentration (number/100 ml) and instantaneous loadings differed significantly among strategies, seasons, and water years. Differences among strategies for mean concentrations were A < C = B < D. For instantaneous loadings, significant differences were A < C, B or D; and C < D. FC concentration were the same for winter and for snowmelt runoff seasons but concentration of both were significantly lower than during the summer period. Loadings were different for each season with winter < summer < snowmelt runoff. A definite relationship was established between the presence of cattle on the pastures and FC concentrations. Elevated FC counts in strategy D watersheds and loadings in excess of 108 organisms day⁻¹ km⁻² in the winter season provide evidence that organisms live into and through the winter period in animal feces, sediment, and soil. Results provide evidence that livestock removal may not provide an immediate solution to elevated levels of FC in streamwater.
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117. Restricting the grazing time of cattle to decrease phosphorus, sediment and E. coli losses in overland flow from cropland.

McDowell, R. W.; Drewry, J. J.; Muirhead, R. W.; and Paton, R. J.
Australian Journal of Soil Research 43(1): 61-66. (2005)
NAL Call #: 56.8 Au7; ISSN: 0004-9573
Descriptors: *Escherichia coli*/ grazing/ particulate P/ pasture/ treading
Abstract: This study investigated the effects of grazing management of brassica crops during winter on soil physical properties and sediment, phosphorus (P), and *E. coli* loss via overland flow. Dairy cows were allowed either unrestricted grazing, grazing restricted to 3 h, or no grazing. Treading in the unrestricted treatment decreased soil bulk density and saturated hydraulic conductivity (K_{sat}), and increased surface roughness, loads and concentrations of suspended sediment, and *E. coli* and P loss in overland flow relative to the ungrazed treatment. Only bulk density was different in the restricted compared with the ungrazed treatment. For total P, the mean load in overland flow from the unrestricted grazing treatment after grazing was 3.31

mg/plot compared with restricted grazing (0.74 mg/plot) and ungrazed (0.76 mg/plot) treatments, with most of the increase in particulate form. E. coli concentrations only exceeded water quality guidelines in the first event after grazing, and only in the unrestricted grazing treatment. We found that restricting grazing on forage crops during winter was beneficial for minimising contaminant loss. © CSIRO 2005.

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118. Runoff and sediment losses resulting from winter feeding on pastures.

Owens, L. B.; Edwards, W. M.; and Van Keuren, R. W. *Journal of Soil and Water Conservation* 52(3): 194-197. (1997)

NAL Call #: 56.8 J822; ISSN: 0022-4561

Descriptors: pastures/ runoff/ sediment erosion/ grazing/ small watersheds/ cattle/ sediments/ erosion/ watersheds/ agricultural runoff/ USA, Ohio/ pasture/ pastures/ sediment erosion/ grazing/ small watersheds

Abstract: Grazing is an important land use in the humid, eastern U.S. When the grass is dormant, late fall through early spring, the land is most vulnerable to the pressures of livestock. Runoff and sediment losses from a small pastured watershed (WS) in eastern Ohio have been studied for 20 years. In Period 1, a beef cow herd grazed it rotationally during the growing season for 12 years and was fed hay in this WS during the dormant season (high animal density with feeding). During the next 3 years of this study (Period 2), there was summer rotational grazing only. There was no animal occupancy on this WS during the last 5 years (Period 3). Annual runoff was more than 10% of precipitation during Period 1 (120 mm) and less than 2% during Periods 2 and 3 (14 and 6 mm, respectively). The decrease in annual sediment loss was even greater with the change in management, yielding 2259, 146, and 9 kg/ha for the three respective periods. Over 60% of the soil loss during Period 1 occurred during the dormant season. In response to weather inputs, there was considerable seasonal and annual variation in runoff and soil loss within management periods. Low amounts of runoff and erosion from three adjacent watersheds with summer-only grazing supported the conclusion that the increased runoff and erosion during Period 1 resulted from the non-rotational, winter feeding on pastures. When the management was changed, the impacts of the previous treatment were not long lasting, changing within a year.

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119. Runoff and sediment yield from snowmelt and rainfall as influenced by forage type and grazing intensity.

Gill, S. I.; Naeth, M. A.; Chanasyk, D. S.; and Baron, V. S. *Canadian Journal of Soil Science* 78(4): 699-706. (1998)

NAL Call #: 56.8 C162; ISSN: 0008-4271

Descriptors: runoff/ sediment yield/ erosion/ grasslands/ meltwater/ rain/ forage/ fodder plants/ barley/ triticale/ grazing

Abstract: A study to examine the runoff and sediment yields of annual and perennial forages in central Alberta, Canada, was initiated in 1994. Runoff and sediment yield were quantified under snowmelt and rainfall events for two seasons. Rainfall simulation was used to further examine runoff under growing season conditions. Four forage treatments [two annuals: Pika triticale (x Triticosecale) and

a barley/Pika triticale mixture and two perennials: Carlton smooth brome grass and Paddock meadow brome grass (Bromus riparius)] and three grazing intensities (light, medium and heavy) were studied, each replicated four times. Total annual runoff was dominated by snowmelt. Generally runoff volumes, sediment yields, sediment ratios and runoff coefficients were all low. Bare ground increased with increasing grazing intensity and was significantly greater in annuals than perennials for all grazing intensities. Litter biomass decreased with increasing grazing intensity and was generally similar in all species for both years at heavy and medium grazing intensities. Results from the rainfall simulation corroborated those under natural rainfall conditions and generally indicated the sustainability of these grazing systems at this site.

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120. Seasonality of the soil biota of grazed and ungrazed hill grasslands.

Bardgett, R. D.; Leemans, D. K.; Cook, R.; and Hobbs, P. J. *Soil Biology and Biochemistry* 29(8): 1285-1294. (1997)

NAL Call #: S592.7.A1S6; ISSN: 0038-0717

Descriptors: animals and man/ disturbance by man/ commercial activities/ ecology/ habitat/ terrestrial habitat/ land and freshwater zones/ Palaeartic Region/ Europe/ United Kingdom/ Nematoda: farming and agriculture/ cattle grazing effects on hill grassland soil communities/ community structure/ grassland soil habitat/ grassland/ soil community structure/ soil habitat/ grasslands/ Wales/ Snowdonia National Park/ grassland soil community structure/ effects of cattle grazing/ Nematoda/ helminths/ invertebrates/ nematodes

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121. Sediment and nutrient losses from an unimproved, all-year grazed watershed.

Owens, L. B.; Edwards, W. M.; and Van Keuren, R. W. *Journal of Environmental Quality* 18(2): 232-238. (1989)

NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: nutrients/ water quality/ nutrient loss/ pasture/ grazing/ watersheds/ livestock/ agricultural pollution/ USA, Ohio/ sedimentation/ effects on/ Ohio

Abstract: A common practice for grazing land in the humid, eastern USA is continuous grazing with little or no fertilizer use. Concentrations and transport of nutrients from a 28-ha unimproved grassed watershed were assessed in east-central Ohio for 2 yr without the presence of livestock, for 3 yr with a 17-cow beef (Bos taurus) herd grazing during the summer months only, and for an additional 6-yr period with all-year grazing with hay being brought in for winter feed. Nutrient concentrations remained low during all three grazing levels. An exception was K concentration, which increased with all-year grazing. All-year cattle grazing/feeding on an unimproved pasture in this area would not be expected to produce degradation of stream water quality from nutrient concentrations or transport.

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122. Sediment losses from a pastured watershed before and after stream fencing.

Owens, L. B.; Edwards, W. M.; and Van Keuren, R. W.

Journal of Soil and Water Conservation 51(1):

90-94. (1996)

NAL Call #: 56.8 J822; ISSN: 0022-4561

Descriptors: grazing/ sediment erosion/ livestock/ grasslands/ pastures/ fences/ agricultural watersheds/ USA, Ohio, Coshocton

Abstract: Livestock induced sediment loss is one of the potential detrimental impacts from grazing grasslands. Near Coshocton, Ohio, a 26-ha unimproved pasture watershed was grazed year-around, and no fertilizer was applied. A beef cow herd had access to the entire watershed area including the small stream that originated within the watershed, i.e. there was no rotational grazing in the pasture. Sediment loss via the stream was measured at the base of the watershed. Following 7 years of this management practice, the stream and the wooded areas on the sides of the stream were fenced so that the cattle no longer had access to them. During the next 5 years, with the cattle fenced out of the stream, the annual sediment concentration decreased by more than 50% and the amount of soil lost decreased by 40%. Average annual soil losses were reduced from 2.5 to 1.4 Mg/ha while annual precipitation averages were similar during each management period.

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123. SGS Water Theme: Influence of soil, pasture type and management on water use in grazing systems across the high rainfall zone of southern Australia.

White, R. E.; Christy, B. P.; Ridley, A. M.; Okom, A. E.; Murphy, S. R.; Johnston, W. H.; Michalk, D. L.; Sanford, P.; McCaskill, M. R.; Johnson, I. R.; Garden, D. L.; Hall, D. J. M.; and Andrew, M. H.

Australian Journal of Experimental Agriculture 43(7/8): 907-926. (2003)

NAL Call #: 23 Au792; ISSN: 0816-1089

Descriptors: Alfisols/ Aridisols/ fertilizers/ grassland management/ grasslands/ grazing/ natural grasslands/ plant water relations/ rotational grazing/ soil types/ soil water balance/ soil water movement/ sown grasslands/ stocking rate/ Ultisols/ water deficit/ water use

Abstract: Eleven experimental sites in the Sustainable Grazing Systems (SGS) national experiment were established in the high rainfall zone (HRZ, >600 mm/year) of Western Australia, Victoria and New South Wales to measure components of the water balance, and pathways of water movement, for a range of pastures from 1997 to 2001. The effect of widely spaced river red gums (*Eucalyptus camaldulensis*) in pasture, and of belts of plantation blue gums (*E. globulus*), was studied at 2 of the sites. The soil types tested ranged from Kurosols, Chromosols and Sodosols, with different subsoil permeabilities, to Hydrosols and Tenosols. The pasture types tested were kikuyu (*Pennisetum clandestinum*), phalaris (*Phalaris aquatica*), redgrass (*Bothriochloa macra*) and annual ryegrass (*Lolium rigidum*), with subterranean clover (*Trifolium subterraneum*) included. Management variables were set stocking v. rotational grazing, adjustable stocking rates, and level of fertiliser input. Soil, pasture and animal measurements were used to set parameters for the biophysical SGS pasture model, which simulated the long-term effects of soil, pasture type, grazing method and

management on water use and movement, using as inputs daily weather data for 31 years from selected sites representing a range of climates. Measurements of mean maximum soil water deficit were used to estimate the probability of surplus water occurring in winter, and the average amount of this surplus, which was highest (97-201 mm/year) for pastures in the cooler, winter-rainfall dominant regions of north-east and western Victoria and lowest (3-11 mm/year) in the warmer, lower rainfall regions of the eastern Riverina and Esperance, Western Australia. Kikuyu in Western Australia achieved the largest increase in Sm compared with annual pasture (55-71 mm), while increases due to phalaris were 18-45 mm, and those of native perennials were small and variable. Long-term model simulations suggested rooting depth was crucial in decreasing deep drainage, to about 50 mm/year for kikuyu rooting to 2.5 m, compared with 70-200 mm/year for annuals rooting to only 0.8 m. Plantation blue gums dried the soil profile to 5.25 m by an average of 400 mm more than kikuyu pasture, reducing the probability of winter surplus water to zero, and eliminating drainage below the root zone. Widely spaced river red gums had a much smaller effect on water use, and would need to number at least 14 trees per hectare to achieve extra soil drying of about 50 mm over a catchment. Soil type affected water use primarily through controlling the rooting depth of the vegetation, but it also changed the partitioning of surplus water between runoff and deep drainage. Strongly duplex soils such as Sodosols shed 50% or more surplus water as runoff, which is important for flushing streams, provided the water is of good quality. Grazing method and pasture management had only a marginal effect in increasing water use, but could have a positive effect on farm profitability through increased livestock production per hectare and improved persistence of perennial species.

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124. Short-term changes in soil nutrients and vegetation biomass and nutrient content following the introduction of extensive management in upland sown swards in Scotland, UK.

Marriott, Carol A.; Bolton, Geoffrey R.; Fisher, Julia M.; and Hood, Kenny

Agriculture, Ecosystems & Environment 106(4):

331-344. (2005)

NAL Call #: S601 .A34; ISSN: 0167-8809

Descriptors: grazing management/ nutrient content/ vegetation biomass

Abstract: Agri-environmental policy changes promote more extensive grazing management but the temporal responses of soil nutrients and vegetation biomass and quality to reductions in grazing intensity are still unresolved. We measured soil nutrients and the biomass and nutrient content of vegetation over 5 years following the introduction of extensive management treatments at three sites in Scotland, UK. Five unfertilised treatments, representing different levels of extensive management, were established on existing sown perennial ryegrass/white clover swards. One treatment was ungrazed (UN) and the others had sward surface height treatments of 4 or 8 cm during two grazing season treatments, summer and autumn, within each year in a factorial combination (4/4, 4/8, 8/8, 8/4 cm). A further treatment, representative of current more intensive systems, received an annual total of 140 kg N ha(-1) plus maintenance P and K and was grazed by sheep

to maintain a sward surface height of 4 cm (417). When compared with more intensive management, there was little effect of 5 years of extensive management on soil nutrients at any of the three sites. The extensive treatments created swards with different above-ground biomass during the season, thus changing the balance between the litter and excretal routes for the recycling of plant nutrients. When expressed relative to treatment 4F, the proportion of live dry mass and N, P and K contents in sown species was on average higher in swards maintained at 4 cm in summer than at 8 cm, and there was evidence of a decline over time in the latter treatments. The proportion of unsown species in live mass increased over time in the unfertilised treatments, and the increase was most rapid in the ungrazed treatment. Nutrient contents of the vegetation in unfertilised swards were lower than those in fertilised swards, and changes over 5 years in the different management treatments differed between sites. However nutrient contents remained above levels that could adversely affect sheep performance throughout this period. Agri-environment schemes that promote extensive grazing management will change vegetation biomass and nutrients but are unlikely to reduce soil nutrients in the short term. (c) 2004 Elsevier B.V. All rights reserved.

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125. The short-term effects of cessation of fertiliser applications, liming, and grazing on microbial biomass and activity in a reseeded upland grassland soil.

Bardgett, R. D. and Leemans, D. K.

Biology and Fertility of Soils 19(2/3): 148-154. (1995)

NAL Call #: QH84.8.B46; ISSN: 0178-2762

Descriptors: grassland soils/ *Lolium perenne*/ fertilizers/ liming/ grazing/ soil microorganisms/ biomass/ soil enzymes/ oxidoreductases/ urease/ phosphoric monoester hydrolases/ adenosine triphosphate/ soil pH/ range management/ highlands/ Wales

Abstract: A field study was conducted to determine the influence of a short-term (2 year) cessation of fertiliser applications, liming, and sheep-grazing on microbial biomass and activity in a reseeded upland grassland soil. The cessation of fertiliser applications (N and NPK) on a limed and grazed grassland had no effect on microbial biomass measurements, enzyme activities, or respiration. Withholding fertiliser and lime from a grazed grassland resulted in significant reductions in both microbial biomass C ($P < 0.05$) and dehydrogenase activity ($P < 0.05$) by approximately 18 and 21%, respectively. The removal of fertiliser applications, liming, and grazing resulted in even greater reductions in microbial biomass C (44%, $P < 0.001$) and dehydrogenase activity (31%, $P < 0.001$), and significant reductions in microbial biomass N ($P < 0.05$), urease activity ($P < 0.05$), phosphatase activity ($P < 0.001$), and basal respiration ($P < 0.05$). The abundance of culturable bacteria and fungi and the soil ATP content were unaffected by changes in grassland managements. With the cessation of liming soil pH fell from 5.4 to 4.7, and the removal of grazing resulted in a further reduction to pH 4.5. A significant negative linear relationship ($r^2 = 0.97$; $P < 0.01$) was found between increasing soil acidity and dehydrogenase activity. Possible mechanisms influencing these changes are discussed.

This citation is from AGRICOLA.

126. Simulating transport of E. coli derived from faeces of grazing livestock using the MACRO model.

McGechan, M. B. and Vinten, A. J. A.

Soil Use and Management 20(2): 195-202. (2004)

NAL Call #: S590.S68; ISSN: 0266-0032

Descriptors: *Escherichia coli*/ feces/ sheep/ coliform bacterial/ contaminants/ water pollution/ drainage water/ soil water content/ soil pore system/ soil transport processes/ simulation models/ rain

Abstract: Coliforms such as *Escherichia coli* and *E. coli* O157 are present in faeces deposited on the ground by grazing livestock, which gives rise to environmental concerns about the consequences of their transport in soil water draining to rivers, lakes, groundwater, water supplies and bathing waters. Following a similar study in relation to slurry spreading (*Soil Use and Management* 2003; 19, 321-330), a two-stage approach was adopted to using the dual-porosity contaminant transport model MACRO to simulate processes by which *E. coli* microorganisms from grazing livestock (sheep) pass through the soil to receiving waters via field drains. First, model parameter values were selected to reproduce experimental measurements showing rapid flows of the organisms by macropore flow without trapping in smaller pores. However, because of the large number of parameters and likely experimental errors, the set of values chosen, although plausible, is not necessarily unique and so any predictions should be considered provisional pending validation. Second, a series of predictive simulations was carried out to test the influence of soil and weather conditions on losses to field drains during grazing. These showed that *E. coli* losses were influenced almost entirely by the soil water content at the time of grazing, rising to a high level during grazing in wet conditions, but low or zero under dry conditions. In contrast, rainfall at the time of grazing had almost no consistent effect, other than large losses on the occasional days with over 20 mm of rain. Overall losses for a period of grazing were generally small during summer, but rose to a high level if grazing continued into autumn, due to the increase in soil water content. This demonstrates that there would probably be substantial reductions in the environmental risks of water pollution by *E. coli* and other faecal microorganisms if continuous grazing were stopped around early September and replaced by grazing on dry days only. This citation is from AGRICOLA.

127. Soil changes associated with cessation of sheep grazing in the Canterbury high country, New Zealand.

Basher, L. R. and Lynn, I. H.

New Zealand Journal of Ecology 20(2): 179-189. (1996)

NAL Call #: QH540.N43; ISSN: 0110-6465

Descriptors: high country/ indicators/ microbial carbon/ nutrients/ sustainability

Abstract: Soil characteristics were examined within and adjacent to two vegetation exclosures near Porters Pass, Canterbury retired from grazing 45 years ago. Soils were analysed for a range of simple physical (topsoil depth, bulk density), chemical (pH, exchangeable cations, P, S, total C and N) and biochemical (microbial carbon) properties to determine whether the vegetation recovery inside the exclosures was reflected in soil differences. At both sites there were few significant differences between the exclosure and the surrounding grazed area, despite vegetation recovery since exclusion of grazing. At Starvation Gully topsoil depth and Na were higher, and bulk

density, pH, K, total C, total N and microbial C mass, and the microbial C to total C ratio were lower in the enclosure. At Cloudy Knoll Ca, Mg, total C and N were higher and Na was lower in the enclosure. There was a marked contrast in the trends at the two sites, with slightly lower nutrient status and organic matter in the enclosure at Starvation Gully, and the reverse at Cloudy Knoll. The differences between the sites probably reflect differences in the partitioning of nutrients and organic matter between vegetation, litter and soil at the two sites. The results suggest a slow rate of change of soil properties following cessation of grazing and the need to sample soils, litter and vegetation when determining trends in organic matter and chemical fertility.
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128. Soil-climate effects on nitrate leaching from cattle excreta.

Stout, W. L.; Gburek, W. J.; Schnabel, R. R.; Folmar, G. J.; and Weaver, S. R.

Journal of Environmental Quality 27(5): 992-998. (1998)

NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: leaching/ cattle/ manure/ farms/ grazing/ soil properties/ climates/ nitrates/ lysimeters/ excretory products/ soils/ agriculture/ climate/ organic wastes/ agricultural runoff/ dairies/ urine/ soil/ animal wastes/ excretion/ nitrogen/ USA, Pennsylvania/ seasonal variations/ cattle manure/ *Dactyls glomerata*

Abstract: Management intensive grazing (MIG) is a grazing system in which animals at a high stocking density are rotated through several paddocks at short time intervals (12-24 h) so that animal performance is maximized.

Although MIG has the potential to increase dairy farm profitability in the northeast USA, recent work in this region has shown that a substantial amount of N recycled through urine is leached below the root zone. How soil properties, particularly water-holding capacity, can affect NO₃-N leaching from beneath urine and feces spots under the climatic conditions of the northeast USA is not known. We conducted a field study to measure NO₃-N leaching loss from spring-, summer-, and fall-applied urine and summer applied feces beneath N-fertilized orchardgrass (*Dactyls glomerata* L., cv. Pennlate) using large drainage lysimeters installed in two soils that differed greatly in soil water storage capacity. The study sites were located in central Pennsylvania on a Hagerstown silt loam soil (fine, mixed, mesic Typic Hapludalf) and a Hartleton channery silt loam (loamy-skeletal, mixed, mesic Typic Hapludult). Compared to the Hagerstown soil, the Hartleton soil provided an 85% decrease in plant N uptake, a 52% increase in leachate volume, but no significant increase in NO₃-N leaching beneath urine spots. However, the lower soil water-holding capacity of the Hartleton soil caused the NO₃-N leaching losses to be more evenly distributed over the year.

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129. Soil compaction under grazing of annual and perennial forages.

Mapfumo, E.; Chanasyk, D. S.; Naeth, M. A.; and Baron, V. S.

Canadian Journal of Soil Science 79(1): 191-199. (1999)

NAL Call #: 56.8 C162; ISSN: 0008-4271

Descriptors: triticale/ grazing/ resistance to penetration/ compaction/ soil compaction/ trampling/ bulk density/ soil

water content/ grasslands/ seasonal variation/ environmental impact/ stocking density/ Triticosecale-wittmark

Abstract: The impact of heavy, medium and light grazing of meadow brome grass [*Bromus riparius*] and triticale on soil bulk density, relative compaction and penetration resistance was assessed at Lacombe, Alberta, Canada, on a orthic black Chernozem of loam to silt loam texture. Sampling was conducted in autumn 1995, spring and autumn 1996, and spring 1997. Core samples were collected to a 15-cm depth for measurement of bulk density and moisture content. Surface (0-2.5 cm) bulk density and penetration resistance were significantly greater under heavily grazed than under medium and lightly grazed meadow brome grass for autumn 1995. Differences in bulk density, relative compaction and penetration resistance for different grazing intensities in spring and autumn 1996 and spring 1997 were not significant. Bulk density decreased over winter in the top 2.5 cm, was not consistent in the 5-10 cm depth interval, and did not change in the 10-15 cm interval. Except for autumn 1995, the relative compaction values for all grazing intensities and forage species were <90%, a value considered critical for plant growth. Generally, within each grazing level, there were minimal differences in bulk density, relative compaction and penetration resistance under triticale compared to those under meadow brome grass.
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130. Soil compaction versus cow-stocking rates on an irrigated grazing system.

Silva, A. P.; Imhoff, S.; and Corsi, M.

Advances in Geoecology(35): 397-406. (2002);

ISSN: 0722-0723

Descriptors: cows/ grazing systems/ irrigated pastures/ soil compaction/ soil physical properties/ soil strength/ soil water/ stocking rate/ trampling/ soil-quality

Abstract: Reduction in pasture productivity is generally attributed to alterations in soil quality. Soil compaction due to animal trampling is one of the factors responsible for the degradation of the physical quality of soils under pasture. The objective of this study was to evaluate soil compaction by determining soil strength in an irrigated short-duration grazing system at three cow-stocking rates. The study was carried out at the ESALQ experimental station (University of Sao Paulo, Brazil), where an irrigated short-duration grazing system was established. Simultaneous measurements of soil strength and moisture were made in plots submitted to three cow-stocking rates: 5.68 animal units (AU) ha⁻¹, 4.42 AU ha⁻¹, and 3.50 AU ha⁻¹. The influence of soil moisture on soil strength was taken into account using regression analysis techniques. After this procedure, the results showed that soil strength was significantly higher for the treatment that employed the highest cow-stocking rate, while similar values were obtained for the other two treatments.

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131. Soil contamination of plant surfaces from grazing and rainfall interactions.

Hinton, T. G.; Stoll, J. M.; and Tobler, L.

Journal of Environmental Radioactivity 29(1): 11-26. (1995)

NAL Call #: QH543.5.A1; ISSN: 0265-931X

Descriptors: environmental transport/ grazing density/ radioactive pollution/ scandium/ soil movement

Abstract: Contaminants often attach to soil particles, and their subsequent environmental transport is largely determined by processes that govern soil movement. We examined the influence of grazing intensity on soil contamination of pastures. Four different grazing densities of sheep were tested against an ungrazed control plot. Scandium concentrations were determined by neutron activation analysis and was used as a tracer of soil adhesion on vegetation. Soil loadings (g soil kg⁻¹ dry plant) increased 60% when grazing intensity was increased by a factor of four ($p = 0.003$). Rain and wind removed soil from vegetation in the ungrazed control plots, but when grazing sheep were present, an increase in rain from 0.3 to 9.7 mm caused a 130% increase in soil contamination. Multiple regression was used to develop an equation that predicts soil loadings as a function of grazing density, rainfall and wind speed ($p = 0.0001$, $r^2 = 0.78$). The model predicts that if grazing management were to be used as a tool to reduce contaminant intake from inadvertent consumption of resuspended soil by grazing animals, grazing densities would have to be reduced 2-5 times to reduce soil loadings by 50%.

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132. Soil derived phosphorus in surface runoff from grazed grassland lysimeters.

Haygarth, P. M. and Jarvis, S. C.

Water Research 31(1): 140-148. (1997)

NAL Call #: TD420.W3; ISSN: 0043-1354

Descriptors: fertilizers/ lysimeters/ phosphorus/ surface runoff/ monitoring/ grasslands/ grazing/ cattle/ rainfall intensity/ water pollution sources/ soil environment

Abstract: Seven 1 ha grazed lysimeter plots, managed as intensive grassland for the last 12 years, were monitored for total phosphorus (TP) and molybdate reactive phosphorus (MRP) in surface runoff plus interflow to 30 cm depth, for up to ten events during 1994. The mean MRP and TP concentrations determined were 40 and 122 $\mu\text{g l}^{-1}$ super(-1), respectively, but the data were heavily skewed by low frequency high intensity events. Thus concentrations of MRP and TP of over 1200 and 1700 $\mu\text{g l}^{-1}$ super(-1) respectively were determined in extreme events, causing a TP export of up to 18 g ha super(-1) per h and, during one event of 30 h duration, over 0.5 kg TP ha super(-1) was estimated to have been removed, representing a significant proportion of the triple super phosphate fertiliser added 6 days earlier. One storm was monitored at 3 h intervals and the patterns for TP concentration and TP load were closely related to discharge. MRP concentration did not follow the hydrographic pattern. Excluding the low frequency high intensity events, an empirical model TP ($\mu\text{g l}^{-1}$ super(-1)) = $58 + [42 \times \text{discharge}]$ (l s^{-1} super(-1)) was postulated, which although significant ($P = 0.0053$), only accounted for 14% of the relationship. It was thus concluded that understanding of release mechanisms in the majority of high frequency, low intensity events is inadequate. Conversely, during one period of high phosphorus (P) export, the mechanisms responsible were suggested to be a combination of the presence of cattle (excretal returns and poaching), timing of inorganic P fertiliser additions, and intensity of rainfall. Grassland soils are a significant source of diffuse P inputs to surface and estuarine waters and may cause eutrophication.

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133. Soil hydrologic response to number of pastures and stocking density under intensive rotation grazing.

Warren, S. D.; Blackburn, W. H.; and Taylor, C. A.

Journal of Range Management 39(6): 500-504. (1986)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1986/396/5warr.pdf>

Descriptors: livestock/ infiltration rate/ sediment production/ sediment loss/ rest period

Abstract: Infiltration rate and sediment production was measured for 2 years on 3 pastures from an intensive rotational grazing system. The pastures were 32, 24, and 16 ha in size. Stocking rate was held constant but stocking density at any given point in time varied due to pasture size. Stocking densities were 0.68, 0.51, and 0.32 ha/AU, respectively. Within the respective treatments, midgrass interspaces exhibited significantly higher infiltration rates and lower sediment production than shortgrass interspaces. Overall, the pasture grazed at the highest stocking density produced the lowest infiltration rates and the greatest sediment loss. However, there was no consistent trend in hydrologic responses over time and the differences appeared to be the result of random selection of a poorer condition site on 1 or 2 occasions rather than the result of stocking density. Regardless of whether the pasture grazed at the highest stocking density was in similar or poorer hydrologic condition in terms of treatment response, the data do not support the hypothesized beneficial hydrologic advantages of increased stocking density via manipulation of pasture size and numbers. Rest, rather than intensive livestock activity, appears to be the key to soil hydrologic stability. The potential for altering the length of the rest period is greatest where the number of pastures is small. Therefore, very little benefit in terms of soil hydrologic condition should be expected from large increases in the number of pastures within rotational grazing systems.

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134. Soil macronutrient distribution in rotationally stocked kikuyugrass paddocks with short and long grazing periods.

Mathews, B. W.; Tritschler, J. P.; Carpenter, J. R.; and Sollenberger, L. E.

Communications in Soil Science and Plant Analysis 30(3-4): 557-571. (1999)

NAL Call #: S590.C63; ISSN: 0010-3624

Descriptors: grazing period length/ kikuyugrass paddock rotational stocking

Abstract: Grazing management affects plant growth and animal production and it may influence the redistribution and cycling of nutrients excreted in dung and urine. Unfortunately, the soil component of pasture systems has received little attention in most grazing trials, and when considered has been evaluated on pastures smaller than those used commercially. A naturalized kikuyu (*Pennisetum clandestinum* Hochst. ex Chiov.) grassland was grazed by heifers (*Bos taurus*) for 2 yr in Experiment 1 to determine the effects of two rotational stocking methods (short vs. long grazing periods) on soil distribution of extractable nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), and sulfur (S) in 4-ha paddocks with natural shade. Additionally, in Experiment 2, kikuyugrass-greenleaf desmodium (*Desmodium intortum* Urb.) paddocks were used to evaluate the effect of distance from waterers on soil nutrient distribution in rotationally stocked paddocks (long grazing periods) without shade in a cooler,

higher elevation, environment. In Experiment 1, soil N, P, and K distribution did not differ between lengths of grazing period when assessed using a zonal soil sampling procedure with zones based on distance from shade and water sources. These nutrients, and in particular K, accumulated within 15 m of shade, but did not accumulate significantly around waterers. In Experiment 2, zonal soil sampling indicated that P, Mg, and especially K, accumulated within 15 m of the waterer. In both studies, extractable K data collected via a grid sampling regime and contour maps constructed from these data supported, in general, the conclusions made using zonal sampling. It is suggested that in this subtropical environment the magnitude of excretal N, P, and K accumulation is greater around shade than waterers, and that in paddocks without shade substantial amounts of P and K accumulate near the waterer. As with small paddocks/pastures, zonal soil sampling appears to be a practical sampling strategy for large paddocks (4 ha).

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135. Soil microbial biomass, C and N mineralization, and enzyme activities in a hill pasture: Influence of grazing management.

Ross, D. J.; Speir, T. W.; Kettles, H. A.; Tate, K. R.; and Mackay, A. D.

Australian Journal of Soil Research 33(6): 943-959. (1995)
NAL Call #: 56.8 Au7; ISSN: 0004-9573

Descriptors: carbon/ elemental sulfur/ fertilizer/ nitrogen/ nutrient cycle/ plant growth/ rock phosphate/ typic Dystrochrept

Abstract: Grazing and fertilizer management practices are of prime importance for maintaining summer-moist hill pastures of introduced grasses and clovers in New Zealand for sheep and cattle production. The influence of withholding grazing (a pastoral fallow) from spring to late summer on microbial biomass, C and N mineralization, and enzyme activities was investigated in a Typic Dystrochrept soil from unfertilized and fertilized (rock phosphate and elemental S) low-fertility pastures at a temperate hill site. The fallow increased pasture but not legume growth in the following year in the unfertilized treatment, but had no effect on pasture or legume growth in fertilized plots. High background levels of the biochemical properties examined, and very variable rates of N mineralization, complicated data interpretation. Extractable-C concentration and CO₂-C production were enhanced at the completion of the fallow. Increases in net N mineralization (14-56 days incubation), following initial immobilization, after the fallow were clearly indicated in the unfertilized treatment, but were less distinct in the fertilized treatment. The fallow had no detectable influence on the concentrations of total C and N or microbial C and P, or on invertase, phosphodiesterase and sulfatase activities. Some small changes in microbial N and an increased proportion of bacteria in the microbial population were, however, suggested. Results are consistent with the concept of fallowing giving a short-term increase in pools of readily decomposable soil organic matter. Generally, the changes that did occur in these soil biochemical properties are, with the partial exception of increased N availability, unlikely to have had any pronounced impact on subsequent pasture performance.

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136. Soil organic C and N pools under long-term pasture management in the Southern Piedmont USA.

Franzleubbers, A. J.; Stuedemann, J. A.; Schomberg, H. H.; and Wilkinson, S. R.

Soil Biology and Biochemistry 32(4): 469-478. (2000)
NAL Call #: S592.7.A1S6; ISSN: 0038-0717

Descriptors: pastures/ range management/ grazing/ botanical composition/ age/ land use/ soil organic matter/ carbon/ nitrogen/ soil microorganisms/ biomass/ grassland soils/ forest soils/ agricultural soils/ Georgia
Abstract: Soil organic matter pools under contrasting long-term management systems provide insight into potentials for sequestering soil C, sustaining soil fertility and functioning of the soil-atmospheric interface. We compared soil C and N pools (total, particulate and microbial) under pastures (1) varying due to harvest technique (grazing or haying), species composition (cool- or warm-season), stand age and previous land use and (2) in comparison with other land uses. Grazed tall fescue-common bermudagrass pasture (20 yr old) had greater soil organic C (31%), particulate organic C (66%), particulate organic N (2.4 fold) and soil microbial biomass C (28%) at a depth of 0-200 mm than adjacent land in conservation-tillage cropland (24 yr old). Soil organic C and total N at a depth of 0-200 mm averaged 3800 and 294 g m⁻², respectively, under grazed bermudagrass and 3112 and 219 g m⁻², respectively, under hayed bermudagrass. A chronosequence of grazed tall fescue suggested soil organic N sequestration rates of 7.3, 4.4 and 0.6 g m⁻² yr⁻¹ to a depth of 200 mm during 0-10, 10-30 and 30-50 yr, respectively. Soil C storage under long-term grazed tall fescue was 85 to 88% of that under forest, whereas soil N storage was 77 to 90% greater under grazed tall fescue than under forest. Properly grazed pastures in the Southern Piedmont USA have great potential to restore natural soil fertility, sequester soil organic C and N and increase soil biological activity. This citation is from AGRICOLA.

137. The soil structure component of soil quality under alternate grazing management strategies.

Southorn, Neil J.

In: Sustainable land management: Environmental protection: A soil physical approach/ Pagliai, Marcello and Jones, Robert; Vol. 35.
Reiskirchen, Germany: Catena Verlag, 2002; pp. 163-170.
Notes: Meeting Information: International Conference on Sustainable Soil Management for Environmental Protection: Soil Physical Aspects, Firenze, Italy; July 02-07, 2001; ISBN: 3923381484

NAL Call #: S596 .158 2001

Descriptors: alternate grazing management: applied and field techniques/ image analysis: imaging and microscopy techniques, laboratory techniques/ soil properties: bulk density, hydraulic conductivity, microbial activity, organic carbon content, penetration resistance, pore geometry/ soil quality: soil structure component
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138. Soil water regimes of rotationally grazed perennial and annual forages.

Twerdoff, D. A.; Chanasyk, D. S.; Naeth, M. A.; Baron, V. S.; and Mapfumo, E.

Canadian Journal of Soil Science 79(4): 627-637. (1999)
NAL Call #: 56.8 C162; ISSN: 0008-4271

Descriptors: rotational grazing: agronomic method, annual

forages, perennial forages/ evaporation/ soil water regime/ water use efficiency

Abstract: To maintain a sustainable agricultural system, management practices such as grazing must ensure adequate soil water for plant growth, yet minimize the risk of soil erosion. The objective of this study was to characterize the soil water regime of perennial and annual forages under three grazing intensities (heavy, medium and light). The study was conducted at the Lacombe Research Station, Alberta, on an Orthic Black Chernozem of loam to silt loam texture. The forages used were smooth brome grass (*Bromus inermis* L. 'Carlton'), meadow brome grass (*Bromus riparius* L. 'Paddock'), a mixture of triticale (X *Triticosecale* Wittmack 'Pika') and barley (*Hordeum vulgare* L. 'AC Lacombe') and triticale. Soil water measurements were conducted between April and October of 1994 and 1995 using a neutron scattering hydroprobe to a depth of 90 cm. Surface (0-7.5 cm) soil water was more responsive to grazing intensity than soil water accumulated to various depths. For all grazing treatments and forages, both surface soil water and accumulated soil water generally fluctuated between field capacity and wilting point during the growing season. Although plant water status was not determined, no visual permanent wilting of forages was observed during the study. Differences in evapotranspiration (ET), as determined by differences in soil water were evident among forage species but not grazing intensities, with perennials having high ET in spring and annuals having high ET in summer. Estimated values of water-use efficiency (WUE) were greater for perennials than for annuals and grazing effects on WUE were minimal. From a management perspective, grazing of annuals and perennials altered soil water dynamics but still maintained adequate soil water for plant growth.

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139. Spatial variability of soil total C and N and their stable isotopes in an upland Scottish grassland.

Marriott, C. A.; Hudson, G.; Hamilton, D.; Neilson, R.; Boag, B.; Handley, L. L.; Wishart, J.; Scrimgeour, C. M.; and Robinson, D.

Plant and Soil 196(1): 151-162. (1997)

NAL Call #: 450 P696; ISSN: 0032-079X

Descriptors: geostatistics/ grazing management/ spatial variability/ total soil carbon/ total soil nitrogen

Abstract: As preparation for a below ground food web study, the spatial variability of three soil properties (total N, total C and pH) and two stable isotopes ($\delta^{13}C$ and $\delta^{15}N$ of whole soil) were quantified using geostatistical approaches in upland pastures under contrasting management regimes (grazed, fertilized and ungrazed, unfertilized) in Scotland. This is the first such study of upland, north maritime grasslands. The resulting patterns of variability suggest that to obtain statistically independent samples in this system, a sampling distance of greater than 13.5 m is required. Additionally, temporal change (a decline of 1permil) was observed in whole soil $\delta^{15}N$ for the grazed, fertilized plot. This may have been caused by new inputs of symbiotically-fixed atmospheric N_2 .

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140. Spatial variation of plant-available phosphorus in pastures with contrasting management.

Sauer, Thomas J. and Meek, David W.

Soil Science Society of America Journal 67(3): 826-836. (2003)

NAL Call #: 56.9 So3; ISSN: 0361-5995

Descriptors: contrasting management systems/ grazing/ pH level/ pasture/ poultry litter/ spatial variation

Abstract: Land application of animal manure, at rates based on soil nutrient content or crop requirements, optimizes nutrient recycling and minimizes offsite environmental impacts. The objective of this research was to characterize the spatial variation of plant-available P and other soil properties (C, N, and pH) in two pastures having contrasting grazing and poultry litter management. One site (Cellar Ridge) was a lightly grazed 6-ha tall fescue (*Festuca arundinacea* Schreb.) pasture with limited poultry litter application and the other (Haxton) was a 9.5-ha tall fescue pasture with annual poultry litter application and intensive rotational grazing for 10 yr. Soil cores (0-0.15 m) were collected on a 30-m grid at both sites and analyzed for plant-available P (Mehlich-3 extract), total C and N (combustion method), and pH (1:1 water/0.01 M CaCl₂). Cellar Ridge had significantly less Mehlich-3 extractable P (32 vs. 341 mg kg⁻¹), more acid pH (5.25 vs. 5.73), and significantly greater C (23.3 vs. 16.3 g C kg⁻¹) and N (1.76 vs. 1.54 g N kg⁻¹). Spatial dependence over approximately 1 to 3 lag distances with a consistent orientation (across ridge) was observed for all parameters at Cellar Ridge. No spatial dependence was observed for Mehlich-3 P, C, N, or pH at the Haxton site (all parameters exhibiting nugget effect). Ten years of poultry litter application likely eliminated spatial structure for these properties. Further research is needed to determine whether additional costs associated with grid sampling and variable rate litter application can be justified.

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141. Stocking method effects on nutrient runoff from pastures fertilized with broiler litter.

Kuykendall, H. A.; Cabrera, M. L.; Hoveland, C. S.; Mccann, M. A.; and West, L. T.

Journal of Environmental Quality 28(6): 1886-1890. (1999)

NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: nutrients/ runoff/ pastures/ fertilization/ litter/ forages/ cattle/ agricultural practices/ grazing/ water quality/ fate of pollutants/ agricultural runoff/ fertilizers/ animal wastes/ manure/ land (grass and pasture)/ animal foodstuffs/ cattle (see also livestock)/ water quality (natural waters)/ *Bos taurus*/ *Gallus gallus domesticus*/ *Festuca arundinacea*/ *Cynodon dactylon*

Abstract: Repeated applications of broadcast broiler (*Gallus gallus domesticus*) litter can increase nutrient runoff from pastures. Rotational stocking (RS) of cattle, as compared with continuous stocking (CS), may be useful in decreasing surface nutrient runoff because of better manure distribution and more uniform forage accumulation to act as filters and trap nutrients. Our objective was to measure nutrient runoff from six 0.75-ha tall fescue (*Festuca arundinacea* Schreb.)-common bermudagrass [*Cynodon dactylon* (L.) Pers.] pastures fertilized with 13 to 15 Mg (dry weight) broiler litter per hectare per year and managed under RS or CS. Two cross-bred beef (*Bos taurus*) steers were maintained on each pasture year around for 2 yr, with additional steers added to maintain

similar forage availability between stocking methods. In each pasture, surface runoff was directed to a flume where it was sampled by an automatic sampler. Runoff was analyzed for total Kjeldahl N, (NO sub(3) super(-) + NO sub(2) super(-)-N, NH sub(4) super(+)-N, total Kjeldahl P, and dissolved reactive P (DRP). Grazing method had no effect ($P > 0.10$) on surface runoff quality or quantity. Average runoff expressed as a percentage of the rain was 15% for the first year and 12% for the second year. The average flow-weighted concentrations of DRP and NH sub(4) super(+)-N were 5.08 mg P L super(-1) and 1.07 mg N L super(-1) for the first year, and 8.22 mg P L super(-1) and 10.11 mg N L super(-1) for the second year ($P < 0.10$).
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142. Stormflow and sediment loss from intensively managed forest watersheds in east Texas.

Blackburn, W. H.; Knight, R. W.; Wood, J. C.; and Pearson, H. A.

Water Resources Bulletin 26(3): 465-178. (1990)

NAL Call #: 292.9 Am34; ISSN: 0043-1370

Descriptors: watersheds/ sediment transport/ river discharge/ forest industry/ resource management/ environmental impact/ USA, Texas, east

Abstract: Five small (4 ha) forested watersheds in East Texas were instrumented in December 1980 to determine the effect of forest harvesting, mechanical site preparation, and livestock grazing on stormflow, peak discharge rate, and sediment loss. After three pretreatment years, four of the watersheds were treated as follows: (1) clearcutting followed by roller chopping; (2) clearcutting following by shearing and windrowing; (3) clearcutting following by shearing, windrowing, and continuous grazing; and (4) clearcutting followed by shearing, windrowing, and rotational grazing. Clearcut harvesting and all site preparation treatments significantly increased stormflow, peak discharge, and sediment losses over the undisturbed condition. Roller chopping and shearing/windrowing had little impact on sediment loss from these watersheds and appears to be a sound forest conservation practice for gently sloping watersheds (<8 percent). As applied, livestock grazing had minimal impact on stormflow and peak discharge. The moderately stocked continuously grazed treatment had little impact on sediment loss, but the high stocking density of the rotational grazing treatment increased sediment losses over the undisturbed condition. Sediment losses from these intensively managed forest watersheds, even though significantly greater than from undisturbed conditions, were within the range of sediment losses from undisturbed watersheds in the Southeast, below the range of losses from mechanically prepared watersheds elsewhere, and well below potential losses from pasture and cropland. (DBO)
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143. Streambank erosion associated with grazing practices in Central Kentucky.

Agouridis, C. T.; Edwards, D. R.; Workman, S. R.; Bicudo, J. R.; Taraba, J. L.; Vanzant, E. S.; and Gates, R. S.

In: 2004 ASAE Annual International Meeting. (Held 1 Aug 2004-4 Aug 2004 at Ottawa, Ontario, Canada.); pp. 2949-2974; 2004.

NAL Call #: S671.3 .A54

Descriptors: BMP/ management/ riparian/ soil loss

Abstract: Research into the effects of cattle grazing on

stream health has been well documented in the western portion of the United States, but is lacking in the east. Western researchers have estimated that 80% of the damage incurred by stream and riparian systems in these arid environments was from grazing livestock. Stream and riparian damage resulting from grazing includes alterations in watershed hydrology, changes to stream morphology, soil compaction and erosion, destruction of vegetation, and water quality impairments. The objective of this project was to provide the agricultural community with a better understanding of the impacts of cattle grazing on stream bank erosion so as to enhance current cattle production methods on farms in the humid region of the U.S. The project site, located on the University of Kentucky's Animal Research Center, consisted of two replications of three treatments: control, selected BMPs with free access to the stream, and selected BMPs with limited access to the stream. Fifty permanent cross sections were established throughout the project site. Over a two year period, 18 surveys were conducted using conventional surveying techniques. Changes in stream cross sectional area were used to quantify soil loss or gain associated with the different treatment levels. Results from this project indicated that streambank erosion can be minimized through the incorporation on a BMP system (with or without a fenced riparian area). In the absence of a protected riparian zone, grazing managers should modify their practices to minimize cattle activity (i.e. flash grazing, no grazing), and associated erosion along streambanks, during periods characterized by higher flows and/or hot humid conditions.
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144. Streambank erosion associated with grazing practices in the humid region.

Agouridis, C. T.; Edwards, D. R.; Workman, S. R.; Bicudo, J. R.; Koostra, B. K.; Vanzant, E. S.; and Taraba, J. L.

Transactions of the ASAE 48(1): 181-190. (2005)

NAL Call #: 290.9 Am32T; ISSN: 0001-2351

[http://www.bae.uky.edu/WQ406/publications/TransASAE48\(1\)181-190.pdf](http://www.bae.uky.edu/WQ406/publications/TransASAE48(1)181-190.pdf)

Descriptors: bank erosion/ cattle/ grazing/ best management practices/ riparian areas/ streams/ fences/ erosion control/ Kentucky

Abstract: The effects of cattle grazing on stream stability have been well documented for the western portion of the U.S., but are lacking for the east. Stream and riparian damage resulting from grazing can include alterations in watershed hydrology, changes to stream morphology, soil compaction and erosion, destruction of vegetation, and water quality impairments. However, few studies have examined the successes of best management practices (BMPs) for mitigating these effects. The objective of this project was to assess the ability of two common BMPs to reduce streambank erosion along a central Kentucky stream. The project site consisted of two replications of three treatments: (1) an alternate water source and a fenced riparian area to exclude cattle from the stream except at a 3.7 m wide stream ford, (2) an alternate water source with free stream access, and (3) free stream access without an alternate water source (i.e., control). Fifty permanent cross-sections were established throughout the project site. Each cross-section was surveyed monthly from April 2002 until November 2003. Results from the project indicated that the incorporation of an alternate water source and/or fenced riparian area did not significantly alter stream

cross-sectional area over the treatment reaches. Rather than exhibiting a global effect, cattle activity resulted in streambank erosion in localized areas. As for the riparian exclosures, changes in cross-sectional area varied by location, indicating that localized site differences influenced the processes of aggradation and/or erosion. Hence, riparian recovery within the exclosures from pretreatment grazing practices may require decades, or even intervention (i.e., stream restoration), before a substantial reduction in streambank erosion is noted. This citation is from AGRICOLA.

145. Study of the contribution of nutrients to the soil by the feces of cows grazing in 3 rotational systems.

Suarez, J. J.; Senra, A.; and Galindo, J. L.
Cuban Journal of Agricultural Science 15(1): 95-102. (1981)
NAL Call #: S1.R4; ISSN: 0864-0408

Descriptors: classification model/ paddock system/ phosphorus/ potassium

Abstract: The contribution of nutrients to the soil by feces of cows grazing 18 h/day in 3 rotational systems (8, 4 and 2 paddocks) was studied in the dry season of 1978. The measurements were as follows: feces number/cow, feces diameter and content of organic matter (DM), P and K in the soil. A simple classification model was used. The feces number/cow (10.1 and 11.5) was higher in the systems of 8 and 4 paddocks compared with the 2 paddock system (7.5). The diameters (26.1; 25.7 and 26.7 cm) of the feces were similar in the 3 systems. The percentage of the covered area/paddock per yr was low (6.28, 6.99 and 5.19%). The amount (kg/ha per yr) of nutrients supplied by feces (40, 50 and 52 kg of N; 9, 11 and 7 kg of P and 10, 12 and 8 kg of K in the 8, 4 and 2 paddock system, respectively) was low. In the 1st yr of grazing the DM and K contents in the soil increased ($P < 0.001$), while the P content decreased ($P < 0.001$). Under grazing conditions, the contribution of N and P to the soil by the feces are so poor that their application is still needed. The increase of K content in the soil could save applications of this nutrient.

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146. The use of a nitrification inhibitor, dicyandiamide (DCD), to decrease nitrate leaching and nitrous oxide emissions in a simulated grazed and irrigated grassland.

Di, H. J. and Cameron, K. C.
Soil Use and Management 18(4): 395-403. (2002)
NAL Call #: S590.S68; ISSN: 0266-0032

Descriptors: lysimeter: field equipment/ dairy farms/ drainage water: nitrate concentration/ free draining lismore stony silt loam: udic haplustept loamy skeletal/ grazed dairy pasture systems/ grazed paddock/ herbage production/ simulated grassland: grazed, irrigated/ water quality

Abstract: In grazed dairy pasture systems, a major source of NO₃- leached and N₂O emitted is the N returned in the urine from the grazing animal. The objective of this study was to use lysimeters to measure directly the effectiveness of a nitrification inhibitor, dicyandiamide (DCD), in decreasing NO₃- leaching and N₂O emissions from urine patches in a grazed dairy pasture under irrigation. The soil was a free-draining Lismore stony silt loam (Udic Haplustept loamy skeletal) and the pasture was a mixture of perennial ryegrass (*Lolium perenne*) and white clover (*Trifolium repens*). The use of DCD decreased NO₃--N leaching by 76% for the urine N applied in the autumn, and

by 42% for urine N applied in the spring, giving an annual average reduction of 59%. This would reduce the NO₃--N leaching loss in a grazed paddock from 118 to 46 kg N ha⁻¹ yr⁻¹. The NO₃--N concentration in the drainage water would be reduced accordingly from 19.7 to 7.7mg N L⁻¹, with the latter being below the drinking water guideline of 11.3 mg N L⁻¹. Total N₂O emissions following two urine applications were reduced from 46 kg N₂O-N ha⁻¹ without DCD to 8.5 kg N₂O-N with DCD, representing an 82% reduction. In addition to the environmental benefits, the use of DCD also increased herbage production by more than 30%, from 11 to 15 t ha⁻¹ yr⁻¹. The use of DCD therefore has the potential to make dairy farming more environmentally sustainable by reducing NO₃- leaching and N₂O emissions.

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147. Use of fertilization and grazing exclusion in mitigating lost meadow production in the Sierra Nevada, California, USA.

Kie, J. G. and Myler, S. A.
Environmental Management 11(5): 641-648. (1987)
NAL Call #: HC79.E5E5; ISSN: 0364-152X

Descriptors: agriculture/ ammonium phosphate/ dolomite/ mitigation/ hydroelectric development/ denitrification/ graminoids/ forbs

Abstract: The effects of single fertilizer treatment (ammonium phosphate at 841 kg/ha, plus dolomite at 336 kg/ha) and cattle exclusion were studied in two meadows in the Sierra Nevada of California in the USA. Grazing exclusion had no effect on soil bulk density during the three years of the study. Fertilization had no effect on total soil nitrogen, soil pH, or crude protein concentrations in graminoids or forbs. Saturated soils and the development of anaerobic conditions close to the surface may have led to denitrification and the loss of usable nitrogen. Fertilization did result in short-term (one- to two-year) increases in available solid phosphorus in the drier of the two meadows, and in total phosphorus concentrations in graminoids and forbs, which were otherwise generally deficient in phosphorus. Few changes in plant species composition or production were detected, although a combination of fertilization and grazing exclusion increased forb production in the drier meadow. Based on our initial results, fertilization with phosphorus was the recommended treatment for meadow improvement projects in the central Sierra Nevada.

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148. Using constructed wetlands to treat subsurface drainage from intensively grazed dairy pastures in New Zealand.

Tanner, C. C.; Nguyen, M. Long; and Sukias, J. P. S.
Water Science and Technology 48(5): 207-213. (2003)
NAL Call #: TD420.A1P7; ISSN: 0273-1223

Descriptors: intensively grazed dairy pastures: subsurface drainage/ non point source pollution

Abstract: Performance data, during the start-up period, are presented for constructed wetlands treating subsurface drainage from dairy pastures in Waikato (rain-fed) and Northland (irrigated), North Island, New Zealand. The wetlands comprised an estimated 1 and 2% of the drained catchment areas, respectively. Nitrate concentrations were high in the drainage inflows at both sites (medians 10 g m⁻³ at Waikato and 6.5 g m⁻³ at Northland), but organic N was

also an important form of N at Waikato (37% of TN). Comparison of wetland inflow and outflow nutrient concentrations showed overall nutrient reductions during passage through the wetlands for NO₃-N (34 and 94% for medians, respectively), TN (56 and 33%, respectively), and DRP (80%, Northland only). Median NH₄-N (both sites) and DRP (Waikato) concentrations showed apparent increases between the wetland inlets and outlets. However, a mass balance calculated for the 3 month preliminary monitoring periods showed substantial mass removal of DRP (80%) and all measured forms of N (NO₃-N 78%, NH₄-N 41%, Org-N 99.8% and TN 96%) in the Waikato wetland. Monitoring of these systems needs to be continued through a range of seasons and years to fully assess their long-term performance.

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149. Using nitrogen-15 to quantify vegetative buffer effectiveness for sequestering nitrogen in runoff.

Bedard-Haughn, A.; Tate, K. W.; and Van Kessel, C. *Journal of Environmental Quality* 33(6): 2252-2262. (2004) NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: water pollution/ pollution control/ nitrogen/ losses from soil/ agricultural runoff/ ground vegetation/ filter strips/ conservation buffers/ environmental fate/ soil transport processes/ pastures/ irrigation/ grazing/ nutrient uptake/ stable isotopes/ California

Abstract: Previous studies have observed higher levels of soluble nutrients leaving vegetative buffers than entering them, suggesting that the buffers themselves are acting as a source rather than a sink by releasing previously stored nutrients. This study used 98 atom % ¹⁵N-labeled KNO₃ at a rate of 5 kg ha⁻¹ to quantify buffer efficiency for sequestering new inputs of NO₃(-)-N in an extensively grazed irrigated pasture system. Buffer treatments consisted of an 8-m buffer, a 16-m buffer, and a nonbuffered control. Regardless of the form of runoff N (NO₃(-), NH₄(+), or dissolved organic nitrogen [DON]), more ¹⁵N was lost from the nonbuffered treatments than from the buffered treatments. The majority of the N attenuation was by vegetative uptake. Over the course of the study, the 8-m buffer decreased NO₃(-)-¹⁵N load by 28% and the 16-m buffer decreased load by 42%. For NH₄(+)-¹⁵N, the decrease was 34 and 48%, and for DON-¹⁵N, the decrease was 21 and 9%. Although the buffers were effective overall, the majority of the buffer impact occurred in the first four weeks after ¹⁵N application, with the buffered plots attenuating nearly twice as much ¹⁵N as the nonbuffered plots. For the remainder of the study, buffer effect was not as marked; there was a steady release of ¹⁵N, particularly NO₃(-)- and DON-¹⁵N, from the buffers into the runoff. This suggests that for buffers to be sustainable for N sequestration there is a need to manage buffer vegetation to maximize N demand and retention. This citation is from AGRICOLA.

150. Water-quality benefits of having cattle manure deposited away from streams.

Larsen, Royce E.; Miner, J. Ronald; Buckhouse, John C.; and Moore, James A.

Bioresource Technology 48(2): 113-118. (1994) NAL Call #: TD930.A32; ISSN: 0960-8524

Descriptors: cattle industry/ agriculture/ bacterial transport/ methods/ soil permeability/ water pollution/ weather

Abstract: A series of runoff and infiltration studies with

bovine feces placed 0.0, 0.61, 1.37, or 2.13 m from a collection point were used to assess effectiveness of vegetative fiber strips. Effectiveness was evaluated on the ability of the separation distance to reduce the number of fecal coliform (FC) bacteria being transported from the manure to the edge of the plots. Bacterial transport was evaluated under conditions of variable distance, soil permeability, and rainfall intensity. The FC bacteria yields were 40-115 million at the edge of the manure pile. This is only 17% of the FC in the manure. FC concentrations and yields were further reduced as the separation increased. The analysis of data did not indicate significant differences of bacteria transport in relation to rainfall intensities of 5 cm/h versus 10 cm/h at the 0.61, 1.37, or 2.13 m distances. © The Thomson Corporation

151. Water quality implications of dairy slurry applied to cut pastures in the northeast USA.

Stout, W. L.; Weaver, S. R.; Gburek, W. J.; Folmar, G. J.; and Schnabel, R. R.

Soil Use and Management 16(3): 189-193. (2000) NAL Call #: S590.S68; ISSN: 0266-0032

Descriptors: drainage lysimeter: equipment/ animal grazing/ dairy slurry: feces, urine/ drinking water standard/ groundwater pollution: non point source/ leaching/ soil type/ US EPA: government agency

Abstract: Nitrate nitrogen (NO₃-N) leaching from animal production systems in the northeast USA is a major non-point source of pollution in the Chesapeake Bay. We conducted a study to measure NO₃-N leaching from dairy slurry applied to orchardgrass (*Dactylis glomerata* L., cv. Pennlate) using large drainage lysimeters to measure the direct impact of four rates of slurry (urine and faeces) N application (0, 168, 336, 672 kg N ha⁻¹ yr⁻¹) on NO₃-N leaching on three soil types. We then used experimentally-based relationships developed earlier between stocking density and NO₃-N leaching loss and leachate NO₃-N concentration to estimate the added impact of animal grazing. Nitrate N leaching losses from only dairy slurry applied at the 0, 158, 336, and 672 kg N ha⁻¹ yr⁻¹ rates were 5.85, 8.26, 8.83, and 12.1 kg N ha⁻¹ yr⁻¹, respectively with corresponding NO₃-N concentrations of 1.60, 2.30, 2.46, and 3.48 mg l⁻¹. These NO₃-N concentrations met the 10 mg l⁻¹ US EPA drinking water standard. However, when a scenario was constructed to include the effect of NO₃-N leaching caused by animal grazing, the NO₃-N drinking water standard was calculated to be exceeded. © The Thomson Corporation

152. Water quality implications of nitrate leaching from intensively grazed pasture swards in the northeast US.

Stout, W. L.; Fales, S. L.; Muller, L. D.; Schnabel, R. R.; and Weaver, S. R.

Agriculture, Ecosystems & Environment 77(3): 203-210. (2000)

NAL Call #: S601.A34; ISSN: 0167-8809

Descriptors: *Dactylis glomerata*/ *Medicago sativa*/ *Trifolium repens*/ pastures/ water quality/ leaching/ nitrates/ groundwater/ stocking rate/ range management/ nitrate nitrogen/ nitrogen fertilizers/ groundwater contamination/ intensive livestock farming/ Pennsylvania

Abstract: High density animal production systems, such as management intensive grazing (MIG), can have a negative effect on water quality. Learning to manage such systems to minimize water quality impacts is essential for the

environmental and economic sustainability of these types of animal production systems. Management intensive grazing is a grazing system in which animals at a high stocking density are rotated through several paddocks at short time intervals (12-24 h) so that animal performance is maximized. Although MIG has the potential to increase dairy farm profitability in the northeast US, recent work in this region has shown that a substantial amount of N applied as fertilizer is leached below the root zone of orchardgrass (*Dactylis glomerata* L., (cv.) 'Pennlate') managed as an intensive pasture. How much N is leached from other forage species managed as intensive pasture under the climatic conditions of the northeast US is not known. A field study was conducted using large drainage lysimeters to measure NO₃-N leaching loss from six pasture swards: orchardgrass + N, orchardgrass + alfalfa (*Medicago sativa* L., (cv.) Alfagraze), orchardgrass + Ladino type white clover (*Trifolium repens* L.), Ryegrass (*Lolium perenne* L., (cv.) Citadel) + N, ryegrass + alfalfa, and ryegrass + white clover. The study site was located in central Pennsylvania on a Hagerstown silt loam soil (fine, mixed, mesic Typic Hapludalf). Nitrate-N leaching losses were most consistent under N fertilized swards where the amount of N could be adjusted for yearly weather conditions. In a drought year, NO₃-N leaching increased dramatically in swards containing alfalfa or white clover. Sward type and stocking density need to be taken into consideration when developing an animal production system that will be both environmentally and economically sustainable.

This citation is from AGRICOLA.

153. Water quality improvement program effectiveness for carbonate aquifers in grazed land watersheds.

Boyer, D. G.

Journal of the American Water Resources Association 41(2): 291-300. (2005)

NAL Call #: GB651.W315; ISSN: 1093-474X

Descriptors: water quality/ aquifers/ livestock/ catchments/ fecal coliforms/ basins/ water resources/ drainage/ dairies/ watersheds/ environmental quality/ cattle/ water wells/ agriculture/ water quality control/ best management practices/ karst/ catchment areas/ catchment basins/ grazing/ forages/ indicators/ rivers/ coliforms/ USA, West Virginia, Greenbrier R.

Abstract: Water quality indicators of two agriculturally impacted karst areas in southeastern West Virginia were studied to determine the water quality effects of grazing agriculture and water quality trends following initiation of water quality improvement programs. Both areas are tributaries of the Greenbrier River and received funding for best management practices under the President's Initiative for Water Quality and then under the Environmental Quality Incentives Program (EQIP). After 11 years of study there was little evidence to suggest that water quality improved in one area. Three and a half years of study in the other area showed little evidence of consistent water quality improvement under EQIP. Lack of consistent water quality improvement at the catchment scale does not imply that the voluntary programs were failures. Increased livestock numbers as a result of successful changes in forage management practices may have overridden water quality improvements achieved through best management practices. Practices that target well defined contributing areas significantly impacting aquifer water quality might be one way to improve water quality at catchment scales in karst basins. For example, a significant decrease in fecal coliform concentrations was observed in subterranean drainage from one targeted sinkhole after dairy cattle were permanently excluded from the sinkhole.

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154. Will a water trough reduce the amount of time hay-fed livestock spend in the stream (and therefore improve water quality)?

Miner, J. R.; Buckhouse, J. C.; and Moore, J. A.

Rangelands 14(1): 35-38. (1992)

NAL Call #: SF85.A1R32; ISSN: 0190-0528

Descriptors: water quality/ cattle/ water troughs/ streams/ environmental impact/ Oregon/ fecal flora

This citation is from AGRICOLA.

Fish and Wildlife Effects

155. Alfalfa weevil (Coleoptera: Curculionidae) management in alfalfa by spring grazing with cattle.

Buntin, G. D. and Bouton, J. H.

Journal of Economic Entomology 89(6): 1631-1637. (1996)

NAL Call #: 421 J822; ISSN: 0022-0493

Descriptors: alfalfa cultivar Alfagraze/ alfalfa cultivar Apollo/ biobusiness/ carbofuran/ economic entomology/ grazing/ grazing tolerance/ host/ insecticide/ integrated pest management/ larva/ larval density/ permethrin/ pest/ pest management

Abstract: The effect of continuous, intensive grazing by cattle in the 1st alfalfa growth cycle on larval densities of the alfalfa weevil, *Hyera postica* (Gyllenhal), was evaluated in 'Alfagraze' and 'Apollo' alfalfa, which are tolerant and not tolerant to grazing, respectively. In small-cage exclusion trials, grazing reduced larval numbers in 1991 by 65% in

Alfagraze and by 32% in Apollo. Larval numbers in 1992 were low (ltoreq 0.6 larvae per stem) and were not reduced significantly by grazing. Grazing and use of early insecticide treatments of permethrin or carbofuran at low rates with ltoreq 7-d grazing restrictions to suppress larval numbers before grazing also were examined in large-plot exclusion trails in 1993 and 1994. Grazing reduced larval densities by 60% in 1993 and 45% in 1994 during a 3-wk period beginning 3 wk after grazing was initiated. However, alfalfa weevil larvae caused moderate leaf injury in 1993 and severe injury in 1994 before grazing reduced larval numbers. Use of permethrin at 0.11 kg (Al)/ha or carbofuran or chlorpyrifos at 0.28 kg(Al)/ha effectively reduced larval numbers and prevented leaf injury before grazing began. Therefore, a combination of an early application of an insecticide treatment with a short grazing

restriction followed by continuous grazing will control alfalfa weevil larvae while allowing cattle to graze and directly use forage of grazing-tolerant alfalfa.

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156. Aphid (Homoptera: Aphididae) management in alfalfa by spring grazing with cattle.

Buntin, G. D. and Bouton, J. H.

Journal of Entomological Science 32(3): 332-342. (1997)

NAL Call #: QL461.G4; ISSN: 0749-8004

Descriptors: aphid management/ integrated pest management/ spring grazing

Abstract: The effect of continuous, intensive grazing by cattle on aphid populations was examined in the first growth cycle of 'Alfagraze' and 'Apollo' alfalfa which are tolerant and not tolerant to grazing, respectively. Populations were almost entirely pea aphid *Acyrtosiphon pisum* (Harris). The effect of grazing on aphid population, was examined in small plot exclusion studies in 1991 and 1992, and the effects of grazing and use of an early insecticide application with 7 day grazing restriction were examined in large plot exclusion trials in 1993 and 1994. Grazing reduced aphid populations by 66% to 90% when numbers exceeded -1 aphid per stem. Populations were not significantly reduced by grazing when numbers did not exceed 1 per stem. Permethrin reduced aphid numbers for up to 7 wks and was more effective than carbofuran. Effects of grazing were similar regardless grazed than ungrazed plots when aphid numbers were reduced by grazing in 1993, but were not greatly affected by grazing in 1994 when aphid numbers were low. Coccinellid numbers paralleled trends in aphid numbers. Continuous, intensive grazing or the early application of an insecticide at a low rate followed by grazing were effective approaches for suppressing pea aphid in alfalfa.

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157. Benefits of rotational grazing and dense nesting cover for island-nesting waterfowl in southern Quebec.

Lapointe, S.; Giroux, J.-F.; Belanger, L.; and Fillion, B.

Agriculture, Ecosystems & Environment 78(3): 261-272. (2000)

NAL Call #: S601 .A34; ISSN: 0167-8809

Descriptors: grazing/ nests/ agricultural practices/ wildlife management/ environment management/ nature conservation/ aquatic birds/ breeding sites/ islands/ population density/ population structure/ dominant species/ habitat improvement/ vegetation cover/ herbivores/ agriculture/ man-induced effects/ Anatidae/ *Anas strepera*/ *Anas acuta*/ Canada, Quebec/ Canada, St. Lawrence R./ Canada/ ducks/ cattle grazing/ rotational grazing/ dense nesting cover/ northern pintail/ gadwall

Abstract: Intensification of agricultural practices is an important factor responsible for the decline of duck populations throughout North America. More than 200 islands covering a total of 5000 ha are found in the St. Lawrence River between Montreal and Trois-Rivieres in southern Quebec. The value of these islands as duck nesting habitat, however, is often limited by cattle grazing. The effects of two types of habitat improvements, rotational grazing and establishment of dense nesting cover (DNC), on island-nesting waterfowl was studied from 1992 to 1994. Four treatments were compared: idle fields with no vegetation improvement but exclusion of cattle, improved pastures with seeding of forage plants for cattle, DNC fields

with improved cover for ducks and exclusion of cattle and unimproved pastures used after the duck nesting season. Before habitat improvements, grazing by cattle reduced dry mass of green vegetation by 53% relative to ungrazed plots. No difference was found in the biomass of live (green) and dead (residual) vegetation among the islands' sections before treatments. Nest density and the number of expected nests based on the area covered by each habitat were also similar among sections before treatment. Gadwall (*Anas strepera* L.), mallard (*Anas platyrhynchos* L.), and pintail (*Anas acuta* L.) were the most abundant species nesting on the islands and this was not affected by treatments. Two years after habitat improvements, the number of duck nests increased. Idle fields and 2-year old DNC had greater visual obstruction, more residual vegetation and more litter. Densities of 2.8 and 7.0 nests ha⁻¹ with 69 and 82% Mayfield nest success were recorded in the idle and DNC fields, respectively. Nest success was low in improved pasture where a large proportion of nests were trampled (33%) or depredated (28%). Fencing permitted growth of emergent vegetation which enabled over-water nesting by ducks. These results indicate that with appropriate management, coexistence of cattle and nesting waterfowl is possible on islands of the St. Lawrence River.

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158. Biological response of aquatic communities to streambank fencing in selected streams impacted by agricultural grazing.

Argent, D. G. and Lenig, A.

In: Proceedings of the 2005 Watershed Management Conference: Managing Watersheds for Human and Natural Impacts: Engineering, Ecological, and Economic Challenges. (Held 19 Jul 2005-22 Jul 2005 at Williamsburg, VA.); pp. 967-978; 2005.

Abstract: Streams impacted by agricultural grazing experience compromised functioning because of physical degradation and various pollutants (e.g., nitrates and fecal coliforms). The objective of this study was to determine if stream functioning could be significantly improved with the removal of livestock from the adjacent corridor. In 1999, four grazed pastures that contained meadow streams received streambank fencing through the Partners for Fish and Wildlife Program (treatment sites). These streams exhibited unstable streambanks and elevated nitrate and fecal coliform levels as a direct result of cattle impacts on the stream. Concurrent with streambank fencing, we established monitoring stations that were 100-m long within each stream. In addition, several control streams were monitored that had (a) no history of grazing and no fencing (control streams) or (b) a history of grazing and no fencing (control farms). At each station seasonal collections were made for benthic macroinvertebrates and fishes; and various water chemistry parameters (TKN, nitrates, ammonia, phosphates, fecal coliforms, and turbidity). Over the course of this study, nitrates have remained reasonably constant during the spring season and declined significantly during the summer and fall seasons; TKN, and phosphorus have not changed appreciably during the spring collection periods at treatment sites, but were slightly elevated during the summer sampling period. Turbidity has declined significantly during the spring sampling period, but remains elevated during the summer and fall periods. Fecal coliform concentrations continue to be quite high in treatment farm

streams, but fluctuate, seasonally. Treatment sites contain a good diversity and abundance of macroinvertebrates and fish that are comparable to those found in control streams. Our findings to date suggest that streams impacted by agricultural grazing may require appreciable periods of time to experience improved stream functioning.

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159. A brief survey of the insects of river banks with or without grazing along the River Itchen.

Drake, Martin

English Nature Research Reports 135: 1-25. (1995); ISSN: 0967-876X

Descriptors: animals and man/ disturbance by man/ commercial activities/ conservation/ conservation measures/ ecology/ community structure/ habitat/ terrestrial habitat/ land and freshwater zones/ Palaearctic Region/ Europe/ United Kingdom/ Insecta/ Coleoptera/ Diptera: farming and agriculture/ trampling by cattle/ effect on river bank species diversity/ habitat management/ endangered status/ nationally rare species recorded/ species diversity/ river bank fauna/ riparian habitat/ river bank/ effect of trampling by cattle/ England/ Hampshire/ River Itchen/ river bank species diversity/ list and effect of trampling by cattle/ Insecta/ arthropods/ coleopterans beetles/ dipterans true flies/ insects/ invertebrates

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160. Burning and grazing effects on bobwhite foods in the Southeastern Coastal Plain.

Lewis, C. E. and Harshbarger, T. J.

Wildlife Society Bulletin 14(4): 455-459. (1986)

NAL Call #: SK357.A1W5; ISSN: 0091-7648

Descriptors: Pinus palustris/ Pinus elliottii/ Colinus virginianus/ prescribed burning/ habitat destruction/ wildlife management/ grazing/ Georgia

This citation is from AGRICOLA.

161. Cattle grazing and avian communities of the St. Lawrence River islands.

Belanger, L. and Picard, M.

Journal of Range Management 52(4): 332-338. (1999)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/1999/524/332-338_belanger.pdf

Descriptors: Phragmites australis/ cows/ islands/ prairies/ grazing intensity/ wild birds/ range management/ wildlife management/ Phalaris arundinacea/ Passeriformes/ canopy/ habitats/ species diversity/ waterfowl/ nesting/ Quebec

Abstract: Three hundred islands are found along the St. Lawrence River in Quebec. Among these islands, over 5,000 ha are used for agricultural purposes and 32% of this total is devoted to communal pasture, a traditional practice in this part of the river. In 1993 and 1994, we compared the avian communities of 500 ha natural spring flooded prairie islands subjected to different degrees of grazing pressure. Three islands were divided into 12 sectors, in which 108 sample plots of 0.5 ha were selected. Results show that the degree of visual obstruction by herbaceous vegetation and the percentage of shrub cover were higher on ungrazed and on moderately grazed prairie (< 1 cow/ha/year) as compared with intensively grazed prairie (> 1 cow/ha/year). More than 1,650 observations of passerines were made and 13 species were identified. The Swamp Sparrow

(*Melospiza georgiana*), Savannah Sparrow (*Passerculus sandwichensis*), Red-winged Blackbird (*Agelaius phoeniceus*), and Bobolink (*Dolichonyx oryzivorus*) were the 4 most abundant species, accounting for over 80% of all birds counted. Ungrazed and moderately grazed prairie contained 6 times more birds than intensively grazed prairie (10.4 birds/ha and 11.7 birds/ha vs 1.6 birds/ha). We also recorded 167 and 113 dabbling duck (anatinae) nests in 1993 and 1994 respectively. Moderately grazed and ungrazed prairies had a nest density nearly 10 times higher than that of intensively grazed prairie (0.50 +/- 0.01 and 0.30 +/- 0.01 nest/ha vs 0.05 +/- 0.01 nest/ha). Our study shows that grazing pressure on prairies of the studied islands largely determined the type of bird species present. However, prairie subjected to excessive grazing pressure is not suitable for waterfowl nesting. Various recommendations are provided for integrated management of wildlife and agriculture on the St. Lawrence River communal pasture islands.

This citation is from AGRICOLA.

162. Cattle grazing and management of dusky seaside sparrow habitat.

Holder, Gregory L.; Johnson, Mark K.; and Baker, James L.

Wildlife Society Bulletin 8(2): 105-109. (1980)

NAL Call #: SK357.A1W5; ISSN: 0091-7648

Descriptors: Fringillidae/ Passeriformes/ Ammodramus maritimus nigrescens/ dusky seaside sparrow/ seaside sparrow/ fires/ burns/ grazing/ habitat alterations/ cattle/ sparrow habitat/ endangered species/ St. Johns River Basin, Florida/ natural resources/ animal science - animal nutrition/ plant science (general) - plant ecology/ North America/ United States/ Florida

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163. Cattle trampling of simulated ground nests in rotationally grazed pastures.

Paine, L.; Undersander, D. J.; Sample, D. W.; Bartelt, G. A.; and Schatteman, T. A.

Journal of Range Management 49(4): 294-300. (1996)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/1996/494/294-300_paine.pdf

Descriptors: cattle/ pheasants/ rotational grazing/ wild birds/ stocking rate/ grazing intensity/ Wisconsin
Abstract: For many grassland songbird species, pastures represent some of the best available breeding habitat in the Upper Midwest. Increasing interest in intensive rotational grazing (IRG) among midwestern livestock farmers may result in an expansion of pasture hectares in the region. We evaluated the effects of several cattle stocking densities on ground nest survival in rotationally grazed cool-season pastures in southwestern Wisconsin. Ground nests were simulated with clutches of 3 unwashed pheasant eggs. We tested 3 rotational grazing systems: a 1-day dairy rotation stocked at 60 head ha⁻¹; a 4-day beef rotation at 15 head ha⁻¹; and a traditional, non-intensive 7-day rotation at 8 head ha⁻¹. Paddock size (1.2 ha) and nest density (15 nests paddock⁻¹) were held constant. The simulated nests were observed 4 times day⁻¹ to document trampling patterns during the herds' diurnal grazing and rumination cycles. Trampling damaged a mean of 75% (+/- 3.1%) of the nests for all 3 treatments during 8 consecutive replications. While the 7-day treatment exhibited a pattern of greater nest trampling during cattle grazing periods than

during rumination periods, this pattern was less evident in the 4-day treatment and absent in the 1-day treatment. Increasing vegetation height-density and percent vegetation cover were associated with reduced nest trampling rates, but pasture forage production and removal were not associated with nest damage.

This citation is from AGRICOLA.

164. Changes in spider araneae assemblages in relation to succession and grazing management.

Gibson, C. W. D.; Hambler, C.; and Brown, V. K.

Journal of Applied Ecology 29(1): 132-142. (1992)

NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: Linyphiidae/ sheep grazing/ invertebrates/ plant species composition arable land/ grassland/ disturbed land/ species accumulation

Abstract: Spiders were sampled, by suction (D-vac) and direct counts of their webs, in a controlled sheep grazing experiment on calcareous ex-arable land and in old calcareous grassland. Results from 1985-89 are presented. Heavily grazed assemblages were dominated by a group of Linyphiidae, also characteristic of disturbed land. Large web-spinners were most sensitive to grazing, preferring ungrazed controls because of their dependence of rigid plant structures. DCA ordination of D-vac data suggested that only heavy grazing (in spring and autumn) produced a distinct assemblage. Three other grazed treatments produced impoverished versions of ungrazed control assemblages. The dominant successional trend was a gradual accumulation of species, especially in ungrazed controls. This process was incomplete by 1989: old grasslands contained many species, including some characteristics of calcareous grassland, which had failed to colonize the ex-arable field 7 years after abandonment. Most features of the assemblages could be explained by the effects of grazing on plant architecture, in contrast to other invertebrates studied in the same system, which were more strongly affected by plant species composition.

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165. Changes in the status of two endangered butterflies over two decades and the influence of grazing management.

Bourn, N. A. D.; Pearman, G. S.; Gooder, B.;

Warren, M. S.; and Thomas, J. A.

In: *Grazing Management*. (Held 2 Feb 1929-2 Mar 2000 at Harrogate, United Kingdom.) Rook, A. J. and Penning, P. D. (eds.); pp. 141-146; 2000.

NAL Call #: SB197.B7; ISBN: 0905944542

166. Consequences for biodiversity of reducing inputs to upland temperate pastures: Effects on beetles (Coleoptera) of cessation of nitrogen fertilizer application and reductions in stocking rates of sheep.

Dennis, P.; Doering, J.; Stockan, J. A.; Jones, J. R.;

Rees, M. E.; Vale, J. E.; and Sibbald, A. R.

Grass and Forage Science 59(2): 121-135. (2004)

NAL Call #: 60.19 B773; ISSN: 0142-5242

Descriptors: grasslands/ grazing intensity/ grazing management/ sward/ height/ species diversity/ Coleoptera/ sown pastures/ stocking rate/ permanent grasslands/ nitrogen fertilizers/ application rate/ pasture management/ sheep/ Carabidae/ Staphylinidae/ botanical composition/ Trifolium repens/ extensive farming/ Wales

Abstract: Current policies for upland pasture management in the UK encourage the integration of environmental objectives with livestock production through extensification of grazing systems. This study tested the hypothesis that a greater sward height in the summer would increase the diversity and abundance of grassland beetles (Coleoptera) as has been demonstrated for insects of indigenous grasslands. The hypothesis was tested with an experiment on an upland sheep pasture in mid-Wales. experimental treatments received different nitrogen fertilizer inputs (0 or 50 kg ha⁻¹), sheep stocking densities (12 or 9 ewes ha⁻¹) and average sward heights in summer were constrained to 3.5 or 5.5 cm by conserving surplus grass for silage in subplots. Five treatments, replicated in three randomized blocks, combined the two stocking densities and two sward heights without nitrogen fertilizer inputs, with the fifth combining the higher stocking density, shortest sward height and the nitrogen fertilizer input. Beetles were sampled with twelve pitfall traps in each of the fifteen plots from June to September in 1993 and 1995. In years 1 (1993) and 3 (1995) of the experiment, more Coleoptera species occurred in the tall sward (an average of nine species in addition to the forty-one species present in the sward with the conventional sward height). Continuously grazed as opposed to ensiled subplots supported more beetle species but fewer individuals. Species composition of ground (Carabidae) and rove (Staphylinidae) beetles varied between treatments more than the arithmetic differences in species number. The experimental results supported the hypothesis but the benefits of taller swards to species diversity were small in the sown pastures of the study compared with indigenous upland grasslands (c. 33% fewer species). Inheritance effects of drainage, fertilizer and lime inputs, and the different species and management of cultivated pastures, may constrain the conservation benefits of altered pasture management compared with indigenous grasslands.

This citation is from AGRICOLA.

167. Conserving the new forest burnet moth (Zygaena viciae ((Denis and Schiffermueller))) in Scotland; responses to grazing reduction and consequent vegetation changes.

Young, Mark R. and Barbour, David A.

Journal of Insect Conservation 8(2-3): 137-148. (2004)

NAL Call #: QL362.J68; ISSN: 1366-638X

Descriptors: grazing reduction: applied and field techniques/ conservation/ vegetation

Abstract: *Zygaena viciae*, the New Forest burnet moth, has only one population in Britain, in western Scotland. Here it was discovered in 1963 and its population sustained itself, before declining seriously from 1980 to 1990. A survey in 1990 discovered at most 20 adult moths and it was clear that the site had become seriously over-grazed. A fence was erected to exclude sheep, with variable success until 1996, since when it has remained effective. Vegetation speedily changed from 1990 onwards, including re-establishment and spread of the main larval foodplant, *Lathyrus pratensis*. The moth population remained low until 1997, since which time it has dramatically increased, reaching an estimated 8500-10,200 in 2003. However, with only one site the moth remains threatened and establishment on new sites is now a priority.

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168. Contribution of paddock trees to the conservation of terrestrial invertebrate biodiversity within grazed native pastures.

Oliver, Ian; Pearce, Sarina; Greenslade, Penelope J. M.; and Britton, David R.

Austral Ecology 31(1): 1-12. (2006)

NAL Call #: QH540 .A8; ISSN: 1442-9985

Descriptors: univariate analysis: mathematical and computer techniques/ multivariate analysis: mathematical and computer techniques/ conservation/ biodiversity/ grazed landscape

Abstract: Paddock trees are a common feature in the agricultural landscapes of Australia. Recent studies have demonstrated the value of scattered paddock trees for soil fertility, native pasture plants and arboreal faunas; however, the degree to which scattered paddock trees contribute to the conservation of terrestrial invertebrate biodiversity within grazed landscapes remains unknown. We ask three questions: (i) Is there a difference between the terrestrial invertebrate assemblages found under paddock trees compared with surrounding grazed native pastures? (ii) Can gradients in soil and litter variables from the base of trees explain patterns in invertebrate assemblages? and (iii) Does the presence of scattered paddock trees have implications for the conservation of terrestrial invertebrate biodiversity within grazed native pastures? We used pitfall trapping and extraction from soil cores to sample the invertebrate assemblages under six New England Peppermint trees (*Eucalyptus nova-anglica* Deane and Maiden) and compared them with assemblages sampled from the open paddock. Formicidae and Collembola univariate and multivariate data were analysed along with a range of soil and litter variables. We found (i) significant differences in the assemblages of invertebrates under trees compared with surrounding grazed pastures; (ii) that most soil and litter variables revealed gradients away from tree bases and these variables explained significant variation in invertebrate assemblages; and (iii) more native invertebrates and more species of invertebrates were found under trees compared with the surrounding pastures. We discuss the relationships between paddock trees, the ground and soil environments and the invertebrate communities that inhabit these environments, and conclude with a discussion of the future for paddock trees and the biota supported by them.

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169. Daytime activity of white-tailed deer in response to short-duration and continuous grazing.

Cohen, W. E.; Reiner, R. J.; Bryant, F. C.; Drawe, D. L.; and Bradley, L. C.

Southwestern Naturalist 34(3): 428-431. (1989)

NAL Call #: 409.6 SO8; ISSN: 0038-4909

Descriptors: *Odocoileus virginianus*/ pastures/ wildlife management/ Texas

This citation is from AGRICOLA.

170. Deer and cattle diets on heavily grazed pine-bluestem range.

Thill, R. E. and Martin, A.

Journal of Wildlife Management 53(3): 540-548. (1989)

NAL Call #: 410 J827; ISSN: 0022-541X

Descriptors: *Odocoileus virginianus*/ *Pinus palustris*/ *Andropogon* sp./ seasonality/ feeding preference/ range management/ Louisiana/ USA

Abstract: We studied dietary overlap between captive white-tailed deer (n = 3) (*Odocoileus virginianus*) and cattle (n = 4) for 3 years on 2 rotationally burned, 54-ha longleaf pine (*Pinus palustris*)-bluestem (*Andropogon* spp.) pastures in central Louisiana [USA]. A third of each pasture was burned each year in late February. One pasture was grazed heavily (61-77% herbage use) yearlong; the other was grazed heavily (50-67% use) from mid-April to 1 November. Deer diets were dominated yearlong by a mixture of browse (49.3-83.2%) and forbs (11.2-47.1%). Cattle consumed mostly grasses during spring and summer and 60 and 40% browse and herbage, during fall and winter, respectively. Cattle consumed more herbage on first-year burns. Dietary overlap under heavy yearlong grazing averaged 25.8, 11.8, 26.0, and 30.7% during spring, summer, fall, and winter, respectively. Overlap under heavy seasonal grazing averaged 18.5, 7.4, and 22.6% during spring, summer, and fall, respectively. Diets of both animals were diverse and overlap generally resulted from sharing small amounts of many plant taxa. Except on recent burns during summer, dietary overlap under heavy yearlong grazing was comparable to that observed under moderate yearlong grazing at half the cattle stocking rate. Moderate grazing (40-50% herbage removal) of similar range from late spring through early fall should have little negative impact on deer forage availability. Grazing during late fall and winter reduces an already limited supply of deer forage by reducing availability of evergreen browse and herbaceous winter rosettes.

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171. Development of earthworm populations in abandoned arable fields under grazing management.

Eijsackers, H. J. P.

In: *Earthworm ecology: From Darwin to vermiculture*/ Satchell, J. E.

London: Chapman and Hall, 1983; pp. 241-246

NAL Call #: QL391.A6E27

Descriptors: *Oligochaeta*/ population dynamics/ physicochemical properties/ Netherlands

This citation is from AGRICOLA.

172. Effect of a reduction in cattle stocking rate on brown-headed cowbird activity.

Kostecke, Richard M.; Koloszar, James A.; and Dearborn, Donald C.

Wildlife Society Bulletin 31(4): 1083-1091. (2003)

NAL Call #: SK357.A1W5; ISSN: 0091-7648

Descriptors: breeding activity/ breeding areas/ brood parasitism/ cattle stocking rate/ commute distance/ cowbird removal programs/ foraging activity/ grazing pressure/ host parasite interaction/ population sustainability/ songbird conservation/ stocking rate reduction

Abstract: Brood-parasitic cowbirds (*Molothrus* spp.) can severely impact host populations. Cowbird removal is the primary means of reducing parasitism. As an alternative to removal, we evaluated the reduction of cattle stocking rate as a tool to shift cowbird-breeding activity away from a breeding area of a sensitive host. Activity of radiotagged, female brown-headed cowbirds (*M. ater*) breeding on Fort Hood, Texas, a United States Army installation that contains a large population of federally endangered black-capped vireos (*Vireo atricapilla*), was monitored 2 years before and 2 years after a reduction in cattle stocking rate. We predicted that cowbirds would respond to the reduction

by shifting both foraging and breeding activities toward more distant herds of cattle. Reduction in stocking rate did not have the desired effect of shifting cowbird breeding areas off the study area, though parasitism rates were lower following the reduction. Following the reduction, cowbirds eventually shifted foraging activity off the study area to sites where more cattle were present and tended to commute greater distances between breeding and foraging sites. Assuming that commute distance between breeding and foraging sites was energetically limiting, the cost of the increased commute may have reduced the number of eggs produced by female cowbirds over the breeding season, thus reducing parasitism. Effectiveness of our stocking rate reduction, even when applied at a large scale (9,622 ha), was reduced by the presence of alternative foraging sites within distances that cowbirds were willing to commute. Removal of cowbirds by trapping likely will remain the most effective means of maintaining a sustainable black-capped vireo population on Fort Hood.

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173. Effect of dairy cattle husbandry on behavioural patterns of red deer (*Cervus elaphus*) in the Italian Alps.

Mattiello, S.; Redaelli, W.; Carenzi, C.; and Crimella, C. *Applied Animal Behaviour Science* 79(4): 299-310. (2002)
NAL Call #: QL750.A6; ISSN: 0168-1591

Descriptors: focal animal sampling/ sampling method/ aggression/ behavioral pattern/ feeding/ land management/ lying/ pasture grazing/ play/ resting/ ruminating/ self grooming/ social interaction

Abstract: The present study aimed to investigate in the field the effect of the presence of cattle on red deer behavioural patterns, in order to provide information that could be used to improve land management strategies. The research was carried out in a summer range at 1500 m a.s.l. in the Italian Central Alps. Observations were conducted at dawn and at dusk from June to September for four consecutive years. Using a focal animal sampling technique, 179 focal observations were made on deer for 10 min each. On the summer range, overall deer spent most of their time feeding (52.86% of time) and moving (24.95% of time), showing that the study site was used principally as a feeding area. The proportion of time dedicated to resting and comfort behaviours (lying, ruminating and self-grooming) was very low. The general presence of cattle on the summer range did not affect most behavioural patterns of deer, except for the percentage of time spent alert, which was higher in the presence of cattle ($P < 0.05$). Deer observed in the same square grid unit (GU; 6.25 ha) with cattle spent more time standing ($P < 0.01$), moving ($P < 0.001$) and alert ($P < 0.05$) and less time feeding ($P < 0.001$) than deer further away from cattle. The time spent performing resting and comfort behaviours was higher when deer were far from cattle, although these differences were not statistically significant. Despite this, when cattle were present on the summer range, about one third of the deer were observed close to them. Independently from the contingent presence or absence of cattle or from their proximity, deer spent more time feeding ($P < 0.001$) and less time moving ($P < 0.001$) and standing ($P < 0.001$) in areas subjected to higher cattle grazing pressure (with an index of presence of cattle higher than 0.5 animals/h/ha), suggesting that these areas were preferred for feeding activity, probably due the fact that

cattle grazing helps to improve the quality of the pasture. Only six "aggressive" interactions without physical contact and one "play" interaction were recorded between deer and cattle over the whole study period. Deer were never observed to win an interaction with cattle, possibly due to their smaller body size. Despite modifications to red deer behaviour in response to cattle proximity, the general disturbance produced by cattle is limited and their presence may be tolerated by deer.

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174. The effect of riparian grazing on brown trout, *salmo trutta*, and juvenile atlantic salmon, *salmo salar*, in an English chalk stream.

Summers, D. W.; Giles, N.; and Stubbing, D. N. *Fisheries Management and Ecology* 12(6): 403-405. (2005)
NAL Call #: SH328.F574; ISSN: 0969-997X

Descriptors: habitat use/ chalk/ riparian grazing

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175. Effect of streambank fencing on herpetofauna in pasture stream zones.

Homyack, J. D. and Giuliano, W. M. *Wildlife Society Bulletin* 30(2): 361-369. (2002)
NAL Call #: SK357.A1W5; ISSN: 0091-7648

Descriptors: riparian environments/ range management/ species richness/ abundance/ biomass/ herpetofauna/ ecosystem management/ ecosystem disturbance/ agriculture/ population density/ community composition/ species diversity/ riparian vegetation/ water quality/ animal populations/ man-induced effects/ stream banks/ ecology/ amphibians/ *Regina septemvittata*/ *Thamnophis sirtalis*/ *Amphibia*/ *Reptilia*/ queen snake/ common garter snake/ reptiles/ streambank fencing/ livestock grazing/ USA
Abstract: Grazing livestock in streams and associated riparian zones may negatively impact a variety of wildlife through direct disturbance and alteration of environmental conditions. To evaluate streambank fencing as a management tool, we measured the richness, abundance, and biomass of reptile and amphibian species on 10 grazed streams and associated riparian areas and 10 similar areas that were recently fenced (1-2 yrs) to exclude livestock, during spring and summer of 1998 and 1999. Effects of streambank fencing on vegetation, water quality, and macroinvertebrate populations also were examined because livestock grazing may indirectly impact communities of herpetofauna through their influence on these factors. We found no difference in species richness, abundance of all species combined, or biomass of herpetofauna between fenced and unfenced streams. However, northern queen snakes (*Regina septemvittata*) and eastern garter snakes (*Thamnophis sirtalis*) were more abundant on fenced than unfenced sites. Percent litter cover and vertical obstruction were higher on fenced sites, terrestrial macroinvertebrate biomass was greater on unfenced sites, and water-quality variables did not differ between site types. Although some species (e.g., birds) responded quickly (<4 yrs) to streambank fencing, it appeared that herpetofauna might require a longer recovery time (>4 yrs). The length of time since livestock were excluded, dispersal ability, reproductive potential, and distance to the nearest remnant population may be important factors in reptile and amphibian recovery in grazed stream and riparian zones.

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176. Effects of agricultural management on the use of lowland grassland by foraging birds.

Buckingham, Dave L.; Peach, Will J.; and Fox, Derren S. *Agriculture, Ecosystems & Environment* 112(1): 21-40. (2006)

NAL Call #: S601 .A34; ISSN: 0167-8809

Descriptors: animals and man/ disturbance by man/ commercial activities/ nutrition/ feeding behaviour/ ecology/ habitat/ terrestrial habitat/ man made habitat/ land zones/ Palaearctic Region/ Eurasia/ United Kingdom/ Europe/ Aves: farming and agriculture/ lowland grassland agricultural management/ effects on habitat use/ diet/ diet related habitat use/ lowland grassland under agricultural management/ food availability/ foraging/ foraging habitat use/ lowland grassland/ habitat utilization/ grassland/ lowland grassland habitat use/ cultivated land habitat/ lowland grassland agricultural management effects on habitat use/ England/ West Midlands/ lowland grassland use/ related to diet/ effects of agricultural management/ Aves/ birds/ chordates/ vertebrates

Abstract: A field-scale correlative study was used to identify which factors had the greatest influence on the usage of agricultural grassland by foraging birds in the English West Midlands. The study extended previous work by directly comparing a more complete range of lowland grassland management practises, bird species and seasons. Sward structure had more influence on bird usage than botanical composition. Bird species fell into two groups based on their sward structure preferences, which closely reflected where they obtained their food. Species that feed on soil-dwelling invertebrates selected short swards, while species that feed on sward-dwelling invertebrates or seeds selected taller swards with greater spatial heterogeneity. Grazing had a greater influence on grassland usage than sward age and other management practices. Birds mainly responded positively to grazing, especially by cattle. Weed control reduced the usage of grass fields by granivorous birds during summer and winter. Intensive grazing systems create and maintain short, uniform swards that favour bird species foraging for soil-dwelling invertebrates, but not those reliant on seeds or sward-dwelling invertebrates. It is proposed that excessive defoliation of agricultural grasslands (associated with intensive grazing and mowing regimes) impacts granivorous birds by reducing prey abundance. Reductions in grazing intensity and the avoidance of weed control should increase food availability for granivorous and insectivorous birds on grass fields. [copyright] 2005 Elsevier B.V. All rights reserved.

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177. The effects of bankside management on chalk stream invertebrate communities.

Harrison, Simon S C. and Harris, Iain T.

Freshwater Biology 47(11): 2233-2245. (2002)

NAL Call #: QH96.F6; ISSN: 0046-5070

Descriptors: bankside management: applied and field techniques/ Shannon diversity/ bankside vegetation types/ chalk stream invertebrate communities/ chalk streams/ grazing/ mid channel gravel/ simply structured grazed grass vegetation/ species abundance/ species richness/ structurally complex herbaceous vegetation/ terrestrial adult phase/ terrestrial phases

Abstract: 1. Communities of aquatic macroinvertebrates and the terrestrial adult phases of aquatic insects were investigated from short stretches of English chalk streams

with two different bankside vegetation types: simply structured grazed grass (grazed) and structurally complex herbaceous vegetation with scattered trees (ungrazed). Macroinvertebrates were sampled in spring, summer, autumn and winter 1996-97 from three aquatic habitats: mid-channel gravel, patches of the aquatic macrophyte *Ranunculus* and marginal emergent macrophytes. The terrestrial adult phases of aquatic insects were sampled in spring, summer and autumn from bankside vegetation. 2. Total macroinvertebrate abundance did not differ between stretches with different bankside vegetation. Taxon richness of mid-channel gravel was, however, significantly higher in ungrazed compared with grazed stretches and Shannon diversity (H') of mid-channel gravel and marginal vegetation was significantly higher in ungrazed compared with grazed stretches. Total abundance, taxon richness and Shannon diversity (H') of the terrestrial adult phases of aquatic insect were significantly higher from the bankside vegetation of ungrazed compared with grazed stretches. 3. Ordination of communities of aquatic macroinvertebrates and terrestrial adults demonstrated that individual families of both groups were generally more abundant in ungrazed stretches. Many more families were significantly associated with ungrazed stretches than with grazed stretches. 4. This investigation has shown that high structural diversity of bankside vegetation along lowland chalk streams is accompanied at the reach scale by increased diversity of both aquatic macroinvertebrates and the terrestrial adult phases of aquatic insects. The conservation potential of such streams may thus be lowered by management practices that result in the removal or simplification of bankside vegetation along extensive stream stretches. © The Thomson Corporation

178. Effects of cattle on duck food plants in southern Texas.

Whyte, R. J. and Silvy, N. J.

Journal of Wildlife Management 45(2): 512-515. (1981)

NAL Call #: 410 J827; ISSN: 0022-541X

Descriptors: Texas

This citation is from AGRICOLA.

179. Effects of grazing and haying on arthropod diversity in North Dakota Conservation Reserve Program grasslands.

Hoernemann, C. K.; Johnson, P. J.; and Higgins, K. F.

Proceedings of the South Dakota Academy of Science 80: 283-308. (2001)

NAL Call #: 500 So82; ISSN: 0096-378X

Descriptors: species diversity/ Conservation Reserve Program/ grazing/ arthropods/ conservation practices

180. Effects of grazing intensity on bird assemblages and populations of Hungarian grasslands.

Baldi, Andras; Batary, Peter; and Erdos, Sarolta

Agriculture, Ecosystems & Environment 108(3): 251-263. (2005)

NAL Call #: S601 .A34; ISSN: 0167-8809

Descriptors: grazing intensity/ meadow/ alkali steppe
Abstract: Agricultural intensification is responsible for the dramatic decline of farmland bird populations in the European Union (EU). The joining of eight Central and Eastern European (CEE) countries to the EU will re-structure agriculture there. One of the main threats is the intensification of farmland management. Can agri-

environmental programs balance the expected decline in bird assemblages of the CEE countries if farming will be intensified? We studied this question by comparing bird assemblages of 42 extensively and intensively grazed paired fields in three regions of Hungary (alkali steppes and meadows in Central Hungary and alkali steppes in Eastern Hungary). Bird assemblages varied significantly across regions and grazing intensity. Intensively grazed sites showed a higher species number and diversity, but lower densities than the extensive sites. This is probably the consequence of higher landscape diversity of intensive sites, which included farm buildings, shelters, wells and other structures. Several bird species, mainly with European conservation concern, showed contrasting responses to grazing intensity in the three regions, including key grassland species (black-tailed godwit *Limosa limosa*, redshank *Tringa totanus*, skylark *Alauda arvensis* and corn bunting *Emberiza calandra*). Therefore, threat and sensitivity to grassland characteristics are correlating. Although many of the declining species of Western Europe are still abundant in Hungarian grasslands, our results project the threat of the expected intensification. This study showed that it is not possible to provide a general grassland management scheme that will favour all bird species in all regions of Hungary. In the process of integrating to the EU and restructuring agriculture, the establishment of scientifically sound schemes is urgent. (c) 2005 Elsevier B.V. All rights reserved.

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181. Effects of habitat management on vegetation and above-ground nesting bees and wasps of orchard meadows in central Europe.

Steffan Dewenter, Ingolf and Leschke, Kathleen
Biodiversity and Conservation 12(9): 1953-1968. (2003)
NAL Call #: QH75.A1B562; ISSN: 0960-3115

Descriptors: mowing: applied and field techniques/ above ground nesting behavior/ agricultural landscapes/ community composition/ grazing impact/ habitat management/ orchard meadows: habitat/ species abundance/ species richness/ vegetation

Abstract: We studied the vegetation, stand structure and communities of above-ground nesting bees and wasps in 45 orchard meadows that were grazed, mown or abandoned (15 of each) in an agricultural landscape near Goettingen, Germany. Total species richness of plants was significantly lower and the proportion of dead wood was significantly higher on abandoned meadows compared to mown or grazed meadows. Species richness of bees, eumenid wasps and sphecid wasps did not differ between the three management types. Abundance of sphecid wasps was significantly higher on abandoned than on managed orchard meadows. Landscape context did not affect management type. The results suggest that management practises affect vegetation more significantly than the studied insect groups.

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182. Effects of livestock breed and stocking rate on sustainable grazing systems: Butterfly diversity and abundance.

WallisDeVries, M. F.; Tallowin, J. R. B.; Dulphy, J. P.; Sayer, M.; and Diana, E.

In: Integrating efficient grassland farming and biodiversity: Proceedings of the 13th International Occasional

Symposium of the European Grassland Federation. (Held 29 Aug 2005-31 Aug 2005 at Tartu, Estonia.); pp. 227-230; 2005.

NAL Call #: SB202.E85 E87 2005

Descriptors: animals and man/ disturbance by man/ commercial activities/ ecology/ habitat/ terrestrial habitat/ man made habitat/ land zones/ Palaearctic Region/ Eurasia/ Europe/ Papilionoidea: farming and agriculture/ grazing livestock breed and stocking rate/ community structure/ Italy and United Kingdom/ grassland/ cultivated land habitat/ France/ Germany/ Italy/ United Kingdom/ grazing livestock breed and stocking rate relationship/ Papilionoidea/ Heteroneura/ Glossata/ Lepidoptera/ Insecta/ arthropods/ insects/ invertebrates/ lepidopterans

Abstract: Finding an optimal balance between livestock production and the impact of grazing on animal biodiversity is an important issue in the development of sustainable grazing systems. Butterflies are suitable indicators of grazing impact. Here, we consider the results of similarly designed grazing experiments, carried out over three years in the United Kingdom, France, Germany and Italy. All sites involved a comparison of three treatments, replicated threefold in a randomized block design: 1) a moderate stocking rate with a commercial breed, 2) a low stocking rate with a commercial breed and 3) a low stocking rate with a traditional breed. Butterfly species richness and abundance were assessed by bi-weekly transect counts. Although countries differed in species composition and butterfly numbers, the effect of the various treatments showed a consistent pattern across countries. Species richness and abundance of butterflies were enhanced by the low stocking rate compared to the moderate stocking rate, but no clear difference between breeds emerged. Both butterfly species preferring short grasslands and those preferring tall grasslands benefited from the lower stocking rate. This project showed that butterfly diversity on grasslands increased within three years by reducing stocking rates.

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183. Effects of livestock breed and stocking rate on sustainable grazing systems: Short-term effects on fauna.

WallisDe Vries, M. F.; Tallowin, J. R. B.; Dulphy, J. P.; Sayer, M.; and Diana, E.

In: Land use systems in grassland dominated regions: Proceedings of the 20th General Meeting of the European Grassland Federation. (Held 21 Jun 2004-24 Jun 2004 at Luzern, Switzerland.); pp. 626-628; 2004.

Descriptors: animal production/ breed differences/ fauna/ livestock/ species richness/ stocking rate/ butterflies/ grasshoppers

Abstract: Finding an optimal balance of the impact of grazing on animal biodiversity is an important issue in the development of sustainable grazing systems. Here, we consider the first year results of grazing experiments conducted in four countries (UK, France, Germany and Italy). All sites involved three treatments: (1) moderate stocking rate with a commercial breed, (2) low stocking rate with a commercial breed and (3) low stocking rate with a traditional breed. Animal biodiversity was studied at the species level for birds, hares, butterflies, grasshoppers and at higher taxonomic level for ground-dwelling arthropods. Bird and hare numbers were low and revealed no treatment effects. Butterflies and grasshoppers showed lower species

richness and abundance at moderate stocking rate but no difference between breeds appeared. In contrast, the number of ground-dwelling arthropod groups was higher at moderate stocking rate, but treatment effects on abundance could not be detected at the family level yet. It is concluded that butterflies and grasshoppers show a quick response to variation in stocking rate. This effect is expected to develop over the next years for other animal groups.

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184. Effects of plant cover improvements for nesting ducks on grassland songbirds.

Lapointe, S.; Belanger, L.; Giroux, J.-F.; and Filion, B. *Canadian Field-Naturalist* 117(2): 167-172. (2003)

NAL Call #: 410.9 Ot8; ISSN: 0008-3550

Descriptors: aquatic birds/ nesting/ Canada, Quebec, St. Lawrence R., Varenne I.

Abstract: Several islands located along the St. Lawrence River in southern Quebec have been used as natural pastureland by cattle for decades. Recently, a rest-rotation grazing system and dense nesting cover were established on four islands near Varennes to improve duck nesting conditions. The effects of these two plant cover improvements on the abundance of grassland songbirds were assessed through four treatments: 1) idle fields with no vegetation improvement but exclusion of cattle (IDLE), 2) improved pastures with seeding of forage plants for cattle (IMPP), 3) dense seeded nesting cover fields improved for ducks and where cattle were excluded (DNC), and 4) natural or unimproved pastures grazed by cattle after the duck nesting season (UIPP). The overall abundance of birds was similar among treatments before cover improvements as well as two years after.

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185. Effects of prescribed burning and cattle grazing on deer diets in Louisiana.

Thill, R. E.; Martin, A.; Morris, H. F.; and Harrel, A. T. New Orleans, LA: U.S Dept. of Agriculture Southern Forest Experiment Station, 1995. 13 p. Research Paper.

NAL Call #: A99.9 F7628Us

http://www.srs.fs.usda.gov/pubs/rp/rp_so289.pdf

Descriptors: *Odocoileus virginianus*/ forage/ nutritive value/ prescribed burning/ grazing/ cattle/ nutrient content/ crude protein/ phosphorus/ calcium/ Louisiana

Abstract: A study was conducted on the dietary and nutritional effects of cattle grazing and rotational prescribed burning on the diets of three to five captive white-tailed deer (*Odocoileus virginianus*) on longleaf pine (*Pinus palustris* Mill.)_bluestem (*Andropogon* spp. and *Schizachyrium* spp.) sites in central Louisiana from October 1980 through February 1987. Deer diets were evaluated under ungrazed, moderate year-long, heavy seasonal, and heavy yearlong cattle grazing treatments. Deer diets were composed mostly of browse and forbs under all grazing treatments, but were less diverse under heavy grazing when compared with moderate and no grazing treatments. Foraging efficiency (computed as the ratio of forage intake per 30-minute trial to the distance traveled) was comparable among treatments during spring and fall but was lower under the heavy grazing treatment during summer and winter. Diets selected under ungrazed conditions contained the highest percentage of uncommon and ephemeral plant taxa during all seasons except fall. Dietary crude protein (CP), phosphorus (P), and calcium-to-

phosphorus ratios varied significantly under various grazing treatments for certain seasons. Prescribed burning did not significantly affect diet diversity; however, diets from areas of first-year burns were higher in CP and P than from areas of older burns during spring and summer, but these differences disappeared by the first fall after burning. From a nutritional standpoint, burning and seasonal influences generally had more

impact than grazing treatments on deer diets. No evidence was found that seasonal or yearlong cattle grazing at moderate levels (40- to 50-percent herbage removal) adversely affected deer nutrition.

This citation is from AGRICOLA.

186. Effects of reduced grazing on population density and breeding success of black grouse in northern England.

Calladine, John; Baines, David; and Warren, Philip *Journal of Applied Ecology* 39(5): 772-780. (2002)

NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: agri environment schemes/ breeding success/ conservation biology/ grazing intensity/ marginal uplands/ moorlands/ pastoral landscapes/ population density/ seasonality

Abstract: 1. The maintenance or modification of grazing regimes is frequently advocated to deliver conservation targets in pastoral landscapes, but there are few quantitative studies of the effects of grazing on upland birds. This is particularly true with respect to grazing management in agri-environmental schemes. 2. Numbers of black grouse *Tetrao tetrix* and their breeding success were therefore monitored at 20 sites in the north of England from 1996 to 2000. Ten treatment sites included areas where grazing was reduced before and during the study to <1.1 sheep ha⁻¹ in summer and <0.5 sheep ha⁻¹ in winter. Each was paired with a reference site that held sheep at two (summer) to three times (winter) the density on the experimental sites. The reduced grazing sites ranged from 0.4 to 3.2 km² in size and most were part of existing agreements within agri-environment schemes that had been in place for 1-5 years before 1996. 3. Numbers of black grouse males displaying increased by an average of 4.6% (SE = 2.1) year⁻¹ at the 10 sites with reduced grazing. Displaying male trends differed significantly between treatment and normally grazed reference sites, where numbers declined annually on average by 1.7% (SE = 1.4). 4. Summer black grouse hen densities showed the greatest rate of increase where grazing was restricted on smaller areas of ground (0.4 km²). Declines occurred at sites where the area of restricted grazing exceeded about 1 km². The rates of change in population density, as indicated by numbers of displaying males, peaked in the early years of grazing reduction and then declined after c. 5-7 years. 5. The proportion of females that retained broods during the late chick-rearing period was 54% (SE = 0.06) at sites with reduced grazing, significantly greater than the 32% (SE = 0.06) at normally grazed reference sites. There was no difference in the size of broods between grazing treatments. 6. This study demonstrates that agri-environment schemes, which encourage extensive management of grazing land, can benefit at least some organisms of conservation importance and lead to some recovery of populations. There is a need, however, for further understanding of how such benefits can be

maintained at a landscape scale and over the greater time scales involved in vegetation dynamics and bird population processes.

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187. Effects of riparian grazing and channelisation on streams in Southland, New Zealand: Benthic invertebrates.

Quinn, J. M.; Williamson, R. B.; Smith, R. K.; and Vickers, M. L.

New Zealand Journal of Marine and Freshwater Research 26(2): 259-273. (1992)

NAL Call #: QH91.57.A1N4; ISSN: 0028-8330

Descriptors: grazing/ benthos/ agriculture/ environmental protection/ river banks/ temperature effects/ vegetation cover/ zoobenthos/ riparian environments/ community composition/ invertebrata/ streams/ freshwater environments/ Invertebrata/ New Zealand, South I., Southland/ New Zealand/ channelization/ riparian grazing/ streams/ freshwater environments/ invertebrata/ grazing/ river banks/ temperature effects/ vegetation cover

Abstract: A survey of benthic invertebrate faunas in riparian-protected, riparian-grazed, and channelised reaches of five Southland streams with catchment sizes of 3-37 km² was carried out. In small streams (catchment areas 3-10 km²; widths 1-4 m), channelisation or intensive grazing by cattle greatly reduced shading by riparian vegetation, resulting in substantial increases in daily maximum temperatures during summer. Channelisation also caused gross changes in channel morphology and intensive grazing of a reach with moist streamside soils was associated with increased bed sedimentation and bank damage. Marked changes in invertebrate communities were associated with these habitat modifications. In general, taxa favoured by cool water and low periphyton abundance (e.g., Plecoptera, *Paraleptamphopus caeruleus*, *Deleatidium* sp., and *Helicopsyche albescens*) decreased in density, whereas densities of taxa favoured by an abundance of periphyton (e.g., Chironomidae and *Oxyethira albiceps*) increased. Shade provided by riparian vegetation appears to play a vital role in maintaining cool, headwater, stream habitats for benthic invertebrate communities in these streams.

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188. Effects of sheep stocking rates and management on the abundance of a pasture-feeding caterpillar *Metacrias huttoni*.

White, E. G.

New Zealand Journal of Experimental Agriculture 13(3): 271-276. (1985)

NAL Call #: S542.A1N45; ISSN: 0301-5521

Descriptors: grazing management/ livestock industry/ crop industry/ New Zealand

Abstract: Merino hogget stocking rates and management (continuous stocking, 2-rotation, and 6-rotation) are shown to interact with the abundance of a pasture-feeding insect *Metacrias huttoni* (Butler) (Lepidoptera: Arctiidae) in a predictable manner [New Zealand]. The 6-year study of 9 grazing treatments demonstrates progressive variations in insect abundance over local space and over time. A multivariate estimator, S, of spatio-abundance is derived over the full range of treatments.

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189. Evaluation of the impacts of grazing on grassland wildlife populations: Evaluation of vegetation structure and floristic composition on continuous and rotational grazing systems with 4 different stocking rates in north central Missouri.

Schulz, J. H. Missouri Department of Conservation, 2002. 52 pp. Annual Report.

Descriptors: grazing/ grassland/ vegetation/ invertebrates/ habitat/ cattle/ size/ statistics/ sampling/ livestock/ North America/ United States/ Missouri/ North-Central Region/ Linn County

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190. Field-scale effects of farming practices on linyphiid spider populations in grass and cereals.

Thomas, C. F. G. and Jepson, P. C.

Entomologia Experimentalis et Applicata 84(1): 59-69. (1997)

NAL Call #: 421 En895; ISSN: 0013-8703

Descriptors: cutting/ dispersal/ farming practices/ field scale effects/ grazing/ insecticide application/ linyphiid spider/ population dynamics/ population studies/ spatial structure/ spatially dynamic model

Abstract: Linyphiid spiders were sampled in three grass and four cereal fields, between October 1989-October 1990, and from one grass and one cereal field, from June-August 1991. Population growth and decline were characteristic of field type and pattern of management. Agricultural operations caused large population depletions: insecticide applications, cutting grass for silage and autumn cultivations reduced spider populations by 56% to 96%; heavy grazing caused virtual extinction. Aerial dispersal activity, monitored by water traps, showed high dispersal frequency with highest intensity in June, July and August. The results are discussed with reference to the large-scale spatial structure of linyphiid spider populations and the use of spatially dynamic models to predict metapopulation size as a function of patterns of crop management, land-use and landscape structure.

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191. Grassland birds associated with agricultural riparian practices in southwestern Wisconsin.

Renfrew, R. B. and Ribic, C. A.

Journal of Range Management 54(5): 546-552. (2001)

NAL Call #: 60.18 J82; ISSN: 0022-409X

Descriptors: grasslands/ population density/ riparian grasslands/ rotational grazing/ species richness

Abstract: Rotational grazing has been proposed as a Best Management Practice for minimizing runoff in Wisconsin agricultural riparian areas. The influence of this land management practice on grassland birds has not been evaluated in relation to more traditional agricultural land management systems in Midwestern riparian areas. This study compared the grassland bird community in riparian areas in Wisconsin, USA that were rotationally grazed to 2 common land use practices along streams in Wisconsin: continuously grazed pastures and rowcrop fields with 10-m-wide ungrazed buffer strips located along the stream. We calculated total number of birds, the Berger-Parker Index of Dominance, and number of birds ha⁻¹ for each site. Vegetation variables used were height-density, litter depth, and percent bare ground. Bird species richness, species dominance, and density did not differ among land use types. In contrast, grassland bird species of management

concern (Savannah Sparrow (*Passerculus sandwichensis*), Eastern Meadowlark (*Sturnella magna*), and Bobolink (*Dolichonyx oryzivorus*)) were found on continuous and rotational pastures but very rarely or never occurred on buffer strips. Contrary to previous research, however, rotationally grazed pastures did not support more of these species than continuously grazed pastures. Bird density was related to vegetation structure, with higher densities found on sites with deeper litter. Within the pasture land use types, there were no consistent differences between species richness and density near the stream (<10 m) and away (>10 m).

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192. Grassland management for the conservation of songbirds in the Midwestern USA.

Walk, Jeffery W. and Warner, Richard E.

Biological Conservation 94(2): 165-172. (2000)

NAL Call #: S900.B5; ISSN: 0006-3207

Descriptors: abundance/ grassland management/ grazing/ habitat type/ mowing/ prescribed burning

Abstract: We monitored breeding eastern meadowlarks, dickcissels, Henslow's sparrows, grasshopper sparrows and field sparrows using strip transect surveys in 1995 and 1996. The 473-ha study area was an array of 3-ha management units of burned, mowed, hayed, grazed and undisturbed (>1 year) cool- and warm-season grasses and annual weeds. Management units grouped by habitat type (management regime and grass type) had different ($P < 0.05$) abundances of each species. Eastern meadowlarks and dickcissels were most frequently observed in grazed warm-season grasses. Observation rates of Henslow's sparrows and field sparrows were highest in undisturbed warm-season grasses, whereas eastern meadowlarks and grasshopper sparrows were observed least often in this habitat type. Grasshopper sparrows were observed most frequently in annual weeds; Henslow's sparrows and field sparrows were not observed in this habitat type. Overall avian abundance was lowest in recently burned cool-season grasses. The low-intensity, late-season grazing system was important for creating a heterogeneous habitat mosaic attractive to the five species studied.

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193. Grazing and burning impacts on deer diets on Louisiana pine-bluestem range.

Thill, R. E.; Martin, A.; Morris, H. F.; and McCune, E. D.

Journal of Wildlife Management 51(4): 873-880. (1987)

NAL Call #: 410 J827; ISSN: 0022-541X

Descriptors: *Odocoileus virginianus*/ plant composition/ diet quality/ foraging selectivity/ feeding efficiency/ seasonality/ management/ protein/ phosphorus/ calcium

Abstract: Diets of 3-5 tame white-tailed deer (*Odocoileus virginianus*) on adjacent ungrazed and continuously grazed (35% herbage removal by late Oct) forested pastures were compared for forage-class use, botanical similarities, foraging selectivity and efficiency, and diet quality. Both pastures were divided into 3 burning subunits and burned in late February on a 3-year rotation. Botanical composition of diets differed between and within pastures, but forage-class use was similar except during winter, when deer selected more browse on ungrazed subunits. Grazing had no effect on dietary protein, phosphorus (P), or calcium (Ca) levels, but diets from ungrazed subunits were higher in digestibility (except during summer), and contained more uncommon

plant taxa. Deer foraged more efficiently on grazed than on ungrazed subunits but were less efficient on recent than on older burns. Diets from 1st-year burns were higher in protein during spring and summer and higher in P during spring.

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194. Grazing effects on between-year variation of farmland bird communities.

Soderstrom, Bo; Part, Tomas; and Linnarsson, Erik

Ecological Applications 11(4): 1141-1150. (2001)

NAL Call #: QH540.E23; ISSN: 1051-0761

Descriptors: Kendall's coefficient of concordance/ between year variation/ body mass/ community variability/ farmland bird communities/ grazing effects/ grazing intensity/ grazing pressure/ habitat composition/ land use/ local extinction/ population decline/ recolonization/ species abundance/ vegetation structure

Abstract: Livestock grazing is the dominant land use in the remaining seminatural grasslands in Europe. Abandonment of grasslands and, conversely, intensified grazing by livestock have been suggested as possible causes for the widespread population declines of many farmland birds, although the direct impact of grazing on farmland birds is poorly known. Here, we use a comprehensive, long-term data set (20 pastures surveyed over five years) to test the effects of changes in grazing intensities in seminatural dry pastures on between-year variation of the farmland bird community, functional groups of species, and individual species. Bird communities in all 20 seminatural pastures showed a low degree of temporal variability (Kendall's coefficient of concordance on ranked abundances: mean $W = 0.72$, range = 0.58-0.89). Community variability was not significantly related to site area, grazing pressure, vegetation structure, or adjacent habitat composition. However, analyses of functional groups of species categorized according to body mass and breeding diet showed that different species subsets had differential responses to between-year changes in grazing pressure (as reflected by changes in grass height). Local extinction and recolonization of ground-feeding insectivorous bird species were affected by yearly changes in grazing pressure, but there was no effect of grazing on ground-feeding species that fed on a mixed diet or on species that foraged in trees and shrubs. In general, large insectivores (>30 g) preferred moderately grazed pastures, and small insectivores (ltoreq30 g) preferred pastures with intensive grazing pressure. We propose that current intensive grazing should be relaxed (i.e., by reducing the number of stock per hectare or by within-season rotational grazing) so that with a given stock size, larger areas of seminatural dry pastures could be grazed. This would decrease the rate of habitat loss and conserve a larger part of the farmland bird community breeding in this habitat.

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195. Grazing management as a means of regulating spittlebug (Homoptera: Cercopidae) numbers in central Brazil.

Hewitt, G. B.

Pesquisa Agropecuaria Brasileira 23(7): 697-708. (1989)

NAL Call #: S15 .P452; ISSN: 0100-204X

Descriptors: cattle/ nymphal density/ oviposition/ egg survival/ pest/ crop industry/ agriculture

Abstract: Short duration, high intensity grazing was

evaluated as a method of reducing spittlebug numbers in central Brazil. Intense grazing pressure during the nymphal period resulted in a temporary reduction in nymphal density but additional hatching of eggs allowed the density to increase. Intense grazing during the last generation of adults, prior to the start of the dry season drastically reduced the nymphal population. Grazing by cattle in general provided an unsuitable habitat for spittlebug egg survival as both grass height and plant cover decreased under all grazing treatments. In heavily infested pastures (> 20 nymphs/m²) it is recommended to graze the grass short (< 10 cm) during the last generation of adults (April-July) in order to discourage oviposition by adults laying diapause eggs and to expose eggs to detrimental conditions during the dry season. In pastures with low spittlebug density (< 20 nymphs/m²) it is recommended to maintain the forage height at 15 cm-20 cm during the rainy season for maximum production and efficient use of the forage resource.

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196. Grazing management of calcareous grasslands and its implications for the conservation of beetle communities.

Woodcock, B. A.; Pywell, R. F.; Roy, D. B.; Rose, R. J.; and Bell, D.

Biological Conservation 125(2): 193-202. (2005)

NAL Call #: S900.B5; ISSN: 0006-3207

Descriptors: grazing management: applied and field techniques/ species richness/ calcareous grassland habitat for floral and faunal communities in the UK and Europe.

Abstract: Calcareous grasslands are an important habitat for floral and faunal communities in the UK and Europe. Declines due to changes in management, scrub invasion and agricultural improvement have left much of the remnants of this habitat in a degraded and fragmented state. Grazing, by cattle or sheep, is one of the main management practices used to maintain and improve the floral and faunal quality of calcareous grassland. The long-term impacts of different grazing regimes, however, are poorly understood, particularly in terms of the invertebrate communities. This study contrasted the impacts of recently introduced and long-term sheep or cattle grazing on beetle communities present on one of the largest areas of calcareous grassland in Europe, the Salisbury Plain military training Area, UK. No effects of grazing management on beetle abundance, species richness or evenness were found, but plant diversity and overall percentage cover of grasses did influence beetle diversity. Proportions of the total number of individuals and overall species richness within beetle guilds (predatory, phytophagous, flower/seed feeders, root feeders and foliage feeders) were strongly influenced by both the duration and type of grazing animal. At the species level, beetle community structure showed significant differences between ungrazed, long-term cattle and long-term sheep grazing treatments. Changes in plant community structure were found to influence beetle community structure. The significance of these results is discussed in terms of the long-term impacts of grazing on beetle community structure, and the benefits of different grazing regimes for the conservation management of calcareous grasslands. (c) 2005 Elsevier Ltd. All rights reserved.

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197. Ground beetle distribution of distinct size and feeding type due to grassland management treatments in orchards (Coleoptera: Carabidae).

Glueck, Erich and Deuschle, Juergen

Entomologia Generalis 28(1): 39-63. (2005)

NAL Call #: QL461.E582; ISSN: 0171-8177

Descriptors: animals and man/ disturbance by man/ commercial activities/ ecology/ population dynamics/ habitat utilization/ habitat/ man made habitat/ land zones/ Palaearctic Region/ Eurasia/ Europe/ Carabidae: farming and agriculture/ community structure/ population density/ distribution within habitat/ habitat colonization/ cultivated land habitat/ orchards/ Germany/ Weilheim/ Limburg Nature Reserve/ grassland management treatment effect on orchard community structure/ Carabidae/ Caraboidea/ Adephaga/ Coleoptera/ Insecta/ arthropods/ beetles/ insects/ invertebrates

Abstract: From April 1995 to November 1997 the following investigation was carried out on 62.7 ha of the nature reserve 'Limburg' (48.36 N/9.23E): data on the type and frequency of grassland use was collected and mapped as well as data on the carabid fauna. 17 sample plots were selected. Parts of the plots have had 25 years of unchanged management regimes. The regimes included three-cutting meadows (3), two-cutting meadows (3), mulched meadows (4), abandoned meadows (3), a horse pasture, a sheep pasture with rotational grazing, a continuously grazed sheep pasture, and a sheep pasture which had been abandoned in 1994. 5229 beetles representing 68 Carabidae species were caught in pitfall traps during the three years of investigation, 18 species (26%) could only be verified by one single individual. Meadows cut once or twice a year did not differ substantially from pastures regarding their mean number of species. But these three management forms show a significant higher number of species compared to mulched meadows or abandoned plots. The number of species on sample plots diminishes with decreasing land use intensity. The carabid species caught were divided into 5 classes according to their size: Large species (SC I, SC II) held percentages between 6 and 29% and between 0 and 29% respectively. Medium-sized and smaller species (SC III, SC IV) were more abundant with 8-54% and 15-63%. Very small species (SC V) were less frequent 0-19%. The percentage of large species increased along the gradient of land use intensity, while the percentage of medium-sized species decreased. Two classes were built regarding the food preferences of carabids: Phytophagous species held percentages between 14 and 41%, predominantly zoophagous species between 54 and 86%. The distribution of food preferences does not show any land use-specific influence. Three discriminant functions on the basis of 20 characters (variables) of the carabid assemblage were extracted, which significantly separated the carabid assemblages from the live groups of management forms. The ecological characteristics of the assemblages in the orchard habitat are quite different.

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198. Habitat preference of *Lestes barbarus* (Fabricius, 1798) (Odonata, Lestidae) on a low-intensity cattle pasture in the Sava floodplain (Croatia).

Hill, Benjamin T.; Beinlich, Burkhard; and Plachter, Harald. In: Verhandlungen der Gesellschaft fuer Oekologie. (Held 7 Sep 1998-7 Sep 1998 at Ulm, Germany.); Vol. 29.

Heidelberg, Germany: Spektrum Akademischer Verlag; pp. 539-545; 1998.

Notes: Meeting Information: 28th Annual Conference of the Society for Ecology (Gesellschaft fuer Oekologie)

NAL Call #: QH540 .G4 Bd. 29; *ISBN:* 3827407850

Descriptors: floodplains grazing systems/ groundwater level/ habitat preference/ land use practice/ limnic habitat/ low intensity cattle pasture/ book chapter/ meeting paper
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199. The impact of buffer strips and stream-side grazing on small mammals in southwestern Wisconsin.

Chapman, E. W. and Ribic, C. A.

Agriculture, Ecosystems & Environment 88(1): 49-59. (2002)

NAL Call #: S601 .A34; *ISSN:* 0167-8809

Descriptors: pastures/ habitats/ cattle/ small mammals/ ecosystems/ streams/ animal husbandry/ rotational grazing/ species diversity/ farm management/ riparian buffers/ plant litter/ intensive livestock farming

Abstract: The practice of continuously grazing cattle along streams has caused extensive degradation of riparian habitats. Buffer strips and managed intensive rotational grazing (MIRG) have been proposed to protect and restore stream ecosystems in Wisconsin. However, the ecological implications of a switch from traditional livestock management to MIRG or buffer strip establishment have not been investigated. Differences in small mammal communities associated with riparian areas on continuously grazed and MIRG pastures, as well as vegetative buffer strips adjacent to row crops, were investigated in southwestern Wisconsin during May-September 1997 and 1998. More species (mean of 6-7) were found on the buffer sites than on the pasture sites (mean of 2-5). Total small mammal abundance on buffer sites was greater than on the pastures as well; there were 3-5 times as many animals on the buffer sites compared to the pasture sites, depending on year. There were no differences in species richness or total abundance between MIRG and continuously grazed pastures in either year. Total small mammal abundance was greater near the stream than away from the stream, regardless of farm management practice but there were no differences in species richness. Buffer strips appear to support a particularly rich and abundant small mammal community. Although results did not detect a difference in small mammal use between pasture types, farm-wide implications of a conversion from continuous to MIRG styles of grazing may benefit small mammals indirectly by causing an increase in the prevalence of pasture in the agricultural landscape.

This citation is from AGRICOLA.

200. The impact of grazing animals on nesting success of grassland passerines in farmland and natural habitats: A field experiment.

Pavel, Vaclav

Folia Zoologica 53(2): 171-178. (2004)

NAL Call #: 410 Z792; *ISSN:* 0139-7893

Descriptors: simulated nest method: applied and field techniques/ farmlands/ natural habitats/ nesting success: grassland passerines, grazing animal impact/ trampling: nest damage/ unmanaged alpine meadow

Abstract: A study was made of the influence of trampling by grazing animals on the nesting success of real nests (meadow pipit, *Anthus pratensis*; water pipit, *Anthus*

spinoletta; and skylark, *Alauda arvensis*) and simulated nests (caps from jam-jars filled by green plasticine) on pasture in the Orlicke Mountains and on unmanaged alpine meadows in the Jeseniky Mountains (Czech Republic, Central Europe). While the pasture was continuously grazed by livestock at high densities, unmanaged alpine meadow was grazed only by wild large herbivores at far lower densities. Trampling was the primary cause of nest failure in the Orlicke Mountains, but was infrequent in the Jeseniky Mountains. The number of real nests lost by trampling corresponded to simulated nests within the localities. Spatial distribution of simulated nests had no effect on their survival on intensively grazed fields. The results indicate that grazing animals negatively influenced the nesting success of real and simulated nests of grassland passerines on continuously grazed mountain pasture. The use of simulated nests was an adequate method of predicting trampling losses by natural nests.
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201. Impact of grazing systems on insects and spiders.

Dennis, P.; Bentley, C.; and Jones, J. R.

In: *Livestock farming systems: Research, development socio-economics and land management.* (Held 1 Sep 1994-2 Sep 1994 at Aberdeen, Scotland.) Dent, J. B. (eds.); pp. 220-226; 1996.

Notes: Proceedings of the Third International Symposium
NAL Call #: 49.9 Eu7 no.79

Descriptors: grasslands/ surveys/ stocking rate/ nitrogen fertilizers/ grazing/ predators/ predatory arthropods/ natural enemies

Abstract: A field study was carried out during 1993 in Wales, UK, to investigate the effects of grazing by sheep (9 or 12 ewes/ha) on Araneae and Coleoptera in grasslands. The total number of species was 40 for Araneae and Opiliones, and 89 for Carabidae and Staphylinidae. More species were found in plots without nitrogen application. Lower stocking rates and taller sward height had a positive effect on the number of species.

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202. The importance of grazed habitat for foraging choughs *Pyrrhocorax pyrrhocorax*, and its implication for agri-environment schemes.

Johnstone, I.; Whitehead, S.; and Lamacraft, D.

Aspects of Applied Biology(67): 59-66. (2002)

NAL Call #: QH301.A76; *ISSN:* 0265-1491

Descriptors: breeding places/ foraging/ grazing/ habitat selection/ heathlands/ pastures/ wildlife conservation/ *Pyrrhocorax*/ *Pyrrhocorax pyrrhocorax*

Abstract: Although the chough is of high conservation priority throughout its North West European range, its' breeding habitat requirements may conflict with other land uses. To assess this, the foraging habitat selection of 14 pairs of breeding choughs in coastal north Wales was measured. The results showed selection for heath and pasture with short swards produced by grazing. However, few choughs nest on nature reserves. In the wider countryside, there is a general trend towards promoting reductions in grazing, and these results suggest that this may be detrimental to choughs. Therefore, if the conservation status of this important farmland bird is to improve, grazing prescriptions appropriate to breeding

choughs should be available within relevant agri-environment schemes, along with the ability to target them effectively.

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203. Improving habitat quality of rotationally grazed pastures for grassland birds.

Wisconsin Department of Natural Resources Wisconsin Dept. Nat. Res., 1997. 7 p.

Descriptors: livestock/ population density/ population loss/ vegetation/ North America/ United States/ Wisconsin
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204. Indirect effects of grazing and nutrient addition on the hemipteran community of heather moorlands.

Hartley, S. E.; Gardner, S. M.; and Mitchell, R. J. *Journal of Applied Ecology* 40(5): 793-803. (2003)
NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: fencing: applied and field techniques/ fertilization: applied and field techniques/ nutrient addition/ conservation biology/ grazing behavior/ heather moorlands: habitat/ indirect effects/ management implications/ mineral soils/ nutrient deposition/ species abundance/ species richness/ vegetation: composition, nutritional quality, structure

Abstract: 1. Moorlands dominated by heather *Calluna vulgaris* are of international conservation importance, but are declining as a result of increased grazing pressure and deposition of atmospheric pollutants. Grazing and nutrient deposition can alter the composition, structure and nutritional quality of the vegetation, which may affect the diversity of herbivorous insects. However, the drivers of insect community diversity in moorlands remain poorly understood. 2. Here we quantify the changes in moorland vegetation caused by grazing and nutrient addition, together with the effects of these changes on the community structure of a major group of herbivorous insects on moorlands, the Hemiptera. Fencing and fertilizer treatments were used to test the hypotheses that: (1) hemipteran species richness is related to plant species richness; (2) fertilizer addition increases host plant quality and hence the abundance and diversity of Hemiptera; and (3) a reduction in grazing alters vegetation structure and hence the composition of the hemipteran community. 3. Sites with more mineral soils had the most plant species and the largest species richness and abundance of Hemiptera, supporting hypothesis 1. Fertilizer increased the nitrogen content of both grasses and *Calluna* and significantly increased Hemiptera abundance and species richness (hypothesis 2), although the effect of fertilizer on diversity was smaller than that of site-based factors such as plant species richness. 4. Grazing altered vegetation structure (hypothesis 3): fenced plots increased *Calluna* ground cover, height and canopy occupancy but reduced grass cover. Four months after the fencing and fertilizer treatments, the level of grazing on *Calluna* was the prime factor influencing the composition of the hemipteran community. However, after 2 years of the treatments, soil organic content and prevalence of *Nardus* and new-growth *Calluna* had become the greatest influence on community composition. 5. Synthesis and applications: Grazing and nitrogen deposition alter the vegetation of moorland landscapes and this study shows that these factors also have significant effects on the abundance, species richness and species composition of moorland invertebrates.

However, site-based factors such as soil organic content and plant species richness had the greatest impact on the hemipteran community because plant diversity appears to be the most important driver of hemipteran diversity. Moorland managers may be able to maximize hemipteran species richness using a grazing regime that maintains a mosaic of dwarf shrub and grass cover. Site-specific factors such as soil type need to be considered when managing moorlands for conservation.

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205. Influence of cattle grazing and pasture land use on macroinvertebrate communities in freshwater wetlands.

Steinman, A. D.; Conklin, J.; Bohlen, P. J.; and Uzarski, D. G.

Wetlands 23(4): 877-889. (2003)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: community structure/ species richness/ nutrient concentrations/ water column/ wetlands/ freshwater environments/ grazing/ stocking rates/ land use/ pasture/ pastures/ invertebrates/ nutrients/ cattle/ livestock/ environmental effects/ ostracods/ macroinvertebrates/ midges/ bioindicators/ eutrophication/ aquatic insects/ freshwater crustaceans/ zoobenthos/ population structure/ community composition/ species diversity/ biotic factors/ dominant species/ aquatic plants/ stocking density/ stocks/ agriculture/ indicator species/ pollution indicators/ Invertebrata/ Culicidae/ *Juncus effusus*/ *Polygonum*/ *Panicum hemitomon*/ USA, Florida/ cattle/ cattle stocking/ mosquitoes

Abstract: Responses of wetland abiotic variables and aquatic invertebrate community structure to cattle stocking density, pasture type, and dominant vegetation were evaluated in subtropical pastures. Cattle were stocked at four treatment levels on improved (fertilized) and semi-native (unfertilized) pastures in south-central Florida, USA. Improved pasture wetlands were dominated either by *Panicum hemitomon* (maidencane) or by a mixture of *Polygonum* spp. (smartweed) and *Juncus effusus*; semi-native pasture wetlands were dominated mainly by maidencane. Cattle stocking density had few significant effects on water-column nutrient concentration or invertebrate community structure. However, water-column nutrient concentrations were significantly greater in the wetlands on improved pastures compared to semi-native pastures. Invertebrate richness and diversity were greater in wetlands on semi-native pastures than on improved pastures, despite lower nutrient concentrations in the former. Overall, the cattle stocking treatment had little impact on invertebrate community structure in these systems relative to prior pasture land use. However, vegetation type influenced invertebrate communities and explained some of the differences between pasture types. Semi-native (lower nutrient) wetland pastures dominated by maidencane had significantly greater invertebrate richness and diversity than improved (higher nutrient) wetland pastures dominated by mixed vegetation but showed no difference when compared to improved wetland pastures dominated by maidencane. Chironomids were the dominant invertebrate in wetlands of both pasture types. Correspondence analysis revealed that ostracods and

Culicidae larvae might be useful as bioindicators of subtropical wetlands that are experiencing cultural eutrophication.

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206. The influence of cattle grazing intensity on grasshopper abundance (Orthoptera: Acrididae).

Wingerden, W. K. R. E.; Musters, J. C. M.; Kleukers, R. M. J. C.; Bongers, W.; and Biezen, J. B.

Proceedings of the Section Experimental and Applied Entomology of the Netherlands Entomological Society(2): 28-34. (1991)

NAL Call #: QL461.P76

Descriptors: nature conservation/ farming systems/ ecology/ grazing/ grasslands/ fodder plants/ biology/ agricultural entomology/ Netherlands Entomological Society

Abstract: With special reference to nature conservation, the effects of grazing on Acrididae were studied in grasslands in the Netherlands. Under excessive vegetation egg development was hindered, but with shortage of vegetation the shelter for nymphs and adults was lost. These diverging effects are explained by a model in which the relationship between grasshopper abundance and the amount of vegetation remaining after grazing follows an optimum curve. This paper was presented at an annual meeting of the Netherlands Entomological Society on 14 December 1990 in Utrecht, Netherlands.

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207. The influence of livestock management on habitat quality for farmland birds.

Buckingham, D. L. and Peach, W. J.

Animal Science 81(2): 199-203. (Oct. 2005)

NAL Call #: SF1.A56; ISSN: 1357-7298

Descriptors: wild birds/ grazing management/ habitat preferences/ soil invertebrates/ foraging/ wildlife habitats/ United Kingdom

Abstract: This review covers research linking foraging habitat quality for birds to livestock management in lowland farmland. Based on this research we propose a framework for predicting the value of grazing systems to birds. This predictive framework is needed to guide the development of agri-environment measures to address farmland bird declines in pastoral areas. We show that the exacting requirements of declining granivorous birds pose the greatest challenges, while the needs of soil invertebrate feeding species are more easily met.

This citation is from AGRICOLA.

208. Influence of management on butterflies of rare grassland ecosystems in Germany.

Dolek, Matthias and Geyer, Adi

Journal of Insect Conservation 1(2): 125-130. (1997)

NAL Call #: QL362.J68; ISSN: 1366-638X

Descriptors: mowing: field method/ biodiversity/ fen meadows: habitat/ grazing/ hay meadows: habitat/ species composition/ species number/ species occurrence

Abstract: Traditional hay-meadows in the Alps and fens at the edge of the Alps are habitats for many rare and endangered butterfly species. Conservation efforts aim at preserving these species, but the biotopes depend on regular mowing, which in turn requires intensive financial support. The feasibility of substituting mowing of these sites by grazing is discussed and considered as a more cost effective management type which produces agriculturally

valuable goods as well. In this study the butterfly fauna of mown and grazed sites were compared. Species composition, species number, and the occurrence of rare species under the two management types were in most cases rather similar for both grassland ecosystems.

Nevertheless, there are hints that for single rare species this might not be true. Additionally, at one site, grazing intensity on a former hay-meadow was too high to preserve the species-rich community. Overall the results are encouraging: grazing does not have to be as detrimental as formerly thought, although details (compartments of pastures, intensity) still have to be confirmed. Experimental grazing management of abandoned grasslands of the studied types should be started.

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209. Late fall harvest, winter grazing, and weed control for reduction of alfalfa weevil (Coleoptera: Curculionidae) populations.

Dowdy, A. K.; Berberet, R. C.; Stritzke, J. F.; Caddel, J. L.; and Mcnew, R. W.

Journal of Economic Entomology 85(5): 1946-1953. (1992)

NAL Call #: 421 J822; ISSN: 0022-0493

Descriptors: cultural control/ egg deposition/ larva/ pests/ seasonality

Abstract: This study was conducted during 1983-1987 to determine influence of late fall cutting and winter grazing in combination with control of cool-season weeds on egg deposition and seasonal occurrence of peak larval populations of the alfalfa weevil, *Hypera postica* (Gyllenhal), in Oklahoma. Alfalfa weevil egg numbers were reduced by an average of 55% by late fall cutting and 67% by grazing in winter by cattle compared with the ungrazed treatment. However, peak larval numbers were not lower due to fall cutting and were reduced by an average of just 25% with grazing. Numbers decreased least in years when the majority of eggs were laid in late winter rather than fall or early winter. There seems to be potential to delay occurrence of peak larval numbers up to 10 d by grazing if most eggs are laid in fall or early winter. Larval numbers per stem changed little with changing stem densities and the extent of weed infestation. As a consequence, larval numbers per 0.1 m² tended to be higher with greater stem densities in treatment combinations that promoted stand longevity.

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210. Long-term changes in collembolan communities in grazed and non-grazed abandoned arable fields in Denmark.

Petersen, Henning; Jucevica, Edite; and Gjelstrup, Peter

Pedobiologia 48(5-6): 559-573. (2004)

NAL Call #: 56.8 P343; ISSN: 0031-4056

Descriptors: animals and man/ disturbance by man/ commercial activities/ ecology/ habitat/ terrestrial habitat/ land zones/ Palaearctic Region/ Eurasia/ Europe/ Collembola: farming and agriculture/ grazing/ community structure/ grassland/ abandoned arable fields/ Denmark/ Jutland/ Mols Hills/ abandoned arable field community changes related to grazing/ long term study/ Collembola/ Insecta/ arthropods/ insects/ invertebrates

Abstract: In order to explore long-term changes in microarthropod communities after introduction of livestock grazing in abandoned fields with herb-grass vegetation at Mols, E. Jutland, Denmark, soil and litter samples were

collected from 7 pairs (blocks) of grazed and non-grazed plots over a period of 14 years. Sampling began just before fencing and initiation of cattle and sheep grazing in the spring of 1985. The total material included 76 collembolan species; 65 and 68 species were recorded in the grazed and non-grazed plots, respectively. The number of species recorded at individual sampling dates fluctuated considerably through the period. In the vegetation/litter layer the mean number of species per plot was significantly higher in the non-grazed than in the grazed plots at several sampling dates while in the soil no significant differences were observed. Grazing significantly reduced the abundance of total Collembola, three composite species groups and 12 species at one or more sampling dates. Only three species or species groups (excluding some accidental occurrences) showed significant population increment in response to grazing at one or more sampling dates, most pronounced towards the end of the study period. No species changed from being significantly highest in grazed plots to being significantly highest in the non-grazed plots or vice versa during the study period. Significant relationships between grazing pressure and grazing effect on population density were only found in the vegetation/litter layer and the combined vegetation/litter/soil strata but not in the soil. The three regularly occurring taxa that had highest population densities in the grazed plots were positively correlated with grazing intensity while this was not the case for the majority of those taxa which were most abundant in the non-grazed plots. Canonical correspondence analysis based on species composition suggests separate successional trends for grazed and non-grazed plots. Grazing pressure accumulated through the whole period from start of grazing and precipitation accumulated over one year preceding the sampling date were the most important environmental variables correlated with species composition. According to a permutation test based on a split-plot design water content of the soil measured at each sampling was not significantly correlated with the community development. [copyright] 2004 Elsevier GmbH. All rights reserved.

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211. The management of lowland neutral grasslands in Britain: Effects of agricultural practices on birds and their food resources.

Vickery, J. A.; Tallowin, J. R.; Feber, R. E.; Asteraki, E. J.; Atkinson, P. W.; Fuller, R. J.; and Brown, V. K.
Journal of Applied Ecology 38(3): 647-664. (2001)
NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: agricultural practices/ ecological diversity/ ecology/ food abundance/ food resources/ grazing/ habitat deterioration: nesting, wintering/ habitat transformation/ hay/ livestock systems/ lowland neutral grasslands: habitat/ organic fertilizer inputs/ phenology/ population dynamics/ silage/ structural complexity/ sward defoliation/ vegetation
Abstract: 1. The effects of agricultural intensification on biodiversity in arable systems of western Europe have received a great deal of attention. However, the recent transformation of grassland systems has been just as profound. 2. In Britain, the management of grassland has changed substantially in the second half of the 20th century. A high proportion of lowland grassland is managed intensively. The major changes include a doubling in the use of inorganic nitrogen, a switch from hay to silage, and increased stocking densities, particularly of sheep.

Structurally diverse and species-rich swards have been largely replaced by relatively dense, fast-growing and structurally uniform swards, dominated by competitive species. 3. Most of these changes have reduced the suitability of grassland as feeding and breeding habitat for birds. 4. The most important direct effects have been deterioration of the sward as nesting and wintering habitat, and loss of seed resources as food. Short uniform swards afford poor shelter and camouflage from predators, whereas increased mowing intensities and trampling by stock will destroy nests and young. Increased frequency of sward defoliation reduces flowering and seed set, and hence food availability for seed-eating birds. 5. The indirect effects of intensification of management on birds relate largely to changes in the abundance and availability of invertebrate prey. The effects of management vary with its type, timing and intensity, and with invertebrate ecology and phenology, but, in general, the abundance and diversity of invertebrates declines with reductions in sward diversity and structural complexity. 6. Low input livestock systems are likely to be central to any future management strategies designed to maintain and restore the ecological diversity of semi-natural lowland grasslands. Low additions of organic fertilizer benefit some invertebrate prey species, and moderate levels of grazing encourage sward heterogeneity. 7. There is now a need to improve understanding of how grassland management affects bird population dynamics. Particularly important areas of research include: (i) the interaction between changes in food abundance, due to changes in fertilizer inputs, and food accessibility, due to changes in sward structure; (ii) the interaction between predation rates and management-related changes in habitat; and (iii) the impact of alternative anti-helminthic treatments for livestock on invertebrates and birds.

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212. Nest-site selection by yellow-eyed penguins *megadyptes antipodes* on grazed farmland.

Mckay, Rod; Lalas, Chris; Mckay, David; and Mcconkey, Shaun

Marine Ornithology 27: 29-35. (1999)

NAL Call #: QL671; ISSN: 1018-3337

Descriptors: avian malaria/ (malaria, avian (mesh)), parasitic disease/ breeding habitat/ disturbance/ grazed farmland: habitat/ land clearance/ nest site selection/ predation/ recruitment

Abstract: The viability of Yellow-eyed Penguins *Megadyptes antipodes* on South Island, New Zealand, is threatened through the loss of breeding habitat by land clearance and the loss of chicks to introduced predatory mammals. Penguin nests at Papanui Beach, Otago Peninsula, were spread through about 7 ha of grazed grassland and shrubland. Here farming and Yellow-eyed Penguin conservation were shown to be compatible through active management: the impact of farm stock was minimised by excluding cattle; predation was minimised by trapping; and disturbance by humans and dogs was minimised by prohibiting public access. Penguin nest sites varied from sites with total lateral concealment and overhead cover to fully exposed sites. Deaths attributed to avian malaria decimated the breeding population of 21 pairs in early 1990. Nest numbers recovered to 21 by the 1995/96 season but their distribution had changed. Nests lacking overhead concealment in grassland habitat

increased from two (10%) in 1989/90 to 12 (57%) in 1995/96. Unexpectedly the new generations of breeders appeared to select open, relatively exposed sites in grassland in preference to sites in dense vegetation offered by shrubland. We have not yet found an explanation for this preference. However, a relatively large number of non-breeders congregated at pastures near the sea in the 1995/96 season with the vast majority in grassland rather than shrubland. The presence of clear areas may be important for the recruitment of breeders at this location.
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213. Nesting birds and grazing cattle: Accommodating both on Midwestern pastures.

Temple, Stanley A.; Fevold, Brick M.; Paine, Laura K.; Undersander, Daniel J.; and Sample, David W.
In: Ecology and conservation of grassland birds of the Western Hemisphere/ Vickery, Peter D. and Herkert, James R.; Vol. 19; Series: Studies in Avian Biology 19, 1999; pp. 196-202.

Notes: ISSN: 0197-9922

NAL Call #: QL671.S8

Descriptors: animals and man/ disturbance by man/ commercial activities/ conservation/ conservation measures/ reproduction/ ecology/ community structure/ population dynamics/ habitat/ terrestrial habitat/ land and freshwater zones/ Nearctic Region/ North America/ USA/ Aves: farming and agriculture/ habitat management/ pasture management/ implications of ecology and reproduction/ reproductive productivity/ species diversity/ population density/ pasture management relationships/ grassland/ Wisconsin/ green/ Iowa and Lafayette Counties/ pasture management effects on biology/ conservation implications/ Aves/ birds/ chordates/ vertebrates

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214. Pastoral management vs. land abandonment in Mediterranean uplands: Impact on land snail communities.

Labaune, Corinne and Magnin, Frederic
Global Ecology and Biogeography 11(3): 237-245. (2002)
NAL Call #: H84 .G56; ISSN: 1466-822X

Descriptors: CANOCO 4.0: computer software/ canonical correspondence analysis: statistical method/ correspondence analysis: statistical method/ stratified quantitative sampling: sampling method/ mediterranean uplands/ altitude/ body size/ community impact/ dry grasslands: habitat/ grazing pressure/ habitat relationships/ land abandonment/ pastoral management/ spatial scales/ species diversity/ species equitability/ species richness/ vegetation

Abstract: The aim of the study was to assess the impact of a pastoral management chosen to limit the recent expansion of woodland on a Mediterranean mountain on land snail diversity. An additional aim was to acquire quantitative data that could be used to identify pasture environments from Holocene molluscan assemblages. The work was undertaken at the Luberon mountain, Provence, south of France. We used a stratified quantitative sampling scheme according to altitude and vegetation structure. A total of 80 sites were studied. Large species were collected within a 5 X 5-m plot. Small species were extracted from litter and surface soil. A standard procedure for site description was used based on 35 environmental variables. Grazing pressure was estimated according to the impact of

grazing on the herb layer. Correspondence analysis and canonical correspondence analysis were performed using CANOCO 4.0 software. The distribution of land snails is related to altitude and grazing intensity. Large patches of grazed grassland harbour open country and mountain snail species. Thermophilic open ground species are located in grazed grasslands at lower altitude. Shade-loving species are present in ungrazed scrublands or in small clearings on the upper slopes. The lowest species richness, diversity and equitability are associated with large patches of grazed grassland, the presence of a continuous cover of short grass reinforcing this negative impact on snail diversity. Our study is consistent with similar works on land snails or other invertebrates but discordant with vegetation studies. A homogeneous grazed herb layer significantly reduces snail diversity and abundance. Heterogeneity seems to favour snail diversity both at the local and landscape scales. However, sheep grazing contributes to the expansion of suitable habitats for rare snail species.

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215. Response of birds to grazing of riparian zones.

Popotnik, Gary J. and Giuliano, William M.
Journal of Wildlife Management 64(4): 976-982. (2000)
NAL Call #: 410 J827; ISSN: 0022-541X

Descriptors: avian abundance/ avian communities: bird counts, nest density, nest monitoring, reproductive success, riparian area livestock grazing impacts, species richness/ livestock grazing/ pasture/ pasture streams/ riparian areas/ vegetative cover/ vegetative structure/ wetlands

Abstract: Livestock grazing of streams and associated riparian areas may negatively impact avian communities through direct disturbance and alteration of vegetation structure. We determined the effects of grazing on vegetation, avian abundance, species richness, and reproductive success on pasture streams and associated riparian habitats in southwest Pennsylvania. Bird counts, nest monitoring, and vegetation sampling were conducted on 12 pairs (grazed and control) of streams in 1996 and 10 pairs in 1997. Compared with control streams, grazed areas had lower avian species richness and abundance. Several wetland-and riparian-dependent species (e.g., common snipe (*Gallinago gallinago*), great blue heron (*Ardea herodias*), green-backed heron (*Butorides striatus*), belted kingfisher (*Ceryle alcyon*), and solitary sandpiper (*Tringa solitaria*)) were found more often or only on control areas. Although nest density was higher and nest destruction rates by livestock were lower on control streams, nest success (all species combined) was not affected by grazing. Avian communities in control areas appear to benefit primarily from improved vegetative cover and structure. Thus, management should focus on excluding livestock from such areas.

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216. The response of epigeal beetles (Col.: Carabidae, Staphylinidae) to varied grazing regimes on upland *Nardus stricta* grasslands.

Dennis, P.; Young, M. R.; Howard, C. L.; and Gordon, I. J.
Journal of Applied Ecology 34(2): 433-443. (1997)
NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: direct gradient analysis/ domestic livestock/ ground/ rove beetles/ pitfall traps/ semi-natural grassland
Abstract: 1. The effect of different livestock grazing regimes on the insect fauna of an upland, semi-natural

grassland was measured in 1993 and 1994 by a survey of the epigeal Carabidae and Staphylinidae within an experiment established in 1991. Grazing by sheep, or sheep and cattle, to achieve two different inter-tussock sward heights, provided four treatments. In addition, a further treatment was ungrazed from 1992 to test the impact on beetles of a short-term cessation of grazing, trampling and dung inputs. 2. Pitfall traps sampled Carabidae and Staphylinidae within the *Nardus stricta*-dominated grassland of the experiment. Data on these epigeal Coleoptera were collected from April to October in 1993 and 1994; years three and four of the experiment. 3. The epigeal Coleoptera species were ranked by decreasing abundance in traps, where the captures in traps were accumulated for both seasons. The responses to the grazing regimes were analysed using ANOVA, applied to the most abundant species (that together represented 99% of the two seasons' catch). There were significant experimental effects of grazing regime on five of these 32 Coleoptera species, namely *Carabus violaceus*, *Othius angustus*, *Pterostichus strenuus*, *Xantholinus linearis* and *Olophrum piceum*. 4. The ordination technique, Canonical Correspondence Analysis (CCA), was applied to the data on the Coleoptera assemblage. Variables measured to represent the experimental treatments (mean vegetation height, stocking rate and botanical diversity) and environmental covariables (altitude and aspect) were entered in the direct gradient analysis procedure of CCA. This application of CCA partialled out the effects of altitude and aspect of each plot and revealed the significant effects of vegetation structure, botanical species composition and stocking density on a larger number of Coleoptera species than suggested from ANOVA. 5. Twenty-four of the 32 most abundant Coleoptera species correlated with the effects of different grazing regimens imposed on *Nardus* grassland. Greater abundances of *C. violaceus*, *O. angustus*, *X. linearis* and *T. corticinus* were indicative of the typical upland grassland and heathland Coleoptera assemblage. These species could be monitored to balance the impact of grazing management on arthropod biodiversity with the need to restrict the dominance of *N. stricta* in drier upland grasslands, achieved in this instance, by summer grazing sheep and cattle to maintain an average, between-tussock sward height of 6-7 cm. However, the results from the direct gradient analysis suggest that the grazing regimes should be varied in rotation over time to achieve a mosaic of structurally different grassland patches (0.70-4.73 ha) because this encourages a larger overall number of beetle species.

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217. The response of invertebrate assemblies to grazing.

Gibson, C. W. D.; Brown, V. K.; Losito, L.; and McGavin, G. C.

Ecography 15(2): 166-176. (1992)

NAL Call #: QH540.H6; ISSN: 0906-7590

Descriptors: animals and man/ disturbance by man/ commercial activities/ ecology/ habitat/ terrestrial habitat/ land and freshwater zones/ Palaearctic Region/ Europe/ United Kingdom/ Invertebrata/ Hemiptera: farming and agriculture/ grazing effects on grassland communities/ community structure/ grassland/ effects of livestock grazing/ England/ grassland community responses to livestock grazing/ Coleoptera/ Insecta/ arthropods/ coleopterans

beetles/ hemipterans true bugs/ insects/ invertebrates
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218. Responses of butterfly and moth species to restored cattle grazing in semi-natural grasslands.

Poyry, Juha; Lindgren, Sami; Salminen, Jere; and Kuussaari, Mikko

Biological Conservation 122(3): 465-478. (2005)

NAL Call #: S900.B5; ISSN: 0006-3207

Descriptors: conservation management: applied and field techniques/ cattle grazing/ semi natural grassland
Abstract: The effects of restorative grazing on the abundance of butterfly and moth species were studied in mesic semi-natural grasslands of SW Finland differing in management history: (1) old continuously grazed, (2) restored (with ca 5 years of reinitiated grazing), and (3) abandoned former pastures. Generalized linear modelling of species abundances and indicator species analysis produced qualitatively similar results. Only three species (*Polyommatus icarus*, *Lycaena hippothoe* and *Camptogramma bilineatum*) were most abundant in old pastures, whereas 12 species (*Polyommatus semiargus*, *Polyommatus amandus*, *Brenthis ino*, *Aphantopus hyperantus*, *Scopula immorata*, *Idaea serpentina*, *Scotopteryx chenopodiata*, *Epirrhoe alternata*, *Cybosia mesomella*, *Polypogon tentacularius*, *Hypena proboscidalis* and *Cryptocala chardinyi*) were most abundant in abandoned pastures. None of the old-pasture species had become more abundant in restored pastures. Three species, *Epirrhoe hastulata*, *Xanthorhoe montanata* and *Chiasmia clathrata*, occurred equally abundantly in abandoned and in restored pastures indicating a slow progress of restoration. Species associated with old pastures differed from species associated with abandoned pastures in their recent distributional changes in Finland. The species of old pastures showed decreasing trends, whereas those of abandoned pastures showed mainly increasing trends in their distribution. In five out of 11 species, the preferred successional stage differed markedly between this study and previous studies conducted in Central Europe. We conclude that (1) ca 5 years of restorative grazing in mesic grasslands has been insufficient for the colonisation of old-pasture species in the restored sites, (2) different management intensities are needed regionally for the maintenance of grassland insect diversity and (3) application of the knowledge on successional preferences of different species in conservation management, even in climatically similar regions, should be made with caution. Copyright 2004 Elsevier Ltd. All rights reserved.
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219. Restoration of butterfly and moth communities in semi-natural grasslands by cattle grazing.

Poyry, J.; Lindgren, S.; Salminen, J.; and Kuussaari, M.

Ecological Applications 14(6): 1656-1670. (2004)

NAL Call #: QH540.E23; ISSN: 1051-0761

Descriptors: agriculture/ biodiversity/ biogeography/ population studies/ methods and techniques
Abstract: The effects of restorative grazing on species composition and community structure of butterflies and moths were studied in mesic semi-natural grasslands differing in their management history: (1) old continuously grazed pastures, (2) restored pastures with approx 5 yr of reinitiated grazing, and (3) abandoned former pastures.

Butterflies and moths were counted with a transect method during 1999 and 2000 in 33 study sites in southwest Finland. In a multivariate ordination (NMDS), the studied grasslands were separated from each other on the basis of their species composition so that the actively grazed pastures differed from abandoned pastures. The first ordination, axis represented most (73%) of the variation in species composition, and it was strongly correlated with variables describing the current grazing intensity. Species richness and total abundance were highest in abandoned pastures, both for all species and for grassland-preferring species. In contrast, relative diversity (N1, N2, and alpha) and evenness (Alatalo's evenness index) were in most cases highest in old pastures and lowest in abandoned pastures. Generalized linear models (GLM) were constructed for four response variables: total species richness, grassland species richness, abundance of all species, and abundance of grassland species. The derived models explained 78-84% of the total variation for species richness and 92-93% for abundance, and the type of grazing history explained the largest proportion of variation. Mean vegetation height was included in the abundance models as a quadratic function, which indicated that butterflies and moths were most abundant at an intermediate level of grazing intensity, as predicted by the "dynamic equilibrium model." The results suggest that grazing management is a useful tool in the restoration of insect communities of abandoned semi-natural grasslands. In order to enhance the survival of species suffering from continuously high grazing intensity, the existing management instructions should be developed toward construction of regional networks of semi-natural grasslands, which would allow differing grazing intensities or rotational grazing on the patch level, but simultaneously ensure continuity of varying management regimes on a regional level.

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220. Resumed forest grazing restored a population of *Euphydryas aurinia* (Lepidoptera Nymphalidae) in SE Finland.

Saarinen, Kimmo; Jantunen, Juha; and Valtonen, Anu *European Journal of Entomology* 102(4): 683-690. (2005)
NAL Call #: QL461.E9884; ISSN: 1210-5759

Descriptors: habitat restoration/ management intensity/ forest grazing

Abstract: In 1996, an old forest pasture grazed from the 1960s to 1988 was restored by coppicing, fencing and grazing by cattle to protect a local population of the endangered butterfly *Euphydryas aurinia*. An adjoining ungrazed meadow provided a control. In the first years, the butterfly became almost extinct due to the nearly complete consumption of the host plant of the larva, *Succisa pratensis*, by cattle. The butterfly population quickly recovered when the grazing pressure was lowered. Thus, the intensity of management should be adjusted by continuous monitoring of the target species. In the 2000s, the annual population was about 50 butterflies, but marked fluctuations took place, probably caused by natural factors. Grazing benefited the meadow flora and improved the habitat of butterflies in general. Extensive forest grazing clearly has the potential for enhancing biodiversity. The value of the experiment is, however, limited because only a single pair of meadows was available for comparison. In the future, it will be even more difficult to arrange a similar

experiment due to the great decline in the numbers of traditional meadows and forest grazing in SE Finland.
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221. Richness and abundance of Carabidae and Staphylinidae (Coleoptera), in northeastern dairy pastures under intensive grazing.

Byers, R. A.; Barker, G. M.; Davidson, R. L.; Hoebeke, E. R.; and Sanderson, M. A.

Great Lakes Entomologist 33(2): 81-105. (2000)
NAL Call #: QL461.M5; ISSN: 0090-0222

Descriptors: ecology/ habitat/ terrestrial habitat/ land and freshwater zones/ Nearctic Region/ North America/ USA/ Carabidae: community structure/ intensively grazed pastures/ Pennsylvania and Vermont/ grassland/ intensively grazed dairy pastures/ New York/ Pennsylvania/ Vermont/ new records/ community structure in intensively grazed pasture/ Carabidae/ Caraboidea/ Adephaga/ Coleoptera/ Insecta/ arthropods/ coleopterans beetles/ insects/ invertebrates

Abstract: Dairy cattle grazing has become popular to dairy farmers in the Northeast looking for management schemes to cut production costs. Carabidae (ground beetles) and Staphylinidae (rove beetles) are indicators of habitat disturbances, such as drainage of wetlands, or grassland for grazing animals, and their monitoring could provide one measure of ecosystem sustainability if intensive grazing management systems expand or intensify in the future. Our objective was to assess the abundance and species richness of these two beetle families under intensive grazing throughout Pennsylvania, southern New York and Vermont. We collected 4365 ground beetles (83 species) and 4,027 rove beetles (79 species) by pitfall traps in three years in Pennsylvania. Nine ground beetle species, *Amara aenea*, *Poecilus chalcites*, *Pterostichus melanarius*, *Bembidion quadrimaculatum oppositum*, *Amara familiaris*, *Poecilus lucublandus*, *Agonum muelleri*, *Bembidion obtusum* and *Bembidion mimus* represented 80% of the Carabidae collected. Five other species were new to Pennsylvania. Four rove beetle species, *Philonthus cognatus*, *Meronea venustula*, *Amischa analis*, and *Philonthus varius* (= *carbonarius*), comprised 74% of the total Staphylinidae collected. Yearly distributions of the dominant species did not change significantly in the three years with *A. aenea* and *P. cognatus* being most abundant every year. A parasitic rove beetle, *Aleochara tristis*, was recovered for the first time in Pennsylvania and Vermont since its release in the 1960's to control face fly, *Musca autumnalis*. Similar results were found in New York and Vermont. We collected 1,984 ground beetles (68 species). *Pterostichus melanarius* was most abundant. *Pterostichus vernalis* was detected for the first time in the United States (Vermont). It was previously reported from Montreal, Canada. We collected 843 rove beetles (45 species). *Philonthus cognatus* was the most abundant rove beetle. In addition, *Tachinus corticinus*, previously known only from Canada, was discovered for the first time in the United States in Vermont. Pastures in Pennsylvania were diverse, containing 14 species of forage plants and 17 weed species. Botanical composition was similar in New York and Vermont. Sixteen species of grasses and legumes made up 90% of the plant composition and 36 species of weeds made up the remainder. This diverse plant ecosystem may explain the richness of ground and rove beetles in northeastern U.S. pastures because the

heterogeneity in the plant population provided additional resources which can support a rich assemblage of beetles. Monitoring richness and abundance of Carabidae and Staphylinidae over three years in Pennsylvania suggests intensive grazing systems are ecologically sustainable.
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222. The role of grazing in creating suitable sward structures for breeding waders in agricultural landscapes.

Tichit, Muriel; Durant, Daphne; and Kerneis, Eric
Livestock Production Science 96(1): 119-128. (2005)
NAL Call #: SF1.L5; ISSN: 0301-6226
Descriptors: grazing/ habitat management/ agricultural landscape/ suitable sward structure/ breeding wader
Abstract: French wet grasslands support important populations of lapwings and other waders. Grazing management is a key issue in the use of grasslands by these birds since they are very sensitive to sward structure (height and heterogeneity). To assess the impact of different grazing regimes on sward structure during spring, sward height was repeatedly measured in a coastal marsh for 2 years. Sward structure was characterised by variables related to height classes and an index of heterogeneity. Grazing regimes were described by stocking rates per period and N fertilisation level. Heterogeneity index was quadratically related to mean sward height both years. Four types of sward structures were characterised through principal component analysis. Coinertia analysis showed a strong relationship between grazing regimes and sward structure. However, during spring, the relationship between stocking rate and sward structure differed according to year, impact of grazing being greater during drought year. Suitable sward structures were observed for both lapwings and redshanks. Wader habitat management through grazing calls for more attention to be paid to the delayed effects of autumn and winter grazing regimes. Sward heterogeneity emerges as a new characteristic to control, because it may introduce new constraints for livestock production. (c) 2005 Elsevier B.V. All rights reserved.
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223. Sheep grazing and rodent populations: Evidence of negative interactions from a landscape scale experiment.

Steen, Harald; Myrsterud, Atle; and Austrheim, Gunnar
Oecologia (Berlin) 143(3): 357-364. (2005)
NAL Call #: QL750.O3; ISSN: 0029-8549
Descriptors: animals and man/ disturbance by man/ commercial activities/ nutrition/ diet/ feeding behaviour/ ecology/ competition/ habitat/ terrestrial habitat/ land zones/ Palaearctic Region/ Eurasia/ Europe/ *Clethrionomys glareolus/ Microtus agrestis (Muridae): farming and agriculture/ food plants/ food availability/ foraging/ population dynamics/ interspecific competition/ grassland/ mountain pastures/ mountain habitat/ Norway/ south/ Buskerud County/ Hol Municipality/ sheep grazing impact on mountain pasture populations/ landscape scale experiment/ Muridae/ Rodentia/ Mammalia/ chordates/ mammals/ rodents/ vertebrates*
Abstract: Inter-specific competition, facilitation and predation influence herbivore assemblages, but no study has experimentally explored the interactions between large ungulates and small rodents. In a fully replicated, landscape scale experiment, we manipulated densities of

domestic sheep in mountain pastures in Norway. We then determined population growth and densities of rodents by live trapping in each of the areas with different sheep densities. We found that the (summer) population growth rate and autumn density of the field vole (*Microtus agrestis*) was lower at high sheep density. This provides the first experimental evidence of negative interactions between an ungulate and small rodent species. There was no effect on the bank vole (*Clethrionomys glareolus*), whose diet differs from sheep. Sheep density, therefore, potentially alters the pattern of inter-specific population synchrony amongst voles. Our study shows that negative interactions between large ungulates and small rodents may be species-specific and negative population consequences for the rodent population appear above threshold ungulate densities.
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224. The short-term effect of sheep grazing on selected invertebrates (Diptera and Hemiptera) relative to other environmental factors in an alpine ecosystem.

Myrsterud, Atle; Hansen, Lars Ove; Peters, Chris; and Austrheim, Gunnar
Journal of Zoology (London) 266(4): 411-418. (2005)
NAL Call #: QL1.J68; ISSN: 0952-8369
Descriptors: animals and man/ disturbance by man/ commercial activities/ nutrition/ diet/ ecology/ population dynamics/ habitat/ terrestrial habitat/ abiotic factors/ land zones/ Palaearctic Region/ Eurasia/ Europe/ Diptera/ Hemiptera: farming and agriculture/ food plants/ community structure/ population density/ grassland/ mountain habitat/ abiotic factors/ Norway/ Buskerud County/ Hol Municipality/ sheep grazing short term effects relative to other environmental factors in alpine ecosystem/ Diptera/ Insecta/ arthropods/ insects/ invertebrates/ true bugs/ true flies
Abstract: Grazing by large herbivores is well-known to influence plant communities, while much fewer studies have been carried out on grazing effects on invertebrates. In Norway, some 2.2 million sheep graze on outlying pastures during summer, most of them in the alpine zone, but no study has reported the relative impact of sheep grazing on invertebrate communities relative to other environmental factors such as the plant community and altitude. A fully replicated landscape-scale experiment (2.7 km²) was performed with no, low (25 per km²) and high (80 per km²) sheep densities in an alpine habitat of Norway (1050-1300 in a.s.l.). The increased vulnerability hypothesis (H1) predicts that the more folivorous invertebrates, the higher the grazing pressure by sheep, as large herbivore grazing may stress the plants so they are more vulnerable to insect herbivory. The increased defence hypothesis (H2) predicts increased levels of general anti-herbivore defences, and thus a lower abundance of invertebrates with increasing sheep densities. Contrary to both predictions, no evidence was found that sheep grazing affected invertebrate richness, or abundance of folivorous, predatory or detritivore invertebrates - in a community dominated by Diptera and Hemiptera. Demonstrating an effect will always be a function of sample size, but at least our study shows that other environmental variables (such as plant species richness and functional plant richness) are more important determinants than sheep grazing for the selected invertebrate groups. Our study was short-term (first year of grazing) mainly designed to test specific hypotheses related to induced plant defences; long-term effects are probably

owing to the impact sheep may have on vegetation composition, primary production, litter cover and soil properties.

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225. Short-term effects of cattle grazing on nematode communities in Florida pastures.

McSorley, R. and Frederick, J. J.

Nematologica 30(2): 211-221. (2000)

NAL Call #: SB998.N4N4; ISSN: 0099-5444

Descriptors: animals and man/ disturbance by man/ commercial activities/ ecology/ population dynamics/ habitat/ terrestrial habitat/ land and freshwater zones/ Nearctic Region/ North America/ USA/ Nematoda: farming and agriculture/ cattle grazing/ community structure/ short term effects of cattle grazing/ pastures/ population density/ short term effects of cattle grazing in pastures/ grassland/ subtropical pasture/ Florida/ Highlands County/ Buck Island Ranch/ short term effects of cattle grazing on community structure/ pasture/ Nematoda/ helminths/ invertebrates/ nematodes

Abstract: Effects of cattle population density on nematode community structure were evaluated in a rotational grazing study involving 16 experimental pastures (each 20-32 ha in size) at a cattle ranch in south-central Florida. Summer pastures were grazed from Apr./May to Oct./Nov. and winter pastures from Oct./Nov. to Apr./May. Experimental design was a split-plot, with two pasture locations (winter, summer) as main plots and four cattle densities (0, 15, 20, or 35 cow-calf pairs per pasture) as sub-plots. With a few exceptions, population densities of most nematode genera in winter and summer pastures were similar ($P > 0.10$). Cattle density had relatively little effect on population levels of individual nematode genera or on indices of nematode community structure. Of the more than 50 nematode genera found at this site, Monhystera populations were affected most frequently by the short-term (6-7 months) grazing, but the nature of the responses were inconsistent. Nematode community data showed strong seasonal trends, with many genera more abundant in autumn than in spring samples ($P [t\text{-test}] < 0.05$). In this study, seasonal effects greatly overshadowed any minor effects of cattle grazing on the soil nematode community.

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226. Short-term grazing exclusion effects on riparian small mammal communities.

Giuliano, W. M. and Homyack, J. D.

Journal of Range Management 57(4): 346-350. (2004)

NAL Call #: 60.18 J82; ISSN: 0022-409X

Descriptors: riparian areas/ grazing intensity/ small mammals/ species diversity/ plant litter/ ground vegetation/ height/ Pennsylvania

Abstract: Grazing of livestock in streams and associated riparian habitats (hereafter referred to as riparian zones) may affect small mammal communities by influencing vegetation, water quality, and other site characteristics. To better understand these effects, we compared vegetation structure, and abundance and richness of small mammals in grazed riparian zones and similar areas where livestock had recently (1-2 years) been excluded in southwest Pennsylvania, 1998 and 1999. Mammalian species richness and abundance (all species combined, meadow voles [*Microtus pennsylvanicus* Ord], and meadow jumping mice [*Zapus hudsonius* Zimmermann]) were greater on

sites where livestock had been excluded than grazed areas. These findings are likely the result of greater litter cover and increased vertical vegetation obstruction observed on these sites. Because small mammal communities respond quickly to relaxation of grazing in riparian zones, subsidy programs exist to partially pay for fencing, and landowners may potentially benefit from fencing these areas through improved water quality, erosion control, and livestock health, fencing may be an effective wildlife and grazing management tool. This citation is from AGRICOLA.

227. Soil dwelling macro-invertebrates in intensively grazed dairy pastures in Pennsylvania, New York and Vermont.

Byers, R. A. and Barker, G. M.

Grass and Forage Science 55(3): 253-270. (2000)

NAL Call #: 60.19 B773; ISSN: 0142-5242

Abstract: This study estimates the relative contributions of environment and farm management strategies in influencing soil faunal assemblages and attempts to identify the species with potential to affect sustainability of intensive grazing management systems in the north-eastern USA. It arises because of the change from confinement feeding of dairy cattle, consequent upon concerns about negative environmental effects, the rising costs for machinery and housing, and reduced profit margins, together with the absence of data from which the consequences of such change on the soil fauna may be predicted. Macro-invertebrates were sampled in soil from seventy-eight grazed pastures on twenty-one dairy farms in Pennsylvania, USA, in the spring of 1994. On five of these farms, macro-invertebrates were sampled (four pastures per farm) in the spring, summer and autumn seasons of 1994, 1995 and 1996. In 1997, macro-invertebrates were sampled in soil during spring, summer and autumn from (four pastures per farm) on three farms in New York, and during spring and summer on three farms in Vermont. Species richness ranged from two to twelve species (mean 6.4) per pasture site in Pennsylvania and five to eighteen species (mean 10.7) in New York and Vermont. The communities were dominated at most sites by earthworms. Earthworms were correlated with soil basal and substrate-induced respiration/carbon ratio, and soil moisture, but were negatively correlated with cows per hectare and herbage biomass in Pennsylvania. Sitona larvae were recorded at nineteen of the twenty-one farms during the spring of 1994 across Pennsylvania and occurred at populations $>5 \text{ m}^{-2}$ in 68% of the sampled pastures. Sitona larvae were less abundant in New York and Vermont. Elaterid larvae comprised a complex of seven species of which *Aeolus melillus* (Say) and *Melanotus communis* (Gyllenhal) comprised 35% and 39%, respectively, of the elaterids collected in Pennsylvania. *Agriotes mancus* (Say) and *Ctenicera destructor* (Brown) comprised 41% and 26%, respectively, of four species collected in New York and Vermont. Scarabaeid larvae, comprising a complex of eight species, were detected at only 27% of the seventy-eight pastures sampled in spring 1994 in Pennsylvania. Five species were collected in ten of the twelve New York pastures and four species in nine of the twelve Vermont pastures. Populations of scarabaeid larvae averaged $<25 \text{ m}^{-2}$ in all three states, except in three Pennsylvania pastures in spring 1994. Detrended canonical correspondence analysis (DCCA) showed pasture standing

biomass, legume diversity, pre-winter stubble height, white clover pasture content, and soil phosphorus levels influenced numbers of invertebrate species more than climatic factors, such as temperature, rainfall, altitude, latitude and seasonal water table. DCCA also showed most pastures to be close to the average of environmental factors. The extremely low density of herbivorous macro-invertebrates in soil and the absence of pest outbreaks may indicate a stable soil ecosystem.

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228. Soil macrofauna under two grazing systems.

Rodriguez, I.; Crespo, G.; Torres, V.; and Fraga, S.
Cuban Journal of Agricultural Science 33(4):

415-422. (1999)

NAL Call #: S1.R4; ISSN: 0864-0408

Descriptors: biomass/ ferrallitic soils/ grassland soils/ grazing intensity/ grazing systems/ rotational grazing/ soil fauna/ soil types/ species diversity

Abstract: The soil macrofauna of an 18 ha *Cynodon nlemfuensis* sward was studied for three years (September 1993-96) on a red ferrallitic soil in Cuba to compare an intensive rotational grazing system with 72 paddocks (Voisin's rational grazing) and 260 large cattle (LC) units (equivalent to liveweight of 500 kg), and a less intensive rotational grazing system with 12 paddocks and an intensity of 51 LC. Three paddocks were selected from each system in which three areas of 0.065 m² each were sampled at 0-20 depth once each trimester to determine the number of macrofauna individuals, the biomass and soil humidity. Data were statistically analysed through a linear model and also the principal component method was used to analyse the influence of climatic factors on the variables studied and their relationship. There were no significant differences between the two grazing systems in the number of individuals (mean 4.37/m²) or in their biomass (19.9 g/m²). Results showed differences ($P < 0.01$) between trimesters with the highest values in September-October-November and March-April-May. Annual performance of the macrofauna showed that in the first year there was a greater number of individuals (8.86 vs 2.26 and 1.96) and higher biomass (39.3 vs 2.43 and 11.07 g/m²) compared to the following years. Among the diversity of individuals there were earthworms, coleopterous larvae and other insects. The first two groups made up most of the total biomass. Results indicate that diversity and biomass of macrofauna will not increase in the short term under similar soil and climatic conditions in the grazing systems used in this study.

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229. Spatial distribution of upland beetles in relation to landform, vegetation and grazing management.

Dennis, Peter; Aspinall, R. J.; and Gordon, Iain J.
Basic and Applied Ecology 3(2): 183-193. (2002)

NAL Call #: QH540 .B37; ISSN: 1439-1791

Descriptors: principle component analysis: mathematical and computer techniques/ climate change/ distance statistics/ grazing intensity/ grazing management/ land use changes/ landform management/ soil management/ soil moisture/ spatial distribution/ structural heterogeneity/ vegetation management

Abstract: We applied a novel analysis based on distance statistics to investigate how patterns of habitat heterogeneity affected the distribution of representative

ground and rove beetle species (Coleoptera: Carabidae, Staphylinidae), sampled at an upland site of varied landform, soil and vegetation structure. The structural heterogeneity of the *Nardus stricta*-dominated grassland was further modified by varying grazing intensity with sheep, or sheep and cattle. We collected pitfall trap data from 120 sample points across the study area. Ground and rove beetle species were selected to represent the major trends in the species-trap abundance data, determined by the extent of their correlation with the main components of a factor analysis (Principal Components Analysis). The novel statistical analytical method, calculation of the Getis and Ord distance statistic, G_i^* , was applied to the distribution data of each selected species of ground and rove beetle. The distance statistic was calculated for the smallest distance to ensure that each sample point had at least one neighbour (73 m) and this distance was used to detect local spatial association and to explore the location and spatial scale of aggregations of each beetle species over the hillside. Clusters of high and low $G_i^*(z)$ values were mapped to indicate the species' functional heterogeneity compared with habitat heterogeneity determined by landform, soils or grazing management. The small number of large aggregations indicated the sensitivity of certain species to patterns of landform (*Calathus melanocephalus* and *Pterostichus adstrictus*). More aggregations of smaller size, coinciding with the pattern of particular grazing regimes indicated species sensitive to grazing intensity and species of mammalian herbivore (*Carabus problematicus* and *Olophrum piceum*). The aggregations of *Othius angustus* and *Philonthus decorus* related to landform, and suggested these species may have been directly responding to soil moisture and patterns of trampling by grazers. The method distinguished between those species that are sensitive to land use change and those that may be affected more by climate change.

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230. Study of the population dynamics of dipterous stem-borer larvae of ryegrass swards under rotationally grazed or cut conditions.

Moore, D. and Clements, O.

Grass and Forage Science 41(4): 289-294. (1986)

NAL Call #: 60.19 B773; ISSN: 0142-5242

Descriptors: *Oscinella frit*/ *Oscinella vastator*/ weather
Abstract: Observations made between 1980 and 1982 showed that dipterous stem-borers were more common in grazed than cut swards. The two forms of *Oscinella frit* were particularly prevalent in grazed swards but *O. vastator* was more evenly distributed and dominated the larval populations of the cut sward in 1981. The population dynamics of all species were probably affected by the number of days on which weather was suitable for high stem-borer adult activity. It was also found that stem-borer larval numbers could expand rapidly after periods suitable for high adult activity even when adult numbers had been low for long periods. Despite low numbers of *O. vastator* being present in winter 1981, their numbers increased markedly and built up to a large population which peaked in September 1981.

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231. Waterbird communities and habitat relationships in coastal pastures of northern California.

Colwell, M. A. and Dodd, S. L.

Conservation Biology 9(4): 827-834. (1995)

NAL Call #: QH75.A1C5; ISSN: 0888-8892

Descriptors: pastures/ habitats/ coastal areas/ plant height/ grazing/ wild birds/ waterfowl/ grasslands/ permanent grasslands/ wetlands/ nature conservation/ wild animals
Abstract: Waterbird (including geese) assemblages (diversity, composition, and species' densities) were examined in 20 pastures near Humboldt Bay, California, in relation to habitat characteristics (vegetation height, soil penetrability, water depth), abundance of invertebrates (worms and other invertebrates), and presence of livestock. From October 1991 to May 1992, 29 species and 10 776 birds were observed, most (78%) of which foraged. Nonrandom pasture use by birds resulted in a highly clumped spatial distribution. Habitat characteristics of pastures were correlated with this nonrandom pattern: waterbird diversity and densities of three sandpiper species and one gull species correlated negatively with vegetation height; densities of two plover species correlated negatively with soil penetrability; and waterfowl densities correlated positively with water depth. Species composition varied among pastures. Wading birds used pastures with tall vegetation, shorebirds and gulls frequented short-grass pastures, and waterfowl used flooded pastures. Both the presence of waterbirds and their densities increased in association with livestock. In coastal areas where much intertidal habitat has been reclaimed as pastureland, pastures offered valuable habitats to nonbreeding waterbirds. It is suggested that grazing in coastal pastures can be used to provide a mosaic of vegetation heights, which would yield greater waterbird diversity as well as higher densities of some species.

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232. What factors determine where invertebrate-feeding birds forage in dry agricultural grasslands?

Atkinson, Philip W.; Buckingham, David; and Morris, Antony J.

Ibis 146(Suppl. 2): 99-107. (2004); ISSN: 0019-1019

Descriptors: mowing: applied and field techniques/ agricultural grassland/ foraging behavior/ grazing

Abstract: Increases in the intensity of the management of agricultural grasslands over the past 50 years have reduced plant species diversity in swards and increased uniformity in structure through changes in fertilizer regimes, grazing and mowing practices. These factors, as well as increased disturbance and trampling, have reduced the number and diversity of forbs and thus the diversity and abundance of invertebrates, in particular of foliar species. Associated with these changes in management, there has been a large decline in the abundance of many species of farmland birds in pastoral areas and more local extinctions compared with arable areas. To understand the impact of these management changes on bird populations, and design measures to reverse the declines, it is necessary to identify the key factors influencing bird usage of fields. We review results from five studies, which have related fertilizer

and grazing management to bird usage of grass fields. Species that fed on soil invertebrates tended to show a positive response to the amount of nitrogen fertilizer added and increased grazing pressure, although there was a high degree of correlation between these two variables. In summer, many species, including corvids, Common Blackbird *Turdus merula*, Common Starling *Sturnus vulgaris*, Pied Wagtail *Motacilla alba* and Hedge Accentor *Prunella modularis*, showed a negative relationship with sward height, and in winter more species showed a positive relationship with bare ground. Taller sward heights are associated with a greater abundance and diversity of bird invertebrate food resources, and accessibility of food items or a lower risk of predation (actual or perceived) are likely to be the reasons for birds choosing to forage on shorter swards and in areas with more bare ground. Birds feeding on soil invertebrates were found to be generally tolerant of modern management practices that maintain short swards short, as accessibility to the soil has been increased. Species that feed on foliar invertebrates or forb seeds have been affected negatively by modern grassland agricultural practices.

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233. Winter bird communities in woodland in the Forest of Dean, England, and some implications of livestock grazing.

Hill, D. A.; Lambton, S.; Proctor, I.; and Bullock, I.

Bird Study 38(1): 57-70. (1991); ISSN: 0006-3657

Descriptors: conifer oak forest/ species composition/ habitat selection/ conservation/ transect method

Abstract: Winter bird communities, sampled by transect methods, were compared between 9 woodland sites (1 ungrazed oak, 4 grazed oak, 4 grazed conifer) in the Forest of Dean Gloucestershire, during 2 winters (1984/85 and 1987/88). Ungrazed oak woodland had the highest counts of individual birds in both years. More species occurred in oak woods than in conifers. Ordination of the combined data from the 2 winters illustrated a consistent gradient of bird species composition (after the exclusion of 2 flocking species, Woodpigeon and Chaffinch), from evergreen coniferous to deciduous broadleaf. Green and Great-spotted Wood-pecker, Hawfinch, Fieldfare, Brambling, Great Tit, Magpie and Siskin occurred largely towards the deciduous broadleaf end of the gradient. Classification of the bird data split the sites firstly into deciduous broadleaf and evergreen coniferous. In further sub-divisions, one group had tree species composition consisting largely of ungrazed oak for which the indicator bird species was Hawfinch. The indicator species of the grazed conifer group were Blue Tit, Goldcrest, Coal Tit and Long-tailed Tit. The tree species composition for the 5 final groups was then related to the number of bird species in them. In both years the mean number of species in the groups increased with an increase of the dominance of oak, with the highest value in ungrazed oak. The implications of the development of further ungrazed areas for conservation purposes are discussed.

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Plant Ecology, Biodiversity, and Other Environmental Effects

234. Achievements in management and utilization of southern grasslands.

Hoveland, C. S.

Journal of Range Management 53(1): 17-22. (2000)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/2000/531/17-22_hoveland.pdf

Descriptors: humid zones/ Festuca/ Festuca arundinacea/ Neotyphodium coenophialum/ agricultural research/ Paspalum notatum/ grazing/ plant breeding/ gypsum/ transgenic plants/ beef cattle/ Southeastern United States
Abstract: Grasslands in the humid southern USA are utilized primarily for grazing on improved pastures, most of which were developed since the 1930s and 1940s. Virtually all of these grasslands were developed from species introduced from other areas of the world. Major achievements in successful developing these grasslands, often on eroded cropland, were: (a) introduction of Kentucky 31 tall fescue (*Festuca arundinacea* Schreb.); (b) introduction of Pensacola bahiagrass (*Paspalum notatum* Flugge); (c) breeding of Coastal bermudagrass [*Cynodon dactylon* (L.) Pers.]; (d) fertilizer and lime use along with availability of low-cost N; (e) no-till planting of winter annual grasses; (f) pasture renovation with legumes; (g) herbicides for weed control; (h) recycling of agricultural wastes in forage production; (i) development of round hay baler; (j) controlled grazing; (k) discovery of the tall fescue fungal endophyte and its effect on livestock and the grass plant; (l) development of grazing-tolerant alfalfa; (m) improved cool season annual grasses and legumes for winter grazing; and (n) near infrared reflectance spectroscopy for rapid and low-cost forage analysis. Future areas of emphasis in improvement of these grasslands may include: (a) greater use of grazing-tolerant grasses and legumes; (b) stress-tolerant tall fescue with "friendly" non-toxic endophytes; (c) feed antidotes to the toxins of endophyte-infected tall fescue; (d) use of herbicide- and pest-resistant biotechnology genes in forage plants; (e) use of gypsum to alleviate subsoil acidity and improve rooting depth of aluminum-sensitive forage cultivars; (f) greater use of computers in information access and decision making by livestock producers; (g) greater use of forages for wildlife food; (h) breeding of pasture plants with greater winter productivity; (i) development of a perennial grass biomass energy industry for electrical generation and liquid fuel production.

This citation is from AGRICOLA.

235. Alternative management on fens: Response of vegetation to grazing and mowing.

Stammel, Barbara; Kiehl, Kathrin; and Pfadenhauer, Joerg

Applied Vegetation Science 6(2): 245-254. (2003)

NAL Call #: QK900 .A66; ISSN: 1402-2001

Descriptors: alternative fen management/ calcareous fen characteristics/ clonal growth/ fen meadow/ grazing effect/ growth form/ mowing effect/ pasture/ plant functional types/ reproduction/ species composition/ species traits/ vegetation response

Abstract: The impact of cattle grazing on the vegetation of calcareous fens was compared to the effects of traditional autumn mowing in southern Germany. Vegetation composition was studied in adjacent pairs of fen meadows and pastures with similar environmental conditions and

biomass production. Vegetation data were analysed with respect to species richness, species composition and response of species traits to disturbance, including morphology, defence mechanisms, clonal growth form and generative reproduction. Species richness was significantly reduced by grazing, but the percentage of typical fen species or Red Data Book species was not affected by land use type. Detrended Correspondence Analysis indicated that species composition could best be explained in terms of a land use gradient. Species traits showed a clear trend in their response to land use type. Grazing favoured grasses and small forbs. Only a few species with defence mechanisms against foraging were more frequent or abundant on pastures. Many other species with defence mechanisms, however, did not have an advantage on pastures. Flowering and seed dispersal traits did not respond significantly to grazing or mowing. Species with fast spreading stem derived clonal organs were favoured on pastures, whereas all other clonal growth forms and, particularly, non-clonal species were more abundant on meadows. More indicator species of wet soil conditions and species adapted to flooding were found on pastures. Grazing can be recommended as an alternative land use to mowing in contrast to abandonment, but a reduction in species richness and changes in species composition and species traits may occur.

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236. Ammonia volatilization from grassland receiving nitrogen fertilizer and rotationally grazed by dairy cattle.

Bussink, D. W.

Fertilizer Research 33(3): 257-266. (1992)

NAL Call #: S631.F422; ISSN: 0167-1731

Descriptors: grassland soils/ ammonia/ volatilization/ losses from soil/ rotational grazing/ calcium ammonium nitrate/ biogeochemical cycles/ application rate/ cattle manure

Abstract: The micrometeorological mass balance method was used to measure ammonia (NH₃) volatilization from rotationally grazed swards throughout the 1987 and 1988 growing seasons. In both years the swards were dressed with calcium ammonium nitrate (CAN) split over 7 dressings. In 1987 the sward received a total of 550 kg N ha⁻¹, in 1988 a total of 550 or 250 kg N ha⁻¹. For the 550 kg N ha⁻¹ treatments there were 8 and 9 grazing cycles, respectively, in 1987 and 1988 and 7 for the 250 kg N ha⁻¹ treatment. Losses from the 550 N sward were 42.2 and 39.2 kg N ha⁻¹ in 1987 and 1988, respectively; this was equivalent to 8.5 and 7.7% of the N returned to the sward in the excreta of the grazing cattle. The NH₃ loss from the 250 N sward was 8.1 kg N ha⁻¹ in 1988, which was equivalent to 3.1% of the N returned to the sward in excreta during the growing season. There was a wide variation in NH₃ volatilization between the individual grazing periods. This indicates the necessity of continued measurements throughout the growing season to obtain reliable data on NH₃ volatilization. Soil humidity is suggested to be a key factor, because emissions were high from wet soil, and low

from drier soil. Results of a Monte Carlo simulation study showed that the measured NH₃ loss from the 250 and 550 N swards had a standard deviation of 13 and 5% of the mean, respectively.

This citation is from AGRICOLA.

237. Animal and plant response on renovated pastures in western Canada.

McCartney, D. H.; Waddington, J.; and Lefkovitch, L. P. *Journal of Range Management* 52(1): 19-26. (1999)
NAL Call #: 60.18 J82; ISSN: 0022-409X
http://jrm.library.arizona.edu/data/1999/521/19-26_mccartney.pdf

Descriptors: beef cows/ rotational grazing/ grazing intensity/ nitrogen fertilizers/ phosphorus fertilizers/ calves/ liveweight gain/ botanical composition/ *Bromus inermis*/ *Agropyron cristatum*/ *Psathyrostachys juncea*/ Canada
Abstract: Extending the present 4 month grazing season in the Aspen parklands of western Canada is of major economic interest to cow-calf producers. A long-term experiment was conducted on 375 ha to compare the present practice of continuous grazing with no fertilizer to a rotational grazing system of 4 paddocks fertilized in alternate years with 90 kg N, 45 kg P₂O₅, 10 kg S ha⁻¹ and a 6 paddocks rotational grazing system including fertilizing and species replacement by cultivation and reseeding. Compared to the continuously-grazed control, the grazing period was extended by 14-days on the 4-paddock rotation system, and by a further 15-days on the 6-paddock rotation system, divided about equally between spring and fall. Forage yield, cow weight gains and calf growth were significantly improved, and year-to-year variation in forage yield and animal weight gain was reduced. In the 6-paddock rotation system, breaking 1 paddock at a time in summer after grazing, and reseeding the following spring caused no noticeable reduction in grazing capacity. Replacing the bromegrass (*Bromus inermis* Leyss.) dominated vegetation in 1 of the 6 paddocks with an early-growing grass contributed to the grazing season extension. Crested wheatgrass (*Agropyron cristatum* (L.) Gaertn.) performed well in this role; Russian wildrye (*Psathyrostachys juncea* (Fisch.) Nevski) died out within 6 years of seeding.

This citation is from AGRICOLA.

238. An attempt to restore a central European species-rich mountain grassland through grazing.

Matejkova, Ivona; Van Diggelen, Rudy; and Prach, Karel *Applied Vegetation Science* 6(2): 161-168. (2003)
NAL Call #: QK900 .A66; ISSN: 1402-2001

Descriptors: violion caninae stand/ food selectivity/ grassland management/ grazing impact/ seed dispersal/ soil seed bank/ species rich mountain grassland restoration/ target species response

Abstract: This paper describes the effects of re-establishing seasonal cattle grazing by 0.7 animal.ha⁻¹ on vegetation in a long-term abandoned, and partly degraded, semi-natural mountain pasture in the Sumava National Park, Czech Republic. There was very uneven grazing intensity inside the locality, and grazing preference changed during the season: cattle grazed most of the time in productive but species-poor *Deschampsia cespitosa* swards, but changed to a species-rich *Violion caninae* stand in the middle of the summer. A species-rich *Carex rostrata* community was only grazed at the end of the

season. Species-poor swards dominated by *Nardus stricta* and *Carex brizoides* were mainly used as resting areas. Both grazing and excluding from grazing had a negative effect on species diversity of the *Deschampsia cespitosa* swards. The soil seed bank contained only few species that are characteristic of mountain grassland communities, and seed dispersal of the target species by cattle dung was also found to be very limited. Thus both grazing and exclusion from grazing are probably of limited value for the restoration of species-rich grasslands from species-poor *Deschampsia cespitosa* swards in this case.

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239. Avoidance of degradation of Alpine pasture through grazing management: Investigations of change in vegetation nutrition characteristics as a consequence of sheep grazing at different periods of the growing season.

Andrighetto, I.; Cozzi, G.; Berzaghi, P.; and Zancan, M. *Land Degradation & Rehabilitation* 4(1): 37-43. (1993)
NAL Call #: S622.L26; ISSN: 0898-5812

Descriptors: sheep/ grazing/ animal husbandry/ highlands/ mountains/ Italy

This citation is from AGRICOLA.

240. Bermudagrass management in the southern piedmont USA: Coastal productivity and persistence in response to fertilization and defoliation regimes.

Franzluebbers, A. J.; Wilkinson, S. R.; and Stuedemann, J. A.

Agronomy Journal 96(5): 1400-1411. (2004)
NAL Call #: 4 AM34P; ISSN: 0002-1962

Descriptors: fertilization: applied and field techniques/ defoliation regime: animal grazing/ fertilization regime/ soil
Abstract: Productivity, quality, and persistence of 'Coastal' bermudagrass (*Cynodon dactylon* (L.) Pers.) pastures are affected by fertilization, but possible interactions with defoliation regime including animal grazing are not fully known. We evaluated three sources of fertilization with equivalent N rates (inorganic, crimson clover (*Trifolium incarnatum* L.) cover crop plus inorganic, and chicken (*Gallus gallus*) broiler litter) factorially arranged with four defoliation regimes (unharvested, cattle (*Bos taurus*) grazing to maintain high (4.5 +/- 1.6 Mg ha⁻¹) and low (2.5 +/- 1.1 Mg ha⁻¹) forage mass, and bayed monthly) on estimated forage dry matter production, forage and surface residue C/N ratio, and ground cover of pastures on a Typic Kanhapludult in Georgia during 5 yr. Mean annual forage dry matter production was 7.5 +/- 0.7 Mg ha⁻¹ with hay harvest but declined (1.3 Mg ha⁻¹ yr⁻¹) significantly with time as a result of lower precipitation. With grazing, estimated production was 8.3 +/- 1.0 Mg ha⁻¹ and did not change with time, suggesting that grazing cattle sustained forage productivity by recycling nutrients and creating better surface soil conditions. Coastal bermudagrass as a percentage of ground cover (initially 81%) declined 5 +/- 2% yr⁻¹ with unharvested and grazing to maintain low forage mass, declined 3 +/- 1% yr⁻¹ with haying, and remained unchanged (-1 +/- 1% yr⁻¹) with grazing to maintain high forage mass. Pastures with high forage mass were more productive than with low forage mass (9.2 +/- 1.6 vs. 7.5 +/- 1.1 Mg ha⁻¹) from a forage sustainability perspective, primarily by avoiding encroachment of undesirable plant species.

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241. Biodiversity in intensive grasslands: Effect of management, improvement and challenges.

Plantureux, S.; Peeters, A.; and Mccracken, D.

Agronomy Research 3(2): 153-164. (2005)

NAL Call #: SB13 .A57; ISSN: 1406-894X

Descriptors: fertilization: applied and field techniques/ cutting management: applied and field techniques/ grazing/ biodiversity/ intensified grassland

Abstract: Intensified grasslands are usually the dominant type of grassland in many countries in Europe but are generally of poor ecological value. Several management factors may affect biodiversity of these grasslands including fertilisation, grazing and cutting management. Their effects on grassland biodiversity are described in this paper. In most cases, intensive and profitable grass production from semi-natural grasslands appears to be incompatible with maintaining a high level of biodiversity. Two key questions then arise: how to restore biodiversity in intensive grasslands while limiting the technical and economical consequences? How to choose the target species on an objective basis? Some solutions are considered in the paper but it is suggested that 1) new tools (i.e. indicators) are required to evaluate the functions of biodiversity and to achieve biodiversity restoration goals and 2) in the short-term the research priority is to understand and predict biodiversity at the field and farm-scale.

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242. Biological control of Canada thistle in temperate pastures using high density rotational cattle grazing.

Bruijn, S. L. and Bork, E. W.

Biological Control 36(3): 305-315. (2006)

NAL Call #: SB925.B5; ISSN: 1049-9644

Descriptors: beef cattle/ biological control/ flowering/ forage/ grazing/ pastures/ shoots/ weed control/ weeds

Abstract: Extensive research exists on the effects of Canada thistle [*Cirsium arvense* (L.) Scop.] (CT) in annual cropland, but few studies have examined CT impacts on pasture and rangeland. While it is known that grazing impacts weed presence and abundance, little is understood about how specific grazing systems can be used as a prescriptive tool to alter weed populations, including CT.

The purpose of this study was to experimentally test three cattle grazing systems, including (1) continuous or season-long grazing (SL), (2) short duration (SD) (or low intensity-high frequency) rotational grazing, and (3) high intensity-low frequency (HILF) rotational grazing, for their ability to reduce CT and release non-CT herbage within permanent pastures of central Alberta, Canada. A secondary objective was to evaluate season-long changes in the quality of CT shoots as potential forage throughout the growing season. Results showed that SL grazing maintained or increased severe CT infestations and reduced forage yield. In contrast, the HILF rotational system reduced CT shoot density and biomass, as well as flowering, and resulted in greater weed suppression than the SD system. Two intense defoliations annually over 2-3 years nearly eliminated CT stems. Remaining CT shoots were also primarily vegetative and greater in forage quality under HILF grazing. As a weed biological control tool for CT, prescribed grazing with an HILF system may be particularly important in areas where other control options, including the use of herbicides, are not possible due to environmental restrictions or inaccessibility to equipment.

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243. Biomass of grazed, burned, and undisturbed paramo grasslands, Colombia: Aboveground vegetation.

Hofstede, Robert G. M.; Castillo, M. Ximena Mondragon; and Osorio, Constanza M. Rocha

Arctic and Alpine Research 27(1): 1-12. (1995)

NAL Call #: GB395.A73; ISSN: 0004-0851

Descriptors: burning history/ ecosystem stability/ grazing management

Abstract: Estimations of the amount of aboveground vegetation mass were made for four paramo grassland sites with different grazing management and burning histories in the Central Cordillera of Colombia. The total mass of live plus dead grassland vegetation showed a decrease from 2820 +/- 190 g m⁻² at the undisturbed to 868 +/- 73 g m⁻² at the intensively grazed and burned sites. Stem rosette mass was highest at both the undisturbed and the heavily grazed sites (666 +/- 168 and 1029 +/- 245 g m⁻², respectively), but considerably lower at the burned sites (397 +/- 94 and 285 +/- 78 g m⁻²). Eighty percent of the total undisturbed vegetation mass consisted of standing dead material and litter. The decrease of dead material mass along the disturbance gradient may have large implications for ecosystem stability. The proportion of live material increased along the grazing and burning gradient, resulting in a similar live material mass at all sites. Under high grazing intensities and in the absence of burning, the vegetation can transform into ground-covering mats, attaining a moderately high biomass. Where burning took place, this transformation does not occur, and both grassland and stem rosette biomass were reduced, leaving many patches of bare ground.

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244. Biomass of grazed, burned, and undisturbed paramo grasslands, Colombia: Root mass and aboveground: Belowground ratio.

Hofstede, Robert G. M. and Rossenaar, Arnout J. G. A.

Arctic and Alpine Research 27(1): 13-18. (1995)

NAL Call #: GB395.A73; ISSN: 0004-0851

Descriptors: burning management/ grazing management/ root distribution/ seasonality

Abstract: In a Neotropical alpine grassland (paramo) in the Colombian Central Cordillera, the root mass, root distribution, and aboveground: belowground (A:B) ratio were determined at four sites with different grazing and burning management. Compared to grasslands at other latitudes, paramos have a relatively low belowground biomass and, due to the combination with a high aboveground biomass, a high A:B ratio. This is attributed to a low productivity and a lack of seasonality. Effects of grazing disturbance on the root system could be observed at a site without burning history, where the tussock grass vegetation was transformed into ground covering mats. Here, belowground biomass increased from 1.2 to 2.1 kg m⁻², which was more concentrated in the upper 10 cm of the soil. An undisturbed and two other grazed sites did not show differences in root mass or distribution, in response to disturbance. Nevertheless, A:B ratios decreased clearly towards more managed sites, as a result of decreased aboveground biomass.

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245. Botanical composition, soil and forage quality under different management regimes in Russian grasslands.

Mikhailova, E. A.; Bryant, R. B.; Cherney, D. J. R.; Post, C. J.; and Vassenev, I. I.

Agriculture, Ecosystems & Environment 80(3): 213-226. (2000)

NAL Call #: S601 .A34; ISSN: 0167-8809

Descriptors: botanical composition/ cutting/ forage quality/ grassland management regime/ grazing/ soil quality

Abstract: Little is known on how management of Russian native grasslands affects botanical composition, soil and forage properties. Three fields were sampled in the V.V. Alekhin Central-Chernozem Biosphere State Reserve in the Kursk region of Russia: a native grassland (not cultivated for at least 300 years), a grazed/hay field with 4 years of annual harvest followed by 1 year of rest (periodically-cut grazed/hay field), and a yearly-cut grazed/hay field. Soil samples were collected from the top 10 cm and analyzed. Plant species were identified at the sampling sites and this plant material was used to determine total elemental analysis of forage, crude protein (CP), neutral detergent fiber (NDF), acid detergent fiber (ADF), in vitro true digestibility (IVTD) and lignin concentrations. Above-ground live and dead plant material and roots were analyzed for C, N and lignin. Soil sample analysis showed that fields were comparable in terms of soil chemical and physical properties. SOC and N contents were not statistically different in the native and yearly grazed/hay fields. Soil bulk density significantly increased as a result of utilization, from 0.80+-0.09 Mg m⁻³ for the native grassland to 0.97+-0.06 Mg m⁻³ for the yearly grazed/hay field. A total of 107 different plant species were recorded at the three fields. There were changes in plant composition among the fields. The native grassland field had the least number of plant species (41) followed by the yearly-cut grazed/hay field (68), and the periodically-cut grazed/hay field (87). There was a greater proportion of grass species (20%) in the native grassland field. Dead plant biomass and roots from the grazed/hay fields were higher in N and lignin concentrations. Forage mineral concentration was highest in the periodically-cut hay field. No significant differences were observed in terms of forage properties.

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246. Burning and exclosure can rehabilitate degraded black speargrass (*Heteropogon contortus*) pastures.

Orr, D. M.; McKeon, G. M.; and Day, K. A.

Tropical Grasslands 25(4): 333-336. (1991)

NAL Call #: SB197.A1T7; ISSN: 0049-4763

Descriptors: botanical composition/ grasslands/ burning/ control/ weed control/ cultural control/ grazing/ fodder plants

Abstract: A 30 x 30 m site on an *Aristida* spp.-dominated *H. contortus* pasture at Gayndah was burnt and fenced in Oct. 1986 and then left ungrazed for 4 years. Two plots within the site were burnt annually in spring and a 3rd plot left unburnt. Plots in an adjacent grazed area were burnt in Oct. 1986 and 1989 as part of normal management practice. Protection from grazing and annual burning increased the proportion of *H. contortus* from 20 to 70% by weight (15 to 57% by basal area) and decreased the proportion of *Aristida* spp. from 70 to 16% by weight or 68 to 37% by basal area. Neither burning once in exclosure nor burning twice under continuous grazing had major effects on pasture composition. It was suggested that while

exclosure for 3-4 years would be economically unviable, pasture rehabilitation may be possible using spring burning for 2-3 years and lenient stocking or deferred grazing in the summer.

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247. Carbon exchange rates in grazed and ungrazed pastures of Wyoming.

Lecain, D. R.; Morgan, J. A.; Schuman, G. E.; Reeder, J. D.; and Hart, R. H.

Journal of Range Management 53(2): 199-206. (2000)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/2000/532/199-206_lecain.pdf

Descriptors: beef cattle/ prairies/ grazing intensity/ biogeochemical cycles/ photosynthesis/ carbon dioxide/ gas exchange/ botanical composition/ rain/ air temperature/ soil water/ *Carex*/ *Artemisia frigida*/ *Sphaeralcea coccinea*/ *Hesperostipa comata*/ *Pascopyrum smithii*/ Wyoming

Abstract: The influence of cattle grazing on carbon cycling in the mixed grass prairie was investigated by measuring the CO₂ exchange rate in pastures with a 13 year history of heavy or light grazing and an ungrazed exclosure at the High Plains Grasslands Research Station near Cheyenne, Wyo. In 1995, 1996 and 1997 a closed system chamber, which covered 1 m² of ground, was used every 3 weeks from April to October to measure midday CO₂ exchange rate. Green vegetation index (similar to leaf area index), soil respiration rate, species composition, soil water content, soil temperature, and air temperature were also measured to relate to CO₂ exchange rates of the 3 grazing treatments. Treatment differences varied among years, but overall early season (mid April to mid June) CO₂ exchange rates in the grazed pastures were higher (up to 2.5 X) than in the exclosure. Higher early season CO₂ exchange rates were associated with earlier spring green-up in grazed pastures, measured as higher green vegetation index. As the growing season progressed, green vegetation index increased in all pastures, but more so in the ungrazed exclosure, resulting in occasionally higher (up to 2 X) CO₂ exchange rate compared with grazed pastures late in the season. Seasonal treatment differences were not associated with soil temperature, soil respiration rate, or air temperature, nor was there a substantial change in species composition due to grazing. We hypothesize that early spring green-up and higher early season CO₂ exchange rate in grazed pastures may be due to better light penetration and a warmer microclimate near the soil surface because of less litter and standing dead compared to the ungrazed pastures. When all the measurements were averaged over the entire season, there was no difference in CO₂ exchange rate between heavily grazed, lightly grazed and ungrazed pastures in this ecosystem. This citation is from AGRICOLA.

248. Cattle and weedy shrubs as restoration tools of tropical montane rainforest.

Posada, Juan M.; Aide, T. Mitchell; and Cavelier, Jaime

Restoration Ecology 8(4): 370-379. (2000)

NAL Call #: QH541.15.R45R515; ISSN: 1061-2971

Descriptors: abundance/ forest regeneration/ grazing/ microhabitat/ species diversity/ species establishment/ species richness/ stocking density/ tropical montane rainforest

Abstract: Over the last 150 years, a large proportion of forests in Latin America have been converted to pastures. When these pastures are abandoned, grasses may slow reestablishment of woody species and limit forest regeneration. In this study, we explored the use of cattle in facilitating the establishment of woody vegetation in Colombian montane pastures, dominated by the African grasses *Pennisetum clandestinum* (Kikuyo) and *Melinis minutiflora* (Yaragua). First, we described woody and herbaceous vegetation in grazed and non-grazed pastures. Second, we tested the effect of grazing and seed addition on the establishment and growth of woody species. We also determined if the effect of grazing was different in *P. clandestinum* and *M. minutiflora* pastures. We found that low stocking density of cattle greatly increased density, number of branches per individual (a measure of "shrubbiness"), and basal area of woody species, but also reduced woody plant species richness and diversity. In the grazed area, the shrubs *Baccharis latifolia* (Chilca) and *Salvia* sp. (*Salvia*) were the most abundant. The combined effect of grazing and shading from the shrubs reduced herbaceous vegetation by 52 to 92%. In the grazing/seed addition experiment, grazing increased establishment of woody seedlings, particularly of the shrub *Verbesina arborea* (camargo), but the largest effect was seed addition. Where grasses are an important barrier to regeneration, grazing can facilitate the establishment of shrubs that create a microhabitat more suitable for the establishment of montane forest tree species.

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249. Cattle grazing a riparian mountain meadow: Effects of low and moderate stocking density on nutrition, behavior, diet selection, and plant growth response.

Huber, S. A.; Judkins, M. B.; Krysl, L. J.; Svejcar, T. J.; Hess, B. W.; and Holcombe, D. W.

Journal of Animal Science 73(12): 3752-3765. (1995)

NAL Call #: 49 J82; *ISSN:* 0021-8812

Descriptors: cattle industry/ forage quality/ grazing management

Abstract: Twelve ruminally cannulated and six intact crossbred beef steers were used in a randomized complete block design to evaluate the effects of stocking density of a riparian pasture in the Sierra Nevada mountains on grazing behavior, dietary selection, forage intake, digesta kinetics, and growth rates of *Carex nebraskensis* and *Juncus balticus*. Nine .5-ha pastures were assigned to one of three treatments: ungrazed (CON) or grazed to leave either 1,500 kg/ha (LOW) or 1,000 kg/ha (MOD). Two collections were conducted during the summer of 1992 (following winter drought) and 1993 (following above-average winter precipitation). Standing crop biomass was greater (P < .05) in grazed pastures than in CON pastures at initiation of grazing in 1992 but not in 1993. After grazing in both 1992 and 1993, a treatment times intrapasture location interaction was noted (P < .05). Tiller growth rates in both 1992 and 1993 were affected (P < .05) by a treatment times growth period interaction. Stocking density did not alter (P > .10) botanical or chemical composition of the diet in 1992, and only minor differences were noted (P < .05) in 1993. Forage intake, passage rate measures, and total time spent loafing did not differ (P > .10) between LOW and MOD steers. Within the midmeadow area in 1992, loafing time was greater (P < .05) for MOD steers than for LOW

steers. In 1993, a treatment times trial interaction was noted for loafing time in all three areas. Total time spent grazing was greater (P < .05) for MOD steers than for LOW steers in 1992 and was affected (P < .05) by a treatment times trial interaction in 1993. In 1992 grazing time along the streamside was greater (P < .05) for LOW steers than for MOD steers, and significant treatment times trial interactions were noted for grazing time spent along the forest edge and mid-meadow areas. In 1993, only streamside grazing time was influenced by treatment being greater (P < .05) for MOD steers than for LOW steers. In general, our data suggest that management decisions to reduce stocking densities may force cattle to congregate along streambanks and to concentrate grazing and loafing activities in those areas.

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250. Cattle management for biodiversity conservation in an alpine pasture.

Gianelle, D.; Guastella, F.; and Vescovo, L.

In: Integrating efficient grassland farming and biodiversity: Proceedings of the 13th International Occasional Symposium of the European Grassland Federation. (Held 29 Aug 2005-31 Aug 2005 at Tartu, Estonia.); pp. 112-115; 2005.

NAL Call #: SB202.E85 E87 2005

Descriptors: alpine grasslands/ biodiversity/ botanical composition/ cows/ dairy farming/ feeding behaviour/ feeding habits/ grassland management/ grasslands/ grazing/ mountain areas/ mountain grasslands/ nature conservation/ supplementary feeding

Abstract: The aim of this work was to evaluate different management techniques of dairy farming on alpine pastures in order to ensure grassland biodiversity conservation in a Central-East Alps alpine mountain barn (Malga Juribello, Trento, Italy). The experimental area was 40 ha, and its altitude ranged between 1,820 and 2,230 m a.s.l. The pasture was divided in two 20 ha paddocks and each was grazed by 12 cattle for 40 days. One group (paddock B) received 2 Kg of supplementary feeding per day, while the other group (paddock A) received 6 Kg per day. To analyze vegetation dynamics, 13 exclusion cages were placed in each paddock. Phytomass samples inside and outside the cages were collected to determine herbage utilisation rates. Vegetation was analysed inside and outside the cages to assess animal selectivity. Species composition and grassland grazing were strongly influenced by the two different feeding rates. Low rates of supplementary feeding seemed to force the cows to graze higher phytomass rates (68% in paddock B and 47% in paddock A), while high concentrate rates allowed the cows to make preferential choices. Low-fed animals were less selective and ate the less palatable plants such as *Deschampsia caespitosa* and *Nardus stricta* resulting in an increase of the number of species in paddock B.

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251. Changes in plant population density, composition and sward structure of a hill pasture during a pastoral fallow.

Nie, Z. N.; Mackay, A. D.; Barker, D. J.; Valentine, I.; and Hodgson, J.

Grass and Forage Science 52(2): 190-198. (1997)

NAL Call #: 60.19 B773; *ISSN:* 0142-5242

Descriptors: plant density/ fallow/ phosphorus fertilizers/

sulfur fertilizers/ tillers/ aspect/ grasslands/ hill grasslands/ fertilizers/ phosphorus/ sulfur/ grazing systems/ grassland improvement/ population dynamics

Abstract: A field study was conducted on two aspects (shady and sunny) of moist, low-fertility hill country with or without added fertilizer (phosphorus and sulphur) in the southern North Island of New Zealand, to investigate the changes in plant population density and sward structure during a full or partial pastoral fallow (in which pasture is not defoliated for a period from late spring/early summer to autumn), compared with a rotationally grazed pasture. A 7-month (October to May) pastoral fallow dramatically decreased the densities of grass tillers by 72% ($P < 0.01$), white clover (*Trifolium repens*) growing points by 87% ($P < 0.01$) and other species by 87% ($P < 0.05$). The decline in tiller density by pastoral fallow was enhanced on the shady aspect. Fertilizer application increased white clover growing-point density on the shady aspect ($P < 0.05$) and grass tiller density on the sunny aspect ($P < 0.05$). Decreased plant density during pastoral fallowing was attributed to above-ground biomass accumulation, which altered sward structure, leading to interplant competition and mortality by self-thinning and completion of the life cycle of some matured plants. The plant size-density relationship during pastoral fallowing in this mixed-species sward followed the self-thinning rule, particularly when the calculation was based on all plant species rather than grass alone. There was no significant ($P > 0.05$) difference in final plant population density between the 7-month pastoral fallow and a shorter term (October to December) pastoral fallow. It is concluded that pastoral fallowing effectively reduced the plant population density and altered sward structure of a hill pasture. Such changes create a more favourable environment for the introduction of improved forage species.

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252. Colonization of grassland by sown species: Dispersal versus microsite limitation in responses to management.

Coulson, Sarah J.; Bullock, James M.; Stevenson, Mark J.; and Pywell, Richard F.

Journal of Applied Ecology 38(1): 204-216. (2001)

NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: habitat diversification/ hay cutting/ management method/ seed sowing/ management method/ grassland colonization/ grazing/ inverse power models/ management responses/ microsite limitation/ seed dispersal distance/ seed production/ seed set/ seedling establishment/ survival

Abstract: 1. Diversification of species-poor grassland often requires the introduction of desirable species by sowing seed. Little is known about the factors controlling the spread of introduced species, or how these interact with management. We determined whether management affected spread rates of two grassland species by modifying seed dispersal or seedling establishment. 2. An experiment was set up in 1995 on a species-poor grassland. It comprised five blocks, each with four treatments: (1) autumn grazed only; (2) cut July; (3) cut July and September; (4) cut July and aftermath grazed. Twenty-two plant species were separately slot-seeded into each treatment plot, providing discrete linear colonization foci. 3. The mechanisms controlling spread were studied in two species: *Rhinanthus minor*, an annual with large seeds

adapted for wind dispersal; and *Leucanthemum vulgare*, a perennial with small seeds with no obvious dispersal adaptations. 4. Perpendicular spread of each species by 1998 was described well by a simple inverse power model. *Rhinanthus* had spread further in the hay-cut treatments (2-4) than in the grazed treatment (1). *Leucanthemum* spread poorly in all plots, with no treatment effects. 5. Seed dispersal from source slots was also described well by the inverse power model. Dispersal curves for *Rhinanthus* were much longer in the hay-cut treatment (3) than in the grazed treatment (1), because more seed dispersed during hay cutting than before, and cutting dispersed seed longer distances. There was no dispersal by grazing animals. Dispersal showed directional effects: seeds travelled further in the prevailing wind direction before the hay-cut and in the grazed treatment; dispersal by hay cutting was further in the cut direction than in the opposite direction. 6. *Leucanthemum* showed poor dispersal, with no treatment effects, except that more seeds were dispersed in the grazed (1) than the hay-cut (3) treatment. 7. The establishment and survival of sown seeds showed no treatment effects for either species. 8. Management effects on the spread of *Rhinanthus* reflected effects on dispersal, rather than establishment. *Leucanthemum* showed poor dispersal but good establishment in all treatments, suggesting its spread may also have been dispersal-limited. *Rhinanthus* was positively affected by hay cutting because it set seed at the time of cutting, whereas *Leucanthemum* set seed later and cutting reduced its seed production. 9. The results indicate that management of grassland to enhance the colonization of sown species might be best targeted at enhancing seed-dispersal distances. Hay cutting can do this, but must coincide with seed set.
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253. Community structure in montane grasslands of central Argentina in relation to land use.

Diaz, Sandra; Acosta, Alicia; and Cabido, Marcelo
Journal of Vegetation Science 5(4): 483-488. (1994)
NAL Call #: QK900.J67; ISSN: 1100-9233

Descriptors: cultivation/ disturbance history/ grazing/ livestock raising

Abstract: We compared the responses of natural montane grasslands in central Argentina to two land-use patterns: cultivation - high intensity, low frequency, and short history of disturbance - and livestock raising - low intensity, high frequency and long history of disturbance. We analysed species composition, richness, and architectural traits in seven neighbouring sites under different land use. There were sharp floristic discontinuities between post-agricultural stages, whereas only minor shifts occurred among different grazing situations. Unlike cultivation, grazing did not produce significant differences in species richness and allowed very slight invasion by exotics. In post-cultivation situations, architectural differences were accounted for by species composition. In the case of different grazing intensities, they were mainly explained by morphological differences among populations of the same dominants. In view of the historical information and current ideas, we suggest that the differential responses to both land uses can be explained not only by the different frequencies and intensities of disturbance they represent, but also by their

contrasting histories in the area. Accordingly, herbivory by ungulates should not be considered as a disturbance in these montane grasslands.

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254. A comparison between continuous and controlled grazing on a red duplex soil: Subsequent effects on seedbed conditions, crop establishment and growth.

Proffitt, A. P. B.; Bendotti, S.; and Riethmuller, G. P.

Soil and Tillage Research 35(4): 211-225. (1995)

NAL Call #: S590.S48; ISSN: 0167-1987

Descriptors: controlled grazing/ direct drilling/ grain protein/ no grazing/ plastic limit/ scarification/ set stocking/ trampling/ yield

Abstract: The effects of past grazing management practice on subsequent seedbed condition, draft requirements, fuel consumption, crop establishment and growth, and grain yield and quality were examined using three tillage systems on two sowing dates. The crop was wheat (*Triticum aestivum*), sown on a fragile sandy clay loam (red duplex soil) in a dryland agricultural area (307 mm average annual rainfall) of Western Australia. The three tillage-sowing systems investigated were: (i) scarifying followed by sowing with wide (180 mm) points; (ii) direct drilling with wide (180 mm) points; (iii) direct drilling with narrow (50 mm) inverted 'T'-shaped Super-Seeder points. The two sowing dates provided differences in seedbed water content at sowing time. The three grazing management strategies practiced in the previous pasture year were: (i) traditional set-stocking (where sheep were grazed continuously for 17 weeks, beginning soon after the start of the early winter rains); (ii) controlled grazing (where sheep were temporarily removed from the enclosure when the topsoil was close to its plastic limit); (iii) no grazing (where the pasture was mown to simulate grazing without trampling). Tillage prior to sowing with wide points reduced the mechanical impedance of the soil following set-stocking and provided a good seedbed for successful crop establishment and growth. In both the controlled-grazing management treatment and the treatment where the pasture had been mown the soil was suitable for direct drilling with both wide and narrow points (i.e. no pre-sowing tillage was required). The use of narrow points had the added advantage of requiring less fuel, but the need for a suitable implement to cover seeds was more critical than for wider sowing points. There were no advantages with respect to grain yield from adopting a controlled-grazing management practice owing to the lack of finishing rainfall. However, grain protein levels were higher in both the controlled and ungrazed treatments compared with the set-stocking treatment.

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255. Comparison of herbage production on moderately grazed and ungrazed western ranges.

Lacey, J. R. and Van Poollen, H. W.

Journal of Range Management 34(3): 210-212. (1981)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1981/343/10lace.pdf>

This citation is from AGRICOLA.

256. Comparison of herbage production under continuous stocking and intermittent grazing.

Grant, S. A.; Barthram, G. T.; Torvell, L.; King, J.; and Elston, D. A.

Grass and Forage Science 43(1): 29-39. (1988)

NAL Call #: 60.19 B773; ISSN: 0142-5242

Descriptors: sheep/ *Lolium perenne*/ forage/ stocking rate/ sward/ grazing intensity/ crop production/ grazing/ range management/ Scotland

This citation is from AGRICOLA.

257. A comparison of methane emissions from sheep grazing pastures with differing management intensities.

Murray, P. J.; Gill, E.; Balsdon, S. L.; and Jarvis, S. C.

Nutrient Cycling in Agroecosystems 60(1/3): 93-97. (2001)

NAL Call #: S631.F422; ISSN: 1385-1314

Descriptors: sheep/ pastures/ grazing/ range management/ methane/ botanical composition/ *Trifolium repens*/ body weight/ diurnal variation/ nitrogen fertilizers/ application rate

Abstract: Methane emissions were measured from sheep grazing on pastures that received one of three managements, either 70 or 270 kg N fertiliser ha⁻¹ or one which had a high proportion of white clover present. A system for measuring the emissions is described which enables measurements to be made under near natural grazing conditions. Continuous measurements of emissions were made over periods of 4 days. There were no significant differences in the amount of CH₄ produced per unit body weight over the study period. Animals feeding on both the grass pastures showed strong diurnal patterns of CH₄ emission with peak emissions between 15:00 and 17:00 h and levels gradually falling throughout the night before starting to rise at around 08:00 h. Those animals feeding on the clover swards also had peak emissions at around the same time in the afternoon, however, levels of CH₄ production did not decline over the night and peaked again in the morning before falling sharply to a low at noon. It is concluded from the present studies that the level of inputs to the sward tends to play little part in the overall levels of CH₄ emissions from grazing sheep, but can influence the diurnal pattern of CH₄ production.

This citation is from AGRICOLA.

258. The conservation management of mesotrophic (meadow) grassland in northern England: Effects of grazing, cutting date and fertilizer on the vegetation of a traditionally managed sward.

Smith, R. S.; Buckingham, H.; Bullard, M. J.; Shiel, R. S.; and Younger, A.

Grass and Forage Science 51(3): 278-291. (1996)

NAL Call #: 60.19 B773; ISSN: 0142-5242

Descriptors: agronomy/ conservation management/ cutting date/ fertilizer/ grazing/ meadow/ mesotrophic grassland/ nitrogen/ phosphorus/ potassium/ traditionally managed sward/ vegetation

Abstract: The results are reported from an experiment on the effects of cutting date (14 June, 21 July and 1 September), fertilizer application (none or 80 kg ha⁻¹ N plus 40 kg ha⁻¹ P and K) and grazing treatments (none, autumn or autumn plus spring) on the vegetation of an upland mesotrophic grassland in Upper Teesdale, northern England, UK. Effects on plant species number and cover are reported for 4 years (1989-93) of treatment. Effects on 'species-attributes' are given for the fourth year. The cessation of grazing combined with the use of fertilizer progressively reduced species number by about 25%. Under traditional management (no fertilizer, cutting date on 21 July, autumn and spring grazing) the species number and cover remained relatively static over the 4 years.

Comparison between treatments in the fourth year showed a reduction in species number under the fertilizer application, cutting date on 1 September and no-grazing treatments. Fertilizer use together with cutting date on 1 September particularly lowered species number and cover. Analysis of variance was used to assess the effect of treatment on species that occurred frequently in the sward. A cutting date of 1 September favoured *Agrostis capillaris*, *Alopecurus pratensis*, *Poa trivialis*, *Phleum pratense* and *Trisetum flavescens*. The absence of grazing favoured *Dactylis glomerata* and *Holcus lanatus*. The use of fertilizer particularly favoured *A. pratensis* and *H. lanatus*. Ordination methods were used to assess the effect of treatment on the less frequent species. These were primarily associated with the treatment combination that matched 'traditional' management. Deviations from this 'traditional' regime acted separately, rather than in combination, and favoured different grass species. Traditional management was associated with ruderal, stress-tolerant ruderal and competitive ruderal strategists and with longer seed germination times, heavier seeds, some of which needed scarifying or chilling to break dormancy, and transient seed banks that germinated in the autumn. The original sward was an *Anthoxanthum odoratum*-*Geranium sylvaticum* grassland, *Briza media* subcommunity (MG3b). After 4 years, *Festuca ovina*-*Agrostis capillaris*-*Galium saxatile* grassland, *Holcus lanatus*-*Trifolium repens* subcommunity (U4b) and *Lolium perenne*-*Alopecurus pratensis*-*Festuca pratensis* grassland (MG7c) were found in many of the fertilized and late-cutting treatments.
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259. The conservation management of mesotrophic (meadow) grassland in northern England: Effects of grazing, cutting date, fertilizer and seed application on the vegetation of an agriculturally improved sward.

Smith, R. S.; Corkhill, P.; Shiel, R. S.; and Millward, D. *Grass and Forage Science* 51(3): 292-305. (1996)
NAL Call #: 60.19 B773; ISSN: 0142-5242
Descriptors: agronomy/ conservation management/ cutting date/ fertilizer/ grazing/ meadow/ mesotrophic grassland/ nitrogen/ phosphorus/ potassium/ seed applications/ traditionally managed sward/ vegetation
Abstract: The plant species number and composition, and yield of herbage biomass of an agriculturally improved hay meadow were assessed after 4 years under various combinations of grazing, fertilizer application, cutting date and seed addition treatments in a replicated split-plot design. Grazing treatments consisted of either autumn grazing with cattle and sheep, spring grazing with sheep or both regimes. Fertilizer application treatments consisted of either 25 kg ha⁻¹ N plus 12.5 kg ha⁻¹ P and K or no fertilizer. Cutting date treatments consisted of cuts on either 14 June, 21 July or 1 September. Seed addition treatments consisted of either no addition or sowing with a range of meadow species in the autumn. Data analysis was by correspondence analysis and analysis of variance. Species number decreased with fertilizer use and when the cutting date was 1 September. A range of species was affected by the main treatments and there were some first-order interactions, mainly between cutting date and fertilizer application. *Rhinanthus minor* was particularly favoured by the seed addition treatment. Species attributes in the regenerative and established phase were related to treatments and their effect on species composition. The

National Vegetation Classification communities were associated with particular treatment regimes. The 21 July cutting date favoured 'improved' over 'unimproved-traditional' swards, with spring grazing favouring 'unimproved-traditional' swards. Lowest yields of herbage biomass were associated with autumn and spring grazing, the 14 June cutting date and no fertilizer treatments. The fertilizer, 1 September cutting date and autumn grazing treatments gave the highest yields. The implications of these results are discussed in terms of the conservation management required to return agriculturally improved mesotrophic grassland to a species composition similar to that of traditionally managed grassland.
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260. Conservation of plant diversity in grassland under grazing management.

Naito, K.
In: Conservation and utilization of land resources in less favored areas with special emphasis on the roles of livestock and technology. (Held 20 Sep 1999-23 Sep 1999 at Matsue and Oda, Japan.); pp. 84-91; 2000.
Notes: Proceedings of the International Workshop
Descriptors: grasslands/ grazing/ pastures/ seed production/ seedlings/ species diversity/ natural grasslands
Abstract: The semi-natural grasslands in Japan dramatically decreased in area after the Second World War. A recent survey has revealed that a considerable number of plant species in semi-natural grasslands have become threatened due to changes in land use. The effects of cattle grazing on plant diversity in grasslands was studied at the western foot (Nishinohara) of Mt. Sanbe, in southwestern Japan, where grazing was reintroduced after a break of 24 years. Within a few years of the reintroduction of cattle, the tall *Miscanthus sinensis* grassland had changed to a mosaic made up of tall ungrazed areas and short heavily grazed areas due to selective grazing. In the pasture, a threatened perennial, *Pulsatilla cernua* (Ranunculaceae), recovered after the reintroduction of grazing. The patch structure minimized plant injury by grazing, as the ungrazed patches in the pasture were suitable habitat for the individuals. Other plant species also showed features relative to the mosaic pattern of vegetation. In particular, autumn-flowering plants were significantly influenced by the mosaic pattern. In another grassland grazed for more than several decades at the eastern foot (Higashinohara) of Mt. Sanbe, the stem densities of most autumn-flowering species were higher in the tall area than in the short area. A more obvious trend was recognized when the density of the flowering stems was compared rather than the total number of stems, suggesting that seed production was higher in the tall area, which is important for the maintenance of plant diversity. Based on these results, cattle grazing seems to have the potential to restore a high level of plant diversity to the grassland community. Further studies on grazing systems and/or vegetation dynamics are still needed in order to develop specific management programs.
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261. Conserving biodiversity on calcareous grasslands in the Franconian Jura by grazing: A comprehensive approach.

Dolek, Matthias and Geyer, Adi

Biological Conservation 104(3): 351-360. (2002)

NAL Call #: S900.B5; ISSN: 0006-3207

Descriptors: grazing: economics, management method, practicability, regulations/ biodiversity conservation/ calcareous grasslands: diverse habitat, species rich habitat/ lamb: meat product/ sales premium/ state subsidies
Abstract: Calcareous grasslands, as extraordinarily species-rich and diverse habitats of northern and central Europe, need some management for their long-term conservation. Traditionally, they have been used as pastures, mainly with sheep, but goats are important, because they mainly browse and climb rocks. This study presents a comprehensive approach to the conservation of these sites, including the requirements of shepherds, which were obtained by a questionnaire, together with autecological information on the habitat requirements of species. Grazing is a central option, which has to be regulated in timing, intensity and spatial distribution, to gain optimum results. Nevertheless, local regulations must consider the requirements of the shepherds regarding infrastructure and social conditions, so that grazing remains practicable. Additionally, sheep-farming on conservation sites is presently unprofitable and therefore needs financial support. This support is supplied by state subsidies in Bavaria (Vertragsnaturschutzprogramm), and in the study area by a lamb-meat sales premium, which allows the shepherds to charge higher prices for lamb-meat produced under the premium regulations. The success of the overall strategy is only possible given a well adjusted interplay of influencing factors.

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262. Continuous and rotational grazing of dairy cows: The interactions of grazing system with level of milk yield, sward height and concentrate level.

Pulido, R. G. and Leaver, J. D.

Grass and Forage Science 58(3): 265-275. (2003)

NAL Call #: 60.19 B773; ISSN: 0142-5242

Descriptors: continuous grazing: applied and field techniques/ rotational grazing: applied and field techniques/ grazing system interaction: concentrate level, milk yield, sward height

Abstract: An experiment was conducted to test the hypothesis that for cows with high levels of milk yield, rotational grazing produces higher milk yields than continuous grazing. The comparison of grazing systems was made at two levels of milk yield (initially 20.3 and 32.5 kg d⁻¹), and interactions with sward height and concentrate level were also examined. The study used 48 multiparous Holstein Friesian cows over a period of 62 d. Mean milk yield, its persistency and composition, live weight, body condition score and liveweight gain were not significantly affected by grazing system at either level of milk yield. There were no significant interactions between grazing system and sward height or concentrate level for any milk production measurement. Mean estimated herbage and total dry matter (DM) intake (P<0.01), grazing time (P<0.05) and ruminating time (P<0.01) were significantly greater on the continuous grazing system. The cows in the higher milk yield group and those grazed at the higher sward height had a significantly (P<0.05) higher estimated daily herbage

DM intake and rate of herbage intake on the continuous grazing system than those on the rotational grazing system. There was no evidence to support the hypothesis that rotational grazing systems support higher levels of milk production than continuous grazing for cows of high milk yield. The shorter grazing time on the rotational grazing system indicated that cows may anticipate the timing of the daily movement of the electric fence, and this reduces their time spent grazing residual herbage.

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263. Contrasting responses of plant and insect diversity to variation in grazing intensity.

Kruess, Andreas and Tschamtkke, Teja

Biological Conservation 106(3): 293-302. (2002)

NAL Call #: S900.B5; ISSN: 0006-3207

Descriptors: animals and man/ disturbance by man/ commercial activities/ conservation/ conservation measures/ ecology/ community structure/ habitat/ terrestrial habitat/ land and freshwater zones/ Palaearctic Region/ Europe/ Coleoptera: farming and agriculture/ cattle grazing/ habitat management/ significance of grazing intensity effects on community ecology/ trophic structure/ grazing intensity influences and conservation implications/ species diversity/ grazing intensity effects and conservation implications/ grassland/ grazing intensity effects on community ecology/ conservation implications/ Germany/ Schleswig Holstein/ grazing intensity effects on community ecology and conservation implications/ Coleoptera/ Insecta/ arthropods/ coleopterans beetles/ hemipterans true bugs/ hymenopterans/ insects/ invertebrates

Abstract: The effects of grazing intensity on plant and insect diversity were examined in four different types of grassland (intensively and extensively cattle-grazed pastures, short-term and long-term ungrazed grassland; 24 study sites). Vegetation complexity (plant species richness, vegetation height, vegetation heterogeneity) was significantly higher on ungrazed grasslands compared to pastures but did not differ between intensively and extensively grazed pastures. However, insect species richness was higher on extensively than on intensively grazed pastures, established by suction sampling of four insect taxa (Auchenorrhyncha, Heteroptera, Coleoptera, Hymenoptera Parasitica). This may be due to intensive grazing disrupting plant-insect associations as predicted by a "trophic-level" hypothesis. Local persistence and small-scale recolonization of insects on plants appeared to be difficult in the highly disturbed environment of intensive grazing. Insect diversity increased across the four treatments in the following order: intensively grazed < extensively grazed < short-term ungrazed < long-term ungrazed. The major predictor variable of differences in species diversity was found to be vegetation height. Predator-prey ratios within the investigated insect groups were not affected by grazing intensity.

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264. Control of sward conditions and apparent utilization of energy in the buffer grazing system.

Illius, A. W.; Lowman, B. G.; and Hunter, E. A.

Grass and Forage Science 42(3): 283-296. (1987)

NAL Call #: 60.19 B773; ISSN: 0142-5242

Descriptors: cattle/ nitrogen/ silage yield/ viability/ land use
Abstract: Experiments were carried out over four years to develop a system of buffer grazing. Groups of 16 cattle

were set stocked with or without buffer areas formed by withholding a proportion of the grazing area by electric fence. It was found that buffers should be grazed if sward height, measured by rising plate meter, was reduced below 5 cm, or otherwise cut for silage. Increasing the area of the buffer reduced cattle gains but increased silage yield and sward quality, and the best compromise over 4 years was a buffer area of 25-30% of the initial grazing area. Buffer treatments gave higher UME and financial output than controls, due to the value of silage from the buffers and to the higher nitrogen inputs which were successfully managed under buffer grazing. The higher outputs over 4 years were also associated with lower viability and therefore lower levels of risk, resulting from a number of compensating processes at sward and animal level. There was no indication that grazed UME was higher on buffer treatments at a given level of nitrogen, suggesting that any increased grazing efficiency must be offset by other disadvantages when comparing intensive with lax defoliation regimes. The results suggest that there is considerable stability in grazing systems which may frustrate attempts to improve their biological efficiency, although there is some scope for manipulating the seasonal pattern of land use and animal performance.

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265. Controlled grazing studies on Molinia grassland: Effects of different seasonal patterns and levels of defoliation on Molina growth and responses of swards to controlled grazing by cattle.

Grant, Sheila A.; Torvell, Lynne; Common, T. G.; Sim, Evelyn M.; and Small, J. L.

Journal of Applied Ecology 33(6): 1267-1280. (1996)
NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: agriculture/ defoliation/ food/ grazer/ growth rate/ pasture management/ seasonality

Abstract: 1. Experiments were carried out at three sites in southern Scotland to determine the suitability of Molinia grassland for sustained use in providing summer grazing for cattle, and to investigate grazing control as a tool to manipulate the species composition of hill pastures in Britain. 2. Cutting experiments showed that frequency and severity of defoliation were more important than timing in their effects on Molinia. Weights of clippings declined in successive years only in response to treatments that involved repeated within-season cutting. 3. Three years of repeated light defoliation (33% lamina length removed each June, July and August), compared with uncut controls, reduced leaf production in a fourth uninterrupted growing season by 40%, while repeated heavy defoliation (66% lamina removal) reduced it by 78%. Reductions in both the numbers and the size of tillers contributed to this result. Single annual cuts only reduced leaf production at 66% lamina removal when they took place late in the season. 4. Plots grazed by cattle at two sites for 6 years compared treatments where 66% rather than 33% of the herbage was removed by grazing. The rates of leaf extension in Molinia were reduced at the higher level of use. In comparison with areas protected from grazing during the final year of treatment only, the biomass of Molinia and other grasses in areas open to grazing showed that the taller Molinia was utilized to a much greater extent than the other grasses. After 6 years of grazing, the biomass of Molinia at 33% utilization was reduced by 46-65% compared with ungrazed exclosures, while at 66% utilization it was reduced by 86%.

5. Basal internode size was greatly reduced in the grazed plots compared with the ungrazed exclosures, with effects on tiller base size being more important than variation in concentrations in determining amounts of starch, total water soluble carbohydrates, N, P and K on a per tiller basis. Site times management interactions for concentrations could be interpreted in terms of variations in stage of maturity, potential for growth and plant/animal nutrient cycling pathways. 6. Floristic diversity was increased on grazed compared with ungrazed areas. The cover of Molinia was decreased and that of other broad-leaved grasses increased by grazing. At 33% utilization, the cover of Molinia appeared to be levelling off (at around 60-65% after 3-5 years) while at 66% utilization a continued downward trend was evident. Species trends were also influenced by site factors, with exclusion of grazing leading to a reduced cover of *Festuca ovina* only where conditions were favourable for high yields of taller grasses. 7. The responses of Molinia to defoliation are discussed in relation to its pattern of growth and low rate of leaf and tiller turnover and to its responses to soil and climatic factors. The effects of grazing on nutrient cycling and sward canopy structure, in influencing competitive relationships with other species, are considered and the wider issues relevant to management protocols are outlined.

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266. Decline of landscape-scale habitat and species diversity after the end of cattle grazing.

Luoto, Miska; Pykala, Juha; and Kuussaari, Mikko
Journal for Nature Conservation 11(3): 171-178. (2003);
ISSN: 1617-1381

Descriptors: grazing/ grazing management/ habitat mosaics/ landscape scale/ landscape scale habitat diversity/ semi natural grassland/ species diversity

Abstract: A decrease of habitat and species diversity in agricultural landscapes, mainly as a result of the decline of semi-natural grasslands, has been shown in several studies. However, no studies have linked the effects of decrease of grassland management with landscape structure and plant and bird species diversity on the landscape scale in a spatial grid system. In this study we examined the differences in the present habitat and species diversity (number of total and rare plant and bird species) among agricultural landscapes differing in their management history. We compared areas of 0.25 km² (n=34) with different grazing history in the Rekijoki river valley, SW Finland. The grazed area decreased to one fifth over 30 years (1960-1990) in our study area. The earlier interconnected network of grazed patches was disrupted, resulting in an isolated grazing pattern. There were statistical differences in the habitat structure and plant species diversity between the landscapes with different management histories, but no difference in bird diversity was observed. The number of rare plant species/0.25 km² was 45% less in areas of 20-40 years of abandonment compared to squares with continuously grazed patches. The results address the importance of grazing management for maintaining heterogeneous habitat mosaics and plant diversity on the landscape scale.

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267. Density of *Trifolium repens* plants in mixed swards under intensive grazing by sheep.

Hay, M. J. M.; Brock, J. L.; and Thomas, V. J.

Journal of Agricultural Science 113(1): 81-86. (1989)

NAL Call #: 10 J822; ISSN: 0021-8596

Descriptors: stolon/ growing points/ pasture management/ agriculture/ crop intensity/ New Zealand/ livestock industry
Abstract: Densities of physiologically independent plants of white clover were studied in New Zealand in pastures stocked at 22.5 ewes plus lambs/ha by set stocking, rotational grazing or a combination of both systems. Plants were sampled once a month for 1 year (1984/85) by taking turves and washing out the plants. Numbers of growing points and stolon dry weight per plant were obtained. At each sampling fifty, 50 mm diameter pasture plugs were taken from each sward and growing point density and stolon mass/m² of white clover were measured. The density of white clover plants in the swards was estimated on the basis of both stolon dry weight and number of growing points. The two estimates gave similar results. There was a trend of lowest densities in set-stocked pastures (334/m²), intermediate densities in combination management pastures (431/m²) and highest densities in the rotationally grazed pastures (553/m²). The overall mean density of white clover plants was 439/m² and the range was 193-811/m². The structure of swards under the three systems of grazing differed and this was considered to contribute towards the variation in density of white clover plants in the various swards.

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268. Determining the effectiveness of grazing and trampling by livestock in transmitting white clover mosaic and subterranean clover mottle viruses.

Mckirdy, S. J.; Jones, R. A. C.; and Sivasithamparam, K.

Annals of Applied Biology 132(1): 91-105. (1998)

NAL Call #: 442.8 An72; ISSN: 0003-4746

Descriptors: agriculture/ disease transmission/ grazing/ mowing/ pasture conditions/ trampling/ wounding
Abstract: Glasshouse and mini-sward experiments were done to determine the relative roles of grazing and trampling by livestock in transmitting white clover mosaic (WCIMV) and subterranean clover mottle (SCMoV) viruses between clover plants in pastures. Wounding due to grazing was simulated by repeatedly cutting plants with serrated scissors (glasshouse) or mowing (mini-swards), while wounding due to trampling was simulated by repeatedly bashing plants with the flat end of a wooden hammer handle (glasshouse) or rolling (mini-swards). In glasshouse experiments, cutting was more effective than bashing in transmitting WCIMV to white clover (*Trifolium repens*) plants but cutting and bashing transmitted it to subterranean clover (*T. subterraneum*) plants at similar rates. In an experiment with white clover mini-swards, mowing was more effective than rolling in transmitting WCIMV, and when both were combined, initially spread exceeded that obtained when the spread from mowing and rolling alone was added together. In glasshouse experiments, bashing was more effective than cutting in transmitting SCSMoV to subterranean clover plants. In one experiment, neither mowing nor rolling spread SCSMoV in mini-swards of subterranean clover. When transmission to subterranean clover cultivars which were 'susceptible' or 'moderately susceptible' to SCSMoV was compared in glasshouse experiments, repeated bashing spread the virus

more slowly to the 'moderately susceptible' cultivars. When mixed with ruminant saliva, infective sap containing WCIMV or SCSMoV was still infective to clover plants after 4 wk storage at room temperature. When infective sap was allowed to dry naturally on a metal surface, SCSMoV still infected clover plants when the dried sap was taken up in tap water after 4 but not 14 days, while WCIMV was infective after 24 h but not 4 days. These results suggest that grazing and mowing are more effective than trampling at transmitting WCIMV to white clover plants in pastures, while trampling is more effective at spreading SCSMoV to subterranean clover. However, both transmitted WCIMV to subterranean clover at similar rates. Possible reasons for these differences are discussed in relation to differences in clover plant morphology and virus-specific factors.

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269. Development removal and death of white clover (*Trifolium repens*) leaves under 3 grazing managements in hill country.

Chapman, D. F.

New Zealand Journal of Agricultural Research 29(1):

39-48. (1986)

NAL Call #: 23 N4892; ISSN: 0028-8233

Descriptors: sheep/ cattle/ set stocking/ rotational grazing/ grassland management

Abstract: The development and fate of white clover leaves in hill country swards under each of 3 grazing managements (set stocking or rotational grazing with sheep, rotational grazing with cattle) were studied for 16 months. Managements did not consistently influence the rate at which leaves matured. Maximum individual leaf areas were reached in 9-11 days in summer and 22-28 days in winter. Over the entire observation period, 61-65% of leaves produced were removed by stock. Differences between managements were relatively small, except in winter when long rotations (63-70 days) allowed considerable leaf death between grazings in the rotational treatments. Over all, the number of leaves per stolon was greater under cattle than sheep grazing (3.05 v. 2.49-2.78) because of longer defoliation intervals in some seasons. However, when defoliation intervals were similar between managements, leaf number differences largely disappeared. Differences in defoliation patterns between managements were not considered large enough to cause substantial differences in plant performance, though greater leaf numbers per stolon under cattle grazing offer a partial explanation for the better clover growth observed under this treatment. The results also demonstrate that, despite high stocking rates, none of the managements were likely to have restricted assimilate supply through excessive leaf removal, as leaves were able to export assimilate for an estimated mean period of 15-17 days before being removed.

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270. Differences in the nitrogen use efficiency of perennial ryegrass varieties under simulated rotational grazing and their effects on nitrogen recovery and herbage nitrogen content.

Wilkins, P. W.; Allen, D. K.; and Mytton, L. R.

Grass and Forage Science 55(1): 69-76. (2000)

NAL Call #: 60.19 B773; ISSN: 0142-5242

Descriptors: simulated rotational grazing: clipping, field method/ nitrogen use efficiency

Abstract: Eight varieties of perennial ryegrass (six new varieties and two old ones) grown at five levels of applied fertilizer (100, 200, 300, 400 and 500 kg of N ha⁻¹) were cut monthly during two growing seasons (March to October in 1997 and 1998) and their herbage dry-matter (DM) yield and nitrogen (N) content were determined. Herbage leaf content and the N content of young fully expanded leaves were also measured in 1997, and monthly recovery of applied N was determined in both the first and second harvest years by using ¹⁵N. The rank order of varieties was similar for annual yield of DM and N at all five fertilizer levels. Proportional differences between varieties in DM yield were greatest in the first cut of each year, the late-heading candidate variety Ba12151 out-yielding the old late-heading variety S23 by more than 70%. However, differences in annual DM yield were much more modest than in early spring yield, up to 10% in 1997 and up to 21% in 1998. The relatively small differences in total annual DM yield were attributed to only a small proportion of the applied N being recovered during a single regrowth period, most of the remainder becoming available for uptake in subsequent regrowth periods. There were small but highly statistically significant differences among varieties in the N content of their leaves, leaf N content being inversely related to yield of DM and N. This lends further support to the hypothesis that the metabolic cost of protein synthesis and turnover is a key factor controlling genetic variation both in leaf yield and in annual DM and N yield under frequent harvesting. Seasonal variation in herbage N content was much greater than differences among varieties in mean N content over all harvests. In May of both years at all applied fertilizer levels, herbage N content fell below the 20 g N kg⁻¹ DM level required by productive grazing animals.

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271. Dry-matter yield and herbage quality of a perennial ryegrass/white clover sward in a rotational grazing and cutting system.

Schils, R. L. M.; Vellinga, T. V.; and Kraak, T. *Grass and Forage Science* 54(1): 19-29. (1999)
 NAL Call #: 60.19 B773; ISSN: 0142-5242

Descriptors: *Lolium perenne*/ *Trifolium repens*/ yields/ forage/ rotational grazing/ cutting/ nitrogen fertilizers/ silage/ botanical composition/ in vitro digestibility/ dairy cows/ application rate/ Netherlands

Abstract: The expected reduction in the use of fertilizer nitrogen (N) on grassland in the Netherlands has led to renewed interest in white clover. Therefore, the performance of a newly sown perennial ryegrass/white clover sward on clay soil was assessed during 4 consecutive years. The experiment consisted of all combinations of two defoliation systems, i.e. one or two silage cuts per year (S1, S2), spring N application rate, i.e. 0 or 50 kg ha⁻¹ year⁻¹ (N0, N50), and the management system, i.e. rotational grazing and cutting, or cutting only (RGC, CO). The overall mean white clover cover was 30%. All treatments affected white clover cover, which was 8% higher with S2 than with S1 6% higher with N0 than with N50 and 12% higher with CO than with RGC. The overall mean annual dry-matter (DM) yield (13.1 t ha⁻¹ year⁻¹) was significantly affected only by the management system: in two relatively wetter years, the annual DM yield was 1.19 t ha⁻¹ higher with RGC than with CO, whereas there was no difference in two relatively drier years. Nitrogen

application increased the DM yield in the first cut by 7(.0 kg kg⁻¹ N applied, but had no significant effect on the annual DM yield. Herbage quality was not affected by the experimental treatments. The average in vitro organic matter digestibility was 0.801, and the average crude protein content was 193 g kg⁻¹ DM. With the expected reduction in the use of fertilizer N, perennial ryegrass/white clover swards should be seriously considered as an alternative option to perennial ryegrass swards on these clay soils.

This citation is from AGRICOLA.

272. Dynamics of heterogeneity in a grazed sward.

Parsons, A. J.; Carrere, P.; and Schwinning, S.
 In: *Grassland ecophysiology and grazing ecology*/ Lemaire, Gilles.
 New York: CAB, 2000; pp. 289-315.

Notes: ISBN: 0851994520

NAL Call #: SF84.84 .G68 2000

Descriptors: grasslands/ grazing/ grazing systems/ selective grazing/ rotational grazing/ continuous grazing/ models/ intake/ crop yield

Abstract: This chapter considers biting (defoliation) as a source of heterogeneity in the grazed sward, with consequent effects on grass growth and animal intake. Three contrasting methods of spatially exploiting the sward (sequential grazing, random grazing and selective grazing) and models of the impact of these methods on bite-sized patches of sward are discussed. The role of heterogeneity in yield and stability is considered and it is suggested that continuous and rotational grazing systems may not be consistently better than each other.

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273. Early changes in species composition of upland sown grassland under extensive grazing management.

Marriott, Carol A.; Bolton, G. R.; Barthram, G. T.; Fisher, J. M.; and Hood, K.

Applied Vegetation Science 5(1): 87-98. (2002)

NAL Call #: QK900 .A66; ISSN: 1402-2001

Descriptors: grazing management: management method/ biodiversity/ grazing/ seed bank/ species abundance/ species composition/ swards: unfertilized, ungrazed/ upland sown grassland/ vegetation change

Abstract: Due to economic pressures and policy changes *Lolium perenne*-*Trifolium repens* sown swards in upland UK sheep systems are likely to become less intensively managed. We present results from the first 5 yr of a long-term experiment studying vegetation change under more extensive grazing management at three sites. One treatment was representative of current, intensive management and 5 were unfertilized with different intensities of seasonal grazing. The species composition of unfertilized, ungrazed swards changed dramatically within 2 yr and the sown species had virtually disappeared by year 5. *Ranunculus repens*, *Poa trivialis*, *Agrostis gigantea*, *Juncus* spp. and *Carex* spp. became dominant at the wettest site. Grasses were dominant at the other sites. In contrast, the sown species were retained in the unfertilized, grazed treatments; there were small shifts in abundance of the species present initially and few additions or losses of species. Some colonizing species were present in the seed bank whereas others with a transient seed bank appeared

to have invaded from neighbouring vegetation. Implications of these results for compensation schemes to reduce animal output and increase biodiversity are discussed.

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274. Ecology and grazing management of alfalfa pastures in the subtropics.

Leach, G. J. and Clements, R. J.

Advances in Agronomy 37: 127-154. (1984)

NAL Call #: 30 AD9; ISSN: 0065-2113

Descriptors: forage legumes/ grazing/ *Medicago sativa*/ range management/ plant ecology/ subtropics

This citation is from AGRICOLA.

275. Effect of continuous and time-control grazing on grassland components in south-eastern Australia.

Dowling, P. M.; Kemp, D. R.; Ball, P. D.; Langford, C. M.; Michalk, D. L.; Millar, G. D.; Simpson, P. C.; and Thompson, R. P.

Australian Journal of Experimental Agriculture 45(4): 369-382. (2005)

NAL Call #: 23 Au792; ISSN: 0816-1089

Descriptors: grasslands/ grazing management/ rotational grazing/ grazing/ pasture management/ forage grasses/ pasture plants/ perennials/ sheep/ cattle/ vegetation cover/ pastures/ botanical composition/ on-farm research/ New South Wales/ Victoria (Australia)/ Tasmania

This citation is from AGRICOLA.

276. Effect of deferred grazing during summer on white clover content of Waikato dairy pastures, New Zealand.

Harris, S. L.; Waugh, C. D.; McCabe, R. J.; and Vught, V. T.

New Zealand Journal of Agricultural Research 42(1): 1-7. (1999)

NAL Call #: 23 N4892; ISSN: 0028-8233

Descriptors: grazing/ grazing intensity/ grazing systems/ rotational grazing/ dairy cattle/ seedlings/ soil water/ survival/ temperature/ tillers/ population dynamics/ persistence/ deferred-rotation-grazing

Abstract: New Zealand dairy pastures rotationally grazed at intervals of 25 to 30 days to low residual herbage masses (<1400 kg DM/ha) over summer often suffer white clover loss. An experiment was conducted over 1994-97 in mixed perennial ryegrass [*Lolium perenne*]/white clover [*Trifolium repens*] dairy pastures to examine the effects of deferred grazing, the practice of holding over pasture in situ for 50, 75, or 100 days over summer, on white clover growth compared with a more common 25-day grazing interval. Additional pasture cover built up in 100-day deferred (100D) plots resulted in significantly lower soil temperatures and higher soil moisture than in the 25D treatment. Clover stolon survival was up to 63% higher in deferred pastures than the 25D treatment. This, combined with higher clover seedling density, resulted in significantly higher clover contents in pastures following deferral compared with the 25D grazed pasture. These differences did not persist through to the following spring. Deferred grazing also resulted in small increases in total herbage accumulation but had little effect on ryegrass tiller density.

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277. Effect of enclosure on soils, biomass, plant nutrients, and vegetation, on unfertilised steeplands, Upper Waitaki District, South Island, New Zealand.

McIntosh, P. D. and Allen, R. B.

New Zealand Journal of Ecology 22(2): 209-217. (1998)

NAL Call #: QH540.N43; ISSN: 0110-6465

Descriptors: biomass/ floristics/ grazing/ high country/ nutrients/ rehabilitation/ soil

Abstract: We sampled soils and vegetation within and outside two sheep and rabbit enclosures, fenced in 1979, on steep sunny and shady slopes at 770 m altitude on seasonally-dry pastoral steeplands. The vegetation of sunny aspects was characterised by higher floristic diversity, annual species, and low plant cover. Here the exotic grass *Anthoxanthum odoratum* dominated on grazed treatments, and the exotic forb *Hieracium pilosella* on ungrazed. Shady aspects supported fewer, and almost entirely perennial, species. Here *Hieracium pilosella* dominated grazed treatments, but co-dominated with the exotic forb *H. praealtum* and the native grass *Festuca novae-zelandiae* on ungrazed treatments. There was 43% more biomass in enclosures ($P < 0.01$). Most of the biomass difference (4285 kg/ha) was from greater root mass (2400 kg/ha). 1385 kg/ha of the difference was from herbage and the remainder (500 kg/ha) from litter. Enclosures had 50 to 100% more Ca, Mg, K and P in the biomass ($P < 0.05$), but the effect on soils was limited to significantly higher concentrations of total N ($P < 0.05$) and exchangeable Mg ($P < 0.01$) in 0-7.5 cm soils. We conclude that stopping grazing for 16 years on seasonally-dry steeplands results in greater plant cover, approximately double the biomass of standing vegetation, greater biomass in roots, and more biomass nutrients relative to grazed areas. However, it does not favour native species and has little effect on soil nutrients or soil carbon. Stopping grazing alone therefore cannot be regarded as a comprehensive short- or medium-term vegetation or soil rehabilitation option.

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278. Effect of fertilizer application and grazing management on grazed New Zealand hill country.

Lambert, M. G. and Clark, D. A.

In: Proceedings of the 39th Southern Pasture and Forage Crop Improvement Conference. (Held 23 May 1983-26 May 1983 at Oklahoma City, Okla.); Vol. 39.

New Orleans, La.: U.S. Department of Agriculture; pp. 108-114; 1983.

Notes: ISSN: 0193-6425

NAL Call #: 60.19 SO83

Descriptors: New Zealand

This citation is from AGRICOLA.

279. Effect of grazing intensity and applied fertilizers on pasture production and animal gain.

Sigurbjornsson, B.; Gudmundsson, O.; Arnalds, A.; Thorsteinsson, I.; and Eiriksson, T.

In: Nuclear techniques in improving pasture management: Proceedings. (Held 10 Nov 1980-14 Nov 1980 at Vienna: International Atomic Energy Agency; pp. 165-174; 1983.

NAL Call #: SB199.A34 1980

Descriptors: fertilizer application/ forage/ yields/ grazing intensity/ lambs/ liveweight gain/ carcass weight/ pastures/ Iceland

This citation is from AGRICOLA.

280. Effect of land management on ecosystem carbon fluxes at a subalpine grassland site in the Swiss Alps.

Rogiers, N.; Eugster, W.; Furger, M.; and Siegwolf, R. *Theoretical and Applied Climatology* 80(2-4): 187-203. (2005); ISSN: 0177-798X

Descriptors: mathematical modeling: mathematical and computer techniques/ land management: applied and field techniques/ seasonal variation/ subalpine grassland/ grazing disturbance/ grass cutting

Abstract: The influence of agricultural management on the CO₂ budget of a typical subalpine grassland was investigated at the Swiss CARBOMONT site at Rigi-Seebodenalp (1025 m a.s.l.) in Central Switzerland. Eddy covariance flux measurements obtained during the first growing season from the mid of spring until the first snow fall (17 Mai to 25 September 2002) are reported. With respect to the 10-year average 1992-2001, we found that this growing season had started 10 days earlier than normal, but was close to average temperature with above-normal precipitation (100-255% depending on month). Using a footprint model we found that a simple approach using wind direction sectors was adequate to classify our CO₂ fluxes as being controlled by either meadow or pasture. Two significantly different light response curves could be determined: one for periods with external interventions (grass cutting, cattle grazing) and the other for periods without external interventions. Other than this, meadow and pasture were similar, with a net carbon gain of -128 +/- 17 C m⁻² on the undisturbed meadow, and a net carbon loss of 79 17 C m⁻² on the managed meadow, and 270 +/- 24 g C m⁻² on the pasture during 131 days of the growing season, respectively. The grass cut in June reduced the CO₂ uptake of the meadow by 50 +/- 2% until regrowth of the vegetation. Cattle grazing reduced gross uptake over the whole vegetation period (37.2%), but left respiration at a similar level as observed in the meadow.

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281. Effect of low-intensity grazing on the species-rich vegetation of traditionally mown subalpine meadows.

Fischer, Markus and Wipf, Sonja

Biological Conservation 104(1): 1-11. (2002)

NAL Call #: S900.B5; ISSN: 0006-3207

Descriptors: mowing: management method/ agricultural quality/ biodiversity/ botanical richness/ ecological compensation measures/ grazing intensity/ ground cover/ land use: low intensity/ species evenness/ species richness/ subalpine meadows/ temporal variation/ vegetation change

Abstract: Subalpine meadows, which traditionally were mown every other year, are particularly rich in plant species, especially forbs. Near Davos (Switzerland) we compared the vegetation of mown sites with that of sites grazed for up to 50 years by non-lactating cows. We recorded an overall mean of 51.5 plant species per 4X4 m plot. Among grazed sites, evenness decreased with time since conversion to grazing (-0.11 in 50 years; P < 0.05), suggesting progressive vegetation change, which may eventually result in the loss of species. Ground cover by forbs tended to be higher in mown than in grazed sites (by 7.2%; P < 0.1). The proportion of not-clonally colonizing perennial species decreased after conversion to grazing (-7.72%; in 50 years, P < 0.05), while the cover by graminoid species increased (+14.2% in 50 years; P < 0.1). More intensively grazed sites had a lower cover of dwarf shrubs

and higher cover of legume species (P < 0.05). Because grazing negatively affects both botanical richness and agricultural quality, mowing of traditionally mown subalpine meadows should be maintained, and recently grazed meadows should be reconverted to mowing.

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282. Effect of rotational and continuous grazing on vegetation of an upland grassland in the Jizerske Hory Mts., Czech Republic.

Pavlu, Vilem; Hejzman, Michal; Pavlu, Lenka; and Gaisler, Jan

Folia Geobotanica 38(1): 21-34. (2003)

NAL Call #: QK339.C95 F6; ISSN: 1211-9520

Descriptors: permanent plot sampling: applied and field techniques/ upland grassland vegetation: continuous grazing effect, rotational grazing effect

Abstract: The effect of different grazing regimes on pasture vegetation was studied during the intensive grazing of heifers in the Jizerske hory mountains during 1993-1997. The vegetation was monitored in 3 pairs of permanent 1 X 1 m plots using a continuous grid of nine 0.33 X 0.33 m subplots. We applied continuous stocking and rotational grazing. Vegetation varied as a result of time and differences between treatments. Several prostrate dicotyledonous species (*Trifolium repens*, *Taraxacum* sp., *Bellis perennis* and *Leontodon autumnalis*) increased under continuous stocking. This treatment also promoted the growth of the perennial grass *Lolium perenne*, which was able to cope with frequent defoliation. Tall grasses sensitive to frequent defoliation (*Poa trivialis*, *Holcus mollis*, *Alopecurus pratensis*, *Dactylis glomerata* and *Elytrigia repens*) were more abundant in rotationally grazed paddocks. Species diversity was not significantly influenced by the different grazing systems. The decrease in the potential sward height under continuous stocking revealed the replacing of tall dominants by lower species. Our results indicate that different grazing systems alter the composition and structure of grassland vegetation. Defining the intensity of grazing under continuous stocking or rotational grazing is complex due to the different stocking rates and the heights of sward during a grazing season. Information about pasture management should therefore involve not only grazing intensity but also the grazing system used.

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283. The effect of sheep and goat grazing on variegated thistle (*Silybum marianum*) populations in annual pastures.

Stanley, D. F.; Holst, P. J.; and Allan, C. J.

Plant Protection Quarterly 15(3): 116-118. (2000)

NAL Call #: SB950.3.A8P535; ISSN: 0815-2195

Descriptors: grazing behavior

Abstract: The effect of sheep and goat grazing on variegated thistle was studied over two years when sheep alone was compared with two ratios of sheep and goats. Measurements were taken on pasture production, thistle plants and thistle seeds in soil. Thistle measurements along a fixed transect included height and width, eaten score, capitula number and number of flowering stems eaten. In each of the two years, sheep ate little variegated thistle whereas goats significantly (P < 0.001) contained plant size and consumed all capitula (year 2; mature capitula per plant 5.41 v 0.0 for sheep and goats respectively). After two years, viable seed reserves in soil were 497 +/- 157 in the

sheep treatments and 126 ± 66 in the goat treatments ($P < 0.05$) with no difference between a high or low ratio of goats. It was concluded that sheep had relatively little impact on variegated thistle whereas goats preferentially grazed the thistle. The goats were particularly effective in reducing the number of capitula and the number of capitula consumed was a function of goat grazing pressure. Removal of capitula would reduce seed production and subsequent population of the thistle.

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284. The effect of sheep trampling and grazing on soil physical properties and pasture growth for a red-brown earth.

Proffitt, A. P. B.; Bendotti, S.; Howell, M. R.; and Eastham, J.

Australian Journal of Agricultural Research 44(2): 317-331. (1993)

NAL Call #: 23 Au783; ISSN: 0004-9409

Descriptors: grazing date/ trampling/ grazing systems/ deferred-grazing

Abstract: In field experiments at Merredin in 1988-90 on a structurally unstable sandy clay loam (a calcic red-brown earth) sown to *Medicago polymorpha*, deferred grazing was investigated as a management option to reduce structural deterioration at the soil surface. Changes in soil physical properties as a result of trampling were related to soil water storage and pasture productivity. Infiltration rates were reduced as a result of sheep trampling, but there were no measurable changes in soil bulk density. Differences in pasture production between continuously grazed and ungrazed treatments were related to the amount of stored soil water, which in turn was related to infiltration rates. Pasture root growth during the season was also reduced as a result of trampling. Deferred grazing yielded the same quantity of biomass for feed over the reduced period available for grazing and proved to be a beneficial management practice since reasonably high infiltration rates were maintained. Results also indicated that pasture must be adequately grazed to reduce leaf area later in the season when evaporative demand increases. A high leaf area over this time period may result in early pasture senescence.

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285. Effect of soil-N and urine-N on nitrate leaching under pure grass, pure clover and mixed grass/clover swards.

Loiseau, P.; Carrere, P.; Lafarge, M.; Delpy, R.; and Dublanquet, J.

European Journal of Agronomy 14(2): 113-121. (2001)

NAL Call #: SB13.E97; ISSN: 1161-0301

Descriptors: rotational grazing system/ soil properties: drainage

Abstract: During six annual drainage periods (DPO to DP5), the drainage water, the NO_3 concentration of the drainage water and the total leached N were compared under bare soils and under ryegrass/white clover, pure ryegrass and pure white clover stands in 80 deep lysimeters with 3m² area. For each soil cover, the sensitivity of the variables to the soil N supplying capacity at sowing was measured, using a set up of 32 lysimeters. This initial capacity to supply mineral N (SoilN) varied from 90 to 230 kg N ha⁻¹ year⁻¹. The stands were managed in a simulated rotational grazing system, without addition of

fertilizer N. During the first drainage period after sowing (DPO), N leaching increased significantly with the initial SoilN under the bare soils, the pure grass and the mixture, but was not influenced under the pure clover. In the following drainage periods, N leaching increased according to the sequence pure grass (1-5 kg N ha⁻¹ year⁻¹), mixed swards (1-19 kg N), pure white clover (28-140 kg N) and bare soils (84-149 kgN ha⁻¹ year⁻¹). It was only slightly greater under the mixture than under the pure grass, despite the N harvest and the N animal returns were much higher. Under the mixed stands, N leaching became independent of the initial SoilN in DP1 and DP2 and decreased with increasing initial SoilN in DP3, DP4 and DP5. This inversion of the SoilN effect in time and the limited amounts of leached N demonstrated that adaptations in the ecosystem tend to counteract the SoilN effect on the N losses. In the mixed stands, the accumulated N leaching represented 12 and 21% of the accumulated N at harvest for the initially rich and poor soils, respectively and 32% of the accumulated N harvest in the mixed clover, whatever the initial SoilN. N leaching also represented 13% of the urine-N above 80 kgN ha⁻¹ year⁻¹. The low values of N leaching under the mixed swards make them sustainable for environment quality. Mechanisms which regulate the N fluxes are discussed, using published data on the soil and some results concerning the harvests in the same experiment.

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286. Effect of spring grazing management of perennial ryegrass and ryegrass-white clover pastures: Tissue turnover and herbage accumulation.

Hernandez Garay, A.; Hodgson, J.; and Matthew, C.

New Zealand Journal of Agricultural Research 40(1): 25-35. (1997)

NAL Call #: 23 N4892; ISSN: 0028-8233

Descriptors: crop industry/ agronomy/ biobusiness/ forage crop/ herbage accumulation/ spring grazing management/ tissue turnover

Abstract: The aim of this study was to investigate the effects of timing and duration of lax spring grazing on rates of leaf growth, botanical composition, and pasture production in perennial ryegrass swards, with and without white clover. In the first field experiment (September 1992-March 1993), swards of perennial ryegrass with and without white clover were rotationally grazed by sheep every 21 days to residual heights of 70-100 mm (lax) and every 14 days to 30-50 mm (hard). Two periods of lax grazing-short release (SR) from 26 October to 8 December and long release (LR) from 15 September to 8 December-were compared with conventional hard grazing throughout-early control (EC). All treatments were grazed to 30-50 mm every 14 days from 8 December until the end of March. Swards without white clover received 28 kg nitrogen (N)/ha every 2 weeks as urea. Treatments were arranged in a factorial design with three replicates. Overall, herbage accumulation in the SR and LR treatments was increased by 20 and 30%, respectively, compared to the EC treatment (P ltoreq 0.001). Leaf growth in ryegrass and white clover was also increased following lax grazing. In the second field experiment (September 1993-April 1994) plots were subjected to similar grazing managements, though all spring treatments were imposed at a consistent grazing interval of 21 days and N use on non-clover swards was reduced to 14 kg/ha every 2 weeks. SR and LR treatments

increased herbage production during spring by 24 and 28%, respectively, by increasing tiller weight, and during summer and autumn by 16 and 26% by enhancing tiller population density and leaf growth per tiller and/or stolon. Spring management effects were similar for swards with and without white clover. It is concluded that lax spring grazing management of ryegrass-white clover swards followed by hard grazing at the time of anthesis enhances pasture production, particularly during the summer-autumn period, by increasing both tiller population density and net leaf growth per tiller. Effects were larger following an extended spell of lax grazing. Contribution of tiller population density differences to these responses is discussed in the second paper in this series (Hernandez et al. 1997, this issue).

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287. Effect of spring grazing management on perennial ryegrass and ryegrass-white clover pastures: Tiller and growing point densities and population dynamics.

Hernandez Garay, A.; Matthew, C.; and Hodgson, J. *New Zealand Journal of Agricultural Research* 40(1): 37-50. (1997)

NAL Call #: 23 N4892; ISSN: 0028-8233

Descriptors: crop industry/ agronomy/ biobusiness/ forage crop/ growing point density/ population dynamics/ spring grazing management/ tiller density

Abstract: The objective of this study was to investigate the effects of timing and duration of lax spring grazing on tiller dynamics in perennial ryegrass swards, with and without white clover. Two periods of lax grazing-short release (SR) from 26 October to 8 December and long release (LR) from 15 September to 8 December-were compared with a conventional hard grazing-early control (EC). These treatments were applied to swards of perennial ryegrass, with and without white clover, and grazed by sheep. Tiller weight, tiller population density, tiller appearance and death, and stolon population were analysed in a factorial design with three (Experiment 1) and four (Experiment 2) replicates. Tiller weight was increased during the reproductive period, particularly in SR and LR treatments. Also, tiller appearance rate increased in all treatments from September to late January, and was particularly high late in December after grazing of the apices of the main group of reproductive tillers. Lax grazing management increased tiller appearance rate by 53% (P ltoreq 0.05) in Experiment 1 and 23% (P gtoreq 0.05) in Experiment 2, and tiller loss rate by 40% in Experiment 1 (P gtoreq 0.05) and 23% in Experiment 2 (P ltoreq 0.05). Over 6 weeks following the return to hard grazing, these effects were reflected in increased tiller population densities of 170, 147, and 115% in LR, SR, and EC treatments respectively in Experiment 1 (P gtoreq 0.05), and 97, 110.5, and 36.5% in LR, SR, and EC treatments respectively in Experiment 2 (P ltoreq 0.05). It is concluded that the increases in herbage production observed in summer-autumn following imposition of managements which combined lax spring grazing and hard grazing at the time of anthesis, can be attributed to increased tiller densities. The increase was most marked when the period of lax grazing was longer.

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288. Effect of two grazing intensities on the rotational grazing method with dairy cattle: Balance of nitrogen, phosphorus and potassium in the system and its components.

Reyes, J. J.; Vidal, Ibis; Gonzalez, Maria R.; Gonzalez, Rosa M.; and Fonte, Damaris

Cuban Journal of Agricultural Science 37(3): 255-263. (2003)

NAL Call #: S1.R4; ISSN: 0864-0408

Descriptors: fertilization: applied and field techniques/ rotational grazing: applied and field techniques/ grazing intensity/ nutrient balance/ red ferralic soil

Abstract: The balance of nitrogen, phosphorus and potassium (N, P and K) was studied for four years in a dairy unit, established with star grass (*Cynodon nlemfuensis*). A completely randomized design with four repetitions was used on a red ferralic soil. Two grazing methods with 9 ha each and commercial Holstein cows were used. The high intensity (HI) method had 184.4 LAU/ha and 3.7 LAU/ha/year of stocking rate and that of low intensity (LI) had 101.2 LAU/ha and 3.2 LAU/ha/year of stocking rate. The mathematical analysis was carried out according to a simple classification model. The soil, in both methods, showed negative balances and was higher in the HI method for nitrogen (P<0.01) (-55.6 vs -45.8 kg/ha/year) and potassium (P<0.05) (-146.2 vs -118.9 kg/ha/year), not differing for phosphorus (-14.9 vs -13.8 kg/ha/year). The component plant showed positive values in both methods, that of LI reached better (P<0.05) balance of N, P and K. In the component animal, the balance was negative and there was no difference between the treatments. In the system in general, there were negative values, being higher in the HI grazing for nitrogen (P<0.01) and potassium (P<0.001), without differences for phosphorus (-20.6 vs -5.9, -95.8 vs -49.3 and -7.0 vs -3.7 kg/ha/year for N,P and K in HI and LI, respectively). This suggests the need for establishing management practices that collect and return efficiently the excretions deposited outside the grazing area, mainly in the rainy season, as well as making changes in the management system that allow animals to remain the longest possible time in the paddocks. Also, the utilization of legumes is proposed for Cuban systems of cattle production and the strategical use of chemical fertilization.

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289. Effectiveness of grazing and herbicide treatments for lucerne removal before cropping in southern New South Wales.

Davies, S. L.; Virgona, J. M.; McCallum, M. H.; Swan, A. D.; and Peoples, M. B.

Australian Journal of Experimental Agriculture 45(9): 1147-1155. (2005)

NAL Call #: 23 Au792; ISSN: 0816-1089

Descriptors: Medicago sativa/ forage legumes/ forage crops/ pastures/ plant cultural practices/ site preparation/ stocking rate/ grazing/ sheep/ herbicides/ cultivars/ mowing/ rain/ grazing management/ New South Wales/ Australian Capital Territory

This citation is from AGRICOLA.

290. Effects of autumn deferment of grazing on subsequent growth, botanical composition and quality of two types of irrigated pasture.

Stockdale, C. R. and King, K. R.

Australian Journal of Experimental Agriculture 25(1): 47-53. (1985)

NAL Call #: 23 Au792; ISSN: 0045-060X

Descriptors: range management/ irrigated conditions/ botanical composition/ dairy cows/ grazing/ forage/ autumn/ pastures/ Australia

This citation is from AGRICOLA.

291. Effects of burning and grazing on carbon sequestration in a Pennine blanket bog, UK.

Garnett, M. H.; Ineson, P.; and Stevenson, A. C.

Holocene 10(6): 729-736. (2000); ISSN: 0959-6836

Descriptors: peatlands/ carbon/ bioaccumulation/ agriculture/ combustion/ bogs/ storage/ wetlands/ marshes/ peat/ nutrient cycles/ carbon cycle/ man-induced effects/ grazing/ fire/ carbon dioxide/ atmospheric chemistry/ air pollution/ British Isles, England, Pennine Mts./ British Isles, England, Pennine Chain/ carbon storage/ sheep

Abstract: Terrestrial ecosystems contain large amounts of carbon (C) and have the potential to significantly increase atmospheric carbon dioxide (CO₂) concentrations. Peatlands are particularly important for C storage, although little is known about the effects of anthropogenic activities on C balance in these ecosystems. Sheep-grazing and rotational burning are widely practised on blanket peat moorlands in the United Kingdom. The effects of these activities on C sequestration in peat has been investigated with a long-term randomized block experiment with treatments: (a) grazed + unburnt; (b) grazed + burnt every ten years; (c) ungrazed + unburnt. C accumulation under these treatments was compared by identifying a chronologically synchronous horizon within the peat common to all treatment plots. This fixed point was defined by the 'take-off' in concentration of spheroidal carbonaceous particles and was supported by the record of charcoal fragments. There was no significant difference in recent C accumulation rates between lightly grazed and ungrazed plots. In contrast, after 30 years there was significantly less C stored in the blanket peat in plots which had been burned every ten years. The results indicate that light sheep-grazing at this site did not affect rates of C accumulation in blanket peat, but decadal burning of moorland reduced C sequestration.

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292. The effects of burning, grazing and herbicide treatments on restored and remnant populations of *Nassella pulchra* at Beale Air Force Base, California.

Marty, Jaymee T.; Rice, Kevin J.; and Collinge, Sharon K.

Grasslands 13(2): 1, 4-9. (2003); ISSN: 1540-6857

Descriptors: burning effects/ grazing effects

Abstract: In two experiments conducted at Beale Air Force Base, Yuba County California, we studied the effects of grazing, fire, and herbicide spraying on restored and remnant populations of *Nassella pulchra*. For the restored population, we planted into herbicide-sprayed and unsprayed plots. We allowed the seedlings to establish for one growing season and then subjected the grasses to various cattle grazing treatments. At the end of the first growing season, seedlings in the sprayed plots were larger, exhibited higher reproductive output and had lower

mortality rates than seedlings in the unsprayed plots.

Grazing did not significantly affect the growth or survival of the bunchgrasses, but grazing did decrease the reproductive output of the grasses. Although grasses in most of the treatment plots produced viable seeds during the experiment, only two seedling recruits were found around parent plants at the end of the experiment. In a separate experiment involving a remnant population of *N. pulchra*, we tagged and measured burning and grazing effects on over 1,900 adult plants. Burning had a more pronounced effect on the grass population than grazing. Bunchgrass mortality was 10 percent higher in burned versus unburned plots but was not significantly different among grazing treatments. Bunchgrass density did not differ significantly in any of the treatments but decreased significantly over time. Seedling density was 100 percent higher in burned versus unburned plots 2 years after the burn; however, seedling densities never attained pre-burn levels. Seedling densities did not differ significantly among grazing treatments, but grazing reduced the height and reproduction of the mature bunchgrasses. The growth survival, and reproduction of the bunchgrasses followed a similar pattern over the 4 years of the experiment regardless of treatment. We believe above-average rainfall and below average temperatures experienced late in the growing season in 1998 provided conditions that favored the native grasses. Although grazing and burning affected growth, reproduction, and mortality of the bunchgrasses in this experiment, it was clear that climatic variability had a stronger and, more ubiquitous effect on the grasses. None of the management treatments tested effectively increased seedling recruitment in the populations. Since native grasses like *N. pulchra* can live for many years or perhaps decades, successful seedling establishment every year may not be necessary for long-term population-viability.
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293. Effects of complementary grazing by goats on sward composition and on sheep performance managed during lactation in perennial ryegrass and white clover pastures.

Del Pozo, M.; Osoro, K.; and Celaya, R.

Small Ruminant Research 29(2): 173-184. (1998)

NAL Call #: SF380.I52; ISSN: 0921-4488

Descriptors: grazing management/ lactation/ perennial ryegrass pasture/ sheep performance/ sward composition/ white clover pasture

Abstract: The liveweight (LW) response of Gallega and Lacha ewes with their single suckling lambs when grazing with a mob of goats on perennial ryegrass (*Lolium perenne* L.)/white clover (*Trifolium repens* L.) pastures and its consequence on sward composition were analysed. From early March (turnout) to mid-June (lamb weaning), swards were grazed either simultaneously mixed in a 1:1 goat to sheep ratio or separately in a goat-first and sheep-last sequential grazing at 6 or 8 cm sward heights or in a 4-paddock rotation where goats grazed swards from 9 to 7 cm followed by sheep from 7 to 4 cm. Changes in botanical composition and in sheep liveweight performance were more significantly affected by the management and species grazing than by the sward height treatment. Swards where goats were last in had higher herbage masses, higher live clover and lower dead and stem proportions than swards where sheep and goats were mixed or sheep were last in. As a consequence of a sward clover enhancement over all

treatments, ewe and lamb performances were benefitted especially in the Lacha genotype, with the rotational and sequential managements having, respectively, an output of 298 and 252 kg LW/ha greater than the mixed management. These results suggest that goats could be used as a pasture management tool when integrated with sheep under these different grazing systems to enhance ovine performance during lactation.

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294. Effects of continuous sheep grazing and cattle rotational grazing on sward floristic composition.

Rogalski, M. T.; Kryszak, J.; and Kos, J. M.

In: Management for grassland biodiversity. (Held 19 May 1997-23 May 1997 at Warszawa omza, Poland.); pp. 103-107; 1997.

Notes: Proceedings of the International Occasional Symposium of the European Grassland Federation
NAL Call #: SB202.E85 E87 1997

Descriptors: grazing/ grazing systems/ continuous grazing/ rotational grazing/ botanical composition/ grasslands/ permanent grasslands/ weeds/ population dynamics/ fodder plants

Abstract: During 1994-96 two systems of sheep continuous grazing at sward heights of 5 and 9 cm and a rotational system of dairy cattle grazing were compared on permanent grasslands at Brody, Poland. In all three experimental grazing systems the amount of *Lolium perenne* in swards decreased, especially when swards were grazed by cattle. Continuous grazing at 5 cm by sheep was favourable for the development of *Poa pratensis*. *Dactylis glomerata* disappeared from the pasture grazed by sheep, while in the pasture grazed by cattle, *Agrostis gigantea* decreased. After three years of grazing, there was an increase in the number of forb and weed species from one species before the initiation of the experiment to nine species in the sward of pastures for sheep and six species in cattle pastures. *Taraxacum officinale* appeared to have responded exceptionally well to the experimental grazing conditions since its share in the sward increased 3-fold in the case of sheep grazing and 6-fold on pastures grazed by cattle.

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295. Effects of cutting or grazing grass swards on herbage yield, nitrogen uptake and residual soil nitrate at different levels of N fertilization.

Nevens, F. and Rehuel, D.

Grass and Forage Science 58(4): 431-449. (2003)

NAL Call #: 60.19 B773; ISSN: 0142-5242

Descriptors: cutting effect/ grass sward/ grassland management/ grazing effect/ herbage yield

Abstract: On a Flemish sandy loam soil, cut and grazed swards were compared at different levels of mineral nitrogen (N) fertilization. Economically optimal N fertilization rates were 400 (or more) and 200 kg N ha⁻¹ yr⁻¹ on cut and grazed swards respectively. Considering the amounts of residual soil nitrate-N in autumn, these N rates also met the current Flemish legal provisions, i.e. no more than 90 kg ha⁻¹ nitrate-N present in the 0-90 cm soil layer, measured between 1 October and 15 November. The N use efficiency was considerably higher in cut grassland systems than in grazed systems, even when the animal component of a cut and conservation system was included. The results indicate that, for cut grasslands, two N application rates should be

considered: intensively managed grasslands with high amounts of N (400 kg ha⁻¹ yr⁻¹ or more) or extensively managed grasslands with white clover and no more than 100 kg N ha⁻¹ yr⁻¹.

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296. Effects of different management methods on the floral composition of pastures on Asiago plateau (NE Italy).

Ronch, F.; Stern, G. R.; and Ziliotto, U.

Options Mediterraneennes Serie A, Seminaires

Mediterraneennes(67): 99-104. (2005)

NAL Call #: S19.O681; ISSN: 1016-121X

Descriptors: botanical composition/ feed supplements/ grassland management/ grasslands/ grazing/ pastures/ surveys/ vegetation/ grazing-management

Abstract: With the aim of learning more about the effects of supplementing the diet of grazing animals with food concentrates on the floral composition in mountain pastures, two neighbouring malghe were chosen in three different areas of the Asiago plateau. In the previous six years one of these malghe had been grazed by cattle which had been supplied concentrates and the other by animals that did not received the supplement. Based on 19 floral surveys done in the 6 malghe, it emerged that in the zone characterized by a mesophil climate and shallow soils, the use of concentrates increases the cover of species that are favoured by high nutrient contents in the soil, without increasing the pastoral value. Instead, in the areas with a fresher climate and deeper soils, the number of nitrophilous species increases with the use of concentrates.

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297. Effects of fertiliser and grazing on the arthropod communities of a native grassland in south-eastern Australia.

Oliver, Ian; Garden, Denys; Greenslade, Penelope J.; Haller, Bronwyn; Rodgers, Denis; Seeman, Owen; and Johnston, Bill

Agriculture, Ecosystems & Environment 109(3-4): 323-334. (2005)

NAL Call #: S601 .A34; ISSN: 0167-8809

Descriptors: animals and man/ disturbance by man/ commercial activities/ ecology/ habitat/ terrestrial habitat/ abiotic factors/ chemical factors/ land zones/ Australasian Region/ Australasia/ Australia/ Arthropoda: farming and agriculture/ fertilizer application and grazing/ community structure/ effects of fertiliser and grazing/ grassland/ native grassland/ effects of fertiliser and grazing on community structure/ fertilizers and pesticides/ effects on native grassland community structure/ New South Wales/ Yass Area/ effects of fertiliser and grazing on native grassland community structure/ arthropods/ invertebrates

Abstract: An experiment commenced in 1998 to test the effects of superphosphate fertiliser application and grazing on production and botanical composition of a native grassland in south-eastern Australia. Superphosphate application resulted in an increase in sheep production but a decline in native perennial grasses and an increase in exotic annual grasses. The study reported here aimed to determine if arthropod assemblages showed changes in community composition on the same experimental plots. The experiment was conducted in grassland dominated by the native perennial wallaby grass, *Austrodanthonia duttoniana*, and consisted of six replicated treatments that

were designed to improve grassland and domestic livestock productivity. Treatments consisted of a control (no fertiliser), three levels of annually applied superphosphate (62.5, 125, and 250 kg ha⁻¹), and two treatments aimed to raise soil pH (superphosphate plus lime, and sewage ash). Soil properties were measured annually and sheep stocking rates were increased over the duration of the experiment according to increases in available forage. Soil and ground-active arthropod populations were sampled from all plots in spring 2001. Fertiliser application and grazing increased the relative abundance of introduced Acari and Collembola, and changed the community composition of Formicidae and Coleoptera. Lime and sewage treatments had variable effects on taxa. Improving the productivity of native grassland with superphosphate led to a decline in plant and arthropod biodiversity through reduced abundance and/or local extinction of native species and increased dominance of introduced species. These findings support the need to protect and restore a representative network of native grassland ecosystems within the agricultural zone of south-eastern Australia. Crown Copyright [copyright] 2005 Published by Elsevier B.V. All rights reserved. © The Thomson Corporation

298. Effects of grazing and management on herbage mass, persistence, animal production and soil water content of native pastures: A mixed native pasture, Manilla, North West Slopes, New South Wales.

Lodge, G. M.; Murphy, S. R.; and Harden, S.
Australian Journal of Experimental Agriculture 43(7-8): 891-905. (2003)

NAL Call #: 23 Au792; ISSN: 0816-1089

Descriptors: animal production/ annual wool production/ grazing effects/ herbage mass/ management effects/ native pasture/ persistence/ red chromosol/ resource management/ soil water content/ stocking rate

Abstract: As part of the Sustainable Grazing Systems (SGS) National Experiment a study was conducted on a native pasture in the Manilla district of northern New South Wales to examine the effects of 5 grazing treatments on total herbage mass, litter mass, basal cover, ground cover, sheep liveweight, wool production and soil water content (SWC, mm) at different depths. The pasture was a mixture of native perennial grasses, with redgrass (*Bothriochloa macra*) and wiregrass (*Aristida ramosa*) dominant on a red Chromosol soil type and bluegrass (*Dichanthium sericeum*) on a brown Vertosol. Wallaby grasses (*Austrodanthonia richardsonii* and *A. bipartita*) were common on both soils. Plots were grazed with Merino wethers and data collected from spring 1997 to spring 2001 were analysed to determine the effect of treatments on both production and sustainability. Five grazing treatments were applied in a randomised 3 replicate design. Grazing treatments were: continuous grazing at 3.1 and 6.2 sheep/ha (C3 and C6), continuous grazing at 9.2 sheep/ha, with subterranean clover (*Trifolium subterraneum*) oversown and fertiliser applied (C9+sub) and rotational grazing at an annual stocking rate of 3.1 sheep/ha with pasture grazed for 4 weeks and rested for 4 weeks (R4/4), or rested for 12 weeks (R4/12). Over time, treatments had no significant effect on either total pasture herbage mass (compared with the C3 control) or the basal cover of the major perennial grasses. Treatments had inconsistent significant effects on ground cover, litter mass, sheep liveweight and wool production (kg/head) over time. Compared with all other

treatments ground cover was less ($P < 0.05$) in the C6 treatment in only May and September 2000 and litter mass less ($P < 0.05$) in only December 1998 and March 1999. Treatment sheep liveweights were not significantly different from the C3 treatment from September 1997 to 1999. However, from October 1999 to October 2001 sheep liveweight in the C6 treatment was significantly less than in the C3 treatment, while in the C9+sub and R4/12 treatments it was significantly greater than the control. In 1999, wool production per head was higher ($P < 0.05$) in the C9+sub and R4/12 treatments compared with all other treatments but treatment differences were not significant in all other years. Significant differences in SWC only occurred at the 0-30 cm depth between the C3 and the C6 and R4/12 treatments, but were predicted to be < 1.5 mm/year. A sustainability index derived from economic (equivalent annual net return (dollar sign/ha) for a 10-year period), animal production, pasture, soil health and soil water data indicated that the overall indices were lowest for the C3, C6 and C9+sub treatments and highest for the R4/4 and R4/12 treatments.

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299. Effects of grazing and management on herbage mass, persistence, animal production and soil water content of native pastures: A redgrass-wallaby grass pasture, Barraba, North West Slopes, New South Wales.

Lodge, G. M.; Murphy, S. R.; and Harden, S.
Australian Journal of Experimental Agriculture 43(7-8): 875-890. (2003)

NAL Call #: 23 Au792; ISSN: 0816-1089

Descriptors: biophysical model: mathematical and computer techniques/ animal production/ annual wool production/ grazing effects/ herbage mass/ management effects/ native pasture/ persistence/ resource management/ soil water content/ stocking rate

Abstract: A study was conducted on a native pasture (dominated by redgrass, *Bothriochloa macra*) in the Barraba district of northern New South Wales to examine the effects of 5 grazing treatments on total herbage mass, litter mass, basal cover, ground cover, sheep liveweight, wool production and soil water content (SWC, mm) at different depths. Plots were grazed with Merino wethers and data were collected from spring 1997 to spring 2001 and analysed to determine the effects of treatments on both production and sustainability. Five grazing treatments were applied in a randomised 3 replicate design. Grazing treatments were: continuous grazing at 4 and 6 sheep/ha (C4 and C6), continuous grazing at 8 sheep/ha, with subterranean clover (*Trifolium subterraneum*) oversown and fertiliser applied (C8+sub), and, rotational grazing at an annual stocking rate of 4 sheep/ha with pasture grazed for 4 weeks and rested for 4 weeks (R4/4), or rested for 12 weeks (R4/12). Total herbage mass declined in the C4 (control) treatment throughout the experiment and, compared with this treatment, the C6 treatment had less ($P < 0.007$) linear trend over time, while the R4/12 treatment had a greater ($P < 0.001$) linear trend. Stocking rates could not be maintained in the C4 and C6 treatments and sheep were supplementary fed or removed from these treatments for a total of 133 and 263 days, respectively. For ground cover, the linear trend was greater ($P < 0.05$) in the C8+sub, R4/4, and R4/12 treatments compared with the continuously grazed C4 and C6 treatments and for litter

mass this trend was also greater ($P < 0.05$) for the R4/12 treatment than the C4 treatment. Basal cover of wiregrass (*Aristida ramosa*), wallaby grass (*Austrodanthonia* spp.) and windmill grass (*Chloris truncata*) was not affected by grazing treatment but for redgrass the linear trend was greater ($P < 0.05$) in the C8+sub, R4/4, and R4/12 treatments compared with the C4 and C6 treatments. Sheep liveweight (kg/head) was greater ($P < 0.001$) in the C8+sub treatment compared with the C4 treatment. Annual wool production (kg/head) was also higher ($P < 0.05$) in the C8+sub treatment compared with all other treatments. Compared with the C4 treatment, significant differences in soil water content occurred in the R4/12 and C8+sub treatments, but these were predicted to be only 2.9 mm per year for the R4/12 treatment (0-30 cm depth) and 5.7 mm per year for the C8+sub treatment (30-170 cm). Use of a biophysical model indicated that evapotranspiration was the largest output term in the soil water balance and that both drainage and surface runoff of water were episodic events. A sustainability index derived from economic (equivalent annual net return (dollar sign/ha) for a 10-year period), animal production, pasture, soil health and soil water data indicated that the C4 and C6 treatments had the lowest scores for each of these parameters and the lowest overall indices. These scores were highly correlated with subjective assessments of the impact of the treatments ($r = 0.93$). Overall, these data indicated substantial benefits of either rotationally grazing or the addition of fertiliser and subterranean clover to the production and sustainability of the native pasture studied.

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300. Effects of grazing by horses and/or cattle on the diversity of coastal grasslands in western France.

Loucougaray, G.; Bonis, A.; and Bouzille, J.-B.

Biological Conservation 116(1): 59-71. (2004)

NAL Call #: S900.B5; ISSN: 0006-3207

Descriptors: additive and compensatory effects/ foraging behaviour/ grazing management/ herbivore species/ plant diversity

Abstract: In the coastal grasslands of western France, extensive mixed grazing by cattle and horses has been practised for many centuries. The vegetation of these old embanked grasslands varies along a topographical gradient with a hygrophilous plant community in low-lying depressions seasonally flooded, a mesophilous community on high level flats that are never flooded, and a meso-hygrophilous community on slopes where the soil remains saline. Recently, fewer horses have been grazed on these pastures and so a 6-year study was designed to investigate the effects of monospecific and mixed grazing by horses and cattle on plant community structure, composition and diversity. Mixed grazing produced the most species-rich and structurally diverse swards. Mixed grazing enhanced the development of rosette, sub-halophyte and halophyte species where the soil is saline, due to additive effects between the two herbivore species. Mixed grazing also limited the strongly competitive *Elymus repens* and *Agrostis stolonifera* on horse latrine areas, cattle grazing, thus showing a compensatory effect. The combination of additive and compensatory effects with mixed grazing could be used to manage plant diversity, heterogeneity in

vegetation structure and communities of conservation value at the scale of the grassland ecosystem. © 2003 Elsevier Ltd. All rights reserved.

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301. Effects of grazing by large herbivores on nitrogen cycling in agricultural ecosystems.

Floate, M. J. S.

In: *Terrestrial nitrogen cycles: Processes, ecosystem strategies and management impacts/* Clark, F. E. and Rosswall, T.; Series: *Ecological Bulletins*.

Stockholm: Swedish Natural Science Research Council, 1981; pp. 585-601.

Notes: ISSN: 0346-6868

NAL Call #: QH540.S7 no.33

This citation is from AGRICOLA.

302. The effects of grazing exclusion and blade-ploughing on semi-arid woodland vegetation in north-western New South Wales over 30 months.

Robson, A. D.

Rangeland Journal 17(2): 111-127. (1995)

NAL Call #: SF85.4.A8A97; ISSN: 1036-9872

Descriptors: woody weeds/ semiarid zones/ brush control/ biomass/ grazing intensity/ rain/ botanical composition/ palatability/ grazing/ New South Wales

This citation is from AGRICOLA.

303. Effects of grazing management and soil amendment on hill land pasture botanical composition.

Bryan, W. B.; Mills, T. A.; and Rosica, F. X.

Applied Agricultural Research 1(5): 297-302. (1987)

NAL Call #: S539.5.A77; ISSN: 0179-0374

Descriptors: Kentucky bluegrass/ meadow fescue/ white clover/ broadleaf weeds/ cattle/ lime/ phosphorus/ in vitro digestibility

Abstract: Grazing management and soil amendments are two of the more easily controlled components of a pasture/livestock production system. In this experiment, effects of continuous stocking at low grazing pressure (less than 2 cows per 1000 kg (2200 lb) of herbage), rotational grazing at high grazing pressure (more than 100 cows per 1000 kg of herbage), and once-a-year grazing at high grazing pressure (more than 80 cows per 1000 kg of herbage) and lime and P application on percentage legume, weeds, grass, and base ground in a hill land pasture were compared over a 4-year period. The pasture consisted mostly of Kentucky bluegrass, meadow fescue, white clover, and broadleaf weeds and was located on a Culleoka-Westmoreland complex soil. Herbage mass, in vitro digestibility, and herbage accumulation were estimated. Grazing management influenced botanical composition of hill land pasture much more than lime and P application. Compared with continuous stocking, rotational grazing resulted in a higher percentage of legumes and bare ground but a lower percentage of grass and tall-growing weeds. Rotationally grazed pasture had a higher in vitro digestibility than pasture stocked continuously or grazed once a year. Lime and P application tended to increase percentage legume ($P < 0.10$) and decreased percentage bare ground, especially in rotationally grazed pasture.

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304. Effects of grazing management on botanical composition of native grass-based pastures in temperate south-east Australia.

Garden, D. L.; Lodge, G. M.; Friend, D. A.; Dowling, P. M.; and Orchard, B. A.

Australian Journal of Experimental Agriculture 40(2): 225-245. (2000)

NAL Call #: 23 Au792; ISSN: 0816-1089

Descriptors: grazing management: botanical composition effects, management method/ native grass based pasture: botanical composition, stability

Abstract: Grazing management strategies to alter botanical composition of native pastures were investigated at 4 locations in the high rainfall zone of south-east Australia, including Tasmania. These studies were conducted as part of the Temperate Pasture Sustainability Key Program, which evaluated the effects of grazing management on a wide range of pasture types between 1993 and 1996.

Pastures in this study were based on *Aristida ramosa*/*Bothriochloa macra*, *Microlaena stipoides*-*Austrodanthonia* spp. or *Themeda triandra*-*Austrodanthonia* spp. Seasonal rests, increased grazing pressure in spring, mob stocking and cutting for hay were compared to continuous grazing at all sites. In addition, specific local treatments were tested at individual sites. Changes in composition resulting from the treatments were minimal at most sites. This may have been due to a combination of the inherent stability of the pastures, the relatively short duration of the experiments, and the drought conditions experienced, which minimized differences between treatments. Some strategies to alter composition of natural pastures are suggested. In the *Aristida*-*Bothriochloa* pasture there was a general decrease in *Aristida* and an increase in *Bothriochloa*, which was largely unaffected by the type of grazing management applied. The combination of drought conditions and increasing grazing pressure was sufficient to alter composition without specific management strategies being necessary. In the *Themeda*-*Austrodanthonia* pasture, resting in spring, 12-month rests or cutting for hay (which involved a spring rest) allowed *Themeda* to increase in the pasture. The *Microlaena*-*Austrodanthonia* pastures were very stable, especially where annual grass content was low. However, certain treatments allowed *Microlaena* to increase, a result which is regarded as being favourable. The major effects in these latter pastures were on undesirable species. *Vulpia* spp. were reduced by resting in autumn and increased spring grazing pressure, while *Holcus lanatus* was increased dramatically by resting in spring and was also increased by resting in autumn or winter, but only when conditions were suitable for growth of this species. In many cases, treatment differences were only expressed following recovery from drought, showing that timing of grazing management to achieve change is critical.

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305. Effects of grazing management on establishment and productivity of aeschynomene overseeded in limpgrass pastures.

Sollenberger, L. E.; Quesenberry, K. H.; and Moore, J. E. *Agronomy Journal* 79(1): 78-82. (1987)

NAL Call #: 4 AM34P; ISSN: 0002-1962

Descriptors: *Hemarthria altissima*/ Florida/ USA/ herbage consumption/ regrowth/ crop industry

Abstract: Low protein concentration in limpgrass [*Hemarthria altissima* (Poir.) Stapf et C.E. Hubb.]herbage is thought to limit the performance of grazing animals. In 1983 and 1984 an experiment was conducted on a sandy, siliceous, hyperthermic Ultic Haplaquod soil to evaluate effects of grazing management on establishment and productivity of the legume aeschynomene (*Aeschynomene americana* L.) seeded in limpgrass. Existing limpgrass pastures were grazed in the spring to 75- to 150-mm stubble heights. After broadcast seeding aeschynomene, stubble heights were maintained by grazing until (i) legume cotyledons were exerted, (ii) two true leaves were present, or (iii) 2 weeks after the two-leaf stage. Summer grazing was initiated when aeschynomene plants were 0.20, 0.40, or 0.80 m tall in 1983 and 0.20, 0.40, or 0.60 m tall in 1984. After initiation of grazing, pastures were grazed every 5 weeks. Limpgrass stubble height during legume establishment did not affect legume productivity, but there was a trend favoring the 75-mm level. Extending the period of early season grazing of limpgrass until aeschynomene seedlings reached at least the two-leaf stage controlled grass competition and maximized legume performance. Legume dry matter (DM) accumulation was greatest if initiation of summer grazing was delayed until aeschynomene was 0.80 (1983) or 0.60 (1984) m tall. Initiation of grazing when aeschynomene was 0.20 to 0.40 m tall resulted in more uniform distribution of total and legume DM, higher efficiency of grazing, more vigorous legume regrowth, and a trend toward greater total herbage consumption. These data indicate that aeschynomene can be established into limpgrass sods under grazing, and that this association has potential on the large expanses of poorly drained soils in Florida [USA].

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306. Effects of grazing management on herbage production and botanical composition of grasslands nui ryegrass-paspalum-white clover pasture: Effect of intensity of grazing by cattle in different seasons.

Weeda, W. C. and During, C.

New Zealand Journal of Agricultural Research 30(4): 423-430. (1987)

NAL Call #: 23 N4892; ISSN: 0028-8233

Descriptors: *Paspalum dilatatum*/ *Lolium perenne*/ *Trifolium repens*/ cattle industry/ agriculture

Abstract: The effects of high and medium grazing intensities at different times of the year (except from mid October to end of November) on composition and on net herbage increments (NHI) of a perennial ryegrass-paspalum-white clover pasture was measured at a site near Hamilton. Store cattle were used and the experiment continued for 3.5 years. No treatment, even high grazing intensity from mid March to mid October, significantly affected annual NHI. Possible reasons for this are proposed. High grazing intensity in early summer increased the percentage of paspalum (*Paspalum dilatatum* Poir.) at the expense of 'Grasslands Nui' ryegrass (*Lolium perenne* L.). The effect was marked where hard grazing was continued throughout the summer. In early spring, hard grazing raised the proportion of paspalum in the sward provided temperatures were high enough for this species to take advantage of the weakened competition from ryegrass. An increase in the proportion of paspalum depressed NHI in early winter without increasing NHI in summer. Therefore, paspalum is considered an undesirable

species under the conditions tested. High grazing intensity in late summer and autumn increased the proportion of *Poa annua* in the sward but without effect on subsequent NHI.

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307. Effects of grazing management on seasonal variation in nitrogen fixation.

Brock, J. L.; Hoglund, J. H.; and Fletcher, R. H.
In: Proceedings of the XVI International Grassland Congress. (Held 15 Jun 1981-24 Jun 1981 at Lexington, Kentucky, USA.) Smith, J. Allan and Hays, Virgil W. (eds.) Boulder, Colo.: Westview Press; pp. p. 339-341; 1983.

NAL Call #: SB197.I5 1981a

This citation is from AGRICOLA.

308. Effects of grazing management on *Sirosa phalaris* herbage mass and persistence in a predominantly summer rainfall environment.

Lodge, G. M. and Orchard, B. A.

Australian Journal of Experimental Agriculture 40(2): 155-169. (2000)

NAL Call #: 23 Au792; ISSN: 0816-1089

Descriptors: grazing management: management method/ pasture/ summer rainfall environment

Abstract: Herbage mass, plant frequency and basal cover data collected from September 1993 to August 1996 were used to compare the effects of various seasonal closures with continuous grazing on the persistence of *Sirosa phalaris* (*Phalaris aquatica* cv. *Sirosa*) at 3 sites on the North West Slopes of New South Wales. Sites were on-farm and consisted of up to 10 treatments with 2 replicates and treatments were initially imposed in 2 different years. Pastures were either newly sown (3 years old) and grazed by either sheep or cattle, or degraded (14 years old) and grazed by sheep. Drought conditions prevailed in 1994-95, confounding the interpretation of the importance of treatments that involved long periods of closure, since significant effects could be attributed to both grazing exclusion and the timing of the closure in relation to plant phenology. However, across all sites and years, fitted values for *phalaris* herbage mass were generally significantly higher than the continuously grazed control in only 2 treatments: spring closure (at 1 site) and an extended spring closure combined with an autumn closure (at all sites). At the end of these studies *phalaris* herbage mass in spring-autumn closures was 4-32 times higher than the control plots. These results were confirmed by analysis of initial and final plant frequency data. At all sites, no recruitment of *Sirosa* seedlings occurred in any treatment. These data support the hypothesis that for increased persistence in a summer rainfall environment *Sirosa phalaris* requires some form of grazing management that involves the exclusion of grazing in the critical periods of spring and autumn.

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309. Effects of grazing management on the botanical composition of a lucerne pasture in south-eastern Queensland.

Leach, G. J.; Dale, M. B.; and Ratcliff, D.

Australian Journal of Experimental Agriculture and Animal Husbandry 24(124): 93-103. (1984)

NAL Call #: 23 AU792; ISSN: 0045-060X

Descriptors: Queensland

This citation is from AGRICOLA.

310. The effects of grazing management on the vegetation of mesotrophic (meadow) grassland in northern England.

Smith, R. S. and Rushton, S. P.

Journal of Applied Ecology 31(1): 13-24. (1994)

NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: plant species diversity/ species composition
Abstract: 1. Haymeadows in the Yorkshire Dales and the North Pennines in Northern England are grazed with cattle and sheep outside the 2-3-month summer period, when a hay or silage crop is grown. Experimental enclosures were used from August 1987 to June 1991 to prevent this grazing for various periods in the year in a meadow at Ravenstonedale, Cumbria. Vegetation change was investigated using biomass samples taken in June of each year. 2. Experimental treatments were: (i) no grazing at any time of the year; (ii) no grazing from the time of the hay cut until 1 January; (iii) no grazing from 1 January to the time of the hay cut; (iv) control plots in which the normal grazing regime was followed each year. All other management factors were kept constant. 3. All plots showed vegetation changes related to treatment and to time. The main trend was the treatment effect, with the greatest reduction in species richness occurring in the ungrazed plots. Changes in the species composition of the plots were associated with species' strategies (sensu Grime 1979) in the established and regenerative phase. 4. The results are discussed in the context of management designed to manipulate plant species composition in old meadowland.

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311. Effects of grazing on plant and soil nitrogen relations of pasture-crop rotations.

Unkovich, Murray; Sanford, Paul; Pate, John; and Hyder, Mike

Australian Journal of Agricultural Research 49(3): 475-485. (1998)

NAL Call #: 23 Au783; ISSN: 0004-9409

Descriptors: crop rotation/ pasture crop rotation: agronomic method/ crop industry/ grazing: soil nitrogen relations

Abstract: Plant and soil nitrogen (N) fluxes were assessed in subterranean clover (*Trifolium subterraneum* L.) based pastures set-stocked at 8 sheep per hectare (light grazing) or grazed at a much higher, but variable, intensity to maintain 1400 kg standing dry matter per hectare (intensive grazing) through the addition or removal of sheep. Pasture composition and biomass production, herbage N concentration, plant nitrate (NO₃⁻) utilization, and N₂ fixation by clover were assessed at 3-weekly intervals over the growing season. Soil ammonium (NH₄⁺) and NO₃⁻ availability were assessed at similar intervals using soil coring and in situ incubation cores. Seasonal pasture yield under light grazing was 11.5 t dry matter/ha compared with 7.9 t/ha under intensive grazing, the difference being mostly attributable to reduced grass growth under intensive grazing. However, there was essentially no difference between the pastures in total N accumulation (300 kg N/ha in the lightly grazed and 302 kg N/ha in the intensively grazed pastures). The lesser dry matter production under intensive grazing was compensated for by higher N concentration and increased clover content of the sward, and faster clover growth late in the growing season. N₂ fixation by clover under intensive grazing (153 kg N/ha) was slightly greater than under light grazing (131 kg N/ha). Proportional dependence of clover on N₂ fixation (%Ndfa)

was similar under intensive grazing (78%) and light grazing (84%), despite higher continued availability of soil mineral N under intensive grazing. Uptake of soil N by the grass component amounted to 147 kg N/ha under light grazing v. 96 kg N/ha in the intensively grazed pasture, and for the clover was 18 and 40 kg N/ha, respectively. Capeweed (*Arctotheca calendula* L.), a common weed of south-west Australian pastures, was extraordinarily active in absorbing, storing, and reducing soil NO₃⁻, especially when subjected to intensive grazing. After the 3 years of the grazing trial, the pastures were cultivated and cropped to oats, triticale, and canola and the biomass and N uptake of each crop assessed. Intensive grazing in the previous pasture resulted in increased availability of soil mineral N in the subsequent cropping phase and accordingly augmented crop N uptake and eventual grain protein levels relative to crops following lightly grazed pasture. The study indicated that intensive grazing before cropping may offer a useful management tool for improving N nutrition and yields of non-leguminous crops in pasture-crop rotations under the conditions prevailing in the south-west of Australia.

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312. Effects of grazing system and phosphorus application on pasture quality.

Frame, H.; Warn, L.; and McLarty, G.

Wool Technology and Sheep Breeding 50(3): 465-470. (2002)

NAL Call #: 304.8 W888; ISSN: 0043-7875

Descriptors: crude protein/ dry matter/ fibre/ grazing/ grazing systems/ nutritive value/ pastures/ phosphorus
Abstract: An experiment at Broadford, Victoria, compared crude protein (CP), digestible dry matter (DDM) and neutral detergent fibre (NDF) of pasture under three grazing systems (continuous grazing, a "Simple" time-based rotation, and an "Intensive" plant-based rotation). Each of these grazing systems received either a "Low" (6 kg/ha) or a "High" (25 kg/ha) annual application of phosphorus. CP concentrations of the green pasture component as a whole, the dead pasture component, the green clover component, and the green grass component under a continuous grazing system were each significantly ($P=0.05$) higher throughout the year than under either of the rotation systems. There were no consistent differences in DDM between grazing systems. The NDF concentrations of both the green and dead pasture components under a continuous grazing system were each significantly ($P=0.05$) lower throughout the year than under either of the rotations. The green grass component of the pasture that received High P had significantly ($P=0.05$) higher CP concentrations than the green grass component of the pasture that received Low P. There were no consistent differences in DDM between phosphorus inputs. There were no significant ($P=0.05$) differences in NDF between phosphorus inputs. The combination of continuous grazing and High P tended to have the highest CP and lowest NDF in each pasture component measured. The results highlight that, although grazing system impacted CP and NDF, there was no effect on DDM.

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313. Effects of initial sowing rate and subsequent grazing management on the growth and clover content of irrigated white clover-perennial ryegrass swards in northern Victoria.

Kelly, K. B.; Stockdale, C. R.; and Mason, W. K.

Australian Journal of Experimental Agriculture 45(12): 1595-1602. (2005)

NAL Call #: 23 Au792; ISSN: 0816-1089

Descriptors: irrigation: applied and field techniques/ grazing management: applied and field techniques/ photosynthesis/ defoliation

Abstract: Two experiments were conducted over 3 years. One was of factorial design involving 2 sowing rates of white clover (*Trifolium repens* L. cv. Haifa; sown at 8 or 3 kg/ha) and perennial ryegrass (*Lolium perenne* L. cv. Grasslands Nui; sown at 5 or 15 kg/ha) grazed by dairy cows at 2 frequencies [frequent (2 - 3 weeks in spring/autumn) and infrequent (4 - 6 weeks in spring/autumn)] and 2 intensities [hard (residual rising plate meter heights of less than 4 cm) and lax (residual rising plate meter heights of more than 5 cm)]; and the second was a regression design involving 5 sowing rates of white clover and ryegrass ranging from pure clover to pure ryegrass (sown at 10/0 through to 0/20 kg/ha), all grazed frequently and at a hard intensity. The hypotheses tested were that (1) pure white clover swards would be at least as productive as those that contained ryegrass, and (2) more frequent grazing would result in greater quantities of DM removed, while hard grazing would maintain a higher clover content. In general, the hypotheses were confirmed. Over the 3 years of the experiments, pure white clover swards were at least as productive as mixed swards in a situation where no nitrogen fertiliser was applied. In the first year, the amount of DM removed declined ($P < 0.05$) as the ryegrass sowing rate increased, but by year 3, the pure clover treatment out-yielded the other treatments. Except for the first year, frequent grazing resulted in more ($P < 0.05$) DM removed than did infrequent grazing. Frequently grazed swards also had higher daily net photosynthesis after grazing than did the swards in infrequently grazed treatments, and achieved maximum levels of photosynthesis more quickly. There was no difference in photosynthesis rate, despite significant differences in clover content, between sowing rate treatments, regardless of grazing management. Initial sowing rate had a large effect on clover content in year 1, but by year 3, most of this had disappeared as clover contents rapidly converged. Frequency of grazing had its greatest effect on clover content in year 1, with infrequent grazing resulting ($P < 0.05$) in the greatest clover contents. Grazing intensity was an important determinant of clover content in years 2 and 3, where hard grazing resulted ($P < 0.05$) in higher clover content. Digestibility of the herbage on offer ranged from 65 to 80%, and crude protein concentrations varied from 12 to 26%. In general, frequent grazing resulted in a digestibility of 2 - 4 percentage units higher than infrequent grazing, with hard grazing also tending to increase digestibility. Hard grazed treatments always had high crude protein concentrations in the herbage present before grazing, and there was a slightly higher concentration in frequently grazed herbage compared with herbage that was grazed less frequently. The white clover - perennial ryegrass swards generally responded best to a combination of frequent and hard grazing. However, neither white clover nor perennial ryegrass appears to be well adapted to the combination of soils, climate, irrigation and grazing by dairy

cows that occurs in the northern irrigation region of Victoria, as evidenced by a rapid influx of weeds and the general decline in productivity over the duration of the experiment.
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314. Effects of large-scale cattle grazing on Orthoptera (Saltatoria et Mantodea) on pastures in Georgia (Caucasus).

Bontjer, Andrea and Plachter, Harald
In: Pasture landscapes and nature conservation/ Redecker, Bernd; Finck, Peter; Haerdle, Werner; Riecken, Uwe; and Schroeder, Eckhard.

Berlin: Springer, 2002; pp. 355-366

NAL Call #: SF140.P38 W672 2001

Descriptors: animals and man/ disturbance by man/ commercial activities/ ecology/ habitat utilization/ habitat/ terrestrial habitat/ land zones/ Palaeartic Region/ Eurasia/ Asia/ Orthoptera: farming and agriculture/ large scale cattle grazing/ community structure/ distributional communities/ effects of large scale cattle grazing/ distribution within habitat/ habitat preference/ grassland/ pasture/ Georgia (Asia)/ Tbilisi area/ pastures/ large scale cattle grazing effects on habitats and distributional communities/ Orthoptera/ Insecta/ arthropods/ insects/ invertebrates
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315. Effects of late summer cattle grazing on the diversity of riparian pasture vegetation in an upland conifer forest.

Humphrey, J. W. and Patterson, G. S.

Journal of Applied Ecology 37(6): 986-996. (2000)

NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: biodiversity conservation/ calcareous springs/ economics/ forage availability/ grasslands: habitat/ grazing management/ litter cover/ riparian pastures/ species abundance/ species richness/ stock husbandry/ stocking density/ upland conifer forests: habitat/ vegetation composition/ water table depths

Abstract: 1. Species-rich grassland is important for biodiversity in upland forests, particularly within riparian zones. Prior to afforestation, the botanical diversity of these grasslands was maintained by domestic stock grazing, but without active management many will revert to coarse, species-poor grassland and eventually to scrub. The reintroduction of stock grazing is a potential solution to this problem, but has not been tested in upland forests. Here we present results from 9 years of monitoring the effects of cattle grazing on the diversity and composition of riparian pasture vegetation in an upland conifer forest in northern Scotland. 2. There were two treatments, late summer grazing and ungrazed. The average stocking density in the grazed treatment was 2.25-2.5 cows ha⁻¹. The cattle were free to range over the entirety of the 40-ha experimental site from early August to late September each year. 3. Assessments of plant species richness and abundance were made in 1988 (prior to the commencement of grazing), 1991 and 1997, in three of the main riparian vegetation types. These were 'Flush' vegetation associated with calcareous springs, acid *Agrostis capillaris*-*Festuca ovina* grassland ('Grass'), and *Juncus effusus* rush pasture ('*Juncus*'). Assessments were also made of grazing impacts, cattle usage and water table depths. 4. Grazing had a significant effect on plant species richness, which declined in ungrazed plots and remained static in grazed plots over the 1988-97 period. There were no recorded

effects of grazing on species abundance, nor on the frequency of rare sedges and herbs of particular conservation importance. Litter cover (dead plant material) was significantly higher in ungrazed plots, which may be a causal factor in declining richness values. 5. Cattle utilized Grass and Flush vegetation to a significantly greater degree than *Juncus* vegetation, and this appeared to be related to forage availability rather than wetness as represented by water table depth. 6. Cattle grazing is of potential value as a management tool for species-rich grasslands in upland forests provided that: areas to be grazed are large enough to minimize localized impacts and allow free ranging of the cattle; the economics and practicalities of stock husbandry are considered; the type of grazing management used is linked clearly to management objectives.
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316. Effects of livestock breed and stocking rate on sustainable grazing systems: Short-term effects on vegetation.

Scimone, M.; Smith, R. E. N.; Garel, J. P.; and Sahin, N.
In: Land use systems in grassland dominated regions: Proceedings of the 20th General Meeting of the European Grassland Federation. (Held 21 Jun 2004-24 Jun 2004 at Luzern, Switzerland.); pp. 623-625; 2004.

Descriptors: animal production/ biodiversity/ breed differences/ grazing/ livestock/ stocking rate/ vegetation
Abstract: This work is part of the EU project FORBIOBEN, which analyses the impact of commercial and traditional breeds with different stocking rates on biodiversity at different levels. This study was conducted to verify the different experimental grazing systems significantly affect the vegetation diversity during the first grazing season and to what extent this happens in different countries (France, Germany, Italy, UK and Spain). Three grazing management systems were compared in five countries in a 3 year experiment, (i) moderate grazing/commercial breed, (ii) low grazing/commercial breed, and (iii) low grazing/traditional breed. The experiments were carried out using cattle in UK, France and Germany; sheep in Italy and goats in Spain. The effect of grazing systems on specific and structural diversity of vegetation was analysed after one year. The responses mainly depend on the background difference of the countries, and resulted to different patterns. The treatment effect appeared to be more evident as a whole with not much difference between levels. A general decrease of the specific biodiversity with grazing pressure was found in all cases, except for the most biodiverse site (France). An increase in structural diversity, especially in the least biodiverse site (UK), for the relatively high impact grazing system was also noticed. The local within treatment variability was high. It is concluded that after the first grazing season, there is a clear change in vegetation diversity in all treatments over time but little evidence of the treatment effects.
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317. Effects of livestock exclusion on the ground flora and regeneration of an upland *Alnus glutinosa* woodland.

Latham, J. and Blackstock, T. H.

Forestry 71(3): 191-197. (1998)

NAL Call #: 99.8 F767; ISSN: 0015-752X

Descriptors: *Alnus glutinosa*/ *Fraxinus excelsior*/ livestock/ grazing intensity/ flora/ natural regeneration/ woodlands/

botanical composition/ sheep/ horses/ grasses/ predation/ seeds/ species diversity/ plant litter/ Bryopsida/ Wales
Abstract: Vegetation composition and tree regeneration were compared between grazing exclosures and unfenced areas of an hillside alder (*Alnus glutinosa*) woodland, at Coedydd Aber, North Wales. Sheep and ponies have had unrestricted access to the unfenced woodland throughout the 20 years since the exclosures were erected. The exclosures had a well developed field layer with significantly higher cover of plant litter, dead wood, bryophytes and woodland species; the unfenced woodland had a sparse field layer and significantly higher cover of bare soil, grasses and wet pasture species. These changes appear to be a consequence of the removal of both herbivory and physical disturbance caused by large herbivores. Tree regeneration from seed was virtually absent from the unfenced areas, and no alder regeneration was recorded in the woodland study plots. The exclosures contained high densities of young ash (*Fraxinus excelsior*), and it is possible that, in the long term, ash will replace alder as the dominant tree in these stands.
 This citation is from AGRICOLA.

318. Effects of management on plant production and nutrient cycling on two annual grassland sites.

Center, D. M.; Vaughn, C. E.; and Jones, M. B.
Hilgardia 57(1): 1-40. (1989)
 NAL Call #: 100 C12H; ISSN: 0073-2230
Descriptors: sheep grazing/ plant biomass/ growing season/ ecological energetics/ fertilization/ leaching/ nitrogen/ mineralization/ resource availability
Abstract: Nutrient (nitrogen, phosphorus, sulfur, potassium, and calcium) dynamics and primary productivity were compared in adjacent sheep-grazed and ungrazed and adjacent subclover-seeded and unseeded annual grassland ecosystems. Aboveground and belowground total plant biomass and nutrient concentrations were measured monthly for two years, and nutrient content of various ecosystem components determined. Nutrient budgets were also developed to compare the effects of the grazing and seeding management practices. Exclusion of sheep grazing had little effect on the system variables we measured. There were only slight differences between the grazed and ungrazed pastures in aboveground and belowground biomass production and nutrient uptake in either year. There were no substantive between-site differences in nutrient transfers. Subclover growth, accompanied by biennial P and S fertilization, resulted in very large increases in biomass production and much larger flows of all nutrients in both years. The largest nutrient fluxes on all sites were the transfers of mineralized nutrients through the soil available pool to live plants during the growing season. Most of this actively cycling nutrient supply was stored in standing dead material and litter, and was thus retained against leaching between growing seasons. The subsequent fate of these nutrients was then determined by new plant uptake and leaching demands, which showed much annual variation.

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319. Effects of management on species dynamics of Canadian aspen parkland pastures.

Waddington, J.; McCartney, D. H.; and Lefkovitch, L. P.
Journal of Range Management 52(1): 60-67. (1999)
 NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/1999/521/60-67_waddington.pdf

Descriptors: botanical composition/ vegetation/ pastures/ rain/ rotational grazing/ forbs/ *Bromus inermis*/ *Poa pratensis*/ *Festuca rubra*/ *Medicago sativa*/ Saskatchewan
Abstract: The effects of grazing, fertilizing, and seeding on persistence of herbaceous species was monitored by point quadrat about every second year from 1975 to 1989 in a low-fertility pasture in the aspen parkland vegetation zone of east-central Saskatchewan, Canada. Ground cover response to continuous grazing was contrasted with that of 4- and 6-paddock rotationally-grazed areas fertilized in the fall of every other year with 90 kg N, 45 kg P₂O₅, 10 kg S ha⁻¹. The original vegetation in 2 paddocks of the 6-paddock system was replaced with Russian wildrye (*Psathyrostachys juncea* (Fisch.) Nevski) in 1976, and in 1 of the other 4 paddocks in turn with smooth brome (*Bromus inermis* Leyss.)-alfalfa (*Medicago sativa* L.) in 1979 and 1981, crested wheatgrass (*Agropyron cristatum* (L.) Gaertn.) in 1983, and a meadow brome (*Bromus riparius* Rehm.)-alfalfa mix in 1985. Initially, smooth brome and creeping red fescue (*Festuca rubra* L.) dominated the vegetation with ground cover estimates of 10-20% and 40-60%, respectively. Alfalfa ground cover was less than 1%. With the changes in management, Kentucky bluegrass (*Poa pratensis* L.) replaced creeping red fescue. Alfalfa increased until 1980 and then declined to its original level, apparently in response to precipitation trends. Russian wildrye almost died out and was replaced by brome and Kentucky bluegrass. Reseeding with smooth brome-grass-alfalfa did not consistently increase brome ground cover beyond that obtained by rotational grazing and fertilization, and increased alfalfa only temporarily. Cultivation during the summer before spring seeding resulted in partial recovery of the old vegetation and invasion by Kentucky blue-grass. Total ground cover varied from year to year in response to spring precipitation. Forbs usually increased after reseeding, but declined to their original levels within 5 years.

This citation is from AGRICOLA.

320. Effects of nitrogen input and grazing on methane fluxes of extensively and intensively managed grasslands in the Netherlands.

Pol-van Dasselaar, A. van den; Beusichem, M. L. van; and Oenema, O.
Biology and Fertility of Soils 29(1): 24-30. (1999)
 NAL Call #: QH84.8.B46; ISSN: 0178-2762
Descriptors: range management/ grazing/ mowing/ soil amendments/ nitrogen fertilizers/ quantitative analysis/ nutrient uptake/ seasonal variation/ soil organic matter/ soil pH/ soil water content/ groundwater/ cattle manure/ application rate/ methane/ methane production/ Netherlands
Abstract: Generally, grasslands are considered as sinks for atmospheric CH₄, and N input as a factor which reduces CH₄ uptake by soils. We aimed to assess the short- and long-term effects of a wide range of N inputs, and of grazing versus mowing, on net CH₄ emissions of grasslands in the Netherlands. These grasslands are mostly intensively managed with a total N input via fertilisation and atmospheric deposition in the range of 300-500 kg N ha⁻¹ year⁻¹. Net CH₄ emissions were measured with vented, closed flux chambers at four contrasting sites, which were chosen to represent a range

of N inputs. There were no significant effects of grazing versus mowing, stocking density, and withholding N fertilisation for 3-9 years, on net CH₄ emissions. When the ground-water level was close to the soil surface, the injection of cattle slurry resulted in a significant net CH₄ production. The highest atmospheric CH₄ uptake was found at the site with the lowest N input and the lowest ground-water level, with an annual CH₄ uptake of 1.1 kg CH₄ ha⁻¹ year⁻¹. This is assumed to be the upper limit of CH₄ uptake by grasslands in the Netherlands. We conclude that grasslands in the Netherlands are a net sink of CH₄, with an estimated CH₄ uptake of 0.5 Gg CH₄ year⁻¹. At the current rates of total N input, the overall effect of N fertilisation on net CH₄ emissions from grasslands is thought to be small or negligible. This citation is from AGRICOLA.

321. Effects of November-April grazing pressure on hill country pastures: 1. Pasture structure and net accumulation rates.

Sheath, G. W. and Boom, R. C.
New Zealand Journal of Experimental Agriculture 13(4): 317-327. (1985)
 NAL Call #: S542.A1N45; ISSN: 0301-5521
 Descriptors: range management/ grazing/ grazing intensity/ botanical composition/ dry matter accumulation/ regeneration/ seasonal variation/ pastures/ New Zealand
 This citation is from AGRICOLA.

322. Effects of November-April grazing pressure on hill country pastures: 2. Pasture species composition.

Sheath, G. W. and Boom, R. C.
New Zealand Journal of Experimental Agriculture 13(4): 329-340. (1985)
 NAL Call #: S542.A1N45; ISSN: 0301-5521
 Descriptors: range management/ grazing/ botanical composition/ grasses/ legumes/ grazing intensity/ seasonal variation/ pastures/ New Zealand
 This citation is from AGRICOLA.

323. Effects of November-April grazing pressure on hill country pastures: 3. Interrelationship with soil and pasture variation.

Sheath, G. W. and Boom, R. C.
New Zealand Journal of Experimental Agriculture 13(4): 341-349. (1985)
 NAL Call #: S542.A1N45; ISSN: 0301-5521
 Descriptors: range management/ grazing/ soil water content/ soil temperature/ nutrient content/ botanical composition/ pastures/ New Zealand
 This citation is from AGRICOLA.

324. Effects of pasture species, fertiliser, and grazing management on the survival of gorse seedlings.

Hartley, M. J. and Thai, P. H.
New Zealand Journal of Experimental Agriculture 10(2): 193-196. (1982)
 NAL Call #: S542.A1N45; ISSN: 0301-5521
 Descriptors: New Zealand
 This citation is from AGRICOLA.

325. Effects of restoration with cattle grazing on plant species composition and richness of semi-natural grasslands.

Pykala, J.
Biodiversity and Conservation 12(11): 2211-2226. (Nov. 2003)
 NAL Call #: QH75.A1B562; ISSN: 0960-3115
 Descriptors: range management/ botanical composition/ species diversity/ biodiversity/ plant ecology/ Finland
 This citation is from AGRICOLA.

326. Effects of rotational grazing and set stocking on pasture production under sheep grazing.

Baars, J. A.; Jagusch, K. T.; Littler, R. A.; and Farquhar, P. A.
Proceedings Annual Conference Agronomy Society of New Zealand 14: 131-134. (1984)
 NAL Call #: S3.A37; ISSN: 0110-6589
 Descriptors: range management/ sheep feeding/ rotational grazing/ stocking rate/ tillering/ *Lolium perenne*/ *Trifolium repens*/ New Zealand
 This citation is from AGRICOLA.

327. The effects of sowing time, sowing technique and grazing on tall fescue (*Festuca arundinacea* Schreb.) establishment.

Charles, G. W.; Blair, G. J.; and Andrews, A. C.
Australian Journal of Experimental Agriculture 32(5): 627-632. (1992)
 NAL Call #: 23 Au792; ISSN: 0816-1089
 Descriptors: crop industry/ agriculture/ herbicide
 Abstract: The effects of sowing time (autumn and spring) and technique (conventional cultivation, inverted T direct drill, triple disc direct drill and aerial seeding), on the establishment of tall fescue into a weed infested pasture on the Northern Tablelands of New South Wales (Australia) were examined. A pre-sowing herbicide treatment was included in the 2 direct drilling treatments, and heavy pre-sowing grazing was used in the autumn sowing. The design used 38 plots of 0.12 ha, analyzed as 2 separate, complete block experiments, with some common treatments. Tall fescue establishment, 120 days after the autumn sowing, averaged 48 seedlings/m² on the inverted T treatment (16% establishment). Establishment was improved by 63%, to 78 seedlings/m², with herbicide and 46%, to 70 seedlings/m², by heavy grazing. These effects were additive, giving 105 seedlings/m² for the combined treatments. Only 52 seedlings/m² established on the triple disc treatment with heavy grazing and herbicide, while establishment on the cultivated seedbed was not different from the inverted T (93 seedlings/m²). There was no establishment after the aerial seeding at either sowing. Fescue establishment showed the same trends in the spring sowing, with 140 seedlings/m² on the inverted T treatment with pre-sowing herbicide, which was higher than the establishment of 107 seedlings/m² on the cultivated seedbed. The fescue yield, 18 months after the autumn sowing, was highest in the autumn sown, inverted T treatment with pre-sowing herbicide and heavy grazing (123 kg/ha). In the spring sowing, fescue was recorded only on the cultivated treatment (84 kg/ha) and on the inverted T treatment with pre-sowing herbicide (39 kg/ha). These results show that tall fescue can be re-established into weed dominated pastures on the Northern Tablelands with

direct drilling, in either autumn or spring, and that heavy, pre-sowing grazing and herbicide increase fescue establishment.

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328. Effects of summer irrigation and trampling in dairy pastures on soil physical properties and earthworm number and species composition.

Lobry De Bruyn, Lisa A. and Kingston, T. J.

Australian Journal of Agricultural Research 48(7): 1059-1079. (1997)

NAL Call #: 23 Au783; ISSN: 0004-9409

Descriptors: agriculture/ agronomy/ animal husbandry/ biobusiness/ dairy pasture/ earthworm number/ earthworm species composition/ female/ grazing/ soil physical properties/ soil science/ summer irrigation/ terrestrial ecology/ trampling

Abstract: In 1989 a replicated split-plot trial on a Krasnozem soil was established at Elliott Research Station (ERS) in the north-west of Tasmania, as well as 14 on-farm trials in newly irrigated pastures on 3 different soil types (Alluvial, Podzolic, Krasnozem) in the dairy districts of Scottsdale, Smithton, and Deloraine. There were 3 main treatments at ERS: irrigated before grazing, irrigated after grazing, and grazed and not irrigated. Part of each main plot was fenced to prevent trampling but still allowed grazing. Effects of summer irrigation and trampling by dairy cows were examined for pasture production, and soil chemical and structural properties. Summer irrigation at ERS and on-farm trials has led to a decline in soil structure indicated by slower ponded water infiltration rates on irrigated plots compared with the dryland plots. The decline in ponded water infiltration rates suggests a reduction in macroporosity, especially in the soil surface. However, other indicators for soil structural change in the top 100 mm-percentage water-stable aggregates (> 2.5 mm) and bulk density-revealed no significant variation between the irrigated and dryland paddocks. There were, however, higher water infiltration rates and lower bulk densities in the untrampled areas than the trampled areas at ERS. Pasture production at ERS was about 50% more with irrigation in each of the 2 years of the study. Data collected at ERS in autumn and spring on the numbers of Aporectodea caliginosa (Savigny) and Lumbricus rubellus (Hoffmeister) earthworms showed that they respond quite differently to irrigation. After 2 irrigation seasons, A. caliginosa numbers in irrigated plots dropped by over 50%, whereas in the dryland plots densities of this earthworm have remained around 390 earthworms/m². In contrast the densities of L. rubellus at ERS rose under irrigation practices, especially in the autumn-winter sampling period. Therefore, with the advent of summer irrigation at ERS, there was a shift in earthworm composition from a fauna dominated by A. caliginosa to a fauna with an increasing proportion of L. rubellus and a decreasing number of A. caliginosa. The typical dairy pasture in the on-farm trials recorded 2 main species, A. caliginosa (70%) and L. rubellus (30%). Total earthworm densities were highest in the north-west (Smithton) region of the State (293-351 earthworms/m²) regardless of soil type, and the lowest densities were recorded in the Alluvial soils of Deloraine (96 earthworms/m²). The north-west area also had the most diverse earthworm fauna, with 5 species recorded in one site: A. caliginosa, A. longa, Allolobophora chlorotica, L.

rubellus, and O. cyaneum. Summer irrigation effects after 2 seasons on earthworm composition and abundance on dairy farms caused no significant change in A. caliginosa numbers, but there was a 45% increase in the numbers of L. rubellus in irrigated treatments. L. rubellus was considerably more active over summer in irrigated paddocks (25 earthworms/m²) than in non-irrigated paddocks (7 earthworms/m²). In contrast the number of A. caliginosa recorded in dryland paddocks was not statistically different to the irrigated paddocks, but the A. caliginosa in dryland paddocks were mostly inactive 8-20 mm from the soil surface.

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329. Establishing tallgrass prairie on grazed permanent pasture in the Upper Midwest.

Jackson, Laura L.

Restoration Ecology 7(2): 127-138. (1999)

NAL Call #: QH541.15.R45R515; ISSN: 1061-2971

Descriptors: grazed permanent pasture/ restoration ecology/ tallgrass prairie establishment/ vegetation

Abstract: The goal of the study was to learn whether native prairie grasses and, eventually, a diverse mixture of native forbs could be incorporated in permanent pastures by means of rotational grazing by cattle. An experiment was established on a farm in northeastern Iowa on a pasture that had never been plowed but had been grazed since the 1880s. One treatment was protected from grazing to test for the presence of remnant vegetation. Andropogon gerardii, Sorghastrum nutans, Panicum virgatum, and Desmanthus illinoensis were introduced in plots first treated with glyphosate; seeds were either drilled (DR) or hand-broadcast and incorporated by controlled cattle trampling (BT). Seedling establishment and aboveground biomass were followed over 3 years. There was no evidence for remnant native plants on uplands, but seven species of native forbs and four native graminoids flowered in enclosures erected within waterways. D. illinoensis initially established up to 12 seedlings/m² but had disappeared from all but one plot by the third year. Variation in native grass establishment among replicate plots within treatments was very high, ranging initially from 0.2 to 9.9 plants/m². In August of the second year, native grasses made up only 8% of the available forage in DR plots and 1% of BT plots. One year later, however, native grasses made up 56% of the available forage in DR plots and 37% of BT plots, and these differences were significant ($p = 0.05$). A pilot study seeded in late winter (frost seeding) suggested that seeds spread after cattle trampling produced five times more seedlings (2.5/m²) than seeds spread before cattle trampling (0.5/m²). Frost seeding had advantages because it did not require herbicide for sod suppression or tractor access to the site. New plantings could be safely grazed in early spring and late fall, before and after most native grass growth, to offset the negative economic impact of protecting new plantings from burning during the growing season. But this practice precluded subsequent prescribed burning. I propose a strategy for incorporating native wildflowers into the pasture over time with minimum cost.

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330. Establishment of corn in rotation and alfalfa and rye: Influence of grazing, tillage, and herbicides.

Morris, Jennifer L.; Allen, Vivien G.; Vaughan, David H.; Luna, John M.; and Cochran, Michele A.

Agronomy Journal 90(6): 837-844. (1998)

NAL Call #: 4 AM34P; ISSN: 0002-1962

Descriptors: crop rotation: agronomic method/ discing: tillage method

Abstract: Integrating livestock into crop rotations offers alternatives for grazing and crop management. Grazing, tillage, and herbicides were evaluated in a randomized block design with four replications for transition from alfalfa (*Medicago sativa* L.) to corn (*Zea mays* L.). For the control (T1), alfalfa was overseeded with rye (*Secale cereale* L.) in October, and corn was no-till established in early May. For alternative treatments, alfalfa was grazed by cattle (*Bos taurus*) from July until October. Treatments were: T2, disking prior to rye planting, grazing rye for 12.5 d prior to corn planting, with dicamba (3,6-dichloro-2-methoxybenzoic acid) applied after corn planting; T3, no spring grazing, with glyphosate (N-(phosphonomethyl)glycine) applied before corn planting; T4, same as T3 plus grazing rye for 1.8 d in early spring; T5, autumn application of glyphosate to alfalfa before planting a rye-hairy vetch (*Vicia villosa* Roth) cover crop; and T6, autumn disking before planting rye-hairy vetch with no herbicides used. System T2 increased suppression of alfalfa and corn plant populations compared with shorter grazing periods. System T4 increased corn plant populations compared with no spring grazing (T3; 3.5 vs. 3.0 plants m⁻¹). Autumn disking (T6) generally provided less control of alfalfa than autumn application of glyphosate (T5). Applying glyphosate before corn planting (T3 and T4) improved corn populations and growth, compared with autumn glyphosate or disking (T5 and T6), and resulted in corn forage yield (23 Mg ha⁻¹) similar to conventional no-till establishment (T1; 22 Mg ha⁻¹). Herbicides completely killed alfalfa, but grazing alfalfa and rye reduced alfalfa persistence. Grazing could provide benefits to corn production systems while providing forage for cattle.

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331. Experimental determination of the effects of cattle stocking density and grazing period on forest regeneration on a subalpine wood pasture.

Mayer, Andrea C.; Estermann, Beda L.; Stoeckli, Veronika; and Kreuzer, Michael

Animal Research 54(3): 153-171. (2005)

NAL Call #: SF1 .A64; ISSN: 1627-3583

Descriptors: stocking density/ germination rate/ grazing period/ herbage quality/ subalpine wood pasture

Abstract: The influence of cattle stocking density and the length of the grazing period on the extent of tree damage on subalpine wood pastures was assessed. An experiment was carried out on four adjoining fields, grazed by zero, three, six and nine heifers. The fields were grazed until herbage resources were exploited. Spruce seeds were seeded, spruce saplings (*Picea abies* (L.) Karst. (average height of 14 cm) as well as young spruces, larches (*Larix decidua* Miller) and rowans (*Sorbus aucuparia* L.) of 42 cm height were planted. The experimental site was situated at 1900 m a. s. l.; 20% of the area was forest. Browsing and other damage on planted spruce saplings and young spruces, larches and rowans were recorded. The germination rate of spruce seeds was recorded and the

survival rate of the seedlings germinated was analysed.

The heifers spent around 30% of the time under the tree canopies, both for resting and grazing, instead of the expected 20% based on the relative forest cover. Since the herbage quality was found to be similar in the forest and on the open pasture and since there was no effect of stocking density on herbage intake and digestibility as assessed in the first week of the experiment, the effects on the trees were considered independent from herbage quality.

Grazing at high stocking densities enhanced the germination of spruce seedlings. Rowan was browsed most frequently, depending on stocking density and grazing period. Also larch was browsed frequently. With increasing grazing time, even spruces of 14 cm and 42 cm height were frequently browsed, but there was no clear relationship to stocking density. The observations showed that individual animals that have developed a specific preference for spruce needles may play a decisive role in the extent of browsing on spruce. In conclusion, guidelines for a sustainable use of subalpine wood pastures require restrictions either in stocking density or in the length of the grazing period or in both.

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332. An experimental study of the effects of sheep grazing on vegetation change in a species-poor grassland and the role of seedling recruitment into gaps.

Bullock, J. M.; Hill, B. Clear; Dale, M. P.; and Silvertown, J.

Journal of Applied Ecology 31(3): 493-507. (1994)

NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: dicotyledon/ fertility/ fertilizer application/ seasonality/ seed rain/ sheep grazing management/ species composition/ sterile loam

Abstract: 1. An experiment was set up in 1986 on a species-poor grassland in Oxfordshire to determine the effect of sheep grazing management on vegetation change after cessation of fertilizer applications. Three seasons of grazing (winter, spring and summer) were applied, each with two grazing intensities, in a 2 times 2 times 2 factorial design with two blocks in 16 paddocks. 2. Point quadrat surveys in 1990 showed that the grassland vegetation was dominated by perennial grasses and that the frequency distribution of species was highly skewed. Dicotyledonous species ('dicots') were extremely rare, having an overall frequency of only 0.43%. 3. The frequencies of eight of the 10 dominant grasses were significantly affected by grazing intensity although these effects depended on the grazing season, were species-specific and were generally small. 4. Intensive surveys of the dicots in 1990-91 discovered 40 species although most of these were rare. The dicots exhibited stronger and more consistent responses than the grasses. Their abundances being significantly increased by increased grazing in one or more grazing periods. Dicot species number was significantly increased by increased grazing intensity in all periods. 5. The potential was studied for seedling establishment in gaps to bring about vegetation change. Regular monitoring of the natural recruitment of seedlings into artificially created gaps was carried out in each paddock. Comparison between the species composition of seedlings emerging in gaps where the soil had been replaced with a sterile loam and that of gaps formed over the original soil showed no evidence of a persistent seed bank and that all seeds were probably derived from recent seed rain. 6. No species novel to the

vegetation emerged in the gaps and the species composition of seedlings in the gaps was significantly and positively correlated with that of the vegetation in a majority of the paddocks. However, some species differences in the contribution to the seed rain were noted. In particular, the dicots were overrepresented. The number of grass seedlings in the gaps was decreased by increased summer grazing. Therefore, grazing had complex effects on vegetation change. Change is likely to be slow, especially while fertility is high, because of the small responses of the grasses to the grazing treatments and the lack of input of novel species from a seed bank. However, the dicots may continue to increase under increased grazing because of their high seed production and the effects of grazing in increasing cap frequencies.

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333. Factors affecting the productivity of irrigated annual pastures: Defoliation by dairy cows.

Stockdale, C. R.

Australian Journal of Experimental Agriculture 26(3): 305-314. (1986)

NAL Call #: 23 Au792; ISSN: 0816-1089

Descriptors: Trifolium subterraneum/ grass/ weed/ botanical composition/ grazing intensity/ regeneration/ Victoria/ Australia

Abstract: The influence of grazing intensity on the productivity of an irrigated annual pasture was studied for 3 years in northern Victoria [Australia] Lax-, medium- and hard-grazing intensities were described by post-grazing pasture heights of 7.2, 5.2 and 3.0 cm, respectively. Also, one instance of variable grazing frequency occurred, in winter of year 1. Hard-grazed plots produced 13 and 17% less herbage in years 1 and 2, respectively, than did lax- and medium-grazed plots, which produced similar amounts of herbage. When the interval between grazings was extended, the variation in productivity was reversed; lax grazing resulted in 9% less total production than heavier grazing. In years 1 and 2, there was little effect of grazing treatment on botanical composition until spring, at which time there was a marked reduction in the amount of subterranean clover (*Trifolium subterraneum*) in the hard-grazed plots, with a concomitant increase in grass content. There were no significant effects of grazing intensity on the amounts of weeds in either year. However, in year 3, weeds were important contributors to pasture production early in the season. This, together with reduced clover seed reserves and increased incidence of disease in subterranean clover with hard grazing, suggests that the long-term regenerating ability of an annual pasture may be impaired if severely grazed at regular intervals.

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334. Fall-grazing management effects on production and persistence of tall fescue, perennial ryegrass, and prairie grass.

Hall, M. H.; Levan, P. J.; Cash, E. H.; Harpster, H. W.; and Fales, S. L.

Journal of Production Agriculture 11(4): 487-491. (1998)

NAL Call #: S539.5.J68; ISSN: 0890-8524

Descriptors: fall grazing management: agronomic method
Abstract: Extending the grazing season for livestock into late fall or early winter can substantially reduce production costs compared with ending the grazing season in October. Most of the published research about fall or early-winter

production of grasses was derived from simulated grazing studies (i.e, frequent mechanical harvesting) and may not be indicative of results obtained with actual grazing. The objective of this research was to evaluate the whole-year production of perennial ryegrass (*Lolium perenne* L.), prairie grass (*Bromus unioloides* (Willd.) H.B.K.; syn. *B. willdenowii* Kunth), and tall fescue (*Festuca arundinacea* Schreb.) under different fall grazing management schemes. In 1994, 1995, and 1996 fall grazing treatments consisting of: 1. stockpile (accumulation forage in the field after the August grazing and then grazing once in November); 2. lax (grazing once in September and then not grazing again until spring); and 3. intensive (continue grazing on approximately 30 d schedule through November) were imposed on established stands of 'Barcel' tall fescue, 'Citadel' perennial ryegrass, and 'Grasslands Matua' prairie grass at the Haller Livestock and Forage Research Center near State College, PA. Perennial ryegrass and tall fescue responded similarly within and across grazing treatments. Total season yield (averaged 7490 lb/acre per year) and persistence of perennial ryegrass were equal to tall fescue regardless of the fall grazing management. During the first year after implementing the grazing treatments, prairie grass survival was only 15% in the stockpile treatment and by the second year, prairie grass had not survived in any of the grazing treatments. Fall grazing and stockpiling tall fescue or perennial ryegrass lengthened the grazing season. However, this increased fall production resulted in 15% less forage production the following spring than pastures not grazed in the fall. A combination of lax, intensive, and stockpile grazing in separate paddocks may be most desirable. Intensive and stockpile grazing would allow continued grazing into the fall and early winter, respectively, and lax grazing would permit early spring grazing while the fall-grazed pastures recover.

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335. Forages and pasture management: Sequential grazing of cool- and warm-season pastures.

Moore, K. J.; White, T. A.; Hintz, R. L.; Patrick, P. K.; and Brummer, E. C.

Agronomy Journal 96(4): 1103-1111. (2004)

NAL Call #: 4 AM34P; ISSN: 0002-1962

Descriptors: cattle grazing sequences/ pasture: management, nutritive value, productivity, sequence/ stocking rate

Abstract: Pasture productivity in Iowa is often limited by low productivity of cool-season grasses during summer. Our overall objectives were to (i) evaluate the impact of legumes on the productivity and nutritive value of cool-season pastures, (ii) evaluate warm-season grasses for summer grazing, and (iii) determine the effects of pasture sequence on the productivity of season-long grazing systems. Cool-season pastures consisted of smooth bromegrass (*Bromus inermis* Leyss.) alone or in mixture with birdsfoot trefoil (*Lotus corniculatus* L.), alfalfa (*Medicago sativa* L.), or kura clover (*Trifolium ambiguum* M. Bieb.). Warm-season pastures were monocultures of big bluestem (*Andropogon gerardii* Vitman) or switchgrass (*Panicum virgatum* L.). Kura clover was the only legume that persisted well over time, and because of this, pastures interseeded with kura clover maintained a higher nutritive value than either those interseeded with alfalfa or birdsfoot trefoil. This resulted in higher total liveweight gains for cattle grazing sequences that included pastures interseeded with

kura clover. In general, rotating cattle to warm-season grass pastures during summer was less advantageous than having them remain on cool-season pastures at a lower stocking rate because warm-season pasture nutritive value was lower and declined more rapidly. However, despite lower nutritive value and consequently animal performance, sequences with warm-season grass pastures did perform well under some conditions and may be a desirable alternative under some circumstances. Having a warm-season grass pasture in the grazing sequence provides an opportunity to relieve cool-season pastures when growth conditions become limiting and introduces flexibility into the management system.

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336. Grazed grassland management and nitrogen losses: An overview.

Jarvis, S. C.

Aspects of Applied Biology 30: 207-214. (1992)

NAL Call #: QH301.A76; ISSN: 0265-1491

Descriptors: grasslands/ leaching/ mineralization/ nitrates/ biogeochemical cycles/ nitrogen fertilizers/ nitrogen/ grazing

This citation is from AGRICOLA.

337. Grazing as a management tool in the restoration of species-rich grasslands.

Bakker, J. P.

Proceedings of the Koninklijke Nederlandse Akademie van Wetenschappen Series C Biological and Medical Sciences 90(4): 403-430. (1987)

NAL Call #: 442.9 AM8; ISSN: 0023-3374

Descriptors: livestock/ community diversity/ soil salination/ nature conservation

Abstract: The possibilities of restoration of species-poor abandoned and fertilized grasslands to communities with a higher diversity are discussed. The management practices grazing with domestic live-stock and hay-making were compared. Although species diversity increased with both practices, more species indicating nutrient poor soil conditions in inland and more species indicating salt conditions in coastal areas appeared with grazing than with hay-making. The structure of the canopy played a more important part than impoverishing or salination of the soil. The community diversity particularly increased with grazing due to the emergence of a mosaic of heavily grazed areas and lightly grazed patches.

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338. Grazing intensity effects on weed populations in annual and perennial pasture systems.

Harker, K. Neil; Baron, Vern S.; Chanasyk, David S.; Naeth, M. Anne; and Stevenson, F. Craig

Weed Science 48(2): 231-238. (2000)

NAL Call #: 79.8 W41; ISSN: 0043-1745

Descriptors: pasture system weed populations: grazing intensity

Abstract: Few studies report animal grazing effects on weed populations. A study was conducted to assess weed populations in annual and perennial forage grasses grazed at various intensities by cattle over a 4-yr period. The perennial forages were *Bromus inermis* and *Bromus riparius*, and the annual forages were winter *Triticosecale* and a mixture of *Hordeum vulgare* and winter *Triticosecale*. With few exceptions, results from the two annual pastures could be adequately described as a group, as could the

results from the two perennial pastures. The two most prevalent weed species were *Capsella bursa-pastoris* and *Taraxacum officinale*; other species encountered over the course of the study were analyzed as a group. Tillage (seedbed preparation) in the annual system supported a proliferation of annual weeds in the spring. In the perennial pasture system, a lack of tillage and spring MCPA allowed *T. officinale* to increase as the study progressed, especially at the highest grazing intensity. In the perennial pastures, each unit increase in grazing intensity led to 51 more *C. bursa-pastoris* m⁻² and 4 more *T. officinale* m⁻². At lower levels of grazing intensity, *C. bursa-pastoris* and other species were most abundant in the annual pastures. Weed population shifts in response to grazing pressure in the annual pasture systems were restricted because of annual tillage and MCPA. Therefore, pasture managers may subject annual pastures to heavy grazing pressure with less negative weed population consequences than perennial pastures where herbicides are not applied.

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339. Grazing intensity impacts on pasture carbon and nitrogen flow.

Baron, V. S.; Mapfumo, E.; Dick, A. C.; Naeth, M. A.; Okine, E. K.; and Chanasyk, D. S.

Journal of Range Management 55(6): 535-541. (2002)

NAL Call #: 60.18 J82; ISSN: 0022-409X

Descriptors: range management/ grazing intensity/ *Bromus riparius*/ beef cattle/ pastures/ leaf area index/ in vitro digestibility/ forage/ biogeochemical cycles/ urine/ sward/ plant litter/ Alberta

Abstract: There is little information on the impact of grazing intensity on productivity and sustainability of intensively managed pastures in the humid, short-season parkland of the Canadian prairies. Our hypothesis was that above-ground productivity of dry matter, carbon, nitrogen, and in vitro digestible organic matter would be reduced proportionately with increasing grazing intensity. The study was conducted on a Typical Haplustoll at Lacombe, Alberta. Paddocks of meadow brome grass (*Bromus riparius* Rhem.), replicated 4 times, were subjected to heavy, medium and light grazing intensities. Measurements and analyses were carried out for 3 years. Yields of dry matter, carbon, nitrogen, and in vitro digestible organic matter before and after grazing were determined and seasonal pools of above ground production, disappearance and residual were calculated. Concentrations of acid and neutral detergent fiber and lignin were also determined before and after grazing. Increasing grazing intensity tended to increase nitrogen and decrease fiber concentrations for available and residual forage. Heavy and medium grazing intensities produced 83 and 90% as much above ground dry matter and 87 and 90% above ground carbon as the light intensity. All disappearance pools were similar among grazing intensities except in vitro digestible organic matter, where heavy was 116% of light. Heavy grazing reduced the contribution of vegetative dry matter, in vitro digestible organic matter, carbon and nitrogen to the residual to 41, 50, 36, and 52% of that for light grazing. Adding estimated fecal-carbon to the residual significantly increased total residual carbon. Estimated fecal-carbon represented 68, 51, and 42% of all carbon inputs to litter for heavy, medium and light grazing, respectively. Grazing

intensity did not affect estimated pools of excreted nitrogen, but increased estimated percent of nitrogen excreted as urine.

This citation is from AGRICOLA.

340. The grazing management of sheep on grass-white clover permanent pasture.

Laws, J. A. and Newton, J. E.

Irish Journal of Agricultural and Food Research 31(2): 143-156. (1992)

NAL Call #: S539.5.I74; ISSN: 0791-6833

Descriptors: feed quality/ grazing management/ livestock production/ productivity/ seasonality

Abstract: A 2-year experiment was designed to examine the effects of grazing management (rotational or continuous) and number of paddocks (3 or 6) on a lowland sheep system using a permanent grass sward into which white clover had been sown. No nitrogen fertilizer was applied. There were two rotational treatments; one was based on a fixed number of grazing days per paddock (RF) whilst on the other the sheep were moved when residual sward height fell below 5 cm (RH). A third treatment involved continuous grazing until weaning followed by rotational grazing based on a fixed number of grazing days (CRF). There was significantly more clover on RH than on RF or CRF and on 6- than on 3-paddock systems. During the course of the experiment ryegrass increased and bare ground decreased on all three grazing treatments. Lambs on RH grew faster than those on RF or CRF from birth to sale and particularly from weaning to sale, and the lambs on the 6-paddock system grew significantly faster than those on the 3-paddock system. The percentage of lambs finished and sold on RH was 90% in the first year and 88% in the second. On the 6-paddock system 89% and 95% of lambs were sold compared with 66% and 58% on the 3-paddock system. Ewe weight was also heaviest on RH and on the 6-paddock system. Other measures of productivity, the quantity of silage made and the number of grazing days in the autumn were also highest, and the amount of supplementary feed was lowest on RH-6 treatment combination, indicating advantages from this more flexible method of grazing management.

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341. Grazing management of temperate pastures: Literature reviews and grazing guidelines for major species.

Fitzgerald, R. D. and Lodge, G. M.

Sydney: NSW Agriculture; 47, 1997. NSW Agriculture Technical Bulletin.

Notes: ISSN: 1039-2602

NAL Call #: S383.A3N44 no.47

Descriptors: agronomy/ cocksfoot/ forage crop/ grazing management/ guidelines/ native species/ phalaris/ temperate pastures

Abstract: Grazing management studies within the Temperate Pasture Sustainability Key Program located at 22 sites throughout south-eastern Australia are described. Experimental treatments on these sites commenced in spring 1993. Plant production and persistence data collected until spring 1995, were presented at a workshop in Launceston in October 1995. From these data, published information and anecdotal evidence, seasonal grazing management guidelines were proposed for pastures dominated by perennial ryegrass, winter active phalaris, tall

fescue, cocksfoot and Danthonia (wallaby grass) - Microlaena (weeping grass) and Aristida (wiregrass) native pastures. These guidelines cover not only the perennial grass component of the pastures, but also management guides for legumes, annual grasses and weeds. Similar grazing management guidelines were also prepared for controlling broadleaf weeds in pastures. These grazing plans are the first such guidelines to be devised for perennial grass-based pastures in the temperate regions of Australia. To support these guidelines literature reviews on the effects of grazing on perennial ryegrass, phalaris, tall fescue, cocksfoot, native grass-based pastures, white clover, subterranean clover annual grass weeds, perennial grass weeds and broadleaf weeds are also presented.

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342. Grazing management of wet pastures in an Environmentally Sensitive Area.

Mallon, E. D.; McAdam, J. H.; and Montgomery, W. I. In: Vegetation management in forestry, amenity and conservation areas: Managing for multiple objectives; Series: Aspects of Applied Biology 44.

Warwick: Association of Applied Biologists, 1996; pp. 245-250.

Notes: ISSN: 0265-1491

NAL Call #: QH301.A76 no.44

Descriptors: natural resource management/ wildlife management

This citation is from AGRICOLA.

343. Grazing methods and stocking rates for direct-seeded alfalfa pastures: I. Plant productivity and animal performance.

Schlegel, M. L.; Wachenheim, C. J.; Benson, M. E.; Black, J. R.; Moline, W. J.; Ritchie, H. D.; Schwab, G. D.; and Rust, S. R.

Journal of Animal Science 78(8): 2192-2201. (2000)

NAL Call #: 49 J82; ISSN: 0021-8812

Descriptors: beef cattle/ steers/ Medicago sativa/ rotational grazing/ duration/ stocking rate/ forage/ biomass/ liveweight gain/ feedlots/ finishing

Abstract: A 4-yr study was conducted to determine the effects of two grazing methods (GM) at two stocking rates (SR) on alfalfa pasture plant productivity and animal performance and to ascertain the effect of grazing systems on subsequent performance of steers fed a high-concentrate diet. Eight pasture plots (.76 ha) were seeded in 1988 with alfalfa (*Medicago sativa* L. var. WL225) and divided into two blocks of four pastures each. Grazing methods consisted of a traditional four-paddock or an intensive 13-paddock system. Pastures were managed to allow a 36-d rest period with an average grazing season of 110 d. The low and high SR were 5.9 vs 11.7, 5.3 vs 10.5, 5.3 vs 7.9, and 5.3 vs 7.9 steers/ha for years 1989 to 1992, respectively. Following the grazing season, steers were placed in a feedlot and fed a high-concentrate diet (81% high-moisture corn, 14% corn silage, 5% protein-mineral supplement) for an average of 211 d. There was no effect of GM on herbage mass, pasture phase ADG, or live weight gain/hectare. Increasing the number of paddocks was beneficial when herbage mass was limited and stocking rate was above 7.9 steers/ha. Increasing SR above 7.9 steers/ha decreased herbage mass and pasture-phase ADG. As for-age allowance increased, pasture-phase ADG increased quadratically ($R^2 = .82$, $P < .001$), reached a

plateau, and then decreased. Previous grazing system did not influence the performance of steers in the feedlot or their carcass characteristics. Optimum SR is dependent on herbage mass produced.
This citation is from AGRICOLA.

344. Grazing methods and stocking rates for direct-seeded alfalfa pastures: II. Pasture quality and diet selection.

Schlegel, M. L.; Wachenheim, C. J.; Benson, M. E.; Ames, N. K.; and Rust, S. R.
Journal of Animal Science 78(8): 2202-2208. (2000)
NAL Call #: 49 J82; ISSN: 0021-8812
Descriptors: beef cattle/ rotational grazing/ stocking rate/ Medicago sativa/ canopy/ protein content/ organic matter/ in vitro digestibility/ digesta/ nutritive value
Abstract: A 2-yr study was conducted to determine the effects of two grazing methods (GM) and two stocking rates (SR) on alfalfa (*Medicago sativa* L. var. WL225) pasture quality and diet selection by Holstein steers. Eight pasture plots (.76 ha) were seeded in 1988 and divided into two blocks of four pastures each. Pastures were managed to allow a 36-d rest period with an average grazing season of 105 d. Before steers entered the next paddock, canopy heights (CH) of alfalfa plants were determined and pasture-forage samples were collected. Forage samples were analyzed for DM, OM, CP, and in vitro OM digestibility (IVOMD). At 12-d intervals beginning with the second grazing cycle, extrusa samples were collected from steers with esophageal fistulas. Extrusa samples were frozen, freeze-dried, and analyzed for OM, CP, IVOMD, in situ ruminal DM degradation, and ruminal undegradable protein. There were no effects of GM on alfalfa CH or pasture DM, OM, CP, and IVOMD. Increasing the SR increased pasture CP content in both years and increased DM, OM, and IVOMD in the 2nd yr. There was no effect of GM or SR on the quality of forage selected by esophageally fistulated steers. Esophageally fistulated steers selected forage that had greater OM, CP, and IVOMD than the average nutrient content of the forage. Although forage quality was greater when stocking rates were increased, the quantity of forage available per animal may have limited gains.
This citation is from AGRICOLA.

345. Grazing of lowland heath in England: Management methods and their effects on heathland vegetation.

Bullock, James M. and Pakeman, Robin J.
Biological Conservation 79(1): 1-13. (1997)
NAL Call #: S900.B5; ISSN: 0006-3207
Descriptors: conservation/ grazer/ grazing/ heathland vegetation/ lowland heath/ management objectives/ succession
Abstract: The disappearance of grazing from much of British lowland heathland over the last century is thought to be a major contributory factor in the loss of heath vegetation by allowing succession towards woodland. The reintroduction of grazing is hindered by the small amount of available information on grazing management methods or on the responses of lowland heath vegetation to grazing. We review a range of grazing management methods (different grazing animals, stocking rates and combination with burning or cutting), and their effects on vegetation in a number of different lowland heath types (dry, humid and wet heath, and mire) distributed across southern England. The introduction of grazing or higher stocking rates

generally increased plant species richness, and the cover of grasses, forbs, bryophytes and lichens and bare ground while reducing litter depth and the cover of dwarf shrubs and scrub species. However, precise effects on species composition varied widely between sites and grazing managements. The desirability of each of these effects is discussed in relation to the need to specify management objectives.

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346. Grazing sheep and cattle together or separately: Effect on soils and plants.

Abaye, A. O.; Allen, V. G.; and Fontenot, J. P.
Agronomy Journal 89(3): 380-386. (1997)
NAL Call #: 4 AM34P; ISSN: 0002-1962
Descriptors: grazing/ botanical composition/ bulk density/ soil density/ mixed grazing/ grazing systems/ grasslands/ sown grasslands
Abstract: Angus cows (*Bos taurus*) with calves and ewes (*Ovis aries*) (1/2 Dorset, 1/4 Finn, 1/4 Rambouillet crossbred) with lambs grazed Kentucky bluegrass-white clover (*Poa pratensis*-*Trifolium repens*) pastures from spring until autumn in a study of the effects on soils and plants of grazing cattle and sheep together and separately. The experiment was a randomized block design with three replications conducted during 1988-90 at Middleburg, Virginia. There were 6 cow-calf pairs per replication of cattle alone and 6 ewes with 11 lambs per replication of sheep alone. For the mixed-grazed pastures, there were 6 cows plus 6 ewes, each with their respective offspring, per replication. Grazing sheep alone increased soil bulk density (1.47 vs. 1.38 g cm⁻³), extractable soil P (140 vs. 80 kg ha⁻¹), and percentage bluegrass (36 vs. 25%), but decreased percentage white clover (3 vs. 10%) compared with grazing cattle alone. Grazing sheep and cattle together resulted in soil bulk density and extractable soil P of 1.45 g cm⁻³ and 115 kg ha⁻¹, respectively. Grazing sheep and cattle together resulted in a higher B horizon soil pH (6.7 vs. 6.4 and 6.5) and percentage organic matter (1.9 vs. 1.5 and 1.7) than where cattle or sheep grazed alone, respectively. Percentage bluegrass and white clover present in the sward where both animal species grazed was 37 and 5%, and there were fewer forbs (12%; $P < 0.08$) than when cattle or sheep grazed alone (18 and 15%, respectively). It is concluded that grazing both animal species together appeared to have beneficial effects on several botanical composition and soil characteristics compared with grazing cattle and sheep in separate pastures.
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347. Grazing system and stocking rate effects on the productivity, botanical composition and soil surface characteristics of alfalfa-grass pastures.

Popp, J. D.; McCaughey, W. P.; and Cohen, R. D. H.
Canadian Journal of Animal Science 77(4): 669-676. (1997)
NAL Call #: 41.8 C163; ISSN: 0008-3984
Descriptors: alfalfa grass pasture/ animal performance/ continuous grazing system/ rotational grazing system/ soil surface characteristics/ stocking rate/ weight gain
Abstract: A 4-yr experiment was conducted (1991 to 1994) near Brandon, MB, to determine the effects of grazing system (continuous and rotational) and stocking rate (light (1.1 steers ha⁻¹); heavy (2.2 steers ha⁻¹)) on the productivity, botanical composition and soil surface characteristics of an alfalfa (*Medicago sativa* L.;

approximately 70%), meadow brome grass (*Bromus biebersteinii* Roem and Schult.; 25%) and Russian wild ryegrass (*Psathyrostachys juncea* (Fisch.) Nevski; 5%) pasture. Grazing season length was shorter ($P < 0.05$) for cattle in continuously compared with rotationally stocked pastures in 1991, while in 1993 and 1994 it was shortest ($P < 0.05$) in heavily stocked continuously grazed pastures. Carrying capacity (steer days ha⁻¹) was greater ($P < 0.05$) in heavily stocked rotationally grazed pastures compared with other treatments in 1991, 1993 and 1994. In 1992, it was greater ($P < 0.05$) in heavy than light stocking rate treatments for both rotationally and continuously grazed pastures. Cattle usually gained more ($P < 0.05$) per day (kg d⁻¹) and during the season (kg hd⁻¹) at light than at heavy stocking rates, while total liveweight production (kg ha⁻¹) was greater ($P < 0.05$) at heavy than at light stocking rates. Forage production and disappearance did not differ ($P > 0.05$) within grazing systems and stocking rates from 1991 to 1993, but in 1994, production and disappearance were greater ($P < 0.05$) at heavy than at light stocking rates. Mean seasonal herbage mass available and carry-over were greater ($P < 0.05$) in lightly stocked pastures than heavily stocked pastures from 1991 to 1994. After the first year of grazing, the proportion of alfalfa increased ($P < 0.05$), while grasses declined ($P < 0.05$) within all grazing treatments. In subsequent years, a trend was observed, where alfalfa declined and grasses increased in all pastures, except those stocked heavily and grazed continuously, which by 1994 had the greatest ($P < 0.05$) percentage of alfalfa. As years progressed, increases ($P < 0.05$) in basal cover concurrent with declines in bare ground were recorded on all grazing treatments, while litter cover often did not differ ($P > 0.05$) within either grazing system or stocking rate, except in 1992, when basal cover was lowest ($P < 0.05$), while litter cover was greatest ($P < 0.05$) on lightly stocked continuously grazed pastures compared with other treatments. Stocking rates were a key factor to optimizing individual animal performance and/or gain per hectare on alfalfa grass pastures, however differences in the effect of continuous and rotational stocking on pasture productivity were minimal.

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348. Herbage and animal production responses to fertilizer nitrogen in perennial ryegrass swards: Continuous grazing and cutting.

Deenen, P. J. A. G. and Lantinga, E. A.

Netherlands Journal of Agricultural Science 41(3): 179-203. (1993)

NAL Call #: 12 N3892; ISSN: 0028-2928

Descriptors: tiller production

Abstract: The effects of fertilizer nitrogen (N) application on herbage intake and animal performance under a continuous grazing management with dairy cows, and on herbage accumulation under a weekly and an approximately 4-weekly cutting regime have been studied in the period 1986-1988 in reseeded perennial ryegrass on a silty loam soil in Oostelijk Flevoland. Annual fertilizer rates of N varied from 250 to 700 kg ha⁻¹ under grazing and from 0 to 700 kg ha⁻¹ under cutting. At an assumed marginal profitability of 7.5 kVEM per kg N applied the optimum N application rate was on average 511 and 308 kg ha⁻¹ yr⁻¹ for 4-weekly cutting and continuous grazing, respectively (1 kVEM = 6.9 MJ Net Energy for lactation). However, especially under grazing, there was a great variation in response to N

between years which could be related to soil N availability, length of the growing season and sward quality.

Throughout the experimental period the mean tiller density in the grazed swards was hardly affected by the level of N application. However, there were temporary differences in openness of the sward which increased with the level of N application, leading to a loss of productivity as a result of impeded N uptake. Herbage N was poorly converted into animal products. The average efficiency of use of ingested N at a fertilizer level of 250 kg N ha⁻¹ yr⁻¹ was 23%. Higher rates of fertilizer N effected a slight decrease in fertilizer N use efficiency (19% at 700 kg N ha⁻¹ yr⁻¹) but a steep rise in the calculated amount of N excreted per ha.

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349. Herbage and animal production responses to fertilizer nitrogen in perennial ryegrass swards: Rotational grazing and cutting.

Lantinga, E. A.; Deenen, P. J. A. G.; and Van Keulen, H. *Netherlands Journal of Agricultural Science* 47(3-4): 243-261. (1999)

NAL Call #: 12 N3892; ISSN: 0028-2928

Descriptors: forage cutting; harvesting method/ rotational grazing; miscellaneous method

Abstract: The yield response of grass swards to fertilizer nitrogen (N) differs under cutting and grazing, as grazing cattle exert positive and negative effects on pasture production, with varying negative effects on different soil types. Nevertheless, current N fertilization recommendations in the Netherlands are based mainly on economic cost-benefit analyses of long-term cutting trials in small plots. To contribute to formulation of improved N fertilizer recommendations for grassland, experiments were carried out on two soil types and under different management regimes. The effect of fertilizer N application on grassland production and sward quality in perennial ryegrass swards was studied during a number of consecutive years under both rotational grazing and 4-weekly cutting. Experiment 1 was performed with dairy cows on a loam soil at 250 and 550 kg fertilizer N ha⁻¹ yr⁻¹. Experiment 2 was performed with beef cattle on a sand soil and fertilizer rates varying from 250 to 700 kg N ha⁻¹ yr⁻¹ under grazing and from 0 to 700 kg N ha⁻¹ yr⁻¹ under cutting. The results indicate that on loam, N had no effect on sward quality. In the second experimental year, total herbage yield under grazing was almost 10% higher than under cutting at 250 kg N ha⁻¹ yr⁻¹ due to recycling of N, whereas at 550 kg N ha⁻¹ yr⁻¹ the yield under grazing and cutting was the same. On sand, the economically optimum fertilizer application rate was on average 430 kg N ha⁻¹ yr⁻¹ for 4-weekly cutting. Under grazing and at whole system level (integrated grazing and mowing for silage), the optimum rate was below 250 kg N ha⁻¹ yr⁻¹. Under grazing on the sand soil, N aggravated sward deterioration due to treading, poaching and especially urine scorching. This was reflected in an increased absence frequency of rooted perennial ryegrass tillers in quadrats with an area of 1 dm² at increasing fertilizer N application rates. It is concluded that current fertilizer N recommendations for grassland can be further refined by taking into account the positive and negative effects of grazing cattle, in dependence of soil type and level of N supply.

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350. Herbage intake and N excretion by sheep grazing monocultures or a mixture of grass and white clover.

Orr, R. J.; Penning, P. D.; Parsons, A. J.; and Champion, R. A.

Grass and Forage Science 50(1): 31-40. (1995)

NAL Call #: 60.19 B773; ISSN: 0142-5242

Descriptors: fecal nitrogen/ grass swards/ management systems/ nitrogen fertilizer/ organic matter/ urinary nitrogen
Abstract: In 1988 and 1989, swards of grass (G0), white clover (C0) and grass/white clover (GC0) receiving no N fertilizer, and a grass sward supplied with 420 kg N ha⁻¹ (G420), were grazed by non-lactating sheep to maintain a sward surface height of 6 cm. Herbage organic matter (OM) intakes averaged between 1200 and 1700 g OM ewe⁻¹ d⁻¹. For treatments G0, C0, GC0 and G420 respectively, the ewes' liveweight gain was 102, 112, 100 and 110 g d⁻¹ and changes in body condition scores were +0.28, +0.52, +0.36 and +0.44 units season⁻¹. However, the effect of treatment was not significant for either variable. There were similar levels of output of faecal N ewe⁻¹ but significantly more urinary N ewe⁻¹ was excreted on treatments C0 and G420, where the concentrations of N in herbage laminae were also higher. For example, in 1989, total daily N excreted was 39.7, 64.4, 44.0 and 63.3 g N ewe⁻¹ for G0, C0, GC0 and G420 respectively. Taking into account the mean daily stocking rates, which were 19.4, 26.6, 27.2 and 36.5 ewe ha⁻¹, the total faeces and urine returns over the season were 161, 358, 249 and 484 kg N ha⁻¹ for each treatment respectively. The herbage OM intakes ewes⁻¹ d⁻¹ measured in September and October were similar for C0 and G420, and so the intake of herbage OM ha⁻¹ d⁻¹ was related to stocking rate, i. e. the estimated herbage intake ha⁻¹ over the growing season for the white clover monoculture was 73% of that for N-fertilized grass. Excretal nitrogen returns to the pasture from grazed mono-cultures of Clover were high, and similar to those from a grass sward receiving 420 kg fertilizer N ha⁻¹. Consequently potential losses of N to the environment are high under these management systems.

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351. How do severity and frequency of grazing affect sward characteristics and the choices of sheep during the grazing season?

Garcia, F.; Carrere, P.; Soussana, J. F.; and Baumont, R.

Grass and Forage Science 58(2): 138-150. (June 2003)

NAL Call #: 60.19 B773; ISSN: 0142-5242

Descriptors: sheep/ grazing intensity/ rotational grazing/ foraging/ feeding preferences/ forage quality/ seasonal variation/ sward/ maturity stage/ regrowth/ height/ biomass/ digestibility/ neutral detergent fiber/ protein content/ crude protein/ grazing management/ pasture management/ France

Abstract: The effect of grazing frequency and severity on sward characteristics and preferences by sheep was investigated from April to September. Two levels of grazing severity were imposed by varying the numbers of ewes grazing 200 m² plots for 24 h: four (S, severe) or two (L, lax) ewes. Grazing frequency was either 1 d week⁻¹ (F, frequent) or 1 d every 2 weeks (I, infrequent). By combining frequency and severity, four treatments were obtained: SF, LF, SI and LI. The six binary combinations (SF/LF, SF/SI, SF/LI, LF/SI, LF/LI and SI/LI) were studied in preference tests. Treatments LF, SI and LI were characterized by a high sward surface height, biomass and amount of

reproductive green tissues relative to treatment SF.

Herbage quality was not different between the grazing treatments between April and July. In September, after a 6-week period of regrowth, herbage quality was significantly higher for the SF treatment than the other treatments. The sheep preferred the swards grazed at a low frequency between April and July, and then changed their preference in favour of the sward with higher quality herbage (treatment SF). The relative abundance of green laminae and the relative digestibility of the swards helped to explain the preferences observed. For a low grazing pressure at the spatio-temporal scale studied, sheep should graze swards at a relatively low frequency but at a high severity of grazing rather than the reverse.

This citation is from AGRICOLA.

352. Impact of beef cattle grazing systems on treading damage and forage supply.

Sheath, G. W. and Boom, C. J.

Proceedings of the New Zealand Grassland Association 59: 87-92. (1997)

NAL Call #: 60.19 N48; ISSN: 0369-3902

Descriptors: treading/ grasslands/ permanent grasslands/ grazing/ controlled grazing/ guidelines/ steers/ liveweight/ grassland management/ environmental degradation/ soil/ beef production

Abstract: Levels of treading damage (poaching) were measured for a range of cattle feeding regimes and grazing managements which were compared during winter and spring in New Zealand. The paddock- and systems-based results provided a context within which component research on soil and plants may be interpreted. Soil surface damage was higher in farmlets with heavier cattle (390 kg vs. 200 kg steers) and on paddocks where feeding was restricted through the use of a slow rotation (100-120 days vs. 35-45 days). Where cattle grazed under wet conditions, with a pre- and post-grazing herbage mass of 2400 and 650 kg DM/ha respectively, damage levels reached 60-70% of the soil surface. Under these conditions, 300-350 kg DM/ha of initial forage on offer was pushed onto or into the surface soil; and pasture growth rates during early-mid spring were reduced by 10 kg DM/ha each day. In practice the objective of grazing plans and management should be to minimize these negative impacts within the constraints of the required feeding regimes. Recommendations are made for the alignment of stock class and enterprise with land capabilities and the feed allocation processes of a winter rotation.

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353. The impact of grazing animals on N-2 fixation in legume-based pastures and management options for improvement.

Menneer, John C.; Ledgard, Stewart; Mclay, Chris; and Silvester, Warwick

Advances in Agronomy 83: 181-241. (2004)

NAL Call #: 30 AD9; ISSN: 0065-2113

Descriptors: defoliation/ farm management/ nitrogen fixation/ excretion/ farming industry/ legume production/ treading/ legume based pasture/ edaphic feature

Abstract: Recent moves toward greater intensification of legume-based pasture systems have raised concerns regarding the impact of grazing animals on legume production and symbiotic N-2 fixation. This review uses recent research to further our understanding of grazing

animal impacts (via treading, defoliation, and excretion) on the N-2 fixation performance of legume-based pastures. Options for improving farm management to minimise adverse animal impacts and improve legume performance and N-2 fixation are also covered with emphasis on white clover (*Trifolium repens*). In general, effects on N-2 fixation involve both soil and plant processes and are mediated by large-scale changes in legume morphology and physiology and/or by influencing the legume-grass competitive interaction. For example, defoliation of legumes by grazing animals causes a marked decrease in nitrogenase activity within several hours and recovery takes anywhere from 5 to 21 days depending on the severity of defoliation. Similarly, new research has shown that animal excreta can have prolonged effects on decreasing N-2 fixation (e.g., urine decreases N fixation by up to 70% with effects lasting for up to 286 days). The magnitude of animal impacts from treading, defoliation, and excretion, individually or as a whole varies greatly and are closely tied to farm management practices and the edaphic features of the entire farm system. Key farm/pasture management strategies identified to optimise N-2 fixation in legume-based pastures include: selecting suitable legume and grass cultivars, restricting grazing intervals, altering seasonal grazing intensity, use of mixed animal types, strategic conservation cuts, and management to reduce soil physical damage. Future research should include the use of validated dynamic models to integrate treading, defoliation, and excretion and predict effects on legume productivity and N fixation. Such an approach provides the best opportunity to determine the overall response of the legume system and define key requirements for management strategies. (C) 2004 Elsevier Inc.
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354. Impact of phosphorus application and sheep grazing on the botanical composition of sown pasture and naturalised, native grass pasture.

Hill, J. O.; Simpson, R. J.; Moore, A. D.; Graham, P.; and Chapman, D. F.
Australian Journal of Agricultural Research 55(12): 1213-1225. (2004)
NAL Call #: 23 Au783; ISSN: 0004-9409
Descriptors: grazing pressure/ pasture production/ stocking rate
Abstract: Botanical composition (basal cover) was measured in 4 replicated pasture treatments based on *Phalaris aquatica* and *Trifolium subterraneum* at Hall, ACT (unfertilised with low and high stocking rate; fertilised with low and high stocking rate) and in 2 unreplicated pasture treatments based on native perennial grasses (*Austrodanthonia* spp. and *Microlaena stipoides*) and *T. subterraneum* at Bookham, NSW (unfertilised and low stocking rate; fertilised and high stocking rate). Current economic pressures are encouraging graziers to increase their use of phosphorus (P) fertiliser and to adopt higher stocking rates. The objective of the research was to determine the changes in botanical composition that may result from these changes in grazing systems management. At Hall, annual species differed in their responses to P fertility. Notably, basal cover of *Bromus* spp. increased significantly with P application, whereas *Vulpia* spp. decreased significantly. Basal cover of *T. subterraneum* also increased significantly with P application when stocking rate was high, but was reduced by P application if

stocking rate was low. Basal cover of perennial grasses (*P. aquatica* and *Holcus lanatus*) was significantly higher at low stocking rate when P was applied. The botanical composition of high stocking rate treatments was relatively stable over time, which contrasted with less stable composition at low stocking rate. At Bookham, fertilised pasture in unreplicated paddocks appeared to have a higher basal cover of productive annual species (i.e. *Bromus* spp. and *T. subterraneum*), but native perennial grasses appeared to have lower basal cover in comparison with the unfertilised area. These results indicated that in some cases, the influence of P fertiliser and high stocking rates on botanical composition was favourable (i.e. increased basal cover of *P. aquatica* and *T. subterraneum*) and in others it could be detrimental (i.e. lower basal cover of native perennial grasses).
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355. Impacts of grazing systems on soil compaction and pasture production in Alberta.

Donkor, N. T.; Gedir, J. V.; Hudson, R. J.; Bork, E. W.; Chanasyk, D. S.; and Naeth, M. A.
Canadian Journal of Soil Science 82(1): 1-8. (2002)
NAL Call #: 56.8 C162; ISSN: 0008-4271
Descriptors: bulk density/ *Cervus elaphus*/ moisture content/ pasture production/ penetration resistance
Abstract: Livestock trampling impacts have been assessed in many Alberta grassland ecosystems, but the impacts of animal trampling on Aspen Boreal ecosystems have not been documented. This study compared the effects of high intensity [4.16 animal unit month per ha (AUM) ha⁻¹] short-duration grazing (SDG) versus moderate intensity (2.08 AUM ha⁻¹) continuous grazing (CG) by wapiti (*Cervus elaphus canadensis*) on soil compaction as measured by bulk density at field moist condition (Dbf) and penetration resistance (PR). Herbage phytomass was also measured on grazed pastures and compared to an ungrazed control (UNG). The study was conducted at Edmonton, Alberta, on a Dark Gray Luvisolic soil of loam texture. Sampling was conducted in the spring and fall of 1997 and 1998. Soil cores were collected at 2.5-cm intervals to a depth of 15-cm for measurement of bulk density (Dbf) and moisture content. Penetration resistance to 15 cm at 2.5-cm intervals was measured with a hand-pushed cone penetrometer. The Dbf and PR of the top 10-cm of soil were significantly ($P < 0.05$) greater by 15 and 17% under SDG than CG, respectively, by wapiti. Generally, Dbf in both grazing treatments decreased over winter at the 0-7.5 cm and 12.5-15 cm depths, suggesting that freeze-thaw cycles over the winter alleviated compaction. Soil water content under SDG was significantly ($P < 0.05$) lower than CG. Total standing crop and fallen litter were significantly ($P < 0.05$) greater in CG treatment than the SDG. The SDG treatment had significantly ($P < 0.05$) less pasture herbage than CG areas in the spring (16%) and fall (26%) of 1997, and in the spring (22%) and fall (24%) of 1998, respectively. The SDG did not show any advantage over CG in improving soil physical characteristics and herbage production.
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356. Improving utilization of warm-season pastures through grazing management.

Rouquette, F. M.

Beef Cattle Science Handbook 23: 274-278. (1989)

NAL Call #: SF207.B4; ISSN: 0522-5892

Descriptors: pastures/ grazing/ range management/ cattle/ annuals/ perennials

This citation is from AGRICOLA.

357. Influence of BMPs on cattle position preference.

Agouridis, C. T.; Edwards, D. R.; Vanzant, E.; Workman, S. R.; Bicudo, J. R.; Koostra, B. K.; Taraba, J. L.; and Gates, R. S.

In: 2004 ASAE Annual International Meeting. (Held 1 Aug 2004-4 Aug 2004 at Ottawa, Ontario, Canada.);

pp. 2569-2596; 2004.

NAL Call #: S671.3 .A54

<http://www.bae.uky.edu/WQ406/publications/ASAE042182.pdf>

Descriptors: BMP/ cattle/ GPS/ grazing/ streams

Abstract: The beef industry is an important component of Kentucky's agriculture accounting for approximately 15% of the state's agricultural sales in 2000. Dairy also plays a prominent role in Kentucky's agriculture (state rank of 18th). The state's significant cattle production occurs primarily on small to mid-sized farms averaging between 25 and 40 head of cattle per operation. Considering this upward trend in cattle production along with Kentucky's 140,000 km of rivers and streams, rolling pastures and karst geology, the potential for damage to riparian ecosystems from uncontrolled livestock access is high. The objective of this project was to determine the influence of alternate management strategies such as off-stream water, fencing, shade (permanent and movable), and pasture improvements on cattle behavior in grazed pastures of the humid region of the U.S. The project site, located on the University of Kentucky's Animal Research Center, consisted of two replications of three treatments: control, selected BMPs with free access to the stream, and selected BMPs with limited access to the stream. Cattle placed on the research pastures were fitted with GPS collars to track their positions. The use of GPS collars for tracking animal movements and behaviors eliminates errors often introduced in human observations. GPS collar data was collected at five minute intervals for seven sampling events over a two year period. Results indicated that the BMP systems (i.e. treatments) did not affect cattle position preference, and as such, these BMP systems did not decrease the amount of time cattle spent along the streambanks. However, significant time effects were noted the cooling pasture feature trees as cattle sought relief from the heat and humidity. Increased cattle presence along the streambank during the daytime period was linked to longer day light hours, but the impractical nature of the model indicated that additional independent variables were required. For the nighttime data set, the significant seasonal variable was solar radiation, as decreases in solar radiation resulted in the model predicting that cattle would tend to avoid the pasture feature trees. The majority of non-zero solar radiation values, while relatively small in comparison to the daytime values, were in the periods dividing daytime and nighttime (i.e. dawn and dusk). Thus, the primary driving factor with regards to cattle position preference appeared to be a desire to avoid trees, a pasture feature often associated with loafing, possibly in

favor of grazing. While the results of this study indicated that no significant treatment effects were present, the significant time effects suggest that the strategic development of 1) cooling features such as shade, wading ponds or water misters and 2) areas of high forage quality and quantity may influence cattle position preference.

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358. Influence of burning and grazing on soil nutrient properties and tree growth on a Georgia Coastal Plain site after 40 years.

McKee, W. H. and Lewis, C. E.

In: Proceedings of the Second Biennial Southern Silvicultural Research Conference. (Held 4 Nov 1982-5 Nov 1982 at Atlanta, Georgia.) Jones, Earle P. (eds.)

Asheville, N.C.: U.S. Dept. of Agriculture, Forest Service, Southeastern Forest Experiment Station; pp. 79-86; 1983.

NAL Call #: aSD433.A53 no.24

Descriptors: soil chemistry/ forestry practices/ controlled burning/ grazing/ Animal husbandry/ soil/ ecology/ conifers

Abstract: Soil analysis of a study area in the Coastal Plain of Georgia indicates that 40 years of grazing and prescribed burning have had no adverse effect on concentrations of total nitrogen, available phosphorus, exchangeable bases, or organic matter in mineral soil. Burning alone reduced organic matter and nutrients in the forest floor and tended to increase them in the surface 6 inches of mineral soil. Grazing did not affect soil nutrient properties nor did grazing interact significantly with prescribed burning. Results indicate that well-managed grazing in conjunction with prescribed burning has no adverse effects on site quality for longleaf-slash pine-wiregrass sites.

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359. Influence of fertilizer and grazing management on North Island moist hill country: Herbage accumulation.

Lambert, M. G.; Clark, D. A.; Grant, D. A.; Costall, D. A.; and Fletcher, R. H.

New Zealand Journal of Agricultural Research 26(1): 95-108. (1983)

NAL Call #: 23 N4892; ISSN: 0028-8233

Descriptors: cattle/ sheep/ grass/ growth/ super phosphate/ rainfall

Abstract: A grazing trial was conducted on 99 ha of moist, low-fertility hill country near Woodville, New Zealand, during 1975-1981. Treatments were low fertilizer (125 kg/ha per annum superphosphate (9% P, 10% S)) and high fertilizer (average 630 kg/ha per annum superphosphate, plus lime) application rates and 3 grazing managements, rotational grazing by sheep and by cattle, and set-stocking by sheep. Some replication was included in the design, 10 self-contained farmlets being used. Over a 6-yr period stocking rate was increased from 6.5-12.0 and from 8.8-16.1 s.u. [stocking unit]/ha on low and high fertilizer farmlets, respectively. Over this period, and also in the 3 previous yr, herbage accumulation was measured, using grazing exclosures and a trim technique. Nov.-April rainfall had a large effect on herbage accumulation rate (HAR), causing year-to-year variation of 23% about mean annual herbage accumulation. The high fertilizer treatment grew 9% more herbage than low fertilizer in the 1st yr after differential application, and 21-50% more in the last 5 yr. The main effect of the grazing management treatments was that annual herbage accumulation in the rotationally grazed

cattle pastures was depressed 12% compared with the sheep-grazed pastures, presumed to be a result of severe treading damage. Differences in HAR between rotationally grazed and set-stocked sheep pastures were not detected. The trim technique used probably overestimated HAR of set-stocked pastures during the reproductive phase of grass growth. Measurements of herbage mass suggested that rotationally grazed sheep pastures grew about 20% more herbage over spring-early summer than set-stocked sheep pastures, or about 12% more on an annual basis. Slope of measurement site, on a within-hillside microtopographic basis, had a strong negative relationship with HAR. For the linear part (15-27 degree slope) of the cubic function used, annual herbage accumulation decreased about 370 kg DM [dry matter]/ha per annum per degree slope increase. Aspect influences on HAR were less marked than those of slope. Northwest and east aspect classes showed similar annual accumulation and pattern of seasonal accumulation. Southwest aspects had higher HAR than northwest aspects for 2-4 mo. in Jan.-April and lower (20-40%) HAR for most of the remainder of the year. Seasonal spread of annual herbage accumulation was also influenced by grazing management, but was not influenced by fertilizer treatment or slope.

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360. Influence of fertilizer and grazing management on North Island moist hill country: Pasture botanical composition.

Lambert, M. G.; Clark, D. A.; Grant, D. A.; and Costall, D. A.

New Zealand Journal of Agricultural Research 29(1): 1-10. (1986)

NAL Call #: 23 N4892; ISSN: 0028-8233

Descriptors: Lolium perenne/ Agrostis capillaris/ Anthoxanthum odoratum/ weeds/ legumes/ sheep/ cattle/ lime/ superphosphate/ soil/ nitrogen availability/ slope aspect

Abstract: A grazing trial was conducted on 99 ha of steep, low fertility hill country in southern Hawke's Bay, during 1975-81. There were 2 fertiliser treatments: low (LF) and high (HF) superphosphate application (plus lime on HF), and 3 grazing managements: rotational grazing by sheep (RGS) or cattle (RGC), and set stocking by sheep (SSS). As part of a larger measurement programme botanical composition of pastures was monitored over the 6-year period. HF pastures had a greater content of ryegrass (*Lolium perenne* L.) and legumes than LF pastures and a small content of low fertility tolerant (LFT) grasses (e.g., browntop, *Agrostis capillaris* L.; sweet vernal, *Anthoxanthum odoratum* L.) and weed species. Ryegrass content of pasture under the 3 managements was in the order RGC > RGS > SSS. RGC pastures had a smaller content of LFT grasses, and a greater content of legumes than sheep-grazed pastures. SSS pastures were more weedy than those rotationally grazed. Slope and aspect of measurement site also influenced botanical composition. As the trial proceeded, legume content rose then fell in all treatments. The decline was attributed to increased competitiveness of associated grasses as symbiotically fixed N was cycled and soil N availability increased. This phenomenon places limitations on the use of fertiliser P to promote and maintain legume dominance.

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361. Influence of fertilizer and grazing management on North Island moist hill country: Pasture species abundance.

Lambert, M. G.; Clark, D. A.; Grant, D. A.; Costall, D. A.; and Gray, Y. S.

New Zealand Journal of Agricultural Research 29(1): 23-32. (1986)

NAL Call #: 23 N4892; ISSN: 0028-8233

Descriptors: white clover/ moss productivity/ sheep/ cattle/ lime/ superphosphate/ plant unit density/ thinning law/ herbage accumulation/ treading damage/ aspect slope
Abstract: A grazing trial was conducted on steep, moist, low fertility hill country in the southern Hawke's Bay during 1975-81. There were 2 fertiliser treatments: low (LF) and high (HF) superphosphate application (plus lime on HF), and 3 grazing managements: rotational grazing by sheep (RGS) or cattle (RGC), and set stocking by sheep (SSS). Annual measurements of pasture species abundance (plant unit density and size) were made in each year during 1976-81. Density of plant units was greater in HF than LF (27.8 cf. 25.3 times. 103/m²) pastures and, for the 3 different grazing managements, SSS > RGS > RGC (30.1, 25.2, and 17.1 times. 103/m² respectively). In addition, plant density decreased with increasing slope of measurement site, and was influenced by aspect. In most instances, lower plant unit density was compensated for by increases in plant unit size, in accordance with the '3/2 thinning law'. This did not occur under RGC because of severe treading damage, and the depression in herbage accumulation rate in these pastures was attributed to this lack of complete compensation. Density of species categories within the total pasture was closely related to botanical composition results presented elsewhere. Moss incidence in pastures was decreased by HF application and RGC management. Several white clover stolon characteristics were measured, of which manipulation of stolon length per unit area of pasture was thought most likely to have effects on white clover productivity.

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362. Influence of fertilizer and grazing management on North Island moist hill country: Performance of introduced and resident legumes.

Lambert, M. G.; Clark, D. A.; Grant, D. A.; and Costall, D. A.

New Zealand Journal of Agricultural Research 29(1): 11-22. (1986)

NAL Call #: 23 N4892; ISSN: 0028-8233

Descriptors: Trifolium repens/ Trifolium dubium/ Trifolium pratense/ Trifolium subterraneum/ Lotus pedunculatus/ sheep/ cattle/ superphosphate/ lime/ herbage accumulation/ slope aspect

Abstract: A grazing trial was conducted on 99 ha of steep, low fertility hill country in southern Hawke's Bay, during 1975-81. There were 2 fertiliser treatments: low (LF) and high (HF) superphosphate application (plus lime on HF), and 3 grazing managements: rotational grazing by sheep (RGS) or cattle (RGC), and set stocking by sheep (SSS). A white clover (*Trifolium repens* L.) similar to Kent wild white, and annual suckling clover (*T. dubium* Sibth.) were already present in the pastures in small amounts. 'Grasslands Huia' white clover, 'Grasslands Turoa' red clover (*T. pratense* L.), 'Grasslands Maku' lotus (*Lotus pedunculatus* Cav.), and Wootenellup subterranean clover (*T. subterraneum* L.) were oversown into the pasture in 1974. Huia, Turoa, and Grasslands 4703 lotus were oversown again in 1977.

Woogenellup subterranean clover was found to be unsuited to the environment. Lotus plants established, but contributed little to total herbage accumulation. Red clover was most important in RGC pastures. Its contribution was short-lived in sheep-grazed pastures, but was significant in the year after oversowing where fertiliser application history was short. Suckling clover produced a significant amount of herbage on steep NW sites during spring. Huia white clover was the most productive of the oversown legumes.

However, the resident white clover was more production than Huia in sheep-grazed pastures but not in RGC pastures. Huia was more responsive to HF (compared with LF) application in RGC than in sheep-grazed pastures-the converse applied for the resident genotype.

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363. The influence of grazing management on weed invasion of *Lolium perenne* pastures under subtropical conditions in South Africa.

Mckenzie, F. R.

Tropical Grasslands 31(1): 24-30. (1997)

NAL Call #: SB197.A1T7; ISSN: 0049-4763

Descriptors: agronomy/ climatology/ ecology/ grazing management/ subtropical condition/ weed invasion

Abstract: *Lolium perenne* (perennial ryegrass) exhibits poor persistence in subtropical environments and this is often characterized by weed invasion. Grazing management may enhance the potential of perennial ryegrass to successfully outcompete weeds. Perennial ryegrass pastures were subjected to various grazing frequencies and intensities and the level of weed invasion monitored over 2 years. The proportional contribution of weed species tillers to total sward tillers was higher during late summer and autumn (4-20%), than winter (2-10%) or spring (1-4%). Pastures infrequently grazed incurred lower levels of weed invasion (56-256 weed tillers/m² in Year 1, and 105-623 tillers/m² in Year 2) than those frequently grazed (105-625 tillers/m² in Year 1, and 256-2489 tillers/m² in Year 2). Grazing intensity, however, did not influence the level of weed invasion. It is concluded that the invasion of perennial ryegrass pastures by weed species, particularly during the summer, can be minimized by sufficiently long grazing intervals (gt 21 days).

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364. Influence of intensive rotational grazing on bank erosion, fish habitat quality, and fish communities in southwestern Wisconsin trout streams.

Lyons, J.; Weigel, B. M.; Paine, L. K.; and Undersander, D. J.

Journal of Soil and Water Conservation 55(3): 271-276. (2000)

NAL Call #: 56.8 J822; ISSN: 0022-4561

Descriptors: rotational grazing/ stream erosion/ streams/ habitats/ water quality/ *Oncorhynchus mykiss*/ depth/ sediments/ width/ Wisconsin

This citation is from AGRICOLA.

365. Influence of seedbed preparation and grazing management on seed production of four tropical legumes in the establishment year.

Mcdonald, C. K.; Jones, R. M.; and Cook, S. J.

Tropical Grasslands 37(2): 111-118. (2003)

NAL Call #: SB197.A1T7; ISSN: 0049-4763

Descriptors: grazing management: applied and field

techniques/ seedbed preparation: applied and field techniques/ seed production/ soil seed bank: pasture legume persistence

Abstract: Two studies in subcoastal south-east Queensland examined factors affecting the seed production of legumes in the first 15 months after being sown into native speargrass (*Heteropogon contortus*) pasture. Both experiments were sown to a mixture of legumes: roundleaf cassia (*Chamaecrista rotundifolia*) cv. Wynn, siratro (*Macroptilium atropurpureum*) cv. Siratro, shrubby stylo (*Stylosanthes scabra*) cv. Seca and fine-stem stylo (*S. hippocampoides*). The first experiment compared the effectiveness of sowing into 5 different seed-beds: complete cultivation, 3 methods of minimum disturbance, and broadcasting seed into undisturbed pasture. There were 2 sowings a year, at the start and in the middle of the growing season, in each of 5 years. Four of the 5 years experienced well below average rainfall. The only species that consistently produced seed in the year of sowing was Wynn cassia, and then only in the fully cultivated seedbed where seed reserves in sowings made early in the growing season averaged about 3000 seeds/m². Seed production in treatments with minimum or zero disturbance was negligible. The second experiment examined the effect of grazing on the seed production of legumes oversown using a minimum-cultivation technique where legumes were sown in a shallow groove in a herbicide-treated strip in an otherwise undisturbed native pasture. Grazing, at 0.65 head/ha, was imposed immediately after sowing or after 3, 8 or 15 months. Two other treatments examined the effect of a high stocking rate (1.2 head/ha) imposed immediately after sowing and of complete exclusion from stock. As in Experiment 1, Wynn cassia produced by far the most seed, followed by fine-stem stylo. Seca and siratro produced very little seed. Cassia produced seed in all treatments, with seed reserves 18 months after sowing ranging from 250 seeds/m² at the high stocking rate to 770 seeds/m² in the absence of grazing. The implications of the results for successful oversowing of legumes into native pasture are discussed.

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366. Influences of mowing and grazing on plant species composition in calcareous grassland.

Schlapfer, M.; Zoller, H.; and Korner, C.

Botanica Helvetica 108(1): 57-67. (1998)

NAL Call #: 451 Sch9; ISSN: 0253-1453

Descriptors: grasslands/ grazing/ cutting/ meadows/ pastures/ plant communities/ species diversity/ trampling/ botanical composition/ management/ grassland management/ surveys/ calcareous grasslands

Abstract: In the Jura mountains in north-western Switzerland extensive management has created some of the species-richest plant communities of central Europe: calcareous grasslands of the *Teucrio-Mesobrometum* type. Evidence from a survey on the influence of contrasting management practices on species diversity and species abundance in these grasslands was summarized. Based on phyto-sociological areas (each ca. 0.1 ha) of 72 sites, 46 of which were regularly grazed by cattle and 26 were cut, it is shown that pastures tend to be richer in species (on average 59 versus 46 species in meadows). 90% of all 137 species recorded occurred in both types of grassland. The higher species diversity in pastures is explained by greater spatial heterogeneity due to micropatterns of grazing,

trampling and dung deposition. It is concluded that only a minor set of species can be considered to be management-specific while the majority of species is equally abundant in both types of grassland. Hence, responses of the vegetation to a change in management are likely to cause only small alterations in community structure, at least for periods of several years to a few decades.

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367. Intensive cattle grazing of oxeye daisy (*Chrysanthemum leucanthemum*).

Olson, Bret E.; Wallander, Roseann T.; and Fay, Peter K. *Weed Technology* 11(1): 176-181. (1997)

NAL Call #: SB610.W39; ISSN: 0890-037X

Descriptors: agronomy/ grazing effects/ herbivore/ oxeye daisy/ pest management/ soil seedbank size/ weed control
Abstract: Oxeye daisy has invaded seeded pastures, roadsides, and mountain rangelands in western Montana. In 1990, we began a study to: (1) determine use of oxeye daisy and introduced perennial grasses by cattle; (2) determine effects of intensive cattle grazing on the number of oxeye daisy seeds in the soil; and (3) assess effects of intensive grazing on year-to-year changes in oxeye daisy and associated perennial grasses. Cattle grazed oxeye daisy but much of their impact was from trampling or removing stems. The number of oxeye daisy seeds in the soil seedbank was lower in 1992 than in 1990 in grazed areas, whereas the number was higher in ungrazed areas. Two years of intensive grazing reduced densities of oxeye daisy seedlings and rosettes, but did not change densities of mature stems. Intensive grazing had minimal impact on the introduced grasses.

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368. "Late control" spring grazing management of perennial ryegrass swards: Effect on sward structure and botanical composition.

Matthew, C.; Hernandez Garay, A.; and Hodgson, J. *Agronomy New Zealand* 30: 121-127. (2000);

ISSN: 0110-6589

Descriptors: botanical composition/ grass sward/ grassland management/ grasslands/ grazing/ tillers

Abstract: A series of experiments was conducted at Massey University, New Zealand between 1985 and 1997 to investigate the increased herbage accumulation rate under laxer spring grazing. This approach to spring grazing management was popularly termed 'late control'. One of the experiments is described in detail and previously unpublished point quadrat data on sward botanical composition are presented. The objective of this experiment was to study the influence of spring grazing management on sward structure, and on herbage production, in perennial ryegrass (*Lolium perenne*) dominant swards with and without white clover (*Trifolium repens*). In one grazing treatment, swards were grazed by sheep to 30-50 mm every 14 days from 15 September to late March (Early Control-EC). In two other grazing treatments, swards were grazed every 21 days to 70-90 mm for periods of 6 weeks (short release-SR) or 12 weeks (long release-LR) before returning to 30-50 mm grazing as in EC from 8 December. The three grazing treatments were applied to plots with or without white clover (N applied to replace clover fixation) making six treatments in all, arranged in a randomized block design with three replicates. Changes in sward structure were reflected in herbage production before

(spring) and after 8 December (summer-autumn). During spring, herbage mass and herbage production on the release treatments was increased as a consequence of an increase in tiller weight. During the summer, herbage production was increased in release treatments, and this was attributable primarily to increased tiller production. Release treatments decreased Poa content of swards, especially on plots without clover. A significant increase in ryegrass stem occurrence was detected in only one of the four release treatments, and there was no indication of clover suppression.

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369. Leaf age structure and canopy photosynthesis in rotationally and continuously grazed swards.

Parsons, A. J.; Johnson, I. R.; and Williams, J. H. H. *Grass and Forage Science* 43(1): 1-14. (1988)

NAL Call #: 60.19 B773; ISSN: 0142-5242

Descriptors: ryegrass/ sheep/ regrowth yield/ mathematical model

Abstract: The leaf age structure of ryegrass canopies and its role in canopy photosynthesis were compared under continuous and rotational grazing by sheep. Under continuous grazing, an increase in the intensity of grazing increased the proportion (by leaf area) of young leaves in the sward. A mechanistic mathematical model was used to demonstrate how this may have arisen, even though it would largely have been the young leaves that were eaten. However, the observations do not confirm the hypothesis that continuously grazed swards have a characteristically greater proportion of young leaves, and so a greater photosynthetic potential, than rotationally grazed ones. The proportion of young leaves increased during regrowth following severe rotational grazing (residual LAI < 0.5) and the photosynthetic potential of the canopy became greater than under continuous grazing. A model of canopy photosynthesis was used to demonstrate that the observed difference in the proportion of young leaves alone was unlikely to account for all the differences in canopy photosynthesis between managements, and further differences in canopy structure were evaluated. Despite the delay in the restoration of leaf area following severe grazing in a rotation, the total photosynthetic uptake of a system involving some 12-13 days regrowth and 3 days grazing exceeded that of a well-utilized continuously grazed sward. Regrowths of longer duration led to progressively greater total photosynthetic uptake, though this was not considered synonymous with greater yield.

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370. Long-term effects of sheep grazing on coastal sandplain vegetation.

Dunwiddie, Peter W.

Natural Areas Journal 17(3): 261-264. (1997)

NAL Call #: QH76.N37; ISSN: 0885-8608

Descriptors: coastal sandplain/ conservation/ habitat/ sheep grazing/ shrub encroachment/ species abundance/ vegetation effects

Abstract: In 1990, vegetation cover and frequency in thirty-one 0.2-m² quadrats in an ungrazed coastal sandplain in Massachusetts (USA) were compared with cover and frequency in matched quadrats in an adjacent grassland that had been used as a sheep pasture until 1948. Species that had significantly higher values of cover or frequency in the former pasture included *Schizachyrium scoparium*,

Comptonia peregrina, *Cladina* spp., and *Helianthemum dumosum*. Four shrubs and a grass-*Myrica pensylvanica*, *Quercus ilicifolia*, *Rosa carolina*, *Vaccinium angustifolium*, and *Festuca ovina*-were more abundant in the ungrazed vegetation. Two dominant species that showed no differences in either abundance measure between the grazed and ungrazed sites were *Gaylussacia baccata* and *Carex pensylvanica*. These results suggest that sheep grazing may be a valuable tool for arresting shrub encroachment into native coastal sandplain grasslands.
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371. The long-term effects on upland sheep production in the UK of a change to extensive management.

Barthram, G. T.; Marriott, C. A.; Common, T. G.; and Bolton, G. R.

Grass and Forage Science 57(2): 124-136. (2002)

NAL Call #: 60.19 B773; ISSN: 0142-5242

Descriptors: extensification/ extensive management/ grazing/ liveweight/ pasture management/ upland livestock production: long term effects

Abstract: Extensification (a reduction in fertilizer inputs and stocking rate of grassland) is seen as one way of increasing the conservation value and of reducing the environmental impact of upland sheep production in the UK, but little is known about the consequences of such a change. This study determines the changes in animal production over ten years following the introduction of four extensive grazing management strategies to perennial ryegrass/white clover pastures at two upland sites. Fertilizer-free treatments were maintained with sward heights of: 4 cm (treatment 4/4U) or 8 cm (8/8U) during the whole of the grazing year, 4 cm during summer and 8 cm during autumn (4/8U) and 8 cm during summer and 4 cm during autumn (8/4U). A control treatment that received 140 kg N ha⁻¹ year⁻¹ was also maintained with a sward surface height of 4 cm (4/4F). Scottish Blackface sheep grazed all treatments. The 4/4F treatment carried the greatest number of animals (3746 grazing days ha⁻¹ year⁻¹); the 4/4U and the 8/8U treatments carried 0.73 and 0.43 of this number respectively. The number on the 4/8U treatment was similar to that on the 4/4U while the 8/4U treatment carried 1.41 of that on the 8/8U treatment (0.61 of 4/4F). Mean individual animal performance was greatest on the 8 cm swards and tended to be lowest on the 4/4F treatment. However, the 4/4F treatment produced the greatest live weight of lamb (623 kg ha⁻¹ year⁻¹) with the 4/4U producing 0.77, and the 8/8U producing 0.55, of this amount. Although there was year-to-year variation in agricultural output, it was concluded that the lower levels of sheep production that result from a change to extensive systems of grazing management can be maintained for at least 10 years.

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372. The long-term impact of nitrogen fertiliser on perennial ryegrass tiller and white clover growing point densities in grazed dairy pastures in south-western Victoria.

Mckenzie, F. R.; Jacobs, J. L.; and Kearney, G.

Australian Journal of Agricultural Research 53(11): 1203-1209. (2002)

NAL Call #: 23 Au783; ISSN: 0004-9409

Descriptors: 3 year grazing experiment: applied and field techniques/ annual pasture dry matter yields/ climatic effects/ grazed dairy pastures/ grazing herbage mass/

grazing management effects/ randomized block design
Abstract: A 3-year grazing experiment determined the impact of multiple applications of different rates of nitrogen (N) fertiliser, applied over autumn and winter in 1997, 1998, and 1999, on perennial ryegrass (*Lolium perenne*)/white clover (*Trifolium repens*) tiller and growing point densities (stolon apices with at least 2 nodes). Annual pasture dry matter (DM) yields were also monitored. Four treatments were replicated 3 times in a randomised block design and included: 0 N (A); 3 applications of 25 kg N/ha (B); 3 applications of 50 kg N/ha (C); and 3 applications of 75 kg N/ha (D). Urea (46% N) was the N source. Grazing of treatment plots occurred at a pre-grazing herbage mass of 2200-2500 kg DM/ha. Over 3 years, N applications consistently increased annual pasture DM yields by 0.9-3.3 t/ha when a total of 75-225 kg N/ha was applied annually. Generally, treatments B, C, and D resulted in higher perennial ryegrass tiller densities than treatment A. An exception occurred from July 1998 in Year 2 to July 1999 in Year 3, when all perennial ryegrass densities were similar. Nitrogen fertiliser generally produced no consistent effect on white clover growing point density, with the exception of July-December in Year 2 when treatments B, C, and D resulted in lower growing point densities than treatment A. Clover growing point density decreased over the trial period irrespective of treatment. There were no N fertiliser effects on 'other' grasses and broadleaved weeds. 'Other' grasses (mainly winter grass, *Poa annua*) did, however, peak in density (up to 2500 tillers/m²) from July to September each year. Seasonally, the peak perennial ryegrass tiller density was similar each year and occurred during late winter-early spring (5450 tillers/m² in July 1997; 6200 tillers/m² in August 1998; 5400 tillers/m² in July 1999). This was followed by a trough over midsummer (800 tillers/m² in January 1998; 725 tillers/m² in January 1999). White clover growing point density declined over 3 years. During this decline there were peaks in June 1997 (2650 growing points/m²), November 1997 (1600 growing points/m²), June 1998 (1250 growing points/m²), April 1999 (1050 growing points/m²), and November 1999 (850 growing points/m²). Troughs occurred in January 1998 (530 growing points/m²) and February 1999 (380 growing points/m²). It is concluded that although increasing applications of N increased annual pasture DM yields and generally increased perennial ryegrass tiller densities, with little effect on clover growing point densities, there is little to suggest that N fertiliser alone would enhance the persistence of these pasture species. Persistence is likely to be influenced by a combination of factors including grazing management and climatic effects, rather than N fertiliser alone.

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373. Managing heterogeneity: The importance of grazing and environmental variation on post-fire succession in heathlands.

Vandvik, Vigdis; Heegaard, Einar; Maaren, Inger Elisabeth; and Aarrestad, Per Arild

Journal of Applied Ecology 42(1): 139-149. (2005)

NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: grazing/ fires/ conservation/ succession/ species composition/ burning/ ordination

Abstract: Semi-natural habitats have been shaped by human disturbance regimes for centuries. Spatially and temporally heterogeneous land-use practices, such as

cutting, burning, grazing and turf-cutting, have resulted in complex mosaic landscapes that are of high priority for conservation in Europe. Contemporary conservation subjects these systems to management regimes that are generally less diverse, in terms of disturbances and fine-scale temporal and spatial variability, than traditional land use, but the ecological consequences of these simplifications are unclear. We investigated the interactive effects of fire and grazing on plant species composition and diversity along local environmental (moisture) gradients in coastal heathlands. A replicated series of post-fire successions (n = 12) was initiated in three heathland habitats and the areas subjected to two grazing regimes. Floristic and environmental data were recorded in permanent plots over a 5-year period. Community data were analysed using multivariate ordination techniques (principal components analysis, partial redundancy analyses, and principal response curves) and generalized linear models. Fire induced strong successional trends in the species composition of the heathlands. These trends differed among heathland habitats, and with grazing. Strong interactions between fire, habitat and grazing implied that the effect of grazing on the successional dynamics differed among habitats. Species diversity decreased in the first year after fire but increased beyond the pre-fire levels during succession. This trend was not affected by local environment or grazing, although there were main effect differences in diversity between environments and grazing regimes. Synthesis and applications. Our results demonstrate that the two management practices do not have simple additive effects within the semi-natural system studied, as grazing created ecological opportunities for additional sets of species, increased variability among habitats, and added complexity to the post-fire successional dynamics. In order to preserve diversity, conservation management should thus aim to preserve the level of complexity of the traditional management regimes, both in terms of the actual disturbances (e.g. fire and grazing) as well as the spatial scales at which they are applied. Further, the considerable change in these effects along the local environmental gradient brings into question the efficiency of general management prescriptions, and indicates that local environmental variability should be taken into account in the conservation of semi-natural habitats.

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374. Managing rotationally grazed pastures for forage production and grassland birds.

Paine, L. K.; Undersander, D. J.; Temple, S. A.; and Sample, D. W.

American Forage and Grassland Council Proceedings 6: 54-58. (1997)

NAL Call #: SB193.F59

Descriptors: range management/ rotational grazing/ birds/ nesting

This citation is from AGRICOLA.

375. Managing saffron thistle in pastures with strategic grazing.

Grace, B. S.; Whalley, R. D. B.; Sheppard, A. W.; and Sindel, B. M.

Rangeland Journal 24(2): 313-325. (2002)

NAL Call #: SF85.4.A8A97; ISSN: 1036-9872

Descriptors: *Carthamus lanatus*/ invasive species/ weed control/ rotational grazing/ sheep/ stocking rate/ plant

competition/ plant litter/ ground vegetation/ pasture management/ cattle/ mortality/ perennials/ forage grasses/ forage legumes/ New South Wales

This citation is from AGRICOLA.

376. Managing the composition of native and naturalised pastures with grazing.

Kemp, D. R.; Dowling, P. M.; and Michalk, D. L.

New Zealand Journal of Agricultural Research 39(4): 569-578. (1996)

NAL Call #: 23 N4892; ISSN: 0028-8233

Descriptors: crop industry/ agronomy/ biobusiness/ native pasture/ naturalized pasture/ pasture composition management

Abstract: Many native, naturalized, and low-input pastures have a low proportion of desirable species. Under the prevailing economic conditions, it is unlikely that these pastures would be replaced with sown native species as there may not be seed of suitable cultivars available and costs would exceed returns. Better management is a preferable strategy to improve the proportion of desirable components. Grazing tactics are central to any improved management strategies for these pastures as they offer a lower cost option for land managers. Additional tactics, which will vary depending upon specific circumstances, include some use of fertilizer (to increase the rate of change), herbicides (where weed problems are particularly severe and animals are unlikely to eat the "weeds"), and fire (to reduce dead material and seed numbers and produce green leaf for grazing). Several examples of manipulating pasture composition are considered. In situations where the desirable species are C-3 perennial grasses (e.g., *Danthonia* spp., *Microlaena*, and *Dactylis*), and the less desirable are C-3 annual species (e.g., *Vulpia*), rests over the summer period, especially in wetter years, improved the perennial grass content. In addition, extra grazing pressure in spring limits seed set by annual grasses. Where the undesirable species are C-4 perennial grasses (e.g., *Bothriochloa* and *Aristida*), heavy summer grazing is more important. In some instances, the timing of a heavy grazing period will depend upon monitoring the plant community to find the "window of opportunity" when the desirable species have completed flowering and seed set but when the less-desirable species are starting to flower. Further development of improved management systems will require knowledge of the ecology of the principal species. Any release of new cultivars of native and low-input species should be supported by knowledge of the better management practices to maintain those species in the pasture.

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377. Manipulation of nutrients and grazing levels on heather moorland: Changes in *Calluna* dominance and consequences for community composition.

Hartley, S. E. and Mitchell, R. J.

Journal of Ecology 93(5): 990-1004. (2005)

NAL Call #: 450 J829; ISSN: 0022-0477

Descriptors: botanical composition/ fencing/ grazing/ mineralization/ moorlands/ nitrogen/ nitrogen fertilizers/ nutrients/ phosphorus/ population decrease/ potassium/ soil organic matter/ soil water/ vascular-plants

Abstract: Experimental studies of the combined effects of herbivory and the availability of nutrients on semi-natural communities remain relatively scarce. Here we report the

effects of 6 years of nutrient addition (N, P and K) and protection from grazing on moorland plant communities in the Scottish uplands, particularly on the cover of the dominant *Calluna vulgaris*. We also recorded the cover of vascular plants and bryophytes, to assess the impact of changes in *Calluna* dominance on competing species. Grazing in combination with nitrogen addition caused the greatest decline in *Calluna* cover, typically 40-50%, but nitrogen addition did not cause a significant decline in *Calluna* on plots protected from grazing. More *Calluna* shoots were browsed on nitrogen-treated plots than on unfertilized ones, presumably because grazing animals preferred fertilized *Calluna*. Nitrogen addition allowed grasses to increase in cover, especially on grazed plots. However, *Nardus stricta*, *Festuca ovina* and *Agrostis* sp. all declined in fenced areas but increased in grazed plots, whereas *Deschampsia flexuosa* and *Festuca rubra* increased in fenced plots. The effects of grazing and nutrient addition varied markedly between sites, possibly because of differences in soil moisture and organic matter. Nitrogen addition, however, increased soil nitrogen mineralization rates in both glens. Fencing increased the cover of grazing-intolerant plants with low nutrient demands (as classified by Ellenberg and suited species scores) that were categorized as competitive plants by Grime's CSR model. Plots receiving nitrogen and phosphorus had more nutrient-demanding plants able to tolerate high grazing pressure that were often classified as ruderals. The impact of nitrogen addition on the cover of *Calluna* and on competing grass species in the community critically depends on the level of grazing. Changes in community composition caused by grazing and fertilizer addition can be explained in terms of the ecological tolerances of individual species, allowing us to predict the types of plants that are likely to increase or decrease in cover.

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378. Methane emissions of beef cattle grazing tall fescue pastures at three levels of endophyte infestation.

Pavao Zuckerman, Mitchell A.; Waller, John C.; Ingle, Teri; and Fribourg, Henry A.

Journal of Environmental Quality 28(6): 1963-1969. (1999)
NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: infestation level variation/ pasture

Abstract: Methane (CH₄) is produced by fermentation in the rumen of cattle. Methane may play a part in global warming scenarios. Tall fescue (*Festuca arundinacea* Schreb.) is an important forage in the eastern United States. The toxic syndrome associated with the endophytic fungus *Neotyphodium coenophialum* (E+) can be mitigated with management strategies that improve forage quality of E+ tall fescue pastures and animal performance. The sulfur hexafluoride (SF₆) tracer technique was used to determine the effects of tall fescue pasture management on CH₄ production in 1997-1998. Two steers (*Bos taurus*) on two pastures each of E+ tall fescue, of endophyte free (E-) tall fescue, of E+/E-(1:1 ratio), and of E+/ladino white clover (*Trifolium repens* L.), and four steers and four lactating cows with nursing calves grazing either unimproved (UP) or best management practices (BMP) pastures were used to collect eructated CH₄ samples. Daily CH₄ emissions were about 95 to 200 g d⁻¹ for steers and 150 to 240 g d⁻¹ for cows. Steers grazing E+/clover pastures emitted 20% less CH₄ kg⁻¹ d⁻¹ than steers grazing E+, E-, or E+/E- in

summer. Season and animal size were the major factors affecting CH₄ emissions. This first estimation of CH₄ emissions from free-roaming cattle grazing tall fescue pastures indicates that (i) improved forage management strategies have little effect on daily emissions per animal that are primarily a function of rumen size and intake, and (ii) the amount of emission per unit of animal product is reduced when improved practices are implemented.

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379. Methane emissions of beef cattle on forages: Efficiency of grazing management systems.

Deramus, H. Alan; Clement, Terry C.; Giampola, Dean D.; and Dickison, Peter C.

Journal of Environmental Quality 32(1): 269-277. (2003)
NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: sulfur hexafluoride tracer technique: applied and field techniques/ bahiagrass hay: animal feed/ beef: meat product/ best management practices grazing: methane production effects/ continuous grazing: methane production effects/ cottonseed meal and corn: animal feed/ efficient beef production strategies/ fermentation: methane production/ grazing management strategies/ limited ryegrass grazing/ management intensive grazing/ milk: dairy product/ protein molasses blocks: animal feed/ urea and corn [URC]: animal feed

Abstract: Fermentation in the rumen of cattle produces methane (CH₄). Methane may play a role in global warming scenarios. The linking of grazing management strategies to more efficient beef production while reducing the CH₄ emitted by beef cattle is important. The sulfur hexafluoride (SF₆) tracer technique was used to determine the effects of best management practices (BMP) grazing compared with continuous grazing on CH₄ production in several Louisiana forages during 1996-1998. Cows and heifers (*Bos taurus*) grazed common bermudagrass (*Cynodon dactylon* (L.) Pers.), bahiagrass (*Paspalum notatum* Flugge), and ryegrass (*Lolium multiflorum* Lam.) pastures and were wintered on bahiagrass hay with supplements of protein molasses blocks (PMB), cottonseed meal and corn (CSMC), urea and corn (URC), or limited ryegrass grazing (LRG). Daily CH₄ emissions were between 89 and 180 g d⁻¹ for young growing heifers and 165 to 294 g d⁻¹ for mature Simbrah cows. Heifers on "ad lib" ryegrass in March and April produced only one-tenth the CH₄ per kg of gain as heifers on LRG of 1 h. Using BMP significantly reduced the emission of CH₄ per unit of animal weight gain. Management-intensive grazing (MIG) is a BMP that offers the potential for more efficient utilization of grazed forage crops via controlled rotational grazing and more efficient conversion of forage into meat and milk. Projected CH₄ annual emissions in cows reflect a 22% reduction from BMP when compared with continuous grazing in this study. With the BMP application of MIG, less methane was produced per kilogram of beef gain.

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380. Mitigation of nitrous oxide emissions in spray-irrigated grazed grassland by treating the soil with dicyandiamide, a nitrification inhibitor.

Di, H. J. and Cameron, K. C.

Soil Use and Management 19(4): 284-290. (2003)
NAL Call #: S590.S68; ISSN: 0266-0032

Descriptors: spray irrigation: applied and field techniques/ animal excreta/ animal urine patches/ free draining lismore

stony silt loam: udic haplustept loamy skeletal/ global warming/ grazed pasture systems/ greenhouse gas inventory/ spray irrigated grazed grassland

Abstract: Nitrous oxide (N₂O) from animal excreta in grazed pasture systems makes up a significant component (c. 10%) of New Zealand's total greenhouse gas inventory. We report an effective method to decrease N₂O emissions from animal urine patches by treating the soil with the nitrification inhibitor dicyandiamide (DCD), in a simulated grazed dairy pasture system under spray irrigation. The soil was a free-draining Lismore stony silt loam (Udic Haplustept loamy skeletal) and the pasture was a mixture of perennial ryegrass (*Lolium perenne*) and white clover (*Trifolium repens*). By treating the soil with DCD, N₂O emissions were decreased by 76% following urine application in the autumn, from 26.7 kg N₂O-N ha⁻¹ without DCD to an average of 6.4 kg N₂O-N ha⁻¹ with DCD over the 6-month experimental period. N₂O flux was decreased by 78% following urine application in the spring, from 18 kg N₂O-N ha⁻¹ without DCD to 3.9 kg N₂O-N ha⁻¹ with the application of DCD over the 3-month period. A single application of DCD immediately after urine was sufficient to effectively mitigate N₂O emissions from the urine. The results showed that repeated applications of DCD after urine application, or mixing DCD with urine, offered no advantage over a single application of DCD immediately after urine deposition.

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381. A model of ammonia volatilization from a grazing livestock farm.

Hutchings, N. J.; Sommer, S. G.; and Jarvis, S. C. *Atmospheric Environment* 30(4): 589-599. (1996)
NAL Call #: TD881.A822; ISSN: 1352-2310

Descriptors: air pollution/ animal housing/ control measures/ manure/ mathematical model/ nitrogen/ slurry handling/ urine

Abstract: A dynamic model was developed to predict the ammonia volatilization from grazing livestock farms and to allow potential control measures to be evaluated. The relationships within the model were based on the underlying physical and chemical processes but empirically based factors were used to reduce the demand for input data and where the understanding of the underlying processes was inadequate. On a daily basis, the model simulates the partitioning of dietary nitrogen into dung and urine and its subsequent fate within the pasture or the slurry handling system. The fate of dry matter and water added in dung, urine and from other sources is also predicted. The model illustrates the indirect interactions between ammonia sources, highlights the influence of slurry management on ammonia losses, stresses the need for integrated, whole farm measurements and demonstrates that assessments of the impact of control measures may be misleading unless considered at the scale of the whole farm.

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382. Modelling the effects of landscape pattern and grazing regimes on the persistence of plant species with high conservation value in grasslands in south-eastern Sweden.

Cousins, Sara A. O.; Lavorel, Sandra; and Davies, Ian *Landscape Ecology* 18(3): 315-332. (2003)
NAL Call #: QH541.15.L35 L36; ISSN: 0921-2973

Descriptors: LAMOS: landscape modelling shell, computer software/ landscape model: mathematical and computer techniques/ landscape modelling: mathematical and computer techniques/ cadastral maps/ competition sensitive groups/ disturbance responses/ grassland pattern effects/ grassland size effects/ grazing frequency effects/ grazing intensity effects/ grazing regimes/ lack of management/ land use change/ landscape pattern effects/ landscape time layers: historical, pre modern, present day/ light requirements/ local dispersal/ local grazing disturbance/ local succession/ plant functional groups/ semi natural grasslands/ vegetation dynamics

Abstract: Semi-natural grasslands in Sweden are threatened by land-use change and lack of management with attendant risk to their biodiversity. We present a model to explore the effects of grazing frequency and intensity on plant species persistence, and the relative effects of grassland size and pattern. We used a landscape modelling platform, LAMOS (Landscape MOdelling Shell), to design a landscape model of vegetation dynamics incorporating the effects of local succession, dispersal and grazing disturbance. Five plant functional groups (PFG), representing various combinations of persistence and dispersal character, light requirements and disturbance responses, were defined to model species dynamics. Based on old cadastral maps three different landscapes were designed representing specific time-layers, i.e., a historical (17th to 18th century), a pre-modern (1940s) and a present-day landscape. Simulations showed that a threshold was crossed when grasslands decreased in area to about 10-30% of the modelled area, and as a consequence the biomass of grassland-specific PFGs was strongly reduced. These competition sensitive groups did not persist in the model even with intense grazing in the present-day landscape, where grasslands occupy 11% of the total area. However, all grassland species would have been able to persist in the historical landscape, where grasslands occupied 59% of the total area, even without grazing. Our results suggest that continuous but low-intensity grazing is more positive for grassland PFGs than discontinuous but highly intensive grazing. This effect was particularly strong when the frequency and/or intensity of grazing dropped below a threshold of 20%. Simulations using three landscape maps designed to explore effects of further fragmentation and habitat loss showed that the spatial pattern of remaining grasslands is important for the persistence of grassland-specific PFG. The model presented here is an advance towards more realistic grazing models to explore the effects of prescribed grazing and landscape fragmentation on the persistence species or plant functional groups.

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383. Modelling the structural changes in vegetation under different grazing regimes.

Thalen, D. C. P.; Poorter, H.; Lotz, L. A. P.; and Oosterveld, P.

Geobotany 10: 167-183. (1987)

NAL Call #: QK901.G45

Descriptors: natural resource management/ simulation models/ grazing/ Netherlands

This citation is from AGRICOLA.

384. The need for a new approach to grazing management—is cell grazing the answer?

Earl, J. M. and Jones, C. E.

Rangeland Journal 18(2): 327-350. (1996)

NAL Call #: SF85.4.A8A97; ISSN: 1036-9872

Descriptors: rotational grazing/ botanical composition/ New South Wales

This citation is from AGRICOLA.

385. Net primary production and carbon stocks in differently managed grasslands: Simulation of site-specific sensitivity to an increase in atmospheric CO₂ and to climate change.

Riedo, Marcel; Gyalistras, Dimitrios; and Fuhrer, Jurg

Ecological Modelling 134(2-3): 207-227. (2000)

NAL Call #: QH541.15.M3E25; ISSN: 0304-3800

Descriptors: pasim pasture model: mathematical model/ carbon dynamics/ climate change/ cutting/ grazing/ managed grasslands/ management options/ net primary production/ precipitation/ soil organic matter

Abstract: Elevated atmospheric CO₂ and climate changes are expected to influence managed grassland ecosystems. The mechanistic pasture simulation model (PaSim) was used to quantify effects on net primary productivity (NPP) and carbon (C) stocks at three locations differing in climate and soil type. An earlier model version was modified to enable long-term simulations at different altitudes, and to consider management in the form of either cutting or grazing by lactating cows. Results from simulations under current conditions agreed favourably with measured data for yield and C stocks, and model behaviour appeared to be plausible. Elevated CO₂ alone or in combination with increased temperature stimulated NPP at all sites. The stimulation was positively related to increasing precipitation at dry sites, but negatively at cool sites. Climate change scenarios in combination with elevated CO₂ led to increase C stocks. The sensitivity of C stocks to changes in temperature and precipitation was similar, and much larger than to management. Grazing led to higher C stocks compared with cutting, depending mainly on the difference in NPP between the management options. Grazing had a positive effect on C stocks under cool conditions, but the effect tended to become negative with increasing temperature. Comparing different sites revealed that local conditions affect system behaviour qualitatively. In quantitative terms, the results confirm that the combination of elevated CO₂ and climate change affects NPP and C stocks, and that the influence of management is site-specific.

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386. Nitrogen and mineral composition of autumn-grazed pasture.

Belesky, D. P.; Turner, K. E.; and Fedders, J. M.

Communications in Soil Science and Plant Analysis 26(17/18): 2941-2959. (1995)

NAL Call #: S590.C63; ISSN: 0010-3624

Descriptors: pastures/ range management/ autumn/ botanical composition/ mineral content/ sheep/ grazing/ chemical constituents of plants

Abstract: Grazing management in autumn can influence the botanical composition and productivity of a sward. Cycling of nutrients as a result of grazing livestock activity and variable canopy growth rates may influence mineral nutrient supply and demand in a dynamic canopy. An

experiment was conducted to determine the influence of autumn grazing practices on the growth and composition, including minerals in terms of ruminant requirements, of a grass/legume sward. Paddocks were established and three replicates grazed by growing lambs for 30-, 60-, or 90-d intervals beginning in late summer. Herbage samples were collected at the beginning of the grazing interval and at the end of each interval (closing date). Herbage mass, and nitrogen (N), phosphorus (P), potassium (K), magnesium (Mg), calcium (Ca), and sulfur (S), as well as copper (Cu) and zinc (Zn) were examined in terms of the influence of sampling date, closing date, year, and the interaction of these factors from stockpiled and grazed canopies. Soil mineral composition was determined as well.

Concentrations of all minerals declined with increasing soil depth and P, Na, Mg, and Ca increased in soil over the course of the experiment. Soil N concentration was reflected in the pattern of herbage growth in autumn. In general, closing date had no influence on herbage mineral composition and concentrations were within the recommended levels for a range of livestock. Phosphorus was the exception and concentrations in herbage were low in terms of requirements for high producing livestock such as lactating dairy cattle. Uptake or mineral reallocation within the plant remained constant during the autumn growth interval, since mineral yields were stable as growth rates declined in 1991 and increased when growth rates were stable in 1992. Mineral related nutritional problems in grazed mixed-species pasture, would most likely be a function of mineral bioavailability or interactions, rather than low concentrations in the herbage.

This citation is from AGRICOLA.

387. Nitrogen fixation during improvement of North Island hill country pastures.

Lambert, M. G.

New Zealand Journal of Experimental Agriculture 15(3): 267-270. (1987)

NAL Call #: S542.A1N45; ISSN: 0301-5521

Descriptors: legumes/ sheep/ fertilizer/ grazing management/ livestock industry/ crop industry/ agriculture
Abstract: Nitrogen (N) fixation was measured, using the acetylene reduction assay, in hill pastures at the Ballantrae Hill Country Research Station near Woodville.

Measurements were made over a 12 month period starting in September 1976, on sunny and shady aspects of the six fertiliser .times. grazing management treatment combinations of a larger grazing trial. Fertiliser treatments were LF (750 kg/ha superphosphate total over the previous 4 years) and HF (1800 kg/ha total plus 1250 kg/ha ground limestone). Grazing managements were set stocking with sheep (SSS), and rotational grazing with sheep (RGS) or cattle (RGC). Annual fixation averaged 103 kg N/ha in LF and 201 kg N/ha in HF pastures, and 105, 129 and 224 kg N/ha in SSS, RGS, and RGC pastures respectively. These levels were in contrast to an annual level of 34 kg N/ha measured within the same area 2 years previously, when pasture improvement was much less advanced. Annual N fixation was similar on sunny and shady aspects, but the pattern of seasonal fixation differed. In particular, fixation on shady sites was greater than on sunny sites in summer and autumn. N fixation was closely related to measured rate of legume herbage accumulation.

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388. Nutrient content, dry matter yield, and species composition of cool-season pasture with management-intensive grazing.

Martz, F. A.; Gerrish, J.; Belyea, R.; and Tate, V.
Journal of Dairy Science 82(7): 1538-1544. (1999)
NAL Call #: 44.8 J822; ISSN: 0022-0302

Descriptors: heifers/ steers/ rotational grazing/ stocking rate/ grazing intensity/ botanical composition/ liveweight gain/ seasonal variation/ nutrient content/ fiber content/ crude protein/ digestibility/ energy content/ hemicellulose/ Missouri

Abstract: The objective of this study was to determine changes in the nutrient content, available pasture, and species stand counts of cool season pastures during the grazing season. Four replicated pastures were flexibly subdivided into 18 to 36 paddocks and grazed rotationally from late April to November in each of 2 yr. Steers were grazed with fresh pasture offered each 1 to 2 d, which resulted in rest periods for paddocks of 17 to 35 d. Samples used to determine the nutrient content of pasture forage dry matter (DM) were collected from two grazing rumen-fistulated heifers that had empty, clean rumens at initiation of the sampling period. Mean stand counts in long-term established pastures for the grazing season were 24% legumes, 45% grasses, 8% grassy weeds, 10% bare ground, 11% broadleaf weeds, and 1% dung piles. Stand counts did not differ between years. Mean DM utilization of pasture per grazing cycle was 1103 kg/ha, and total DM temporal utilization per season was 6624 kg/ha, which was 35% of the pasture available for each grazing. Pasture content of neutral detergent fiber, crude protein, in situ digestible DM, and net energy for lactation did not differ between years but did differ among months of harvest: neutral detergent fiber decreased, crude protein and in situ digestible DM increased, and acid detergent fiber and estimated net energy for lactation remained relatively constant over the grazing season. The content of measured nutrients in ingested herbage did not differ among heifers sampled. These results indicate that individual cattle select similar quality diets from given pastures and nutrient differences occurred among months of sampling. Even though differences among months of season were statistically different, actual differences were small. Management-intensive grazing of pastures was uniform enough over season, and animal selectivity was strong enough over season to result in constant quality of consumed pasture.

This citation is from AGRICOLA.

389. Observed spatial and seasonal patterns of cattle activity versus simulated effects in an enclosure experiment.

Buttler, A.; Kohler, F.; Wagner, H.; and Gillet, F.
In: Land use systems in grassland dominated regions: Proceedings of the 20th General Meeting of the European Grassland Federation. (Held 21 Jun 2004-24 Jun 2004 at Luzern, Switzerland.); pp. 578-580; 2004.

Descriptors: animal behaviour/ cattle dung/ environmental factors/ foraging/ grazing/ pastures/ seasonal variation/ shrubs/ slope/ spatial variation/ temporal variation/ trampling/ trees/ vegetation

Abstract: Cattle activity or grazing s.l. can be subdivided into three components: dung deposition, herbage removal (foraging or grazing s.s.) and trampling. All these actions modify vegetation. At medium or large scale, the pattern of

cattle activity is generally described only as the foraging behaviour. Such a description implicitly consider grazing as the principal behaviour of the three primary activities. Our purpose was first to determine in an observational study the medium-scale distributions of dung-pat density, trampling effect and herbage removal in a mountain wooded pasture. These distributions were related to 'natural structures', such as slope, vegetation openness, cover of trees, shrubs and rock outcrops, fodder potential, and 'management-induced structures', such as distance to fence or to the nearest watering place. Results showed that the three variables describing cattle activity exhibited significantly different spatio-temporal patterns. Moreover, the relative influence of environmental factors was different for each activity. Secondly, in an enclosure experiment we simulated the fine scale effects of these factors, separately or in combination, and compared them with cattle grazing over a one-year period. Multivariate analyses of vegetation data in the first year showed an overwhelming seasonal shift and significant differences induced by treatments. Thus, grazing alone appears to be an unrealistic indicator of cattle activity and it might be necessary to consider dunging, trampling and grazing separately in spatially explicit models of vegetation dynamics.

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390. An on-farm test of perennial forage grass varieties under management intensive grazing.

Casler, M. D.; Undersander, D. J.; Fredericks, C.; Combs, D. K.; and Reed, J. D.
Journal of Production Agriculture 11(1): 92-99. (1998)
NAL Call #: S539.5.J68; ISSN: 0890-8524

Descriptors: crop industry/ available forage/ forage intake/ intensive grazing systems

Abstract: Perennial cool-season grasses have historically been bred and evaluated strictly under hay managements with mechanical harvesting. Forage yield and persistence data collected under such circumstances may have little value in choosing cultivars for management intensive grazing (MIG) systems. The objectives of this study were to begin developing a database of cool-season grass cultivars for MIG and a protocol for expansion of the database: Ninety-one grass varieties were planted in randomized complete block designs in 1990 on three dairy farms in southern Wisconsin (Fayette silt loam and Dubuque loam-both fine-silty, mixed, mesic Typic Hapludalfs). Each study was rotationally grazed rive or six times in 1991 and 1992. Compressed pasture heights (bulk density) were measured on each plot immediately before and after each grazing event and converted to estimates of available forage using a linear regression calibration. Apparent intake of each plot was computed as the difference between pre- and postgrazing estimates of available forage. Across all varieties, available forage ranged from 1.2 to 1.7 tons/acre, apparent intake ranged from 0.45 to 0.82 tons/acre, and ground cover (fall 1992) ranged from 18 to 93%, with significant differences observed among species and within several species. Reed canarygrass (*Phalaris arundinacea* L.) had markedly greater available forage and apparent intake than the other very hardy species. Creeping foxtail (*Alopecurus arundinaceus* Poir.) had very high apparent intake (0.70 tons/acre) and Kentucky bluegrass (*Poa pratensis* L.) had very low apparent intake (0.57 tons/acre) although their available forage differed by only 0.05 tons/acre. Timothy (*Phleum pratense* L.) varieties

were highly variable, while smooth brome grass (*Bromus inermis* Leyss.) varieties did not show marked differences. Many orchardgrass (*Dactylis glomerata* L.) varieties had extremely high available forage and apparent intake, always higher in apparent intake than tall fescue (*Festuca arundinacea* Schreb.) for the same level of available forage. Similarly, perennial ryegrass (*Lolium perenne* L.) had higher apparent intake than meadow fescue (*F. pratensis* Huds.) for the same level of available forage. Intermediate and Italian ryegrasses (*L. multiflorum* Lam.), festulolium (*Festulolium braunii* K-A.), and 'Matua' prairie brome (*Bromus unioloides* (Willd.) H.B.K.) were not well adapted to the combination of MIG and harsh, relatively snow-free winters. The study provided the beginning of a database that will be extremely useful in developing credible recommendations of perennial grasses for cool-season pastures.

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391. Pasture growth, production, and quality under rotational and continuous grazing management.

Paine, L. K.; Undersander, D.; and Casler, M. D. *Journal of Production Agriculture* 12(4): 569-577. (1999)
NAL Call #: S539.5.J68; ISSN: 0890-8524

Descriptors: pastures/ rotational grazing/ grazing/ range management/ animal husbandry/ forage/ nutritive value/ crude protein/ seasonal variation/ dietary fiber/ Wisconsin
Abstract: Management intensive rotational grazing (MIRG) is an expanding practice among dairy farmers in the Upper Midwest. Despite the high productivity associated with MIRG pastures, many acres of unmanaged, continuously grazed pastures still exist. Our goal was to document relationships between forage growth, production, and quality in rotational and continuous grazing systems and to evaluate the role that management plays in the productivity of these pastures. Forages were monitored under farmer management on three MIRG dairy farms and on three continuously grazed pastures (CON) on conventional livestock farms in 1994 and 1995. Evaluation of the results was complicated by the range of conditions and management practices that characterized the study's participants. As is typical for this region, CON pastures in this study were unmanaged. In contrast, MIRG pastures were monitored daily by their owners and sward health was maintained through movement of the herd and such practices as interseeding legumes. Forage mass for MIRG pastures was greater than CON every week of the 24-wk grazing season, averaging 1763 lb/acre for ready-to-graze MIRG paddocks vs. 850 lb/acre for CON. Crude protein averaged 16.6% for MIRG vs. 15.3% for CON. Seasonal average ADF values were 34.2% for MIRG and 34.1% for CON. Average NDF values were 53.4% for MIRG and 56.8% for CON. Forage mass between 1300 and 1900 lb/acre appeared to provide a balance between yield and quality on MIRG pastures. Cooperating farmers most often chose to graze paddocks at this level. For CON, forage quality decreased as forage biomass increased. Ready-to-graze MIRG paddocks had significantly higher quality than CON pastures at equivalent levels of forage biomass. It was not possible in this study to isolate individual management practices and test them separately, so no one factor can be viewed as responsible for the differences we observed. Indeed, these differences probably are the result

of the interaction among several management practices on MIRG farms and the lack of pasture management on CON farms.

This citation is from AGRICOLA.

392. Pasture management.

Murphy, B.
In: Sustainable agriculture in temperate zones/ Francis, C. A.; Flora, C. B.; and King, L. D.
New York: John Wiley and Sons, 1990; pp. 231-262.
Notes: ISBN 0471622273
NAL Call #: S494.5.S86S87
Descriptors: sward dynamics/ grazing/ paddock layout/ fencing
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393. Pasture management in semi-arid tropical woodlands: Effects on species diversity.

Mcivor, John G.
Australian Journal of Ecology 23(4): 349-364. (1998)
NAL Call #: QH540.A8; ISSN: 0307-692X
Descriptors: fertilizer application: field method, pasture management method/ introduced species sowing: field method, pasture management method/ timber treatment: field method, pasture management method/ grazing pressure/ semi arid tropical woodland: pasture management
Abstract: The effects of pasture management options (sowing introduced legumes and grasses, timber treatment, applying fertilizer, cultivation before sowing, and stocking rate) on species diversity were measured at two experimental sites (Hillgrove and Cardigan) near Charters Towers, northeast Queensland. Species were divided into three groups (sown, native and exotic) and diversity was measured as species density (number of species recorded in each plot and number of species/quadrat) annually from 1982 to 1992. The responses of individual native and naturalized species to treatment were also determined. All management options affected diversity but the responses varied with site and season, and with the different measurement scales. The density of sown species either increased or was unaffected by all the management options; there were no significant decreases. The density of native species showed both positive and negative responses; it increased at high stocking rates and with tree killing at Hillgrove, and decreased with pasture sowing and cultivation. The density of exotic species increased as stocking rate was increased and decreased when pastures were sown (although not at the quadrat scale at Hillgrove). Overall the most diverse vegetation was on plots grazed at high stocking rates; at the plot scale these were native pastures but at the quadrat scale the sown pastures had more species. Among the native and naturalized species, only *Portulaca* spp. were more frequent on the oversown plots than the native pasture plots; 48% (Hillgrove) and 68% (Cardigan) of the species were less frequent on the oversown plots. Fertilizer application had little effect on species frequencies, while timber treatment resulted in both increases and decreases in frequency of a small number of species. The species were divided into four groups on the basis of their responses to stocking rate: a grazing-sensitive group (e.g. *Themeda triandra*), two grazing-tolerant groups which either slightly decreased (e.g. *Chrysopogon fallax*) or slightly increased (e.g. *Sida spinosa*) in frequency as stocking rate increased, and a

fourth group of species which were frequent only at high stocking rates (e.g. *Bothriochloa pertusa*). There were no close relationships between herbage yield and species density.

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394. Pasture management in semi-arid tropical woodlands: Regeneration of degraded pastures protected from grazing.

Mcivor, J. G.

Australian Journal of Experimental Agriculture 41(4): 487-496. (2001)

NAL Call #: 23 Au792; ISSN: 0816-1089

Descriptors: botanical composition/ grass basal area/ grazing/ ground cover/ pasture degradation/ pasture regeneration/ semi arid tropical woodland/ soil cover/ soil seed bank

Abstract: Regeneration of native and oversown pastures following exclusion of grazing was studied over 3 years on a fertile soil at Hillgrove, near Charters Towers, north-east Queensland. The pastures covered a wide range of initial conditions reflecting the grazing pressures they had been exposed to during 2 dry years before enclosure. Pasture measurements made before the exclusion of grazing (yield, botanical composition, basal area, ground cover, height, soil seed banks) were related by regression analysis to subsequent changes in site condition described by a site condition value, calculated from herbage yields and botanical composition, to determine suitable predictors of regeneration during resting from grazing. The pastures recovered (increases in soil cover, grass basal area and the proportion of desirable species) under the generally favourable growing conditions during the period of enclosure although some plots, initially in poor condition, had not recovered after 3 years. There were only minor differences between the native and oversown pasture types in their recovery. Relative yields and site condition values were not affected by pasture type and botanical composition index values differed with pasture type in 1989 only. The site condition values of both pasture types after the first year of enclosure were closely and positively related to all the pasture characteristics measured the previous year except for soil seed numbers in the native pastures. All characteristics could be used to predict site condition value and potential of the pasture to regenerate, and their merits are discussed. The proportion of desirable species in the pasture combined with level of ground cover is suggested as a useful means of predicting regeneration and potential for future grazing.

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395. Pasture production in cleared and uncleared grazing systems of central Queensland, Australia.

Kaur, K.; Jalota, R. K.; Midmore, D. J.; and Rolfe, J.

Rangeland Journal 27(2): 143-149. (2005)

NAL Call #: SF85.4.A8A97; ISSN: 1036-9872

Descriptors: agroforestry/ agroforestry systems/ biomass/ botanical composition/ grassland soils/ grazing/ grazing systems/ land clearance/ silvopastoral systems/ soil pH/ soil types/ species diversity/ sustainability/ microbial biomass

Abstract: Clearing land of trees and introducing exotic pastures to enhance pasture and cattle production and hence enterprise financial performance are widely practised in Queensland. The results from many previous studies on tree clearing have emphasised the gains in pasture

production, but over periods of less than 10-15 years after clearing. The present study questioned the sustainability of pasture production in cleared systems over a longer time-frame (>10 years of clearing). For this, three different age groups of clearing i.e. 5 year, 11-13 year and 33 year were selected in each of 3 major types of tree communities i.e. *Eucalyptus populnea*, *E. melanophloia* and *Acacia harpophylla* in central Queensland. Paired comparisons of cleared and uncleared (intact) pasture systems were selected for each age group of clearing. The results suggest that the initial gains in pasture production upon clearing were compatible with published studies. However, for longer periods of time since clearing, the gains in pasture production were not sustained and were accompanied by risks of land degradation and loss of pasture plant diversity. For *E. populnea* and *A. harpophylla*, the maximum benefits from clearing were achieved at 13-15 years whereas for *E. melanophloia*, any benefits existed only over a short period of 5-6 years. The study emphasises that each tree community exhibits a specific response with regard to the duration of increased pasture production following clearing. To estimate the total benefits from tree clearing in pasture development, it is important to consider both monetary benefits and non-monetary losses from clearing for different types of tree communities.

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396. Pasture renovation and grazing management impacts on cool-season grass pastures.

Cuomo, G. J.; Johnson, D. G.; Forcella, F.; Rudstrom, M. V.; Lemme, G. D.; and Martin, N. P.

Journal of Production Agriculture 12(4): 564-569. (1999)

NAL Call #: S539.5.J68; ISSN: 0890-8524

Descriptors: pastures/ grazing/ range management/ *Medicago sativa*/ *Trifolium pratense*/ *Lotus corniculatus*/ botanical composition/ forage/ dairy cows/ glyphosate/ Fabaceae/ grasses/ sowing/ *Carduus*/ *Cirsium*/ weeds/ economic analysis/ plant communities/ Minnesota

Abstract: Legumes have been shown to increase production in cool-season grass pastures. However, they are included in relatively few acres of pasture. A split plot experiment with six replications was conducted to evaluate the impact of pasture renovation and grazing management on forage production and species composition of cool-season grass pastures. Grazing management main plots were grazed to leave low (2-4 in.), medium (4-6 in.), or high (6-8 in.) residue levels. Main plots were intensively grazed (50 000-70 000 lb of cows per acre) five or six times per grazing season by lactating Holstein cows. Subplot pasture renovation treatments were (i) an untreated check, or sprayed with glyphosate and interseeded with (ii) alfalfa (*Medicago sativa* L.), (iii) red clover (*Trifolium pratense* L.) and birdsfoot trefoil (*Lotus corniculatus* L.), or (iv) "graziers mix" (a mixture of legumes and grasses). Areas that were grazed to leave low residue level produced less forage mass (4.7 ton/acre) than areas grazed to medium (5.4 ton/acre) or high (5.5 ton/acre) residue levels. When averaged across years and grazing management treatments, renovated areas produced 1.8 ton/acre (46%) more forage than the control. Of interseeded species, alfalfa, red clover, and orchardgrass persisted through the study (more than 25% of the dry matter in at least one of the pasture renovation treatments). By June 1998, thistle (*Carduus* and *Cirsium* spp.) was present in all treatments. Fewer thistle was present in areas that were grazed to

leave low residue (10 sq yd) than high residue (18 sq yd) and in renovated areas (9 sq yd) than the control (22 sq yd). The additional forage produced as a result of pasture renovation cost from \$8.07/ton to \$12.81/ton. This study indicates that pasture renovation can be a valuable tool for increasing forage production in cool-season grass pastures. This citation is from AGRICOLA.

397. Pasture yield and composition changes in a central Queensland black speargrass (*Heteropogon contortus*) pasture in relation to grazing management options.

Orr, D. M.; Burrows, W. H.; Hendricksen, R. E.; Clem, R. L.; Rutherford, M. T.; Conway, M. J.; Myles, D. J.; Back, P. V.; and Paton, C. J.

Australian Journal of Experimental Agriculture 41(4): 477-485. (2001)

NAL Call #: 23 Au792; ISSN: 0816-1089

Descriptors: pasture composition/ pasture yield/ rainfall/ stocking rate

Abstract: A grazing study commenced in 1988 at Calliope, Central Queensland, measured the effects of stocking rate, legume over-sowing and animal diet supplements/burning on pasture and animal production in a native black speargrass (*Heteropogon contortus*) pasture. This paper reflects on changes in yield and pasture composition between 1988 and 1996, during which time the seasonal rainfall was below average. At the pasture community scale, the highest stocking rate of 1 steer/2 ha reduced pasture yield but had little impact on pasture composition. The frequency of *H. contortus* showed no clear differences due to stocking rate although there was a slight overall trend for it to decline with time. The frequency of increaser species such as *Chloris divaricata* was highest at the highest stocking rate. At the individual plant scale, the density of *H. contortus* plants declined at high stocking rate. The proportion of the sown legume *Stylosanthes scabra* cv. *Seca* increased with time reaching a density of 15 plants/m² and contributing 33% to the total yield in the legume treatments. Burning has reduced the occurrence of *H. contortus* compared with that in unburnt native pasture and this may be due to the stocking rates being too high following the fire. These results indicate the stability of pasture composition across a 4-fold range of stocking rates from 1988 to 1996. This study needs to continue, at least through a period of above average rainfall, to determine further effects of stocking rate and pasture type on pasture composition.

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398. Persistence and productivity of perennial ryegrass in sheep pastures in south-western Victoria: A review.

Waller, R. A. and Sale, P. W. G.

Australian Journal of Experimental Agriculture 41(1): 117-144. (2001)

NAL Call #: 23 Au792; ISSN: 0816-1089

Descriptors: climate/ environmental conditions/ grazing management/ rotational grazing

Abstract: Loss of perennial ryegrass (*Lolium perenne* L.) from the pasture within several years of sowing is a common problem in the higher rainfall (550-750 mm annual rainfall), summer-dry regions of south-eastern Australia. This pasture grass came to Australia from northern Europe, where it mostly grows from spring to autumn under mild climatic conditions. In contrast, the summers are generally

much drier and hotter in this region of south-eastern Australia. This 'mismatch' between genotype and environment may be the fundamental reason for the poor persistence. There is hope that the recently released cultivars, Fitzroy and Avalon, selected and developed from naturalised ryegrass pastures in south-eastern Australia for improved winter growth and persistence will improve the performance of perennial ryegrass in the region. Soon-to-be released cultivars, developed from Mediterranean germplasm, may also bridge the climatic gap between where perennial ryegrass originated and where it is grown in south-eastern Australia. Other factors that influence perennial ryegrass persistence and productivity can be managed to some extent by the landholder. Nutrient status of the soil is important since perennial ryegrass performance improves relative to many other pasture species with increasing nitrogen and phosphorus supply. It appears that high soil exchangeable aluminium levels are also reducing ryegrass performance in parts of the region. The use of lime may resolve problems with high aluminium levels. Weeds that compete with perennial ryegrass become prevalent where bare patches occur in the pasture; they have the opportunity to invade pastures at the opening rains each year. Maintaining some herbage cover over summer and autumn should reduce weed establishment. Diseases of ryegrass are best managed by using resistant cultivars. Insect pests may be best managed by understanding and monitoring their biology to ensure timely application of pesticides and by manipulating herbage mass to alter feed sources and habitat. Grazing management has potential to improve perennial ryegrass performance as frequency and intensity of defoliation affect dry matter production and have been linked to ryegrass persistence, particularly under moisture deficit and high temperature stress. There is some disagreement as to the merit of rotational stocking with sheep, since the results of grazing experiments vary markedly depending on the rotational strategy used, climate, timing of the opening rains, stock class and supplementary feeding policy. We conclude that flexibility of grazing management strategies is important. These strategies should be able to be varied during the year depending on climatic conditions, herbage mass, and plant physiology and stock requirements. Two grazing strategies that show potential are a short rest from grazing the pasture at the opening rains until the pasture has gained some leaf area, in years when the opening rains are late. The second strategy is to allow ryegrass to flower late in the season, preventing new vegetative growth, and perhaps allowing for tiller buds to be preserved in a dormant state over the summer. An extension of this strategy would be to delay grazing until after the ryegrass seed heads have matured and seed has shed from the inflorescences. This has the potential to increase ryegrass density in the following growing season from seedling recruitment. A number of research opportunities have been identified from this review for improving ryegrass persistence. One area would be to investigate the potential for using grazing management to allow late development of ryegrass seed heads to preserve tiller buds in a dormant state over the summer. Another option is to investigate the potential, and subsequently develop grazing procedures, to allow seed maturation and recruitment of ryegrass seedlings after the autumn rains.

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399. Phalaris persistence under rotational grazing on a highly acidic soil on the south-west slopes of New South Wales.

Li, G. D.; Helyar, K. R.; Conyers, M. K.; Cullis, B. R.; Poile, G. J.; and Knight, P. G.

Australian Journal of Experimental Agriculture 44(8): 771-778. (2004)

NAL Call #: 23 Au792; ISSN: 0816-1089

Descriptors: acid soil/ feed scarcity/ rotational grazing
Abstract: Phalaris (*Phalaris aquatica* L.)-based pastures were established with and without lime in 1992 as a part of a long-term pasture-crop rotation experiment (Managing Acid Soils Through Efficient Rotations). Pre- and post-grazing pasture dry matter, phalaris basal cover and proportion of phalaris in sward were measured since 1992. In general, phalaris persisted well and its productivity was high on the highly acidic soil studied in the current experiment, and this was improved on the limed treatment. After establishment in 1992, the average proportion of phalaris in spring 2001 was 32.1% in the limed treatment and 15.6% in the unlimed treatment. Basal cover at the end of summer 2002 was 4.5% and 2.0% for the limed and unlimed treatments, respectively. The results from the current experiment showed that subsurface acidity (low pH_{Ca} and high exchangeable aluminium percentage in the 10 - 30 cm soil depth) had significant impacts on phalaris persistence. It is concluded that subsurface pH was one of the major constraints for the persistence of phalaris. The long-term management of soil acidity should aim to eliminate the exchangeable aluminium from the soil profile by maintaining a high pH_{Ca} (5.5 or above) in the 0 - 10 cm soil depth. Rainfall during growing season had no direct effect on phalaris persistence. Nevertheless, feed scarcity in dry years due to moisture stress often exacerbated grazing pressure on phalaris, which may affect the phalaris persistence indirectly. It is the grazing management in autumn and summer that had significant effects on phalaris persistence. It is suggested that rotational grazing plus strategic rest if possible in autumn could prolong the life of phalaris-based pastures. Repeated heavy grazing should be avoided during summer, particularly after light to moderate summer rainfall events have stimulated sprouting.

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400. A pilot scale long-term experimental study on the effects of grazing and gap creation on burren grassland dynamics: Implications for conservation.

Moles, R.; Breen, J.; and O'regan, B.

Biology and Environment 105B(1): 15-32. (2005); ISSN: 0791-7945

Descriptors: vegetation dynamics/ grazing effect/ limestone pavement

Abstract: Burren grassland is an important habitat for biodiversity conservation, but studies to date have not provided sufficient scientific understanding of vegetation dynamics to inform selection of appropriate management prescriptions. This paper reports on a pilot scale study on a small grassland patch on limestone pavement near Mullach More in the Burren National Park. Through experimental manipulation, it examines the effects of grazing and bare soil gap creation on vegetation dynamics and reproductive success over six years, with a focus on temporal changes in cover, species richness, flowering rates, turnover and mobility. Cessation of grazing resulted in very marked

frequency reductions for most species, but increases for some grasses and increased flowering frequency in some forb species. Gap creation resulted in vegetation change that persisted for at least two years under ungrazed treatment, but for six years in grazed sward. Soil depth decreased under grazing but increased under ungrazed treatment. The grassland patch had attributes suggestive of both equilibrium and non-equilibrium vegetation dynamics. As the small study area selected may not be fully representative of the markedly heterogeneous Burren landscape, this paper does not arrive at conclusions in relation to all Burren grasslands and their conservation, but rather identifies some attributes important in informing prescription selection that require further testing at larger scale.

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401. Plant responses to grazing, and opportunities for manipulation.

Bullock, J. M. and Marriott, C. A.

In: *Grazing management*. (Held 2 Feb 1929-2 Mar 2000 at Harrogate, United Kingdom.) Rook, A. J. and Penning, P. D. (eds.); pp. 17-26; 2000.

NAL Call #: SB197.B7; ISBN: 0905944542

402. Plant species diversity and management of temperate forage and grazing land ecosystems.

Sanderson, M. A.; Skinner, R. H.; Barker, D. J.; Edwards, G. R.; Tracy, B. F.; and Wedin, D. A.

Crop Science 44(4): 1132-1144. (July 2004-Aug. 2004)

NAL Call #: 64.8 C883; ISSN: 0011-183X

Descriptors: literature reviews/ temperate zones/ grasslands/ pastures/ species diversity/ ecosystem management/ pasture management/ forage production/ plant communities/ forage/ grazing/ ecological function/ economic impact/ environmental impact/ biogeochemical cycles/ animal production

Abstract: More than a century since Charles Darwin stated that diverse grasslands produce more herbage than monocultures, scientists still debate the relationship between species diversity and ecosystem function. Postulated benefits of diversity in experimental grasslands include greater and more stable primary production along with more efficient nutrient use. These benefits have been extrapolated to forage and grazing land systems with little supporting objective data. Most information on the potential benefits of increased plant diversity comes from studies of synthesized grasslands that have not included domestic grazing animals. We explore this debate relative to the management of temperate forage and grazing lands. Plant species diversity refers to the number of species (richness) and their relative abundance (evenness) within a defined area. Plant relations influence biodiversity responses through positive (e.g., facilitation, N₂ fixation, hydraulic lift) and negative interactions (e.g., competitive exclusion, allelopathy). Early 20th century research on complex mixtures of forage species (limited to grasses and legumes) for pasture indicated equivocal results regarding benefits of species-rich mixtures and typically recommended using the best adapted species in simple grass-legume mixtures. Recent research indicates potential herbage yield benefits from species-rich mixtures for pastures. Limited animal productivity research on species-rich mixtures indicates variable responses and much more research is needed. Grazing land productivity is a primary focus for biodiversity

benefits because of the direct economic relevance to producers. However, taking a broader view of the multifunctionality of grazing lands to include environmental and aesthetic benefits to humans reveals a great scope for using biodiversity in grazing land management. This citation is from AGRICOLA.

403. Plant species responses to cattle grazing in mesic semi-natural grassland.

Pykala, J.

Agriculture, Ecosystems & Environment 108(2): 109-117. (2005)

NAL Call #: S601 .A34; ISSN: 0167-8809

Descriptors: grasslands/ range management/ cattle feeding/ grazing/ agroecosystems/ ecological restoration/ species diversity/ plant ecology

Abstract: Cattle grazing is generally recommended for management of semi-natural grassland, but its effects on flora are insufficiently studied in northern Europe. Plant species responses to cattle grazing of mesic semi-natural grasslands were studied in SW Finland managed by private farmers under three kinds of management: old (continuously grazed, n = 10), restored new (grazing restarted 3-8 years ago, n = 10) and abandoned pastures (grazing ceased >10 years ago, n = 11). Positive effects of cattle grazing were observed on most grassland plants, 34 species being significantly more frequent in grazed than in abandoned grassland and four in abandoned than in grazed grassland. The frequencies of most species in restored new pastures were between those observed in old and in abandoned pastures. Changes in species number with different Ellenberg indicator values showed that grazing increased the number of species indicating nitrogen-poor soils, high light intensity and low soil moisture, but decreased species indicating nitrogen-rich soils. Grazing was beneficial to indicator species of both high and low pH. Species numbers in new pastures were consistently between those of old and abandoned pastures. Based on Ellenberg indicator values, restored grazing changed species assemblages towards that of old pastures. Many grassland species seem to recover under grazing regimes applied by private farmers, but insufficient management quality may prevent full success of restoration.

This citation is from AGRICOLA.

404. Post-pastoral changes in composition and guilds in a semi-arid conservation area, Central Otago, New Zealand.

Walker, Susan

New Zealand Journal of Ecology 24(2): 123-137. (2000)

NAL Call #: QH540.N43; ISSN: 0110-6465

Descriptors: competition/ exotic species/ grazing cessation/ guild composition/ post pastoral succession/ semi arid conservation area: post pastoral change/ species diversity/ species invasion/ species richness

Abstract: Changes in the vegetation of Flat Top Hill, a highly modified conservation area in semi-arid Central Otago, New Zealand, are described four years after the cessation of sheep and rabbit grazing. Unusually moist weather conditions coincide with the four-year period of change in response to the cessation of grazing. Between 1993 and 1997, the average richness and diversity (H') of species increased, and the average proportion of native species decreased significantly. The vegetation was

significantly richer in exotic annual and perennial grass species, exotic perennial forbs, exotic woody species and native tussock grasses in 1997 than in 1993. Eight response guilds of species are identified. Most "remnant" native shrubs and forbs were stable, in that they remained restricted to local refugia and showed little change in local frequency. However, taller native grass species increased, some locally, and others over wide environmental ranges. Rare native annual forbs and several native perennial species from "induced" xeric communities decreased, and this may be a consequence of competition from exotic perennial grasses in the absence of grazing. The invasive exotic herb *Sedum acre* decreased in abundance between 1993 and 1997, but several other prominent exotic species increased substantially in range and local frequency over a wide range of sites. Exotic woody species, and dense, sward-forming grasses are identified as potential threats to native vegetation recovery.

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405. The productivity of irrigated legumes in northern Victoria: Effect of grazing management.

Kelly, K. B.; Stockdale, C. R.; and Mason, W. K.

Australian Journal of Experimental Agriculture 45(12): 1577-1585. (2005)

NAL Call #: 23 Au792; ISSN: 0816-1089

Descriptors: biomass production/ carbon/ crop establishment/ defoliation/ dry matter/ grass sward/ grassland management/ grasslands/ grazing/ grazing intensity/ growth rate/ irrigated conditions/ leaf area/ legumes/ lucerne/ persistence/ photosynthesis/ regrowth/ seasonal variation/ sown grasslands/ stolons

Abstract: The productivity of irrigated white (*Trifolium repens* L.) and red (*Trifolium pratense* L.) clover swards was compared in an experiment of more than 3 years duration. It was hypothesised that white clover would be more productive than red clover when defoliation was frequent and intense, and less productive when defoliation was infrequent and lax. The experiment was a factorial design involving 2 species of clover [white clover (cv. Haifa) and red clover (cv. Redquin)], 2 grazing frequencies and 2 grazing intensities (with the criteria for both being based on quantities of herbage present before/after grazing). There were 4 extra treatments sown: perennial ryegrass (*Lolium perenne* L. cv. Grasslands Nui) and white clover (cv. Haifa), lucerne (*Medicago sativa* L. cv. Validor), Persian clover (*Trifolium resupinatum* L. cv. Maral) or subterranean clover (*Trifolium subterraneum* L. cv. Trikkala), but only 1 defoliation treatment was used for each of these treatments. There were 4 replicated blocks of all treatments. Apparent growth rates [calculated from measurements of dry matter (DM) removed by grazing] of white clover ranged from a low of 10 kg DM/ha.day in winter to a high of 70 kg DM/ha.day in summer. The growth rates of white clover swards were superior to those of ryegrass and white clover swards over summer, but were generally lower from May to October. In 2 of the 4 years, frequent grazing of white clover resulted in greater (P<0.05) production than infrequent grazing (average of 12.8 v. 10.7 t DM/ha) whereas intensity of grazing only affected DM net accumulation in the first year (P<0.05). The data show no evidence of a decline in productivity over time. Sward structure of white clover was influenced by grazing treatment with the numerically highest yielding treatment (frequent and hard) having the highest density of stolon tips

(vegetative buds). In relation to days of regrowth, the frequently grazed treatment had higher levels of net photosynthesis in spring and summer compared with the infrequently grazed treatment. The frequently grazed treatment achieved positive carbon balance immediately after grazing and reached maximum levels of photosynthesis at 8-10 days, whereas the infrequent treatment showed negative carbon balance for the first 2-3 days after grazing with maximum photosynthesis being achieved later than in the frequently grazed treatment. When net photosynthesis was related to leaf area, there were fewer differences between the 2 treatments. The exception was in spring when photosynthesis was lowest where the initial leaf area was highest in the infrequent and hard treatment. Maximum photosynthesis was achieved at diminishing leaf area index from spring through to winter. Red clover was the most productive legume in the first year after establishment, but it did not persist beyond the second year and its DM net accumulation was reduced by more frequent grazing (12.4 v. 15.3 t DM/ha in the first year and 6.1 v. 9.1 t DM/ha in the second year; $P < 0.05$). The DM net accumulation of lucerne was greater than that in any other treatment (an average of 16.7 t DM/ha in the 2 completed years), whereas the annual legumes, subterranean clover and Persian clover, averaged 6.6 and 10.7 t DM/ha.year, respectively. The seasonal growth rate data showed that lucerne had very good summer production whereas the annuals tended to be at least as good as the perennials from May to October.

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406. Quantity and quality changes of autumn-saved pasture in a high country winter.

Abrahamson, M. and Talbot, J.

New Zealand Journal of Experimental Agriculture 14(3): 247-256. (1986)

NAL Call #: S542.A1N45; ISSN: 0301-5521

Descriptors: Poaceae/ Trifolium/ botanical composition/ highlands/ crop quality/ quantitative analysis/ digestibility/ range management/ grazing/ New Zealand

This citation is from AGRICOLA.

407. Recent changes in grassland management and their effects on botanical composition.

Hopkins, A.; Bunce, R. G. H.; and Smart, S. M.

Journal of the Royal Agricultural Society of England 161: 210-223. (2000)

NAL Call #: 10 R81; ISSN: 0080-4134

Descriptors: biodiversity/ botanical composition/ drainage/ fertilizers/ grassland management/ grasslands/ nature conservation/ pest control/ pesticides/ pests/ reviews/ weeds/ intensification/ carrying capacity/ grazing

Abstract: This article discusses the factors that have led to the evolution of grass and arable land in British landscape, and examines the evidence from surveys of the changes to grassland that agriculture has brought about in recent decades. The effects of the various components of grassland management and how they have contributed to the present situation, and some comments on the effects of future developments, are also considered. The losses of natural and semi-natural grasslands, and reduction in biological diversity with increased intensification are outlined. Grassland management practices covered are:

ploughing and reseeded; land drainage; fertilizers; stocking rates and grazing pressure; weeds and pests and their control.

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408. Recovery of short tussock and woody species guilds in ungrazed *Festuca novae-zelandiae* short tussock grassland with fertiliser or irrigation.

Walker, S.; Wilson, J. B.; and Lee, W. G.

New Zealand Journal of Ecology 27(2): 179-189. (2003)

NAL Call #: QH540.N43; ISSN: 0110-6465

Descriptors: fertilization: applied and field techniques/ irrigation: applied and field techniques/ conservation management/ grasslands/ grazing/ guild recovery/ native cover/ pastoral management/ soil nutrients/ species richness/ succession

Abstract: In a *Festuca novae-zelandiae* short tussock grassland in South Island, New Zealand, we tested the propositions (1) that present regional trends in vascular plant species-richness in tussock grasslands are independent of current pastoral management, and (2) that grazing retards the invasion and dominance of non-native species, particularly where soil resources are not limiting. Sheep and rabbit-grazed, ungrazed, ungrazed+fertilised and ungrazed+irrigated treatments were applied in a replicated experiment that was sampled annually from 1988 to 2000. Native species richness and native forb cover decreased, and exotic grasses increased in all treatments, with no significant differences between grazed and ungrazed treatments in either trends or final cover. Exotic species richness decreased in the ungrazed, ungrazed+fertilised and ungrazed+irrigated treatments but showed no trend in grazed vegetation. Cover of native tussock grasses and the tall shrub *Carmichaelia petriei* decreased in the grazed treatment, remained steady in the ungrazed treatment and increased in the ungrazed+fertilised and ungrazed+irrigated treatments. Native subshrubs decreased in the grazed, ungrazed+fertilised and ungrazed+irrigated treatments but not in the ungrazed treatment. The invasive forb *Hieracium pilosella* increased with time in grazed, ungrazed, and ungrazed+irrigated treatments, but after 10 years it decreased in the ungrazed+fertilised treatment and its cover was negligible there after 12 years. Grazing appeared to reduce the cover of tussocks and certain woody species, and we conclude that current management affected vegetation trends. Grazing did not decrease the dominance of exotic species, or maintain native species richness at a higher level than in ungrazed vegetation. There was limited recovery of taller native species with grazing removal alone. However, grazing removal plus 12 years of resource enrichment promoted the growth of native tall shrubs and tussocks and did not result in physiognomic dominance by exotic species. Succession towards taller native tussock-shrubland communities may be an appropriate goal for conservation management of short tussock grasslands, and nutrient enrichment in the absence of grazing may be an appropriate management device in some circumstances.

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409. Relationships between ammonia volatilization and nitrogen fertilizer application rate, intake and excretion of herbage nitrogen by cattle on grazed swards.

Bussink, D. W.

Fertilizer Research 38(2): 111-121. (1994)

NAL Call #: S631.F422; ISSN: 0167-1731

Descriptors: grassland soils/ ammonia/ volatilization/ losses from soil/ nitrogen fertilizers/ cattle/ rotational grazing/ forage/ nitrogen/ nutrient intake/ nutrient retention/ excreta/ range management/ meteorological parameters/ cation exchange capacity/ application rate/ mathematics and statistics

Abstract: Grazed pastures emit ammonia (NH₃) into the atmosphere; the size of the NH₃ loss appears to be related to nitrogen (N) application rate. The micrometeorological mass balance method was used to measure NH₃ volatilization from rotationally grazed swards on three plots in the autumn of 1989 and throughout the 1990 growing season. The aim of the research was to derive a mathematical relationship between NH₃ volatilization and N application rate, which would vary between soil type and weather conditions. In both years the plots received a total of 250, 400 or 550 kg N ha⁻¹ as calcium ammonium nitrate (CAN) split over 6 to 8 dressings. The number of grazing cycles ranged from 7 to 9 for the three N plots. In the last two grazing cycles of 1989, NH₃ losses were 3.8, 12.0 and 14.7 kg N ha⁻¹ for the 250N, 400N and 550N plots, which was equivalent to 5.3%, 13.9% and 14.4% of the amount of N excreted on the sward, respectively. In 1990, NH₃ losses were 9.1, 27.0 and 32.8 kg N ha⁻¹ for the 250N, 400N and 550N plots, which was equivalent to 3.3%, 6.9% and 6.9% of the N excreted, respectively. Differences in urine composition between the plots were relatively small. Rainfall and sward management affected the size of the NH₃ volatilization rate. Volatilization of NH₃ was related to N excretion and N application rate. A calculation procedure is given to enable the estimation of NH₃ volatilization from N application rate. Adjustments can be made for grazing efficiency, grazing selectivity, N retention in milk and liveweight gain, concentrate N intake and milking duration. Losses of NH₃ increase progressively with an increase in N application rate until herbage yield reaches a maximum at an application rate of about 500 kg N ha⁻¹ yr⁻¹.

This citation is from AGRICOLA.

410. Relationships between soil biota, nitrogen and phosphorus availability, and pasture growth under organic and conventional management.

Parfitt, R. L.; Yeates, G. W.; Ross, D. J.; Mackay, A. D.; and Budding, P. J.

Applied Soil Ecology 28(1): 1-13. (2005)

NAL Call #: QH541.5.S6 A67; ISSN: 0929-1393

Descriptors: animals and man/ disturbance by man/ commercial activities/ ecology/ population dynamics/ habitat/ terrestrial habitat/ abiotic factors/ land zones/ Australasian Region/ Australasia/ Nematoda: farming and agriculture/ community structure/ population density/ soil fauna/ grassland/ pasture/ soil community composition and densities/ habitat management and nutrient availability relationships/ soil habitat/ community composition and densities/ pasture management and nutrient availability relationships/ chemical factors/ soil nutrient availability/ pasture management and soil community relationships/ New Zealand/ Ballantrae/ pasture management/ soil community and nutrient availability relationships/

Nematoda/ annelids/ invertebrates/ nematodes

Abstract: Legume-based pastures generally rely on soil biological activity to provide nitrogen (N) for plants. This study examined seasonal pasture growth in nine adjacent hill pastures, under sheep or beef, with different long-term managements, including certified organic, no fertilizer, and conventional fertilizer application, that formed a sod-fertility sequence. We determined relationships between net N mineralization, as a measure of soil biological activity and N availability, and microbial biomass, soil organic matter, and fauna. Net N mineralization generally explained differences in pasture production ($r = 0.87$). On an areal basis, net N mineralization was strongly related ($r = 0.93$) to total soil N (0-200 mm depth) and negatively related ($r = -0.92$) to soil C:N ratio, but not to soil C. Total N and C:N ratios were related to soil phosphorus (P) status and probably past N fixation by legumes. Where labile P was low, the N:P ratios of both soil microbes and enchytraeids were wide, and the organisms appeared to be P limited, possibly competing with plants for P. Faunal grazing on soil micro-organisms appeared to release P. We could find no convincing evidence that net N mineralization, pasture growth or soil biological diversity increased under organic farming. Rather, the data from organic pastures followed similar trend lines to data from pastures under conventional management. Copyright 2004 Elsevier B. V. All rights reserved.

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411. Restricted autumn grazing to reduce nitrous oxide emissions from dairy pastures in Southland, New Zealand.

De Klein, C. A. M.; Smith, L. C. B.; and Monaghan, R. M. *Agriculture, Ecosystems & Environment* 112(2-3, Sp. Iss. SI): 192-199. (2006)

NAL Call #: S601 .A34; ISSN: 0167-8809

Descriptors: greenhouse gas emissions/ dairy pastures/ restricted autumn grazing

Abstract: Animal excreta deposited on pasture during grazing represent the single largest source of N₂O emissions in New Zealand. These emissions are highest when pastures are grazed during the wet autumn/winter season. The strategic use of a feed pad on dairy farms could restrict the amount of excreta N returned to pasture during this time of year, and thus reduce N₂O emissions and other environmental losses. The effect of restricting autumn grazing to 3 h per day on N₂O emissions and NO₃ leaching losses was measured in a 3-year field study. Nitrous oxide emissions were measured weekly between April and September using a soil cover methodology. Nitrate leaching losses were measured from the NO₃ concentration of drainage water that was collected from the hydrologically isolated and artificially drained field plots. Restricted autumn grazing reduced both N₂O emissions and NO₃ leaching losses from grazed pasture by about 40%. The effect of this grazing regime on total on-farm N₂O emissions was estimated using the field measurements and the New Zealand IPCC inventory methodology. These calculations indicated that restricted autumn grazing could reduce direct and indirect on-farm N₂O emissions by 7-11%, and could thus be an effective tool for reducing N₂O emissions, while also reducing NO₃ leaching losses, and preventing soil and sward damage. The study further highlighted that the currently used IPCC inventory methodology cannot easily account for reductions in

national N₂O emission following adoption of N₂O mitigation strategies. It also reinforced the need for assessing the impact of mitigation strategies at a whole farm level. (c) 2005 Elsevier B.V. All rights reserved.
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412. A review of cattle grazing effects on lake margin vegetation with observations from dune lakes in Northland, New Zealand.

Tanner, C. C.

New Zealand Natural Sciences 19: 1-14. (1992);
ISSN: 0113-7492

Descriptors: bacterial contamination/ endangered plant/ erosion/ native vegetation/ trampling/ wildlife habitat
Abstract: Lake margin vegetation has become increasingly valued as a habitat for wildlife and as a moderator of sediment and nutrient inputs from surrounding catchments. This has encouraged action to exclude livestock from Lake shorelines. Cattle grazing effects are reviewed in relation to natural grazing of lake margin vegetation. Direct consumption and trampling of plant biomass by livestock affects the structure, diversity, productivity, succession and nutrient dynamics of plant communities. In addition, livestock grazing may affect lake marginal vegetation and water quality by pugging and erosion of lakeshores, nutrient addition, bacterial contamination and promotion of weed invasion. Agricultural modification of surrounding catchments also causes many indirect effects such as increased nutrient runoff and changed hydrological regimes. However, low levels of grazing can result in beneficial changes in lake margin vegetation by reducing domination by tall rank species and increasing plant and habitat diversity. Observations of cattle grazing impacts on the lake margin vegetation of Northland dune lakes showed a graded range of effects dependant largely on grazing pressure. Ungrazed, agriculturally undeveloped shortlines were characterised by *Leptospermum scoparium* growing to the wetted margin, grading into an inshore zone of mixed sedges (*Baumea juncea*, *B. huttonii*, *Leptocarpus similis*, and *Eleocharis acuta*) to 0.3-0.8 m depth, an outer sedge zone of *Eleocharis sphacelata* to 1-2 m depth, then a sharp boundary into fully submerged communities of charophytes and *Potamogeton* spp. in deeper water. At sites subject to heavy grazing pressure inshore sedge communities were absent, leaving only a remnant outer zone of emergent *E. sphacelata* in water too deep to graze. Sites with light to moderate grazing pressure were associated with more open inshore sedge zones showing an increased diversity and abundance of short shallow-water species including *Myriophyllum*, *Potamogeton*, *Lilaeopsis*, *Juncus* and *Triglochin* spp., and in some areas the endangered species *Hydatella inconspicua*. It is concluded that although heavy grazing of lakeshores is clearly detrimental to marginal vegetation, low levels of grazing may be an appropriate management tool in areas of some lakes to promote more diverse inshore habitats for plants and wildlife.

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413. Role of grazing management in manipulating the balance of rye grass (*Lolium* spp.) and paspalum (*Paspalum dilatatum*) in pastures.

Percival, N. S. and McClintock, M. B.

New Zealand Journal of Experimental Agriculture 10(4): 365-370. (1982)

NAL Call #: S542.A1N45; ISSN: 0301-5521

Descriptors: productivity/ New Zealand

Abstract: The effects of 2 spring and 4 summer grazing managements on the productivity and composition of a ryegrass-paspalum pasture are described. Lax spring grazing decreased paspalum content and increased that of ryegrass, whereas hard spring grazing had the opposite effect. Very hard summer grazing increased tillering of paspalum, but had no effect on its contribution to yield. Very lax summer grazing maximized content of paspalum. Management induced differences in paspalum content of mixed pasture had no effect on pasture yield. This was contrary to the pattern of previous New Zealand studies, and may be related to moisture availability of the soil type on which the trial was located. The role of paspalum in New Zealand pastures is discussed, and reasons are advanced to explain its decreasing abundance.

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414. The role of white clover in the loss of diversity in grassland habitat restoration.

Warren, John M.

Restoration Ecology 8(3): 318-323. (2000)

NAL Call #: QH541.15.R45R515; ISSN: 1061-2971

Descriptors: abundance/ community diversity/ cutting intensity/ grassland habitat restoration/ grazing/ habitat creation/ sowing density/ species richness

Abstract: A field experiment was designed to recreate a species-rich mesotrophic grassland community of conservation worth. *Trifolium repens* (white clover) was observed to increase significantly in both frequency and abundance in sown plots grazed by cattle, but not in plots cut in June and subsequently grazed by cattle. In both these treatments permanent quadrats containing clover patches were found to be lower in species richness than were quadrats without clover. In both treatments botanical diversity was seen to decline over time. In the grazed-only treatment the loss of diversity may be linked to the increase in clover. In the cut and grazed plots, *T. repens* did not become so abundant but diversity was still seen to decline, possibly due to the loss of low growing species from the taller sward. A pot experiment which varied the sowing density of a mix of seven wild flower species in full factorial combination with cutting frequency was established on soils from an arable field also sown with a single density of clover. *T. repens* was seen to decline from initial high cover estimates in infrequently cut and uncut treatments. In the pot experiment where a grass component to the vegetation was absent, clover was seen to have less impact on the other forbs than it did in the field. It is suggested that, being a nitrogen fixer, *T. repens* may have a competitive edge in ex-arable soils low in available nitrogen. The observed reduction in botanical diversity may be a result of this increase in available nitrogen, facilitating the spread of the sown grasses and preventing the recovery of the sown forbs that were excluded by the invasion of *T. repens*. It is suggested that reducing the proportion of grass in the seed mixtures during grassland habitat creation on these soils may help reduce or delay this effect.

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415. Seasonal changes in quality and botanical composition of a rotationally grazed grass-legume pasture in southern Ontario.

Marshall, S. A.; Campbell, C. P.; and Buchanan-Smith, J. G.

Canadian Journal of Animal Science 78(2): 205-210. (1998)
NAL Call #: 41.8 C163; ISSN: 0008-3984

Descriptors: pastures/ Poaceae/ Fabaceae/ rotational grazing/ forage/ botanical composition/ seasonal variation/ cattle/ grazing intensity/ weeds/ crude protein/ in vitro digestibility/ protein content/ rumen fermentation/ energy content/ metabolizable energy/ dietary fiber/ Ontario

Abstract: Seasonal changes in quality and botanical composition of a grass-legume pasture were investigated under a controlled rotationally grazed system. A 19.2-ha area divided into sixteen 1.2-ha fields, each subdivided into eight paddocks, was grazed by 40 cows with calves over three consecutive summers. Grazing was managed by setting target sward heights for exit of each paddock between 8 and 10 cm and allowing at least 25 to 30 d for regrowth. Herbage growth in those paddocks not grazed by cow-calf pairs was consumed by yearling heifers on a "put and take" basis. Paddocks were topclipped at 10 cm and fertilized with 34 kg ha⁻¹ of N immediately following the second grazing cycle. Botanical composition changed both within and among the grazing seasons. Legume content of the pasture increased ($P < 0.05$) throughout the grazing season, while grass content declined ($P < 0.05$) across all 3 yr. The amount of weeds and dead material averaged 8.9 and 3.8%, respectively, over the 3 yr. Crude protein (CP), in vitro organic matter digestibility (IVOMD), soluble protein (% total CP), rumen degradable protein (RDP) (% total CP) and metabolizable energy (ME) decreased ($P < 0.05$) from May to June in each season and then increased ($P < 0.05$) to or surpassed levels seen at the beginning of the grazing seasons (May). Neutral detergent fibre (NDF) and acid detergent fibre (ADF) content increased ($P < 0.05$) during June and July and were lowest in the spring and the fall across all 3 yr. Mean entry sward heights were 24.8, 30.3 and 28.1 cm for years 1, 2 and 3, respectively. Pre-grazing sward height was negatively correlated to CP ($n = 786$, $r = -0.38$, $P < 0.0001$) and IVOMD ($n = 786$, $r = -0.45$, $P < 0.0001$), but positively related to NDF ($n = 786$, $r = 0.43$, $P < 0.0001$) and ADF ($n = 786$, $r = 0.68$, $P < 0.0001$) across all 3 yr. The highest CP and IVOMD of the pasture were measured at a sward height of between 12 and 15 cm. Pasture quality varied both within and across all three grazing seasons but remained relatively high and was influenced by botanical composition and sward surface height.

This citation is from AGRICOLA.

416. Seasonal variations in radiocaesium uptake by reseeded hill pasture grazed at different intensities by sheep.

Salt, C. A. and Mayes, R. W.

Journal of Applied Ecology 28(3): 947-962. (1991)
NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: Lolium perenne/ Festuca rubra/ Trifolium repens/ Cerastium fontanum/ herbage content/ sward height/ soil injection/ contamination level/ toxicity/ 1986 Chernobyl nuclear accident/ Scotland/ UK/ radiocaesium

Abstract: On a reseeded hill pasture in north-east Scotland [UK], two grass/clover swards were continuously grazed by sheep to maintain sward heights of 3 and 5 cm from May to

September in 1988 and 1989. Within small areas of pasture, ¹³⁴Cs was injected into the peaty topsoil in June 1988 and the uptake by the vegetation was recorded during both years. ¹³⁴Cs concentrations in the herbage increased in spring and decreased in autumn, but considerable fluctuations occurred during the growing season. The pattern of these fluctuations and the overall concentration of ¹³⁴Cs in the herbage varied between years, whereas there was no change in ¹³⁴Cs concentration in the top 5 cm of the soil. On both swards the seasonal patterns of Lolium perenne, Festuca rubra, Trifolium repens, and Cerastium fontanum were similar. In all species except C. fontanum, ¹³⁴Cs concentrations were higher on the 5-cm sward than on the 3-cm sward. In summer, concentrations in C. fontanum were 4-6 times higher than those in the other species. Depending on season and sward height, 0.3-2% of the ¹³⁴Cs injected into the soil was present in the sward. The total amount of ¹³⁴Cs taken up by the sward during the growing season was equivalent to 1.5-8.5% of the amount injected.

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417. Seasonal vegetation changes in mountain pastures due to simulated effects of cattle grazing.

Kohler, F.; Gillet, F.; Gobat, J. M.; and Buttler, A.

Journal of Vegetation Science 15(2): 143-150. (2004)
NAL Call #: QK900.J67; ISSN: 1100-9233

Descriptors: liquid waste manuring: applied and field techniques/ mowing: applied and field techniques/ multivariate analysis: mathematical and computer techniques/ trampling simulation: applied and field techniques/ herbivore grassland dynamics interaction: dung deposition, herbage removal, trampling

Abstract: Cattle influence grassland dynamics in three ways: herbage removal, dung deposition and trampling. The objective of this study was to assess the effects of these factors, separately or in combination, and to compare them with cattle grazing over a one year period in a field experiment conducted in the Jura Mountains of northwestern Switzerland. A set of controlled treatments simulating the three factors was applied in a fenced area: (1) repeated mowing - three levels; (2) intensive trampling - two levels; (3) manuring with a liquid mixture of dung and urine - three levels. All treatments were applied homogeneously to the entire surface of each of the 40 plots inside the enclosure. Additionally, ten plots outside the fenced area represented reference plots with regular cattle pasturing. The multivariate response of species composition was assessed three times with the point-intercept method: in spring before the treatments, in autumn after one season of treatments and at the beginning of the following year after winter rest. Multivariate analyses of vegetation data in the first year showed an overwhelming seasonal shift and significant differences induced by treatments. Abandoned and manured plots showed the largest deviation from the cattle grazed reference. Herbage removal, simulated by repeated mowing, appeared to be the most important factor for maintaining vegetation texture. Seasonal treatment effects were only partially carried over to the next spring, showing an unexpected resilience of the plant community, probably due to life-history traits and competition release following climatic disturbance in winter.

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418. Seedbank diversity in grazing lands of the Northeast United States.

Tracy, B. F. and Sanderson, M. A.
Journal of Range Management 53(1): 114-118. (2000)
 NAL Call #: 60.18 J82; ISSN: 0022-409X
http://jrm.library.arizona.edu/data/2000/531/114-118_tracy.pdf
Descriptors: cattle/ rotational grazing/ cutting/ *Poa pratensis*/ *Trifolium repens*/ botanical composition/ seed germination/ biomass/ Northeastern United States
Abstract: We evaluated the species composition of soil seed banks from 9 farms (36 pastures total) located in the northeast United States. Our objective was to quantify the soil seed bank composition of pastures managed for intensive grazing and hay production. Seeds from pasture soils were allowed to germinate in a greenhouse under natural light conditions. Seedlings were identified as they germinated, and the experiment was concluded after 4 months. Germinable seed was dominated by annual (40%) and perennial (23%) forbes most of which contributed little useful forage for cattle. Perennial grasses (11%), except for bluegrass (*Poa pratensis* L.), were largely absent from the terminable seed bank, while legumes (19%) were more abundant. Seed bank species composition showed little similarity (44%) to the existing vegetation. Exceptions were bluegrass, white clover (*Trifolium repens* L.), and common dandelion (*Taraxacum officinale* Weber ex Wiggers). These species were abundant in both the germinable seed bank and existing vegetation on most pastures. Overall, our study suggests that seed banks in these northeast pastures support abundant white clover and bluegrass seed, both of which are important forages for cattle. Soil seed banks, however, will not supply a diverse assemblage of useful forages. If a manager seeks to establish diverse, mixed-species pasture, then re-seeding pastures with desired mixes may be the best option.
 This citation is from AGRICOLA.

419. Sequential grazing of cool- and warm-season pastures.

Moore, K. J.; White, T. A.; Hintz, R. L.; Patrick, P. K.; and Brummer, E. C.
Agronomy Journal 96(4): 1103-1111. (2004)
 NAL Call #: 4 AM34P; ISSN: 0002-1962
Descriptors: *Bromus inermis*/ *Lotus corniculatus*/ *Medicago sativa*/ *Trifolium ambiguum*/ *Andropogon gerardii*/ *Panicum virgatum*/ botanical composition/ pasture plants/ pastures/ intercropping/ continuous cropping/ pasture management/ beef cattle/ rotational grazing/ liveweight gain/ summer/ spring/ autumn/ Iowa
Abstract: Pasture productivity in Iowa is often limited by low productivity of cool-season grasses during summer. Our overall objectives were to (i) evaluate the impact of legumes on the productivity and nutritive value of cool-season pastures, (ii) evaluate warm-season grasses for summer grazing, and (iii) determine the effects of pasture sequence on the productivity of season-long grazing systems. Cool-season pastures consisted of smooth brome grass (*Bromus inermis* Leyss.) alone or in mixture with birdsfoot trefoil (*Lotus corniculatus* L.), alfalfa (*Medicago sativa* L.), or kura clover (*Trifolium ambiguum* M. Bieb.). Warm-season pastures were monocultures of big bluestem (*Andropogon gerardii* Vitman) or switchgrass (*Panicum virgatum* L.). Kura clover was the only legume that persisted well over time, and because of this, pastures

interseeded with kura clover maintained a higher nutritive value than either those interseeded with alfalfa or birdsfoot trefoil. This resulted in higher total liveweight gains for cattle grazing sequences that included pastures interseeded with kura clover. In general, rotating cattle to warm-season grass pastures during summer was less advantageous than having them remain on cool-season pastures at a lower stocking rate because warm-season pasture nutritive value was lower and declined more rapidly. However, despite lower nutritive value and consequently animal performance, sequences with warm-season grass pastures did perform well under some conditions and may be a desirable alternative under some circumstances. Having a warm-season grass pasture in the grazing sequence provides an opportunity to relieve cool-season pastures when growth conditions become limiting and introduces flexibility into the management system.
 This citation is from AGRICOLA.

420. Sheep grazing as a management tool for heathland conservation and regeneration in the Netherlands.

Bakker, J. P.; De Bie, S.; Dallinga, J. H.; Tjaden, P.; and De Vries, Y.
Journal of Applied Ecology 20(2): 541-560. (1983)
 NAL Call #: 410 J828; ISSN: 0021-8901
Descriptors: *Lolium perenne*/ *Juncus effusus*/ *Calluna vulgaris*/ *Erica tetralix*/ vegetation/ woodland/ rosette/ plant cover/ dung/ species richness/ diversity mapping
Abstract: In 1972, 11 ha of heathland, woodland and pasture was fenced in for a sheep-grazing experiment with the aim of rejuvenating the heathland vegetation and regenerating heathland from the pasture. The research objective was to find out how far vegetation changes could be related to different grazing intensities. Comparison with a hay-making regime was also part of the design. Grazing intensity was determined for different sections of the fenced area, from the amount and dispersion of voided dung. Vegetation changes were recorded by sequential vegetation mapping and permanent plots. During the summer period, the sheep preferred pasture and during the winter period heathland and woodland. Great differences in preference for individual pasture sections were found, probably caused by the character of the vegetation. Areas with the greatest rate of dunging contained shorter pasture vegetation, higher rosette plant cover and, to a lesser degree, greater persistence of *Lolium perenne* and lower cover of *Juncus effusus*/*Agrostis tenuis*. Grazing resulted locally in an increased species diversity, greater variation of vegetation types and greater differences in height and cover of the canopy. Calculations showed that fewer nutrients were removed under grazing than under hay-making conditions, but soil chemical analyses did not reveal differences between the regimes. The process of making the sward short and open probably played an important role in the vegetation changes observed. The heathland vegetation became increasingly grassy where greater amounts of dung were found. In heathland areas with relatively small amounts of dung, *Erica tetralix* and *Calluna vulgaris* produced fresh tillers and seedlings. Young saplings were prevented from growing up.
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421. Some effects of a rotational grazing treatment on quantity and quality of available forage and amount of ground litter.

Heitschmidt, R. K.; Dowhower, S. L.; and Walker, J. W. *Journal of Range Management* 40(4): 318-321. (1987)
NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1987/404/8heit.pdf>

Descriptors: cow/ crude protein/ herbage growth/ digestibility

Abstract: A 16-paddock, cell-designed, rotational grazing (RG) system was initiated in March 1981 to evaluate the effects of RG on various vegetation response variables and cow/calf production. This 20-month study was initiated in January 1983 to contrast herbage dynamics in the RG treatment to those in a yearlong continuously grazed treatment (MC). Rate of stocking in the RG treatment was 3.7 ha/cow/year as compared to a moderate rate of 5.9 ha/cow/year in the MC treatment. There was no difference between treatments in herbage growth dynamics. Total herbaceous standing crop, however, was greater in the MC treatment than the RG because of greater amounts of senesced forage. The resultant effect on forage quality, in terms of crude protein (CP) concentration and organic matter digestibility (OMD) was that they were generally greater in the RG than the MC treatment. Litter standing crop was also less in the RG than MC treatment although seasonal dynamics were similar. Results indicate differences between treatments were caused primarily by differences in stocking rates and not grazing systems.

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422. Spatiotemporal dynamics in herbage mass and tiller density in a bahiagrass (*Paspalum notatum* Flugge) pasture under cattle grazing: Results from 4-year monitoring in permanent quadrats.

Hirata, M. and Pakiding, W.

Grassland Science 50(2): 201-204. (2004);

ISSN: 0447-5933

Descriptors: biomass/ grazing/ pastures/ rotational grazing/ tillering

Abstract: A 1.06 ha *Paspalum notatum* pasture at Miyazaki University, SW Japan, was monitored in 1996-2000 under rotational grazing by Japanese Black cattle. Temporal variations in herbage mass and tiller density are presented. Tiller density was much more stable over time than herbage mass. Herbage mass tended to show greater temporal heterogeneity than spatial heterogeneity.

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423. Species diversity and functional composition of pastures that vary in landscape position and grazing management.

Guretzky, John A.; Moore, Kenneth J.; Brummer, E. Charles; and Burras, C. Lee

Crop Science 45(1): 282-289. (2005)

NAL Call #: 64.8 C883; ISSN: 0011-183X

Descriptors: continuous stocking system: applied and field techniques/ non grazed stocking system: applied and field techniques/ rotational stocking system: applied and field techniques/ grazing management/ landscape position: backslope, summit, toeslope/ pasture: functional composition/ species diversity/ vegetative cover

Abstract: The productivity of grasslands depends in part on their diversity of species and functional composition. Our objective was to examine the effects of three landscape

positions (summit, backslope, and toe- slope) and three stocking systems (continuous, rotational, and non- grazed) on species diversity and percentage of cover of grass, legume, and weed species functional types in southeastern Iowa pastures. Data were collected in 0.2-m² plots randomly distributed throughout each of four replicate pastures in spring and summer 2000 and 2001. Backslope landscape positions within pastures managed with either continuous or rotational stocking contained the greatest overall diversity of species. Across years, overall species richness under grazing averaged 4.8 on backslopes, 3.5 on summits, and 2.9 on toeslopes. Legume cover was greatest within the rotational stocking system, averaging 21% on backslopes, 10% on summits, and 3% on toeslopes across years. Cool-season grasses dominated summits and toeslopes, consisting of 88 to 94% of the cover. Weed species diversity and cover were greatest on backslopes within the continuous stocking system. Our results showed that rotational stocking had more desirable effects through greater legume cover and less weed cover on backslopes than continuous stocking. This research suggested that spatial components of pastures should be considered to optimize the production and quality of forage for grazing livestock.

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424. Stability, resilience and sustainability in pasture-based grazing systems.

Kaine, G. W. and Tozer, P. R.

Agricultural Systems 83(1): 27-48. (2005)

NAL Call #: HD1.A3; ISSN: 0308-521X

Descriptors: dynamic simulation model: mathematical and computer techniques/ beef grazing/ financial variable/ pasture envelope concept/ pasture growth rate/ rotation period/ soil nutrient/ stocking rate/ sustainability

Abstract: In this paper we employ a simple dynamic simulation model to illustrate and extend the pasture envelope concept as an approach to characterising the stability, resilience and sustainability of pasture-based beef grazing enterprises. The pasture envelope is a form of phase diagram in which the trajectories over time of key biophysical variables such as pasture biomass and composition are graphed against critical thresholds established on the basis of pasture growth rates and livestock growth requirements. We extend the concept to incorporate key financial variables such as cash flow and critical financial thresholds. The model simulates a steer fattening enterprise based on a phalaris and sub-clover pasture in the Northern Tablelands of New South Wales, Australia. The model incorporates pasture growth and senescence for the two pasture species with competition between the species for soil nutrients and light, preferential grazing of the two species by the livestock with livestock growth based on pasture consumption. The model incorporates a variety of decision rules for rotating livestock among multiple paddocks. The model did not simulate changes in soil nutrients. Scaling the seasonal growth pattern of the pasture species captured the influence of rainfall and temperature on pasture growth. Two sets of simulations were run to illustrate the use of the pasture envelope concept to explore the economic and biological stability and resilience of the pasture system. The first set was designed to explore the financial and biological stability of the enterprise and involved simulating the impact of different stocking rates and rotation period on pasture

production and composition, and cash flow. The second set of simulations was designed more to explore the resilience of the enterprise and involved introducing shocks to the enterprise in the form of 'droughts' of varying strengths. This was achieved by, for example, reducing the maximum growth rate for both pasture species by 50% but maintaining the same seasonal pattern in the maximum growth rates of each species. The first simulation showed that at low stocking rates the enterprise was biologically stable, but cash flow was also low. Increasing stocking rates increased the cash flow, but also reduced the biological stability of the pasture until at very high stocking rates the pasture system collapsed. Changing the rotation period also affected the stability of the enterprise. In situations where the rotation period was very long, greater than 120 days (or 20 days/paddock), the biological system became unsustainable due to detrimental changes in pasture composition. The enterprise was somewhat resilient to drought at stocking rates less than 1 steer/ha. At stocking rates of 1 steer/ha, the enterprise was economically and biologically unsustainable in moderate or severe droughts. At a stocking rate of 1.25 steers/ha, the enterprise was unsustainable for droughts of any severity. Copyright 2004 Elsevier Ltd. All rights reserved. © The Thomson Corporation

425. Stocking method affects plant responses of Pensacola bahiagrass pastures.

Stewart, R. L.; Dubeux, J. C. B.; Sollenberger, L. E.; Vendramini, J. M. B.; and Interrante, S. M.
Forage and Grazinglands(October): 1-8. (2005)
 NAL Call #: SF84.82 .F67; ISSN: 1547-4631
Descriptors: chemical composition/ continuous grazing/ crude protein/ grassland management/ grasslands/ herbage/ in vitro digestibility/ nutritive value/ organic matter/ plant composition/ protein content/ rotational grazing/ stocking rate
Abstract: Stocking method is an important management tool that may affect plant responses, but there are few studies that have evaluated these responses under a wide range of stocking methods. The objective of this research was to determine the effect of different stocking methods on herbage accumulation and nutritive value. Treatments were four rotational stocking strategies differing in length of grazing period (1, 3, 7, and 21 days) but with the same resting period of 21 days, and one continuous stocking treatment of 'Pensacola' bahiagrass (*Paspalum notatum*) pastures in northeast of Gainesville, Florida, USA. Herbage accumulation did not differ among rotational strategies, but rotational stocking lead to higher herbage accumulation than continuous stocking (62 versus 37 lb/acre of dry matter per day). Herbage crude protein, P, and in vitro organic matter digestion were not affected by grazing method (continuous versus rotational) or length of grazing period (rotational treatments) in more than 1 out of 3 years. The results suggest that rotational stocking, across a range of lengths of grazing period, promotes greater herbage accumulation than continuous stocking but there is little variation among grazing methods in herbage nutritive value.
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426. Stocking rate and sustainable grazing systems.

Rickert, K. G.
 In: Grassland science in perspective; Series: Wageningen Agricultural University Papers 96.
 Wageningen, Netherlands: Wageningen Agricultural University, 1996; pp. 29-66.
Notes: Meeting Information: International Farewell Symposium for Leendert t'Mannetje, Wageningen, Netherlands; June 20, 1996; ISBN 9073348633; ISSN 0169-345X
 NAL Call #: S539.5.A35 no.96-4
Descriptors: agronomy/ animal husbandry/ stocking rate/ sustainable grazing system
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427. A study of two grazing methods: Effect on star grass production and quality.

Reyes, J.; Garcia Trujillo, R.; Senra, A.; Vidal, I.; and Fonte, D.
Cuban Journal of Agricultural Science 29(2): 159-163. (1995)
 NAL Call #: S1.R4; ISSN: 0864-0408
Descriptors: agriculture/ animal husbandry/ crude protein/ field method/ food item/ grass productivity/ grass quality/ leaf percentage/ pasture availability/ rational voisin grazing/ rotational grazing
Abstract: An experiment with star grass (*Cynodon nlemfuensis*) established on a red ferralitic soil was conducted. The grazing methods were: rational Voisin grazing (RVG) with 72 paddocks (36 paddocks/group) and 0.125 ha/paddock and na intensive pressure of 280 animals/ha and traditional grazing (RG-12) with 12 paddocks (6 paddocks/group) and 0.75 ha for each one and a grazing intensity of 110 animals/ha. The objective of this study was to compare the grazing performance with two grazing methods. In both methods two groups of cows rotating in line were used. pasture availability per unit area per rotation favored RVG (P lt 0.001) in the rainy season (0.25 vs. 0.19 kg DM/m² for RVG and RG-12, respectively). The leaves in RG-12 showed a better crude protein percentage (P lt 0.05) and no differences were found with the remaining quality indices. leaf percentage in the treatments surpassed 45% and no differences were found between them. total pasture production did not differ between treatments, but both were reduced (P lt 0.01) with time. Average annual pasture availability per animal was higher with RG-12 (P lt 0.05) (36.4 vs 47.6 kg DM/cow/day for RVG and RG-12, respectively). On concluding the trial after three years no advantages were observed with RVG since pasture productivity id not augment. However, regardless the method used, a reduction of pasture production was observed.
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428. Sward quality affected by different grazing pressures on dairy systems.

Mosquera-Losada, M. R.; Gonzalez-Rodriguez, A.; and Rigueiro-Rodriguez, A.
Journal of Range Management 53(6): 603-610. (2000)
 NAL Call #: 60.18 J82; ISSN: 0022-409X
http://jrm.library.arizona.edu/data/2000/536/603-610_mosquera.pdf
Descriptors: dairy cows/ stocking rate/ rotational grazing/ sward/ Lolium perenne/ Trifolium repens/ tillering/ botanical composition/ protein content/ fiber content/ maturity stage/

seasonal variation/ rain/ heat sums/ mineral content/
calcium/ potassium/ magnesium/ phosphorus/ dietary
mineral supplements/ Spain
This citation is from AGRICOLA.

429. Tiller dynamics of grazed swards.

Matthew, C.; Assuero, S. G.; Black, C. K.; and
Hamilton, N. R. S.

In: *Grassland ecophysiology and grazing ecology*/
Lemaire, Gilles.

New York: CABI, 2000; pp. 127-150.

Notes: ISBN: 0851994520

NAL Call #: SF84.84 .G68 2000

Descriptors: reviews/ tillers/ plant morphology/ population
dynamics/ leaf area/ tillering/ grassland management/
sustainability/ biomass production/ grazing systems/
continuous grazing/ rotational grazing/ mixtures

Abstract: Topics discussed in this review, mainly of the
major forage grasses include tiller morphology, canopy leaf
area optimization for continuously and rotationally grazed
swards, and tiller population demography including its
manipulation and the effects of mixed species swards. It is
considered that the primary driving principle for tiller
dynamics is the optimization of leaf canopy area in relation
to defoliation intensity and available resources, such as
light and water. The concept of a multiphase size-density
compensation relationship along an environmental
boundary may rationalize otherwise conflicting observations
on tiller density and on tiller appearance and death rate and
are relevant to issues such as carrying capacity or
sustainability. There remain substantive complex
differences in tillering behaviour, often unique to a particular
species, which are best explained from a tiller demography
basis. A well-directed understanding of tiller demography
may result in significant improvements in productivity in
some situations.

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**430. Tradeoffs between pasture production and plant
diversity and soil health attributes of pasture systems
of central Queensland, Australia.**

Sangha, K. K.; Midmore, D. J.; Rolfe, J.; and Jalota, R. K.
Agriculture, Ecosystems & Environment 111(1-4):
93-103. (Dec. 2005)

NAL Call #: S601 .A34; ISSN: 0167-8809

Descriptors: pastures/ plant communities/ species
diversity/ pasture management/ soil quality/ soil fertility/
anthropogenic activities/ yields/ botanical composition/ soil
organic matter/ nitrogen/ soil pH/ soil microorganisms/ plant
litter/ mineralization/ nutrient availability/ plant ecology/
ecosystems/ Queensland

Abstract: The clearing land of trees and introduction of
exotic pastures to enhance pasture production and
associated monetary gains has been a common practise in
Queensland. Previous studies on tree clearing emphasised
the gains in pasture production, but over periods of less
than 10-15 years after clearing, thus potentially misleading
land managers who plan to continue grazing beyond that
time. The present research follows an integrated approach
to quantify the pasture yield and the effects of tree clearing
on pasture species composition, soil properties (organic
carbon, available N (NO₃-), pH(w) and microbial biomass
(C and N)), and litter production over time-since-clearing on
a grazing property in central Queensland, and to evaluate
the implications of our findings for the region. The cleared

pasture systems were taken at <5, 11-13 and >33 year age
of clearing in comparison to their paired uncleared pastures
for three major tree communities representative of the
region: *Eucalyptus populnea*, *Eucalyptus melanophloia* and
Acacia harpophylla. The paper evaluates the effects of
clearing on individual attributes as well as an integrated
effect of these attributes, i.e. overall ecological services.
Pasture production generally increased with clearing but
plant diversity, litter production and potential return of N and
P through litter decreased. Among soil attributes, clearing
of trees adversely impacted upon soil pH and microbial
biomass, which play an important role in nutrient availability
and mineralisation. This, the initial gains in pasture
production are not sustainable over time. The multivariate
analysis for such ecological attributes suggests that at the
>33 year age of clearing, the ecological state of pasture
systems changed compared to that at 5 year or 11-13 year
or to the uncleared system. A disturbed pasture system will
most likely take longer to revert to the original state
compared to the time that would have taken to harvest the
benefits. The results are important for landholders and
policy makers to comprehend the real gains and losses
following tree clearing for pasture development over the
long term.

This citation is from AGRICOLA.

**431. Tree windbreaks and shelter benefits to pasture in
temperate grazing systems.**

Bird, P. R.

Agroforestry Systems 41(1): 35-54. (1998)

NAL Call #: SD387 .M8A3; ISSN: 0167-4366

Descriptors: windbreaks/ shelter/ shelterbelts/ pastures/
climate/ effects/ models/ reviews/ silvopastoral systems/
agroforestry systems/ temperate zones

Abstract: The effects of windbreaks on pastures are
reviewed, with an emphasis on temperate grazing systems.
Mechanisms of plant response to shelter are dealt with
briefly. Few papers on measured responses of pasture
species to shelter were located in a search of the global
literature for the period 1972-97. Except in cold climates,
where the benefits of snow-trapping on water availability
can be demonstrated, there were few reports of increased
production of pasture in response to shelter. A significant
result was obtained in a summer rainfall environment in
Australia, where a 43% increase in wool production was
obtained over 3 yr in small plots sheltered with iron
sheeting on the fences. The gain was attributed to
increased pasture growth. In New Zealand, one study over
3 yr with a narrow, permeable shelterbelt in a windy, dry
summer environment showed a 60% increase in pasture
growth in the sheltered zone. However, another study on a
high rainfall site with a dense, wide shelterbelt found no
substantial shelter effect on pasture. In dry, hot and windy
climates there appears to be scope for protecting spray-
irrigated pasture with windbreaks. The feasibility of
evaluating shelter effects on pastures or crops from old
windbreaks is questioned. Variability of soil over the site
can not be satisfactorily accounted for and there are
problems in defining the true 'unsheltered' yield. Shelter
effects on pastures could best be determined by comparing
production in small completely sheltered plots and open
plots. Effects in and near the competitive zone should be
measured for living windbreaks. Modelling could then be

used to evaluate windbreak systems. It is concluded that it is not yet possible to provide unequivocal advice to farmers on windbreak outcomes for particular purposes or regions.
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432. The use of Conservation Reserve Program land for grazing cattle.

Boyles, S. L.; Stoll, B. W.; and Dobbles, T. L.
Journal of Sustainable Agriculture 18(4): 113-120. (2001)
NAL Call #: S494.5.S86S8; ISSN: 1044-0046
Descriptors: cattle/ grazing/ natural resource management/ agricultural land/ land use/ rotational grazing/ stocking rate/ liveweight gain/ crude protein/ protein intake/ nitrate nitrogen/ Ohio
Abstract: The Conservation Reserve Program (CRP) is a voluntary program under which landowners enter into contracts with the United States Department of Agriculture (USDA) to remove highly erodible and environmentally sensitive cropland from production. A 3 year project was done to evaluate intensive, rotational cattle grazing as an alternative for this land when it is removed from the federal program. A 16 ha area was divided into 28 cells for grazing. Cattle were moved to a new cell on a daily basis. A seasonal average stocking rate of 3.5 hd ha(-1) was used during the three-year study. Yearling cattle (248 +/- 17.9 kg) were placed on grass in the spring. Average daily gain was .7 +/- .03 kg d(-1). Crude protein (23 +/- 4.7%) did not change over years (P > .05). Breakeven values needed to meet direct and overhead expenses ranged from \$US 0.87 to \$US 0.73/kg gain. Based on nitrate-nitrogen levels in run-off water samples, maintaining forage on what was CRP land and using it for grazing does meet the Environmental Protection Agency (EPA) conservation compliance demands to participate in other USDA programs.
This citation is from AGRICOLA.

433. Use of fire for spelling monsoon tallgrass pasture grazed by cattle.

Andrew, M. H.
Tropical Grasslands 20(2): 69-78. (1986)
NAL Call #: SB197.A1T7; ISSN: 0049-4763
Descriptors: Australia/ crop rotation
Abstract: Continuous grazing of preferred patches in set-stocked, unburnt pastures of native monsoon tallgrass results in the death of the perennial grass plants within several years. In paddocks of this pasture type at Katherine, N.T., [Australia], in which half of each paddock was burnt in rotation each dry season, cattle strongly preferred to graze in those halves which had been most recently burnt. The other halves of these paddocks were thus spelled in a complementary rotation. This spelling appeared to enable previously grazed patches of pasture to recover, and thus pasture degradation was arrested. Data from enclosures indicated that grazing early in the rainy season (but not thereafter) depressed the final yield of individual grass plants by about 60%. However, the mean pasture yield was depressed by only about 10% because many plants were not grazed at all.
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434. Use of goats to manage vegetation in cattle pastures in the Appalachian region of North Carolina.

Luginbuhl, J. M.; Green, J. T.; Poore, M. H.; and Conrad, A. P.
Sheep & Goat Research Journal 16(3): 124-135. (2000)
NAL Call #: SF371.R47; ISSN: 1535-2587
Descriptors: goats/ cattle/ pastures/ field experimentation/ rotational grazing/ Robinia pseudoacacia/ Rosa multiflora/ canopy/ weed control/ forbs/ North Carolina
This citation is from AGRICOLA.

435. Using fire to manage species composition in Heteropogon contortus (black speargrass) pastures: Enhancing the effects of fire with grazing management.

Orr, D. M. and Paton, C. J.
Australian Journal of Agricultural Research 48(6): 803-810. (1997)
NAL Call #: 23 Au783; ISSN: 0004-9409
Descriptors: grasslands/ rangelands/ grazing/ botanical composition/ burning/ control
Abstract: Burning in spring can increase the proportion of *Heteropogon contortus* when pastures remain ungrazed following burning and to a lesser extent when the pasture is grazed. Consequently, an experiment examined the effects on pasture composition of annual spring burning followed by grazing deferment by cattle for 0, 2, 4 or 6 months or for 0 months but at half the stocking rate of the other 4 treatments in Queensland. Either deferring grazing for 4 or 6 months or halving the stocking rate after burning in spring resulted in an increase in the proportion of *H. contortus*. Burning reduced the undesirable *Aristida* spp. as a pasture component and this effect occurred independently of grazing treatment. The development of 2 cohorts of *H. contortus* seedlings was monitored for 18 months. Seedlings were selectively grazed but developed rapidly with few differences between treatments. Differences in seedling survival between years reflected differences in rainfall after establishment. It is concluded that burning in spring to increase the proportion of *H. contortus* will be more effective if followed by 4-6 months rest or by reduced grazing pressure.
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436. Using stream macroinvertebrates to compare riparian land use practices on cattle farms in southwestern Wisconsin.

Weigel, B. M.; Lyons, J.; Paine, L. K.; Dodson, S. I.; and Undersander, D. J.
Journal of Freshwater Ecology 15(1): 93-106. (2000)
NAL Call #: QH541.5.F7J68; ISSN: 0270-5060
Descriptors: benthos/ riparian environments/ land use/ agriculture/ sedimentation/ environmental effects/ Invertebrata/ USA, Wisconsin
Abstract: Vegetative riparian buffer strips are typically used to curb stream degradation due to cattle grazing, but intensive rotational grazing has shown promise as an alternative best management practice. The authors compared aquatic macroinvertebrate assemblages among stream segments within continuously grazed pastures, intensive rotationally grazed pastures, undisturbed grassy vegetative buffer strips, and undisturbed woody vegetative buffer strips. Macroinvertebrate and stream sedimentation data were collected from four streams in each land use category in two consecutive years. In an attempt to account for inherent watershed variability among streams,

watershed condition was represented with a sample collected upstream of each treatment reach. Watershed condition tended to have greater influence on macroinvertebrate measures than local riparian land use. However, local riparian land use influences were apparent if watershed condition was statistically accounted for with analysis of covariance. Stream reaches with intensive rotational grazing tended to have macroinvertebrate assemblage characteristics intermediate of the buffer and continuously grazed reaches. Although we detected some differences in macroinvertebrate assemblages that apparently reflected very local land use, our results suggest the macroinvertebrates were mostly responding to large-scale watershed influences.

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437. Variability of sward structure and plant species composition of pastures at low stocking rates.

Isselstein, J.; Correll, O.; Strodthoff, J.; Zhao, G.; and Hofmann, M.

In: Optimal forage systems for animal production and the environment: Proceedings of the 12th Symposium of the European Grassland Federation. (Held 26 May 2003-28 May 2003 at Plevn, Bulgaria.); pp. 606-609; 2003.

Descriptors: animal nutrition/ biodiversity/ botanical composition/ grass sward/ grazing/ grazing systems/ heifers/ herbage/ methodology/ nutritive value/ pastures/ spatial variation/ stand structure/ stocking rate/ temporal variation/ live-weight

Abstract: Grazing at a low stocking rate is considered a promising option to meet both the requirement for a reasonable agronomic output and the maintenance and enhancement of biodiversity. Such grazing creates a mosaic pattern of patches of variable defoliation and resulting sward height and structure. An extended rising-plate-meter method was developed to investigate the spatial and temporal variability of the grass sward and the resulting pasture and animal performance. Along permanent transect lines, a high number of fixed points is established and the following recordings are made repeatedly during the grazing season: compressed sward height, dominating plant species, development of the plant (vegetative, reproductive growth). Additional sampling at random points was used to establish a relationship between sward height and herbage mass. The nutritive value of the herbage samples was analysed. Live weights of grazers and quality of ingested herbage were measured. The data were analysed to provide information on the variability of the amount and the quality of the herbage on offer, the percentage of different dominating species in the different grazing patches, the contribution of the different patches to the nutrition of the grazing animals, and the percentage of patches with reproductive plant growth which indicates the opportunity for seedling recruitment.

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438. Vegetation change on embankments in the southwestern part of the Netherlands under the influence of different management practices in particular sheep grazing.

Sykora, K. V.; Van Der Krogt, G.; and Rademakers, J. *Biological Conservation* 52(1): 49-82. (1990)
NAL Call #: S900.B5; ISSN: 0006-3207

Descriptors: Lolio-Cynosuretum plantagnetosum media/ Arrhenatherum elatioris alopecuretosum/ Ulmo rubetum ulmifolii/ synecology/ mowing/ burning/ conservation/ succession

Abstract: The vegetation of the embankments of the Zak van Zuid-Beveland were surveyed phytosociologically, the vegetation being assigned to the Lolio-Cynosuretum plantagnetosum mediae, Arrhenatherum elatioris picridetosum, Arrhenatherum elatioris alopecuretosum and Ulmo-Rubetum ulmifolii. In total, including the subordinate fragmentary communities and variants, 12 communities are described, together with an indication of their synecology. The composition of the vegetation in 1986 is compared to that in 1972 and the influence of different management practices, i.e. grazing, mowing, burning and no management, on the vegetation changes is illustrated. The changes in vegetation composition and structure are clearly related to management practices. This even applies to the low level of syntaxonomic hierarchy, i.e. subassociations and variants. In general the highest intensities of grazing by the flock, i.e. between 8 and more than 15 h a month by 200 sheep per 500 m of embankment, were best suited for the improvement or maintenance of the conservation value. Under the same conditions, light grazing (less than 8 hours) proved to be insufficient.

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439. Vegetation changes after cessation of grazing management in the Jizerske Mountains (Czech Republic).

Pavlu, Vilem; Hejcman, Michal; Pavlu, Lenka; Gaisler, Jan; Nezerkova, Pavla; and Andaluz, Milan Guerovich *Annales Botanici Fennici* 42(5): 343-349. (2005)
NAL Call #: 450 AN79; ISSN: 0003-3847

Descriptors: grazing cessation/ vegetation change/ plant species diversity/ grazing management

Abstract: Vegetation changes following the cessation of grazing of highly productive pasture in the Jizerske Mountains in 1997 were studied. The experiment included three replicate pairs of plots and data were collected before and after grazing was ended. Cover was estimated in 1-m(2) permanent plots. Abandonment of the pasture resulted in a significant decrease in plant species diversity. Annuals and perennials such as *Trifolium repens* and *Poa trivialis* disappeared within three years of the end of grazing. Species scores on the first ordination axis of RDA analyses, where time was the only explanatory variable were highly positively correlated with species heights obtained from the local flora and species height was the single parameter that best explained the reaction of species to the cessation of grazing. Within five years of abandonment, differences among swards caused by continuous stocking and rotational grazing had disappeared and tall grasses and shade-tolerant forbs dominated all swards. No new species were recorded after the abandonment of the pasture. If the abandoned grasslands will not reforest, alternative management regimes must be practiced in order to prevent their degradation and spread of tall dominants.

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440. Vegetation characteristics in relation to different management regimes of calcareous grassland: A functional analysis using plant traits.

Eler, K.; Vidrih, M.; and Batic, F.

Phyton (Horn) 45(3, Sp. Iss. SI): 417-426. (2005)

NAL Call #: 450 P565; ISSN: 0079-2047

Descriptors: functional analysis: applied and field techniques/ species composition/ vegetation/ calcareous grassland/ plant trait/ grazing regime

Abstract: Designation of management strategies for preservation of calcareous grasslands demands in-depth understanding of vegetation processes. For this purpose the functional approach using plant functional types and traits has been widely promoted. In this study we focused on the analysis of CS-R established strategies and some simple plant traits to detect general trends in trait responses to abandonment on one side and to eutrophication on the other giving us a basis for future management strategies. Five treatments were applied to calcareous grassland in SW Slovenia representing different combinations of fertilization and grazing regimes. Effects of these two factors along with other environmental variables on species composition were evaluated. Trait composition of original low-intensity grazed vegetation showed importance of stress-tolerance (S component), relatively high abundance of small plants, chamaephytes, phalanx strategy and summer green plants. Abandonment increased abundance of grasses and suppressed forbs and legumes. C component, showing appearance of competitive exclusion, increased, resulting in increased average plant height. Fertilization promoted the abundance of therophytes and persistent green, mesophyllous plant species with guerrilla lateral spread. It also caused significant increase in abundance of species expressing ruderality (R component).

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441. White clover growth patterns during the grazing season in a rotationally grazed dairy pasture in New York.

Karsten, H. D. and Fick, G. W.

Grass and Forage Science 54(2): 174-183. (1999)

NAL Call #: 60.19 B773; ISSN: 0142-5242

Descriptors: rotational grazing: agronomic method, dairy pasture/ climatic influence/ soil organism activity

Abstract: White clover (*Trifolium repens* L.) is an important stoloniferous pasture legume in the Great Lakes region of the United States, but it often has limited persistence. Researchers in New Zealand and Wales have found that in spring, compared with other seasons, white clover plants have reduced branching complexity and have the fewest buds that produce leaves. They therefore suggested that in spring the plants are most vulnerable to grazing and climatic stress. Because of severe winter and cool, wet spring weather in New York State, it was hypothesized that white clover plants would also be of low branching complexity, smaller and have low axillary bud activity in spring compared with later in the grazing season. To test this, growth of white clover was monitored in an orchard grass (*Dactylis glomerata* L.)/white clover pasture in New York that was rotationally grazed with dairy cows during the 1993 and 1994 grazing seasons. Three sets of plants were sampled. The first set consisted of forty random plants sampled before each grazing event. Stolon branching order, number of each stolon branching type and area the plant occupied were determined. Approximately each

month before one grazing event, a separate set of 32 random plants was measured in the field to determine the area they occupied; these plants were then removed to the laboratory for the measurement of stolon order, number of each stolon type, stolon lengths, total number of growing points, number of taproots and adventitious roots, root position and above-ground dry matter. Once a month, 12 additional plants were removed to measure axillary bud activity at each node. Leaf development from nodes tended to increase from spring to summer. However, the stolon branching order of white clover plants was not simpler in spring compared with summer or autumn. In 1994 during and after a dry and hot period, white clover plants were smaller, of lower stolon branching order and had fewer roots. Climate and associated soil organism activity appear to explain the different white clover growth patterns observed in New York and New Zealand. Severe winters in New York limit earthworm activity and stolon burial, which is important in contributing to stolon/plant breakdown in New Zealand. During the years of this study in New York, a hot and dry period had the most negative effect on the growth pattern of white clover.

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442. White clover response to grazing method.

Brink, G. E. and Pederson, G. A.

Agronomy Journal 85(4): 791-794. (1993)

NAL Call #: 4 AM34P; ISSN: 0002-1962

Descriptors: *Trifolium repens*/ cultivars/ leaves/ *Festuca arundinacea*/ cattle/ rotational grazing/ grazing/ leaf area/ plant morphology/ stolons/ mortality/ forage/ Mississippi

Abstract: Grazing management is a major factor influencing white clover (*Trifolium repens* L.) growth. Our objective was to determine the response of white clover cultivars differing in leaf size to grazing method (continuous vs. rotational stocking) using cattle (*Bos* spp.). In each of 2 yr, a predominantly tall fescue (*Festuca arundinacea* Schreb.) sod on a Savannah flue sandy loam (fine-loamy siliceous, thermic Typic Fragiuudult) was oversown in September with 'Grasslands Huia' (medium-small leaf), 'Louisiana S-1' (medium-large leaf), and 'Regal' (large leaf) white clover. From March to August of the following year, plots of each cultivar were stocked continuously (3- to 5-cm stubble) or rotationally (grazed to 5-cm stubble every 35 to 38 d). Clover growth was measured prior to rotational grazing and stolon survival was determined in November. When precipitation during the grazing season was 59% above normal, grazing method had no influence on mean single leaf area, stolon dry weight, and stolon growing point density of white clover. In contrast, continuous stocking reduced these responses when precipitation was 32% below normal the following year. Cultivar ranking for mean single leaf area was generally the same as that for leaf size category: Grasslands Huia < Louisiana S-1 < Regal. Although stolon length and growing point density were frequently greatest for Grasslands Huia, stolon survival of Grasslands Huia was no greater than that of the larger-leaved cultivars. Despite varying effects of grazing method on growth and morphology, stolon survival of white clover was always greater under rotational stocking.

This citation is from AGRICOLA.

443. Whole-farm management of grazing systems based on native and introduced species.

Simpson, P. and Langford, C.

New Zealand Journal of Agricultural Research 39(4): 601-609. (1996)

NAL Call #: 23 N4892; ISSN: 0028-8233

Descriptors: crop industry/ livestock industry/ agronomy/ biobusiness/ grazing systems/ introduced species systems/ native species systems/ whole farm management

Abstract: For whole-farm management, there is a wide range of development and management options.

Recognizing and understanding the role of pasture species, soil types, farm physical environment, livestock enterprise needs, and farm goals are essential ingredients for successful whole-farm management. The more variable the environment, soil types, and topography then the more important pasture diversity becomes. The adoption of non-destructive pasture development and management strategies, especially for the undulating to steeper areas on acid soils with west- or north-facing slopes, are crucial. Pastures are classified into five types depending on the species present. The management implications of the relationship between pasture type, soil characteristics, and slope are discussed together with the suitability of the pasture types for different livestock performance levels. The importance of these factors, for whole-farm management is also discussed.

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Rangeland Conservation Practices Soil and Water Effects

444. Assessing the impact of overgrazing on soil erosion in arid regions at a range of spatial scales.

Sharma, K. D.

In: Human impact on erosion and sedimentation/ Walling, D. E. and Probst, J. L.; Series: IAHS Publication 245.

Oxfordshire: IAHS Press, 1997; pp. 119-123.

Notes: ISBN: 0901502309; Conference: 5. Scientific Assembly of the International Association of Hydrological Sciences (IAHS), Rabat (Morocco), 23 Apr-3 May 1997

Descriptors: grazing/ soil erosion/ arid lands/ assessments/ erosion rates/ scaling/ spatial distribution/ livestock

Abstract: Increased livestock numbers in arid regions cause overgrazing which results in reduced infiltration and accelerated runoff and soil erosion. Results from a range of studies indicate that at the macro- and mesoscales soil erosion can increase dramatically due to overgrazing; causing increases of five to 41 times over the control at the mesoscale and three to 18 times at the macroscale.

However, the establishment of simple relationships across the range of scales is difficult due to spatial variation of soil erosion rates and patterns. Water authorities should be actively associated with range management activities for the protection of arid zone drainage basins.

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445. Association of herd composition, stocking rate, and duration of calving season with fecal shedding of *Cryptosporidium parvum* oocysts in beef herds.

Atwill, Edward R.; Johnson, Eileen M.; and Pereira, Maria Das Gracias C.

Journal of the American Veterinary Medical Association 215(12): 1833-1838. (1999)

NAL Call #: 41.8 Am3; ISSN: 0003-1488

Descriptors: calving season/ herd composition/ reproductive management/ rotational grazing practices/ stocking rate

Abstract: Objective: To evaluate the association of herd demographics, parturition variables, stocking rate, and rotational grazing practices with the probability of fecal shedding of *Cryptosporidium parvum* from beef cow-calf herds in California. Design: Cross-sectional study. Sample Population: 38 beef cow-calf operations. Procedure: Fecal specimens were collected and examined for *C parvum* oocysts, using immunofluorescent microscopy. Association between various demographic and management factors and the probability of shedding *C parvum* were statistically evaluated. Results: Adjusted for age and month of collection of a fecal sample, cattle from herds with a high number of young calves (ltoreq 2 months old) on the day of sample collection, a high stocking rate (No. of cattle/acre/mo), or a longer calving season were more likely to shed *C parvum* oocysts, compared with cattle from herds with fewer young calves, a lower stocking rate, or a shorter calving season. Cattle from herds with a higher number of older calves (> 2 months old) on the day of sample collection were less likely to shed *C parvum* oocysts, compared with cattle from herds with fewer older calves. Using our multivariate model, rotational grazing systems or season of onset of calving were not associated with shedding status for *C parvum* oocysts. Conclusions and Clinical Relevance: Reproductive management that would

result in a shorter calving season and use of a lower stocking rate for cattle may be associated with reduced risk of *C parvum* shedding. Intensive rotational grazing systems and time of year for onset of calving season apparently have little effect on reducing prevalence of oocyst shedding.

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446. Bacterial water quality responses to four grazing strategies--comparisons with Oregon standards.

Tiedemann, A. R.; Higgins, D. A.; Quigley, T. M.; Sanderson, H. R.; and Bohn, C. C.

Journal of Environmental Quality 17(3): 492-498. (1988)

NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: range management/ water quality/ streams/ grazing/ watersheds/ Oregon

Abstract: Concentrations of fecal coliform (FC) and fecal streptococcus (FS) were measured weekly during summer 1984 in streamwater of 13 wildland watersheds managed under four range management strategies. The strategies were (A) no grazing; (B) grazing without management for livestock distribution; (C) grazing with management for livestock distribution; and (D) grazing with management for livestock distribution and with cultural practices to increase forage. Counts of FC were compared to Oregon water quality standards. Data for FS were used for determining the FC/FS ratio to assess origin of FC organisms. Counts of FC were significantly lower under strategies A and C than under strategy D, but no significant differences were apparent among other strategy comparisons. Two strategy D watersheds violated the Oregon water quality 30-d log₁₀ standard of no more than 2 X 10³ FC L⁻¹ (200 FC X 100 mL⁻¹). One watershed was in violation for most of the sampling period. Ratios of FC to FS indicated that wildlife was the major source of FC bacteria in strategies A, B, and C watersheds. Cattle were the primary source of FC bacteria on strategy D watersheds.

This citation is from AGRICOLA.

447. Bladeploughing and enclosure influence soil properties in a semi-arid Australian woodland.

Eldridge, D. J. and Robson, A. D.

Journal of Range Management 50(2): 191-198. (1997)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/1997/502/191-198_eldridge.pdf

Descriptors: range management/ shrubs/ soil erosion/ runoff/ grazing intensity/ hydrology/ sediment yield/ New South Wales

Abstract: Runoff and sediment yield were evaluated on a sandplain dominated by woody perennial shrubs in north-western NSW, Australia. The site was bladeploughed; and some plots were grazed by sheep and cattle and others excluded from grazing. Two years after ploughing and enclosure, grazed plots had significantly lower levels of aggregate stability and organic carbon compared with ungrazed plots, but there was no effect of ploughing. Surface pH levels were significantly greater on unploughed plots compared with ploughed plots. Two years after treatment, runoff and sediment yield were greatest on plots with the least disturbance (unploughed and ungrazed) and

least on sites with the greatest disturbance (ploughed and grazed). We attribute differences in soil hydrology to the development of a thin physical soil crust on the unploughed-ungrazed plots, which restricted infiltration. On the ungrazed plots, increases in plant cover and biomass, and colonisation of the physical crust by biological elements, are hypothesised to lead to reduced runoff and sediment yield over time.

This citation is from AGRICOLA.

448. Cattle grazing has varying impacts on stream-channel erosion in oak woodlands.

George, M. R.; Larsen, R. E.; McDougald, N. K.; Tate, K. W.; Gerlach, J. D.; and Fulgham, K. O.

California Agriculture 58(3): 138-143. (2004)

NAL Call #: 100 C12Cag; ISSN: 0008-0845

Descriptors: grazing/ rangelands/ sediment/ stream erosion/ streams/ trails/ trampling/ woodlands

Abstract: We conducted a 5-year study on the impact of grazing on stream-channel bare ground and erosion, and a 3-year study of cattle-trail erosion on intermittent stream channels draining grazed oak (*Quercus*)-woodland watersheds. These studies were conducted on the San Joaquin Experimental Range in Madera County, California, USA. While the concentration of cattle along stream banks during the dry season resulted in a significant increase in bare ground, we were unable to detect stream bank erosion resulting from any of the grazing treatments applied. However, we did find that cattle trails are an important mode of sediment transport into stream channels. While cattle trails are common on grazed rangeland, excessive trailing often indicates that stock watering points are too far apart.

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449. Consequences of livestock grazing on water quality and benthic algal biomass in a Canadian natural grassland plateau.

Scrimgeour, G. J. and Kendall, S.

Environmental Management 29(6): 824-844. (2002)

NAL Call #: HC79.E5E5; ISSN: 0364-152X

Descriptors: phosphorus/ watersheds/ biomass/ concentration/ nitrogen/ nutrients/ grazing/ water quality/ grasslands/ communities/ livestock/ streams/ environmental impact/ algae/ agricultural pollution/ nutrient concentrations/ man-induced effects/ phytobenthos/ rivers/ riparian vegetation/ nutrients (mineral)/ environmental effects/ agricultural runoff/ environmental quality/ Canada, Alberta, Cypress Hills/ Canada, Alberta/ livestock grazing

Abstract: The effects of livestock grazing on selected riparian and stream attributes, water chemistry, and algal biomass were investigated over a two-year period using livestock enclosures and by completing stream surveys in the Cypress Hills grassland plateau, Alberta, Canada. Livestock enclosure experiments, partially replicated in three streams, comprised four treatments: (1) early season livestock grazing (June-August), (2) late season livestock grazing (August-September), (3) all season grazing (June-September), and (4) livestock absent controls. Livestock grazing significantly decreased streambank stability, biomass of riparian vegetation, and the extent to which aquatic vegetation covered the stream channels compared with livestock-absent controls. Water quality comparisons indicated significant differences among the four livestock grazing treatments in Battle and Graburn creeks but not in

Nine Mile Creek. In Graburn Creek, the concentration of total phosphorus in the all-season livestock grazing treatment was significantly higher than that in the livestock-absent control, and the early season and late season grazing treatments. Concentrations of soluble reactive phosphorus in the all-season livestock grazing treatment also exceeded that in livestock-absent control. In contrast, differences in water quality variables in the remaining 22 comparisons (i.e., 22 of the total 24 comparisons) were minor even when differences were statistically significant. Effects of livestock grazing on algal biomass were variable, and there was no consistent pattern among creeks. At the watershed scale, spatial variation in algal biomass was related ($P < 0.05$) with concentrations of NO sub(2) super(m) + NO sub(3) super(m) and soluble reactive phosphorus in two of the four study creeks. Nutrient diffusing substrata experiments showed that algal communities were either nitrogen-limited or not limited by nutrients, depending on stream and season.

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450. Correlations of stocking with the cryptogamic soil crust of a semi-arid rangeland in southwest Queensland.

Hodgkins, I. W. and Rogers, R. W.

Australian Journal of Ecology 22(4): 425-431. (1997)

NAL Call #: QH540.A8; ISSN: 0307-692X

Descriptors: biodiversity/ community structure/ cryptogamic soil crust: community, condition/ dung density/ hoof impact/ semi arid rangeland: habitat/ water supply

Abstract: The soil crust community from a sub-tropical grassland in southwest Queensland was found to include 34 taxa with cyanobacteria, other algae, lichens, fungi, mosses and liverworts represented. Cyanobacteria and liverworts were the major components of the cryptogamic cover. This is a significant component of the biodiversity of the region. Changes in the structure of this community were significantly correlated with distance from a linear water supply (bore drain) and with dung density. It was concluded that hoof impact by grazing stock had measurably affected the cryptogamic community even under a moderate stocking policy. This research suggests that management for sustainable use of low-nutrient rangelands should include consideration of soil crust condition.

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451. Debunking the myth of overgrazing and soil erosion.

Rowntree, K.; Duma, M.; Kakembo, V.; and Thornes, J.

Land Degradation and Development 15(3): 203-214. (2004)

NAL Call #: S622.L26; ISSN: 1085-3278

Descriptors: carrying capacity/ communal rangeland/ ecology/ equilibrium and non equilibrium theory/ grazing impact/ land use change/ myth debunking/ overgrazing/ soil erosion

Abstract: What is overgrazing? Does it cause soil erosion? The recent debate from the ecological literature is reviewed as background to the debate on overgrazing and soil erosion. This debate stresses the need to view dryland grazing systems as dynamic ecosystems driven more by rainfall events than by livestock numbers. The case for soil erosion is then examined. Two case studies from communal rangelands in the Eastern Cape, South Africa, have cast doubts on the conventional wisdom that overgrazing leads to soil erosion. The first, a study of

historical land-use change and erosion in a communal area, showed that the most intense erosion, taking the form of steeply dissected badlands, was associated with cultivated land that had been abandoned and reverted to grazing from the 1960s onwards. Such severe erosion was generally absent from land that had been under grazing since the 1930s. The second study demonstrated that erosion rates from communal grazing lands ('overgrazed') were only slightly higher than those from land under 'optimal' grazing, that is grazing at a level considered not to exceed the carrying capacity of the land. These results support the ecologist's contention that communal grazing systems do not necessarily degrade the range condition relative to management systems based on a notional carrying capacity. Copyright 2004 John Wiley & Sons, Ltd. © The Thomson Corporation

452. Discharge and suspended sediment patterns of an intermittent cold desert stream.

Ellison, C. A.; Skinner, Q. D.; and Reddy, K. J.
Journal of the American Water Resources Association 42(1): 55-68. (2006)
 NAL Call #: GB651.W315; ISSN: 1093-474X
Descriptors: best management practices (bmps)/ channel storage/ runoff/ sediment transport/ time series analysis/ watersheds
Abstract: Sage Creek in south-central Wyoming is listed as impaired by the U.S. Environmental Protection Agency (USEPA) due to its sediment contribution to the North Platte River. Despite the magnitude of sediment impacts on streams, little research has been conducted to characterize patterns of sediment transport or to model suspended sediment concentration in many arid western U.S. streams. This study examined the relationship between stream discharge and suspended sediment concentration near the Sage Creek and North Platte River confluence from 1998 through 2003. The objectives were to determine patterns of stream discharge and suspended sediment concentration, produce a sediment prediction model, and compare sediment concentrations for the six-year period. Stream discharge and suspended sediment transport responded rapidly to convective storms and spring runoff events. During the study period, events exceeding 0.23 m³/s accounted for 92 percent of the sediment load, which is believed to originate from erodible headwater uplands. Further analysis of these data indicates that time series modeling is superior to simple linear regression in predicting sediment concentration. Significant increases in suspended sediment concentration occurred in all years except 2003. This analysis suggests that a six-year monitoring record was insufficient to factor out impacts from climate, geology, and historical sediment storage. JAWRA Copyright © 2006.
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453. Effect of animal grazing on streamflow quality in the Pacific Northwest.

Saxton, K. E.; Elliott, L. F.; Papendick, R. I.; and Jawson, M. D.
American Society of Agricultural Engineers Paper(82-2616): 16 p. (1982)
Descriptors: pollution/ water pollution/ erosion/ pastures/ water/ quality/ grazing

Abstract: Streamflow water quality was intensively studied for 3 yr on a grazed (21.5 ha) and an ungrazed check (0.9 ha) watershed in order to identify water quantity, erosion, and water quality from a typical summer grazed watershed. Emphasis was on sediment, nitrogen, phosphorous, and bacteriological quality.

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454. Effect of animal grazing on water quality of nonpoint runoff in the Pacific Northwest.

Saxton, K. E.; Elliott, L. F.; Papendick, R. I.; Jawson, M. D.; and Fortier, D. H.
 Ada, Okla.: United States Environmental Protection Agency Research & Development, 1983. 7 p.
Notes: EPA 600/S2-83/071
 NAL Call #: TD223.7.E442 1983
Descriptors: Pacific Northwest/ freshwater environment/ impact of agriculture/ cattle/ grazing/ erosion/ sedimentation/ water quality/ management/ manure/ indicator bacterial/ freshwater environment/ impact of forestry or agriculture/ policy, management, education or information
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455. Effect of canopy and grazing on soil bulk density.

Tate, K. W.; Dudley, D. M.; McDougald, N. K.; and George, M. R.
Journal of Range Management 57(4): 411-417. (2004)
 NAL Call #: 60.18 J82; ISSN: 0022-409X
Descriptors: annual rangeland/ compaction/ RDM/ residual dry matter/ Sierra Nevada
Abstract: This study compared soil surface bulk density between: 1) sites not grazed by cattle > 26 years; 2) sites not grazed for 6 years; 3) sites grazed for 15 years to October residual dry matter levels of > 1100 kg ha⁻¹; 4) sites grazed for 15 years to October residual dry matter levels of 670 to 900 kg ha⁻¹; 5) sites grazed for 15 years to October residual dry matter levels of < 450 kg ha⁻¹; and 6) sites subject to concentrated cattle use (trails, corrals, and supplemental feed-water stations). Sites were collected from across the 1,772 ha San Joaquin Experimental Range (SJER) in Madera County, Calif. to represent canopy cover (open grassland, blue oak (*Quercus douglasii* Hook and Arn.), live oak (*Quercus wislizenii* A.DC.), foothill pine (*Pinus sabiniana* Douglas), wedgeleaf ceanothus (*Ceanothus cuneatus* (Hook) Nutt.), and ceanothus interspace) and topography (swale, uplands) typical of the rocky coarse sandy loam soils of the southern Sierra Nevada foothill oak savannah. Soil surface (0 to 7.62 cm) bulk density (g cm⁻³) was determined for 1489 soil cores collected across all available combinations of grazing management, canopy cover and topographic position at the SJER. Soil surface bulk density was 0.23 to 0.30 g cm⁻³ lower under canopy compared to open grasslands. Bulk density was not different ($P > 0.05$) between sites not grazed > 26 years and sites not grazed for 6 years. Grazing to residual dry matter levels of > 1100, 670 to 900, and < 450 kg ha⁻¹ created bulk densities which were 0.08, 0.18, and 0.21 g cm⁻³ greater than non-grazed sites, respectively. Cattle concentration sites had bulk densities 0.37 to 0.47 g cm⁻³ greater than areas not grazed > 6 or 26 years. For the purpose of maintaining soil surface bulk density current residual dry matter recommendations for sites with canopy cover > 50% appear appropriate, but

recommendations for open grasslands need additional review. In particular, residual dry matter level must be directly linked to soil surface infiltration capacity.

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456. Effect of grazing and cultivation on some chemical properties of soils in the mixed prairie.

Dormaar, J. F. and Willms, W. D.

Journal of Range Management 43(5): 456-460. (1990)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1990/435/19dorm.pdf>

Descriptors: Hesperostipa comata/ Bouteloua gracilis/ prairies/ pastures/ grassland soils/ tillage/ soil organic matter/ physicochemical properties/ monosaccharides/ organic acids and salts/ grazing/ soil quality/ Alberta
This citation is from AGRICOLA.

457. Effect of grazing on surface soil properties of interdune duplex soils in a chenopod shrubland.

Greene, R. S. B. and Tongway, D. J.

In: Effects of management practices on soil physical properties. (Held 7 Sep 1987-10 Sep 1987 at Toowoomba, Queensland.) Coughlan, K. J. and Truong, P. N. (eds.) Brisbane: Queensland Department of Primary Industries; pp. 56-60; 1987.

NAL Call #: S599.7.A8E44 1987; ISBN: 0724224513

Descriptors: duplex soils/ animal husbandry/ grazing/ soil/ physical properties/ rangeland soils/ soil physics/ soil types ecological

Abstract: The effects of grazing on the soil resource base, and in particular, how stocking rate influences the physical and chemical properties of the duplex soils occurring in interdune areas, are discussed.

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458. Effect of livestock grazing on physical properties of a cracking and self-mulching Vertisol.

Taddese, G.; Saleem, M. A. Mohamed; and Ayalneh, W. *Australian Journal of Experimental Agriculture* 42(2): 129-133. (2002)

NAL Call #: 23 Au792; ISSN: 0816-1089

Descriptors: penetrometer measurements: field method/ vertisol: cracking, self mulching/ livestock trampling: grazing, soil resistance

Abstract: The impact of grazing on physical properties of Vertisol was studied from 1996 to 2000 in the Ethiopian highlands. The study was conducted at 2 sites with 0-4 and 4-8% slopes at Tero Jemjem watershed in Ginchi, 80 km west of Addis Ababa. The objective of the study was to compare selected soil physical properties at different grazing pressures and slopes. The stocking rate was moderate grazing 1.8 animal-unit months per hectare (1.8 AUM/ha), heavy grazing 3.0 AUM/ha and a control treatment with no grazing. The result showed that heavy grazing pressure removed grass cover, which consequently enhanced soil cracking. Effect of livestock trampling on soil resistance to penetration (indicated by penetrometer readings) was higher in the heavily grazed plots than in non-grazed plots. Penetrometer readings were influenced by soil moisture content. Low moisture content was observed in the heavily grazed plots at both sites. The infiltration of accumulated water to the soil matrix was lower in heavily grazed plots.

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459. Effect of timing of grazing on soil-surface cryptogamic communities in a Great Basin low-shrub desert: A preliminary report.

Marble, J. R. and Harper, K. T.

Great Basin Naturalist 49(1): 104-107. (1989)

NAL Call #: 410 G79; ISSN: 0017-3614

Descriptors: sheep/ vascular plant/ species diversity/ percent cover/ richness/ seasonality/ resource management/ soil stability/ Utah

Abstract: Cover and species richness of vascular and cryptogamic components of the plant community were inventoried in experimental grazing paddocks at the USDA/FS Desert Range Experimental Station, Millard County, Utah. The grazing treatments considered have been applied continuously for over 50 years. The effects of heavy (ca 17 sheep days/acre) grazing treatment applied in two different seasons (early winter versus a split between early and late winter) differed significantly between seasons. Cryptogamic over and cryptogamic species richness both showed larger decreases under early-late as opposed to early winter only grazing. Vascular plant cover (relative to controls) was also reduced by early-late winter grazing, but not to a significant degree. Late season grazing, likewise, had no significant effect on number of vascular species per transect.

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460. Effect of various grazing systems on type and density of cattle trails.

Walker, J. W. and Heitschmidt, R. K.

Journal of Range Management 39(5): 428-431. (1986)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1986/395/12walk.pdf>

Descriptors: rotational/ continuous/ deferred rotation/ soil erosion/ paddocks

Abstract: Number and kinds of cattle trails may have a dramatic impact on relative amount of bare soil and subsequently on amount and rate of soil erosion. The objective of this study was to quantify the effect of a cell-designed, rotational grazing treatment (RG) on density and kinds of cattle trails. Density of cattle trails in the RG treatment was compared to those in heavy continuous (HC), moderate continuous (MC), and deferred rotation (DR) treatments at 4 distances from water. There were no differences among the HC, MC, and DR treatments in density of trails. Trail densities ranged from 14/km near water sources to 9/km at the far end of the pastures. This compares to the RG treatment where trail densities ranged from 164/km near the cell center to 24/km at the far end of the paddock. The effect of increasing the RG treatment from 14 to 42 paddocks was also investigated. Subdivision of paddocks increased trail densities near the center from 32/km to 57/km with no increased noted at the far ends of the paddocks. It is concluded that implementation of a cell-designed, RG system will cause a significant increase in density and number of cattle trails particularly near the cell center.

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461. Effect of watershed management operations on runoff and sediment release in Hazara Pakistan.

Abbas, S. H. and Hanif, M.

Pakistan Journal of Forestry 37(2): 89-98. (1987)

NAL Call #: 99.8 P17; ISSN: 0030-9818

Descriptors: planting/ grazing/ closure

Abstract: To study the effect of watershed management practices (mainly planting) on runoff and sediment release an experiment was conducted at two sites in Hazara. The analysis of 6 years data collected, revealed that planting coupled with closure to grazing on the slopes proved to be extremely helpful in reducing the runoff and sediment release from 30% to 1% and 239 gms/plot to 10 gms per plot respectively.

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462. Effects of intense, short-duration grazing on microtopography in a Chihuahuan Desert grassland.

Nash, M. S.; Jackson, E.; and Whitford, W. G.

Journal of Arid Environments 56(3): 383-393. (2004)

NAL Call #: QH541.5.D4J6; ISSN: 0140-1963

Descriptors: cattle/ grazing/ hoof-action/ microdepressions/ micromounds/ microtopography index/ wind erosion

Abstract: We studied the effect of three consecutive years of short duration (< 48 h per year), and intense grazing (20-40 yearling cows per hectare) on soil surface microtopography in a Chihuahuan Desert grassland. We also studied the effects of shrub removal plus grazing on microtopography. Microtopography was measured in 18 plots (treatments). Treatments were a combination of two factors: (1) three levels of grazing (winter-grazed, summer-grazed, and not grazed), and (2) two levels of habitat structure (shrubs-removed and shrubs-intact). Mesquite (*Prosopis glandulosa*) shrubs were removed from half of the plots (nine out of 18 plots). The average height of the micromounds, the average depths of intermound depressions, and the number of micromounds were significantly reduced on the grazed plots. Shrub removal had no significant effect on the height of the micromounds or the depth of the intermound depressions of ungrazed plots. There were significant differences in average micromound heights and intermound microdepression depths attributable to the season of grazing.

Microtopography was significantly reduced on grazed plots from which shrubs were removed, compared to ungrazed plots, and grazed plots with shrubs present. Grass canopy reduction, and destruction of the micromound structure in a short duration, plus intense grazing results in erosion of micromounds and in-filling of intermound depressions. The loss of microtopography coupled with reduction in vegetation height and cover resulting from short-duration intense grazing by cattle exposed soils to an increased risk of soil erosion. Destruction of the micromound/microdepression topography by cattle changes the spatial patterns of water infiltration, and may homogenize nutrients in desert grasslands. © 2003 Published by Elsevier Science Ltd.

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463. Effects of livestock grazing on infiltration and erosion rates measured on chained and unchained pinyon-juniper sites in southeastern Utah.

Busby, F. E. and Gifford, G. F.

Journal of Range Management 34(5): 400-405. (1981)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1981/345/15busb.pdf>

Descriptors: Utah

This citation is from AGRICOLA.

464. Effects of livestock grazing on nutrient retention in a headwater stream of the Rio Puerco Basin.

Sewards, M. A. and Valett, H. M.

In: *Desired future conditions for Southwestern riparian ecosystems: Bringing interests and concerns together.* (Held 18 Sep 1995-22 Sep 1995 at Albuquerque, N. Mex.)

Shaw, Douglas W. and Finch, Deborah M. (eds.)

Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station, U.S. Dept. of Agriculture; pp.

135-142; 1996.

NAL Call #: aSD11.A42 no.272

Descriptors: streams/ grazing/ livestock/ nutrient retention/ hydrology/ biogeochemistry/ riparian buffers/ sediments/ New Mexico

This citation is from AGRICOLA.

465. Effects of livestock grazing on sediment production, Edwards Plateau of Texas.

Mccalla, G. R.; Blackburn, W. H.; and Merrill, L. B.

Journal of Range Management 37(4): 291-294. (1984)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1984/374/1mcca.pdf>

Descriptors: cattle/ sheep/ goats/ midgrass/ shortgrass/ community/ grazing duration/ stocking rate/ soil loss/ overgrazing/ erosion

Abstract: The influence of short duration grazing (SDG), moderate continuous grazing (MCG), heavy continuous grazing (HCG) and grazing exclusion on sediment production of midgrass and shortgrass-dominated communities was evaluated over a 20-mo. period on the Texas Agricultural Research Station located near Sonora in the Edwards Plateau, Texas. A combination of cattle, sheep and goats was used in each grazing treatment. Sediment production was consistently less from the midgrass (bunchgrass) than from the shortgrass (sodgrass) community. The HCG pasture was severely overgrazed and resulted in excessive soil loss. The midgrasses in this pasture were destroyed after 26 mo. of overgrazing. Sediment production from the SDG pasture stocked at double the recommended rate increased during the study period. The SDG pasture, by the end of the study, had lost more sediment from both the midgrass- and shortgrass-dominated communities than the MCG pasture. Sediment loss from the midgrass community in the MCG pasture was consistently low during the study; sediment production from the shortgrass community decreased in the MCG pasture. Sediment production from the midgrass community in the non-grazed pasture remained consistently low throughout the study, but the shortgrass community showed a strong decrease in sediment loss during the study.

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466. Effects of long-term grazing on cryptogam crust cover in Navajo National Monument, Arizona.

Brotherson, J. D.; Rushforth, S. R.; and Johansen, J. R.

Journal of Range Management 36(5): 579-581. (1983)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1983/365/9brot.pdf>

Descriptors: Arizona

This citation is from AGRICOLA.

467. Effects of season and stage of rotation cycle on hydrologic condition of rangeland under intensive rotation grazing.

Warren, S. D.; Blackburn, W. H.; and Taylor, C. A.
Journal of Range Management 39(6): 486-491. (1986)
 NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1986/396/2warr.pdf>

Descriptors: livestock/ sediment production/ growth damage

Abstract: Infiltration rate and sediment production were measured over a 2-year period on an intensive rotationally grazed pasture. Measurements were taken prior to the movement of livestock onto the pasture, soon after their removal, and approximately midway through the subsequent rest period of each rotation through the system. Midgrass-dominated interspaces were characterized by significantly higher infiltration rates and lower sediment production than shortgrass-dominated interspaces. Infiltration rate declined and sediment production increased following the short-term intense grazing periods inherent in the rotational system. The detrimental effect was significant during periods of drought or winter dormancy, but not during periods of active growth. Soil characteristics relating to higher hydrologic condition were significantly more stable during the growing season, providing greater resistance to and resilience from the damaging impact of livestock activity.

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468. Efficacy of vegetated buffer strips for retaining *Cryptosporidium parvum*.

Tate, K. W.; Pereira, M. das G. C.; and Atwill, E. R.
Journal of Environmental Quality 33(6): 2243-2251. (Nov. 2004-Dec. 2004)

NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: *Cryptosporidium parvum*/ intestinal microorganisms/ oocysts/ drinking water/ water pollution/ fecal contamination/ cattle/ grazing/ feces/ grasslands/ watersheds/ conservation buffers/ ground vegetation/ water flow/ slope/ sandy loam soils/ rainfall simulation/ rainfall duration/ California

Abstract: Overland and shallow subsurface hydrologic transport of pathogenic *Cryptosporidium parvum* oocysts from cattle feces into surface drinking water supplies is a major concern on annual grasslands in California's central and southern Sierra Nevada foothills. Soil boxes (0.5 m wide x 1.1 m long x 0.3 m deep) were used to evaluate the ability of grass vegetated buffer strips to retain 2×10^8 spiked *C. parvum* oocysts in 200-g fecal deposits during simulated rainfall intensities of 30 to 47.5 mm/h over 2 h. Buffers were comprised of Ahwahnee sandy loam (coarse-loamy, mixed, active, thermic Mollic Haploxeralfs; 78:18:4 sand to silt to clay ratio; dry bulk density = 1.4 g/cm³) set at 5 to 20% land slope, and greater than or equal to 95% grass cover (grass stubble height = 10 cm; biomass = 900 kg/ha dry weight). Total number of oocysts discharged from each soil box (combined overland and subsurface flow) during the 120-min simulation ranged from 1.5×10^6 to 23.9×10^6 oocysts. Observed overall mean log₁₀ reduction of total *C. parvum* flux per meter of vegetated buffer was 1.44, 1.19, and 1.18 for buffers at 5, 12, and 20% land slope, respectively. Rainfall application rate (mm/h) was strongly associated with oocyst flux from these vegetated buffers, resulting in a decrease of 2 to 4% in the log₁₀ reduction per meter buffer for every additional mm/h

applied to the soil box. These results support the use of strategically placed vegetated buffers as one of several management strategies that can reduce the risk of waterborne *C. parvum* attributable to extensive cattle grazing on annual grassland watersheds. This citation is from AGRICOLA.

469. Erosion studies from experimental watersheds impacted by livestock grazing.

Daniel, J. A.

In: Soil erosion research for the 21st century: Proceedings of the International Symposium. (Held 3 Jan 2001-5 Jan 2001 at Honolulu, Hawaii, USA.); pp. 599-602; 2001.
 NAL Call #: S622.2 .S656 2001

Descriptors: drought/ erosion/ grassland management/ grasslands/ grazing intensity/ livestock/ overland flow/ precipitation/ rain/ runoff/ sediment yield/ stocking density/ storms/ summer/ watersheds

Abstract: Three 1.6 ha experimental watersheds in Oklahoma, USA, equipped with stream gauge recorders, water samplers, and rain gauges, were used to determine the potential erosion by livestock grazing during simulated drought and wet periods. Surface runoff and sediment yield data was collated for each watershed for storm events between 1980 to 1991 during summer grazing. Grazing treatments included three stocking densities of 2.5, 5, and 7.5 head/ha by stocker calves. Since no grazing occurred during 1981, 1982, 1985, and 1986, these years were not included in the calculations, but were instead used as controls. Regression equations for each grazed treatment were calculated to determine the relation between precipitation, surface runoff and sediment yield per storm event. Precipitation of dry and wet years was estimated from a 40-year CLIGEN weather simulation utilizing local weather trend data. Results show that increasing stocking density on the watershed increased the erosion potential of the watersheds. Also the erosion potential increased in the wet years compared with the dry years. A 12% increase from light to heavy stocking density occurred for the dry years and a 25% increase occurred for the wet years. However, sediment movement off the watershed during rest periods was greater than when livestock was present. This suggests that for grazing under conservative management practices, the impact of livestock grazing on sediment movement is minimal.

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470. Evapotranspiration from northern semiarid grasslands.

Frank, A. B.

Agronomy Journal 95(6): 1504-1509. (2003)

NAL Call #: 4 AM34P; ISSN: 0002-1962

Descriptors: bowen ratio energy balance method/ mathematical and computer techniques/ biomass production/ canopy structure/ energy budget/ evapotranspiration/ forage production management/ grazed mixed grass prairie/ grazed western wheatgrass stand/ nongrazed mixed grass prairie/ northern semiarid grasslands/ semiarid environment/ soil water conservation
Abstract: Management of forage production for livestock grazing on semiarid grasslands depends on water availability. Evapotranspiration (ET) was measured using the Bowen ratio energy balance method on three grasslands at Mandan, ND: a nongrazed mixed-grass prairie (prairie), a grazed mixed-grass prairie (grazed

prairie), and a grazed western wheatgrass (*Pascopyrum smithii* (Rybd) Love) site (western wheatgrass). Measurements were made from 24 April to 17 October (the growing period) in 1996, 1997, and 1998. Peak ET rates generally coincided with periods of peak biomass production and occurred between early July and early August. Peak biomass averaged 1097 kg ha⁻¹ for the prairie, 1227 kg ha⁻¹ for grazed prairie, and 1725 kg ha⁻¹ for western wheatgrass, and peak leaf area index averaged 0.38 for the prairie, 0.44 for grazed prairie, and 0.59 for western wheatgrass. Growing period (175 d) ET averaged 489 mm for the prairie, 455 mm for the grazed prairie, and 497 mm for the western wheatgrass while growing period precipitation averaged 320 mm. Evapotranspiration of grazed prairie was 7% less than nongrazed prairie and 8% less than western wheatgrass. Evapotranspiration of the nongrazed prairie and the grazed western wheatgrass were similar. The ratio of the latent heat of ET to net radiation averaged 0.25 for grazed prairie and 0.28 for prairie, suggesting that grazing changed the canopy structure and energy budget components that affected ET. These results suggest that in a semiarid environment, proper grazing of prairie grasslands conserves soil water.
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471. Factors influencing development of cryptogamic soil crusts in Utah deserts.

Anderson, D. C.; Harper, K. T.; and Holmgren, R. C. *Journal of Range Management* 35(2): 180-185. (1982)
NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1982/352/10ande.pdf>
Descriptors: electrical conductivity/ silt/ phosphorus/ grazing pressure/ range management
Abstract: The relation of some physical and chemical soil characteristics to cryptogamic crust development was determined from sites in semidesert regions of southern Utah. The effects of grazing on cryptogamic crust development also were examined. Electrical conductivity, percentage silt and soil P were correlated with well-developed cryptogamic crusts. Both total cryptogamic cover and the number of cryptogamic species decreased under grazing pressure. The management of rangelands, especially in arid regions, would be strengthened by understanding the role of cryptogamic crusts and considering them in range management decisions.
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472. Flash grazing and trampling effects on infiltration rates and sediment yield on a selected New Mexico range site.

Weltz, M.; Wood, M. K.; and Parker, E. E. *Journal of Arid Environments* 16(1): 95-100. (1989)
NAL Call #: QH541.5.D4J6; ISSN: 0140-1963
Descriptors: cattle/ bulk density/ hydrology
Abstract: This study evaluated the influence of flash grazing and livestock trampling on selected hydrologic variables on the Rio Bonito watershed in central New Mexico. Terminal infiltration rates were significantly reduced after cattle had grazed within an enclosure for 14 hours. After 110 days, the enclosures' infiltration rates were one-half that of the pretrampled treatment. Trampling during both sampling periods significantly increased sediment yield and bulk density.
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473. Grassland structure in native pastures: Links to soil surface condition.

Mcintyre, Sue and Tongway, David
Ecological Management and Restoration 6(1): 43-50. (2005)
NAL Call #: QH75.A1 E362; ISSN: 1442-7001
Descriptors: grassland/ grazing pasture/ soil surface condition
Abstract: When grassland is grazed by livestock, the structure of the sward changes in a patchy manner. With continuous selective grazing there is a mosaic of short and tall patches but as grazing intensifies the area of short-grazed patch increases until the paddock has a lawn-like appearance. This mosaic of patch structures can be stable, as short patches tend to attract repeated grazing and tall patches tend to be avoided. Because heavy grazing can detrimentally affect soil and water functions in grassland (ultimately resulting in erosion), we aimed to assess how well the physical structure of the sward reflects soil surface condition. We described four grassland patch structures that were assumed to reflect different levels of present grazing, and to some extent, past grazing pressure. We assessed patch structure and two other grass-related variables (basal area of a 'large tussock' functional group and basal area of all perennial grass) as possible indicators of soil surface condition. Three indices of condition were measured in the field. The infiltration and nutrient cycling index declined progressively across patch structures, consistent with increasing grazing pressure. The stability index was found to be reduced only for the most heavily grazed grass structure (short patches). We found the 'large tussock' grass functional group to be a more sensitive indicator of soil surface condition than the group consisting of all perennial grasses. We found no evidence of sudden soil surface condition decline beyond a certain level of grass basal area, that is, there was no evidence of thresholds, rather, incremental loss of condition accompanied grass decline. We are thus not able to further refine an earlier proposed management recommendation 'Graze conservatively to maintain dominance of large and medium tussock grasses over 60-70% of the native pastures', except to suggest the use of short patches as a more practical indicator, rephrasing the recommendation as 'Graze conservatively to allow a maximum of 30% short-grazed patches in native pastures'.
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474. Grazing and haying effects on runoff and erosion from a former Conservation Reserve Program site.

Gilley, J. E.; Patton, B. D.; Nyren, P. E.; and Simanton, J. R.
Applied Engineering in Agriculture 12(6): 681-684. (Nov. 1996)
NAL Call #: S671.A66; ISSN: 0883-8542
Descriptors: agricultural land/ land management/ federal programs/ land use/ change/ soil conservation/ grassland management/ grazing/ rotational grazing/ haymaking/ prescribed burning/ runoff/ water erosion/ sediment/ losses from soil/ canopy/ vegetation/ coverage/ surface roughness/ bulk density/ soil compaction/ North Dakota/ season long grazing
Abstract: Grazing and haying effects on runoff and erosion from a former Conservation Reserve Program (CRP) site near Streeter, North Dakota, were determined. Treatments included undisturbed CRP, twice-over rotational grazing,

season-long grazing, haying, and burning. Runoff and erosion were measured from simulated rainfall which was applied to 3.7 X 10.7 m (12.0 X 35.1 ft) plots. Following an initial stabilization period, no significant difference in runoff or erosion was found between the season-long grazing and burned treatments. Use of the CRP site for grazing or haying resulted in a significant increase in runoff compared to leaving the area in an undisturbed condition. Similar amounts of erosion were measured from the twice-over rotational grazing, season-long grazing, and hayed treatments. If adequate canopy and basal cover is maintained, use of this CRP site for grazing or haying would not be expected to result in excessive erosion. This citation is from AGRICOLA.

475. Grazing and plant-canopy effects on semiarid soil microbial biomass and respiration.

Kieft, T. L.

Biology and Fertility of Soils 18(2): 155-162. (1994)

NAL Call #: QH84.8.B46; ISSN: 0178-2762

Descriptors: soil microorganisms/ microorganisms/ microbial activity/ rangelands/ *Bouteloua*/ *Atriplex canescens*/ *Yucca glauca*/ canopy/ carbon/ range management/ grasslands/ semiarid zones/ grazing/ soil respiration/ New Mexico

This citation is from AGRICOLA.

476. Grazing effects on soil water in Alberta foothills fescue grasslands.

Naeth, M. A. and Chanasyk, D. S.

Journal of Range Management 48(6): 528-534. (1995)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/1995/486/528-534_naeth.pdf

Descriptors: cattle/ soil water content/ grazing intensity/ slope/ groundwater recharge/ evapotranspiration/ soil depth/ grazing/ Alberta

Abstract: Grazing can have a profound impact on soil water through its influence on infiltration via treading and on evapotranspiration through defoliation. Hydrologic changes in rangelands are most often associated with heavy grazing intensities although these changes do not increase linearly with grazing intensity. The objectives of this study were to quantify the impacts of grazing on the soil water regimes of sloped areas of the foothills fescue grasslands of Alberta. The study site was located at the Agriculture Canada Research Station at Stavely, Alberta. The effects of 2 grazing intensities (heavy = 2.4 AUM ha⁻¹ and very heavy = 4.8 AUM ha⁻¹) for 2 grazing treatments (short duration = 1 week in mid-June and continuous grazing = May through October) were compared to an ungrazed control. The study was initiated in June 1988 and ended in April 1991. Surface soil water and soil water with depth were measured throughout each growing season using a neutron probe. Surface soil water (0 to 7.5 cm) across slope positions was lowest in the control and highest in the continuous very heavy treatments, but the trend in profile soil water (to 50 cm) was the opposite. Total profile soil water in the short duration very heavy treatment was greater than that in the continuous very heavy treatment, while soil water in the short duration heavy treatment was similar to that in the continuous heavy treatment. Vegetation at the study site was regularly water-stressed, as evidenced by soil water that was often below permanent wilting point, generally by mid-summer each year. Soil was near or below permanent

wilting point in the autumn, regardless of its status throughout the growing season. Profile soil water was similar across treatments in autumn, indicating vegetation is using all available soil water. In contrast, soil water was generally near or above field capacity every spring, indicating the importance of snowmelt infiltration in these ecosystems. Only major (greater than 75 mm) summer rainstorms recharged soil water to field capacity. Thus it is concluded that maintenance of a vegetative cover that will trap snow for potential snowmelt infiltration is critical to soil water recharge of these ecosystems. Any grazing management regime that enhances litter accumulation and carryover should facilitate such snowmelt soil water recharge.

This citation is from AGRICOLA.

477. Grazing effects on the bulk density in a Natraquoll of the Flooding Pampa of Argentina.

Taboada, M. A. and Lavado, R. S.

Journal of Range Management 41(6): 500-503. (1988)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1988/416/12tabo.pdf>

Descriptors: soil water retention/ environmental condition/ land use

Abstract: The influence of grazing by cattle on soil bulk density was studied in a typical Natraquoll of the Flooding Pampa of Argentina for a period of 33 months, by comparing a grazed situation to an enclosure deferred from grazing for 7 years. Floods took place in this period as usual. Bulk density (BD) at -33.3 kPa of water retention varied from 1.00 to 1.11 Mg m⁻³ in the ungrazed soil and in the grazed soil from 1.04 to 1.16 Mg m⁻³. Environmental factors were the primary agent controlling BD; only in some periods were there significant differences between treatments. Slight increases in BD occurred under grazing after the recession of the flood water, and significant decreases occurred in the ungrazed soil during the large and sudden falls in water content. In this case the effect of trampling, therefore, would consist mainly of impeding the decrease in BD. No compaction was observed in periods when no flood occurred or while soil remained submerged in water. The results indicated that the variations of bulk density caused by cattle trampling were superimposed on those produced by floods and showed an interaction between the effects of land-use and the particular environmental conditions of the region.

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478. Grazing impacts on selected soil parameters under short-term forage sequences.

Mapfumo, E.; Chanasyk, D. S.; Baron, V. S.; and Naeth, M. A.

Journal of Range Management 53(5): 466-470. (2000)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/2000/535/466-470_mapfumo.pdf

Descriptors: beef cattle/ grazing intensity/ botanical composition/ rotational grazing/ *Bromus inermis*/ *Bromus riparius*/ *triticales*/ *Hordeum vulgare*/ soil properties/ water holding capacity/ potassium/ soil test values/ mineral content/ carbon/ nitrogen content/ electrical conductivity/ soil depth/ soil pH/ Alberta

Abstract: Long-term cultivation is known to change soil physical and chemical properties, but little is known about whether short-term agricultural practices, such as rotational

grazing, can initiate such changes. This study investigated the impacts of 3 grazing intensities (heavy, medium, and light) and 4 forages on selected soil physical and chemical parameters of a Typic Haplustoll at Lacombe, Alberta. Measurements were conducted on soil samples collected at the beginning (1993) and the end (1996) of the study. Two perennial forages, smooth bromegrass (*Bromus inermis* cv. 'Carlton') and meadow bromegrass (*Bromus riparius* cv. 'Paddock'), and 2 annuals, a mixture of triticale (*X Triticosecale* Wittmack cv. 'Pika') and barley (*Hordeum vulgare* L. cv. 'AC Lacombe') and triticale alone were used for the study. Grazing intensity or forage species did not affect carbon-to-nitrogen ratio. Grazing intensity influenced changes in available water holding capacity for the 0-5 cm interval, soil nitrogen for the 30-45 cm interval, soil pH for the 5-15 cm interval and electrical conductivity for all depth intervals except for the 0-5 cm interval (P less than or equal to 0.05). Forage species affected changes in soil carbon in the 0-5 cm interval, soil pH between 0 and 15 cm, and electrical conductivity between 5 and 45 cm (P less than or equal to 0.05). Soil electrical conductivities for all grazing levels and forage treatments were within the range (i.e. 0-2 dS m⁻¹) considered to have negligible effects on plant growth. The minimal effects of grazing and plant species on soil parameters in this study may have been due to the resilient intrinsic properties of the soil and/or the short study length.

This citation is from AGRICOLA.

479. Grazing impacts on soil nitrogen and phosphorus under Parkland pastures.

Baron, V. S.; Dick, A. C.; Mapfumo, E.; Malhi, S. S.; Naeth, M. A.; and Chanasyk, D. S.

Journal of Range Management 54(6): 704-710. (2001)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/2001/546/704-710_baron.pdf

Descriptors: range management/ *Bromus inermis*/ *Bromus riparius*/ triticale/ grazing intensity/ beef cattle/ NPK fertilizers/ soil chemistry/ nitrate nitrogen/ prairies/ phosphorus/ nitrogen content/ stocking rate/ soil fertility/ application rate/ Alberta

Abstract: Because intensive grazing is new to the humid western Canadian parkland (prairies), there is little information available about its effects on soil N and P status. This study addressed the question of grazing intensity and pasture species effects on soil macronutrient status in a Typic Haplustoll at Lacombe, Alberta. Paddocks of smooth bromegrass (*Bromus inermis* Leyss.), meadow bromegrass (*Bromus riparius* Rhem.), and winter triticale (*X Triticosecale* Wittmack.), replicated 4 times, were subjected to 3 grazing intensities (heavy, medium, and light as defined by frequency and severity of defoliation) using yearling beef heifers. Nitrogen (N), P and K fertilisers were broadcast annually at 100, 22 and 42 kg ha⁻¹ during production years. The experiment was maintained on the same paddocks for 4 years. In the establishment year and in the third and fourth production years, soil samples were taken randomly from each paddock to a depth of 60 cm. Concentrations of nitrate-N (NO₃-N), ammonium-N (NH₄-N), mineral-N (the sum of NO₃-N and NH₄-N), total Kjeldahl-N, and extractable-P were determined in the 0-15, 15-30, 30-60, and 0-60-cm depths. Nitrate-N concentration was (1.7 to 2.4 times) greater for heavy than light grazed treatments for each soil depth increment and the amount of

NO₃-N in the 0-60 cm depth was 2.2 times greater than light paddocks. More NO₃-N was measured under perennials than triticale (22.2 vs 13.6 mg kg⁻¹), respectively) at the 30-60-cm depth. Ammonium-N amount (0-60 cm) was greater in meadow bromegrass (30 kg ha⁻¹) than in triticale (25 kg ha⁻¹), but not smooth bromegrass paddocks for the 0-15-cm depth. Extractable-P concentration was greater in the 0-15-cm depth of heavy (154 mg kg⁻¹) than in medium (138 mg kg⁻¹) or light-grazed (127 mg kg⁻¹) paddocks and was higher under meadow bromegrass than under triticale. Given the large amounts of NO₃-N in the heavy paddocks, there is potential for loss through both leaching and denitrification. Differences among treatments for NH₄-N, and P concentrations are not of particular concern environmentally, but are important from a fertility management point of view.

This citation is from AGRICOLA.

480. Grazing impacts on soil water in mixed prairie and fescue grassland ecosystems of Alberta.

Naeth, M. A.; Chanasyk, D. S.; Rothwell, R. L.; and Bailey, A. W.

Canadian Journal of Soil Science 71(3): 313-326. (1991)

NAL Call #: 56.8 C162; ISSN: 0008-4271

Descriptors: livestock/ rangeland/ trampling/ soil infiltration/ seasonality

Abstract: Reduced soil water under grazing is generally attributed to reduced infiltration as livestock trampling compacts the soil surface. Grazing can also have the opposite effect on soil water through reduced evapotranspiration when vegetation is removed. On the Canadian Prairies, grazing impacts on soil water have been assessed in short-term studies but impacts of long-term grazing have not been documented. In this study, impacts of long-term grazing on soil water were assessed in mixed prairie, parkland fescue grassland, and foothills fescue grassland ecosystems of southern and central Alberta. Grazing regimes were of light to very heavy intensities, grazed early, late, and continuously during the growing season. Soil water was measured with a neutron probe to a depth of 1 m from April through October over three growing seasons. Normal patterns of soil water recharge in autumn and spring and soil water depletion in summer due to evapotranspiration were not altered by grazing. Fluctuations in soil water were most pronounced in the uppermost 30 cm but still evident in the 30- to 50-cm and 50- to 80-cm depth intervals. Heavy intensity and/or early season grazing had a greater impact on soil water than light intensity and/or late season grazing. Season of grazing affected soil water more under light than heavy grazing intensities. On most sampling dates, soil water in grazed treatments was lower than in the ungrazed control, particularly in the 30- to 50-cm and 50- to 80-cm depth intervals. Differences between the control and grazed treatments were least pronounced during the summer months with evapotranspiration depleting soil water reserves in all treatments.

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481. Grazing impacts on the spatial distribution of soil microbial biomass around tussock grasses in a tropical grassland.

Northup, B. K.; Brown, J. R.; and Holt, J. A.
Applied Soil Ecology 13(3): 259-270. (1999)
 NAL Call #: QH541.5.S6A67; ISSN: 0929-1393
 Descriptors: grassland soils/ tropical grasslands/ soil microorganisms/ biomass/ carbon/ grazing/ grazing intensity/ Bothriochloa/ Heteropogon contortus/ slope/ stocking rate/ range management/ pastures/ soil fertility/ nitrogen/ phosphorus/ soil organic matter/ soil water/ Queensland
 This citation is from AGRICOLA.

482. Grazing management and soil salinization in two Pampean Natraqualfs.

Lavado, R. S.; Rubio, G.; and Alconada, M.
Turrialba 42(4): 500-508. (1992)
 NAL Call #: 8 T86; ISSN: 0041-4360
 Descriptors: grazing/ salinization/ Alfisols/ pampas
 Abstract: The effect of grazing management (continuous grazing, rotational grazing and no grazing) on soil salinization was studied in two Natraqualfs of the Flooding Pampa of Argentina. Under continuous grazing the A1 horizon showed episodic increases in salt content due to the reduction of the soil cover and increased evaporation, resulting in salinization of the topsoil. This occurred to a much lesser degree under rotational grazing and was not observed under the no-grazing treatment.
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483. Grazing systems their influence on infiltration rates in the Rolling Plains of Texas.

Wood, M. K. and Blackburn, W. H.
Journal of Range Management 34(4): 331-335. (1981)
 NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1981/344/18wood.pdf>
 Descriptors: grass pastures/ rotation/ water movement/ aggregate stability/ organic matter/ mulch/ bulk density/ ground cover
 Abstract: Water infiltration rates into soils after 30 min in shrub canopy areas and in shortgrass interspaces on the Rolling Plains were similar across grazing treatments of heavy and moderate stocking, continuous grazing; rested and grazed deferred-rotation; rested and grazed high intensity, low frequency (HILF); and 2 livestock enclosures grazed for 20 yr. The mid-grass interspace infiltration rates for the deferred-rotation treatments approached rates in the enclosures and exceeded rates in the heavily stocked, continuously grazed, and grazed HILF pastures. Infiltration rates in the HILF grazing treatments were similar to those of the heavily stocked, continuously and moderately stocked continuously grazed pastures. Infiltration rates in the rested HILF pasture were similar to those of the deferred-rotation pastures; however, the grazed HILF pasture had rates lower than the deferred-rotation pasture rates or rates of the enclosures. Aggregate stability, organic matter content, mulch, standing crop, bulk density, and ground cover significantly influenced infiltration rates.
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484. Guidelines for managing cattle grazing in riparian areas to protect water quality: Review of research and best management practices policy.

Mosley, Jeffrey C.
 Moscow, ID: Idaho Forest, Wildlife and Range Policy Analysis Group, University of Idaho; 67 p. (1997)
 Notes: "December 1997"--Cover. Includes bibliographical references (p. 51-63).
 NAL Call #: SF85.35.I2G95--1997
 Descriptors: grazing---Idaho---management/ water quality---Idaho/ riparian areas---Idaho---management/ stream conservation---Idaho
 This citation is from AGRICOLA.

485. Hydrologic characteristics of vegetation types as affected by livestock grazing systems, Edwards Plateau, Texas.

Thurrow, T. L.; Blackburn, W. H.; and Taylor, C. A.
Journal of Range Management 39(6): 505-509. (1986)
 NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1986/396/6thur.pdf>
 Descriptors: soil/ drainage/ erosion/ grazing systems/ soil water movement/ infiltration/ pastures/ soil organic matter/ soil density/ grasslands
 Abstract: Infiltration rate and sediment production were assessed in sites dominated by either *Quercus virginiana* or *Bouteloua curtipendula*, *Stipa leucotricha* and *Aristida* spp. (bunchgrasses) or *Hilaria belangeri* in moderate continuous (MCG), heavy continuous (HCG) and short duration (SDG) grazing systems, and in a livestock enclosure (LEX). Infiltration rate was related to the total organic cover and bulk density characteristics of the site. SDG and HCG pastures had lower total organic cover with correspondingly lower infiltration rates compared to MCG and LEX pastures. Bulk density was lower in *Q. virginiana* mottes than in the grass areas between *Q. virginiana* plants, but there was no difference between pastures. Sediment production was related to total aboveground biomass and the bunchgrass cover of the site. Total aboveground biomass was greatest in the *Q. virginiana* motte and least in the *H. belangeri* areas, and was greater in the MCG and LEX than in the SDG and HCG pastures.
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486. Hydrologic impacts of sheep grazing on steep slopes in semiarid rangelands.

Wilcox, B. P. and Wood, M. K.
Journal of Range Management 41(4): 303-306. (1988)
 NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1988/414/7wilc.pdf>
 Descriptors: soil water movement/ infiltration/ grazing/ rangelands/ steepland soils/ semiarid zones/ animal husbandry/ land types/ soil types physiographic/ erosion/ sediment yield
 Abstract: Infiltration, sediment concentration of runoff, and sediment production from lightly grazed and ungrazed semiarid slopes in the Guadalupe Mountains of southeastern New Mexico were compared using a hand-portable rainfall simulator. Average slope steepness was 50%. Infiltrability on the grazed slopes was 12-17% lower than on the ungrazed slopes. These results are comparable to those reported from moderate slope gradients. Sediment concentration of runoff from the lightly grazed slopes was significantly higher than from the ungrazed slopes only at the end of the dry run (45 min.) Sediment production was

significantly greater from the grazed slopes for the dry run, but not the wet run. Percentage difference of sediment production between the grazed and ungrazed slopes was well within the range published for moderate slope conditions. These data give no indication that steep slopes (30-70%) in semiarid regions are any more hydrologically sensitive to light grazing than are moderate slopes (<10%).
© CAB International/CABI Publishing

487. Hydrologic response to cattle grazing in the Ethiopian highlands.

Mwendera, E. J. and Mohamed Saleem, M. A.
Agriculture, Ecosystems & Environment 64(1): 33-41. (1997)

NAL Call #: S601 .A34; ISSN: 0167-8809

Descriptors: hydrology/ livestock/ grazing/ infiltration/ runoff/ soil erosion/ cattle/ pastures/ Ethiopia

Abstract: The effect of grazing pressure on infiltration, runoff, and soil loss was studied on a natural pasture during the 1995 rainy season in the Ethiopian highlands. The study was conducted on 0.01 ha plots established on sites with 0-4% and 4-8% slopes at the International Livestock Research Institute (ILRI) Debre Zeit research station, 50 km south of Addis Ababa. The grazing regimes were: light grazing stocked at 0.6 animal-unit-months (AUM) ha super(-1); moderate grazing stocked at 1.8 AUM ha super(-1); heavy grazing stocked at 3.0 AUM ha super(-1); very heavy grazing stocked at 4.2 AUM ha super(-1); very heavy grazing on ploughed soil stocked at 4.2 AUM ha super(-1); and a control with no grazing. Heavy to very heavy grazing pressure significantly increased surface runoff and soil loss and reduced infiltrability of the soil. It was observed that fine textured soils were more susceptible to trampling effects than coarse textured soils, and that reduction in infiltration rates was greater on soils which had been tilled and exposed to very heavy trampling. The problems of high runoff and erosion rates on the upper slopes is likely to be exacerbated by the fact that during the rainy season higher grazing pressure is exerted on the upper than lower slopes. Sediments produced from the highlands, which form headwaters of major rivers in the region, are likely to pollute streams and lakes and pile up on bottom-lands, in stream channels, and in reservoirs. With some modifications, the plot design presented here can be used for assessing livestock impacts on natural resources on different landforms at large scales such as watersheds. How the same amount of livestock mass dispersed by different livestock species impacts on the grazing lands needs to be studied further.

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488. Impact of deferred rotation grazing on stream characteristics in central Nevada: A case study.

Myers, T. J. and Swanson, S.
North American Journal of Fisheries Management 15(2): 428-439. (1995)

NAL Call #: SH219.N66; ISSN: 0275-5947

Descriptors: land use/ ranching/ watersheds/ fluvial morphology/ habitat improvement/ grazing/ range management/ USA, Nevada/ range management/ ranching/ fluvial morphology/ habitat improvement

Abstract: Three central Nevada streams were selected to study the watershed-scale effects on stream morphology and bank stability of deferred rotation cattle grazing, complete rest from grazing, and the presence of road

crossings. The streams had gravel substrates, and their entrenchments, width: depth ratios, sinuosities and gradients were moderate. Based on statistical analysis of 1980 stream survey results, geologic basin features, and the occurrence of similar flooding, we concluded that the three streams had similar conditions at the start of the grazing treatment. Since 1980, deferred rotation grazing allowed much improvement of aquatic and riparian habitats but the improvement was limited by the presence of roads, which apparently added sediment to the streams. Complete rest from grazing without the presence of roads allowed the most improvement. Of the variables measured in the 1980 survey, streambank soil stability, type and amount of vegetation cover, and quality of pools improved most in all three streams. The best values for channel and water width: depth ratios, channel entrenchment, bank angle, bank undercut, and bank depth were measured on the stream managed with complete rest. Deferred rotation grazing in the absence of roads produced the second best values. The ratio of channel width to base flow water width was significantly higher on bare ground transects. Shrub and tree cover increased significantly more on the rested than on the grazed watersheds. These results should help managers select aquatic habitat and stream morphology objectives for grazing management.

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489. Impact of grazing and tillage on water erosion in northeastern Syria.

Shinjo, Hitoshi; Fujita, Haruhiro; Gintzbuger, Gus; and Kosaki, Takashi
Soil Science and Plant Nutrition 46(1): 151-162. (2000)
NAL Call #: 56.8 SO38; ISSN: 0038-0768

Descriptors: aggregate stability/ grazing impact/ semiarid conditions/ tillage impact/ water erosion

Abstract: Impact of grazing and tillage on water erosion under natural rainfall conditions was investigated during the 1994/95 and 1995/96 rainy seasons in the Abd Al-Aziz mountain region, northeastern Syria. The grazing impact was not significant (0.4 Mg ha⁻¹ y⁻¹ at most) because the vegetation coverage was relatively abundant. Tillage enhanced soil loss (1.4 Mg ha⁻¹ y⁻¹) presumably due to the mechanical disturbance and the removal of shrub species. The ratio of the total nitrogen content in the sediments to that in the bulk soils (enrichment ratio) in the cropland exceeded unity, suggesting the selective removal of the organic matter by water erosion. Measures to reduce water erosion and to replenish organic matter should be taken.

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490. Impact of grazing livestock and distance from water sources on soil fertility in southern Mongolia.

Stumpp, Markus; Wesche, Karsten; Retzer, Vroni; and Mieke, Georg
Mountain Research and Development 25(3): 244-251. (2005)
NAL Call #: GB500.M68; ISSN: 0276-4741

Descriptors: soil fertility/ habitat degradation/ grazing impact/ plant community composition/ pastoral land/ dung unit density

Abstract: The impact of livestock grazing on soil nutrients and vegetation parameters was studied in dry montane steppes of southern Mongolia in order to assess the risk of habitat degradation. Data were collected along transects radiating away from permanent water sources. Dung unit

density counts revealed gradients of livestock activity, but utilization belts around water sources overlapped, indicating that pastoral land use affects the entire landscape. Dung unit counts corresponded to gradients in soil nutrient parameters (C, N, P), which significantly decreased with distance from the wells. However, no significant correlation was observed for plant species richness and vegetation composition with distance from water source. This indicates that soil parameters and livestock grazing exert a relatively smaller influence on the vegetation than the high inter-annual variability in precipitation. Therefore, the ecosystem at the study site was found to react in a non-equilibrium way, which suggests that the risk of degradation is low, at least insofar as plant community composition is concerned.
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491. Impact of grazing on soil nutrients in a Pampean grassland.

Lavado, R. S.; Sierra, J. O.; and Hashimoto, P. N.
Journal of Range Management 49(5): 452-457. (1996)
NAL Call #: 60.18 J82; ISSN: 0022-409X
http://jrm.library.arizona.edu/data/1996/495/452-457_lavado.pdf

Descriptors: grasslands/ nitrogen/ phosphorus/ soil fertility/ soil organic matter/ nitrate nitrogen/ ammonium nitrogen/ spatial variation/ statistical analysis/ geostatistics/ Argentina
Abstract: Cattle exclusion induced dramatic changes in the plant community and modifications in nutrient cycling in grazed native grasslands of the Flooding Pampa (Argentina). The study was carried out to analyze the effect of grazing on the status and spatial variability of soil organic matter, nitrogen and phosphorus. Sampling was performed in the late summer and early spring. Geostatistical methods were used to study the spatial dependence of these soil properties. Organic carbon (OC) and total nitrogen (TN) showed spatial structure only in the ungrazed area with a similar range of dependence (39 m and 36 m respectively). The occurrence of litter in this area lead to a large and spatially homogeneous C input to the soil, which would be the key factor of the spatial structure of organic carbon and total nitrogen. Mineral nitrogen content $1(\text{NO}_3(-1)\text{-N} + (\text{NH}_4+)\text{-N})$ was higher in the ungrazed area on both sampling dates. The mineral N content showed a large short-range variability (nugget variation) independent of grazing history. A significant decrease in the extractable P (Bray & Kurtz #1) in the grazed area was found. The extractable P exhibited spatial structure only in the ungrazed area. However, its spatial pattern was different from those of organic carbon and total nitrogen: the range of dependence was higher (57 m) and the spatial structure exhibited a great irregularity. The differences between C, N, and P variability were possibly related to their dynamics in the soil. No evidence of effects of animal excrete on nutrient content or spatial variability was found.
This citation is from AGRICOLA.

492. Impact of herbivores on nitrogen cycling: Contrasting effects of small and large species.

Bakker, E. S.; Olf, H.; Boekhoff, M.; Gleichman, J. M.; and Berendse, F.
Oecologia (Berlin) 138(1): 91-101. (2004)
NAL Call #: QL750.O3; ISSN: 0029-8549
Descriptors: biomass/ body size/ enclosure experiments/ floodplain grasslands: habitat/ grazing behavior/ herbivory/

laboratory conditions/ litter accumulation/ microclimates/ nitrogen cycling/ plant animal interactions/ soil parameters/ vegetation

Abstract: Herbivores are reported to slow down as well as enhance nutrient cycling in grasslands. These conflicting results may be explained by differences in herbivore type. In this study we focus on herbivore body size as a factor that causes differences in herbivore effects on N cycling. We used an enclosure set-up in a floodplain grassland grazed by cattle, rabbits and common voles, where we subsequently excluded cattle and rabbits. Exclusion of cattle lead to an increase in vole numbers and a 1.5-fold increase in net annual N mineralization at similar herbivore densities (corrected to metabolic weight). Timing and height of the mineralization peak in spring was the same in all treatments, but mineralization in the vole-grazed treatment showed a peak in autumn, when mineralization had already declined under cattle grazing. This mineralization peak in autumn coincides with a peak in vole density and high levels of N input through vole faeces at a fine-scale distribution, whereas under cattle grazing only a few patches receive all N and most experience net nutrient removal. The other parameters that we measured, which include potential N mineralization rates measured under standardized laboratory conditions and soil parameters, plant biomass and plant nutrient content measured in the field, were the same for all three grazing treatments and could therefore not cause the observed difference. When cows were excluded, more litter accumulated in the vegetation. The formation of this litter layer may have added to the higher mineralization rates under vole grazing, through enhanced nutrient return through litter or through modification of microclimate. We conclude that different-sized herbivores have different effects on N cycling within the same habitat. Exclusion of large herbivores resulted in increased N annual mineralization under small herbivore grazing.
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493. Impacts of cattle on streambanks in north-eastern Oregon.

Kauffman, J. B.; Krueger, W. C.; and Vavra, M.
Journal of Range Management 36(6): 683-684. (1983)
NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1983/366/2kauf.pdf>

Descriptors: livestock/ environmental impact/ streams/ erosion/ river banks/ cattle/ USA, Oregon, Catherine Creek/ livestock/ streams
Abstract: Impacts of a late season livestock grazing strategy on streambank erosion, morphology, and undercutting were studied for 2 years along Catherine Creek in northeastern Oregon. Streambank loss, disturbance, and undercutting were compared between grazing treatments, vegetation type, and stream-meander position. No significant differences were found among vegetation type or stream-meander location. Significantly greater streambank erosion and disturbance occurred in grazed areas than in enclosed areas during the 1978 and 1979 grazing periods. Over-winter erosion was not significantly different among treatments. However, erosion related to livestock grazing and trampling was enough to create significantly greater annual streambank losses when compared to ungrazed areas.
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494. Impacts of rest-rotation grazing on stream banks in forested watersheds in Idaho.

Platts, W. S. and Loren Nelson, R.

North American Journal of Fisheries Management 5(4): 547-556. (1985)

NAL Call #: SH219.N66; ISSN: 0275-5947

Descriptors: grazing/ watersheds/ environmental protection/ agriculture/ water quality/ fluvial morphology/ river banks

Abstract: Rest-rotation grazing in Idaho allowed forage in the stream-side zone to be used at a higher rate than on either immediately adjacent range or the overall grazing allotment. Stream-sides received unauthorized grazing during the scheduled rest periods, however, and complete rest was difficult to achieve. Cattle appeared to graze stream-side meadows at high elevations with less intensity during the early grazing period when vegetation was lush than during the late grazing period. Stream-bank alteration occurred soon after cattle were turned into ungrazed meadows.

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495. Increasing summer flow in small streams through management of riparian areas and adjacent vegetation: A synthesis.

Stabler, D. F.

In: *Riparian ecosystems and their management: Reconciling conflicting uses.* (Held 16 Apr 1985-18 Apr 1985 at Tuscon, Ariz.) Johnson, R. Roy; Ziebell, Charles D.; Patton, David R.; Ffolliott, Peter F.; and Hamre, R. H. (eds.)

Fort Collins, Colo.: Rocky Mountain Forest and Range Experiment Station, United States, Forest Service; pp. 206-210; 1985.

NAL Call #: aSD11.A42

Descriptors: stream flow/ riparian buffers/ grazing

This citation is from AGRICOLA.

496. Infiltration and interrill erosion responses to selected livestock grazing strategies, Edwards Plateau, Texas.

Thurow, T. L.; Blackburn, W. H.; and Taylor, C. A.

Journal of Range Management 41(4): 296-302. (1988)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1988/414/6thur.pdf>

Descriptors: livestock/ grazing/ grasslands/ interrill erosion/ runoff/ water conservation/ range management/ sediments/ Texas

This citation is from AGRICOLA.

497. Infiltration and water quality on range sites at Fort Stanton, New Mexico.

Wood, James C. and Wood, M. Karl

Water Resources Bulletin 24(2): 317-323. (1988)

NAL Call #: 292.9 Am34; ISSN: 0043-1370

Abstract: The hydrologic impacts of livestock grazing schemes on selected plant communities and soils at Fort Stanton, New Mexico, were evaluated. Simulated rainfall was applied to 1 m² plots. On a mesa-top, infiltration rates for a grassland livestock enclosure and a pinyon pine-juniper community closely approximated each other and were significantly greater (P equals 0.10) than either a moderate continuous or a heavy continuous treatment in a grassland community. Sediment concentration from the heavy continuous treatment was more than twice that of the

other treatments. Infiltration rates on the hillside site were highest in a pinyon pine-juniper community receiving short duration grazing. Infiltration for this treatment was found to be significantly higher (P equals 0.10) than that of a short duration grazing treatment on grassland. The short duration grazing treatment on a grassland had the highest sediment concentration.

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498. Infiltration rates and sediment production as influenced by grazing systems in the Texas Rolling Plains.

Pluhar, J. J.; Knight, R. W.; and Heitschmidt, R. K.

Journal of Range Management 40(3): 240-243. (1987)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1987/403/11pluh.pdf>

Descriptors: watershed condition/ stocking/ summer vegetation/ standing crop/ organic matter/ aggregate stability/ soil

Abstract: Research was initiated in August 1982 at the Texas Experimental Ranch to evaluate effect of selected grazing treatments on watershed condition. Two production scale grazing treatments were sampled on 4 dates over a period of 15 months. Treatments were yearlong continuous grazing stocked at a moderate rate (MC) and a 16-paddock rotational grazing treatment stocked at a heavy rate (RG). In addition, hydrologic conditions in an ungrazed enclosure (EX) and a moderately stocked 4-pasture, 3-herd deferred rotation treatment (DR) were examined during the summer of 1982. Regression analyses indicated infiltration rates increased and sediment production declined as vegetation standing crop and cover increased, soil bulk density decreased, and soil organic matter and aggregate stability increased. Averaged across the 4 sample dates, sediment production was least (33 kg/ha) and infiltration rate greatest (89 mm/hr) in the MC treatment as compared to the RG treatment (63 kg/ha and 82 mm/hr). Infiltration rates and sediment production in the RG and DR treatments before grazing were not significantly different from those in the MC treatment; however, grazing caused a significant decline in infiltration rates and a significant increase in sediment production in both treatments. Sediment production was least in the enclosure (23 kg/ha) while infiltration rates were generally greater and sediment production less in the midgrass communities as compared to the shortgrass communities. All effects were closely related to the effect of the various treatments on vegetation standing crop and cover.

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499. Infiltration rates, surface runoff, and soil loss as influenced by grazing pressure in the Ethiopian highlands.

Mwendera, E. J. and Saleem, M. A. Mohamed

Soil Use and Management 13(1): 29-35. (1997)

NAL Call #: S590.S68; ISSN: 0266-0032

Descriptors: conservation/ Ethiopian highlands/ government agency/ grazing pressure influence/ infiltration rates/ international livestock research institute/ land use planning/ soil loss/ soil science/ surface runoff/ trampling effects

Abstract: The effect of grazing pressure on infiltration, runoff, and soil loss was studied on a natural pasture during the rainy season of 1995 in the Ethiopian highlands. The

study was conducted at two sites with 0-4% and 4-8% slopes at the International Livestock Research Institute (ILRI) Debre Zeit research station, 50 km south of Addis Ababa. The grazing regimes were: light grazing stocked at 0.6 animal-unit-months (AUM)/ha; moderate grazing stocked at 1.8 AUM/ha; heavy grazing stocked at 3.0 AUM/ha; very heavy grazing stocked at 4.2 AUM/ha; very heavy grazing on ploughed soil stocked at 4.2 AUM/ha; and a control with no grazing. Heavy to very heavy grazing pressure significantly reduced biomass amounts, ground vegetative cover, increased surface runoff and soil loss, and reduced infiltrability of the soil. Reduction in infiltration rates was greater on soils which had been ploughed and exposed to very heavy trampling. It was observed that, for the same % vegetative cover, more soil loss occurred from plots on steep than gentle slopes, and that gentle slopes could withstand more grazing pressure without seriously affecting the ground biomass regeneration compared to steeper slopes. Thus, there is a need for developing 'slope-specific' grazing management schedules particularly in the highland ecozones rather than making blanket recommendations for all slopes. More research is needed to quantify annual biophysical changes in order to assess cumulative long-term effects of grazing and trampling on vegetation, soil, and hydrology of grazing lands. Modelling such effects is essential for land use planning in this fragile highland environment.

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500. Influence of grazing management on vegetation soil structure and nutrient distribution and the infiltration of applied rainfall in a semi-arid chenopod shrubland.

Graetz, R. D. and Tongway, D. J.

Australian Journal of Ecology 11(4): 347-360. (1986)

NAL Call #: QH540.A8; ISSN: 0307-692X

Descriptors: lichen/ vegetation cover/ plant growth/ soil chemistry/ Landsat imagery

Abstract: The experiment utilized a fenceline contrast in vegetation and soil condition that was clearly visible on Landsat imagery. Measurements of vegetation cover, soil structure and chemistry, and infiltration were made. The greatest vegetation change was at the soil surface where the loss of litter and lichen crust cover under heavy grazing accompanied the loss of perennial shrubs. Although grazing caused changes in soil structure and chemistry to less than 10 cm in depth, these changes are quite significant for plant growth. Consistent differences in the infiltration of applied rainfall at two intensities were measured between the grazed and ungrazed sites. At both intensities of application the absence of a lichen crust increased infiltration three-fold on the heavily grazed site compared with the ungrazed site. The implications of these observations on the long-term functioning of this landscape are discussed.

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501. Influence of grazing on channel morphology of intermittent streams.

George, M. R.; Larsen, R. E.; McDougald, N. K.; Tate, K. W.; Gerlach, J. D.; and Fulgham, K. O.

Journal of Range Management 55(6): 551-557. (2002)

NAL Call #: 60.18 J82; ISSN: 0022-409X

Descriptors: annual rangelands/ California/ grazing effects/ sediment/ streambank erosion

Abstract: Alteration of stream channel morphology by cattle and associated streambank erosion is a concern on rangeland watersheds. The objective of this study was to determine changes in stream channel morphology in response to 5 grazing treatments applied to 0.4 ha pastures and replicated on 3 intermittent streams at the San Joaquin Experimental Range in the central Sierra Nevada foothills of California. Baseline stream channel morphology parameters were determined along 10 transects in each pasture in June 1994. Seasonal grazing treatments (no grazing, wet season moderate, wet season concentrated, dry season moderate, and dry season concentrated) were repeated annually over 4 years beginning in July 1994. Stream channel morphology parameters were measured annually from 1995-1998. When stream morphological responses were averaged across years, there were no detectable effects of grazing on the parameters measured. Year effects and their interaction with grazing were significant, primarily for stream morphological parameters that included channel depth in their measurement or calculation. Channel depth increased significantly in the ungrazed controls, but did not change due to any grazing treatment. These results indicate that grazing had little effect on the morphology of these bedrock limited, intermittent stream channels.

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502. Influence of grazing, vegetation life-form, and soil type on infiltration rates and interrill erosion on a Somalian rangeland.

Takar, A. A.; Dobrowolski, J. P.; and Thurow, T. L.

Journal of Range Management 43(6): 486-490. (1990)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1990/436/3taka.pdf>

Descriptors: livestock/ rangelands/ pastures/ sandy soils/ clay soils/ watersheds/ watershed management/ grazing intensity/ interrill erosion/ shrubs/ hydrology/ grazing/ plant litter/ Somalia

This citation is from AGRICOLA.

503. The influence of livestock trampling under intensive rotation grazing on soil hydrologic characteristics.

Warren, S. D.; Thurow, T. L.; Blackburn, W. H.; and Garza, N. E.

Journal of Range Management 39(6): 491-495. (1986)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1986/396/3warr.pdf>

Abstract: Infiltration rate decreased significantly and sediment production increased significantly on a site with a silty clay surface soil devoid of vegetation following periodic trampling typical of intensive rotation grazing systems. The deleterious impact of livestock trampling generally increased as stocking rate increased. Damage was augmented when the soil was moist at the time of trampling. Thirty days of rest were insufficient to allow hydrologic recovery. Soil bulk density, aggregate stability, aggregate size distribution and surface microrelief were related to the soil hydrologic response of the trampling treatments.

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504. Influence of stream characteristics and grazing intensity on stream temperatures in eastern Oregon.

Maloney, S. B.; Tiedemann, A. R.; Higgins, D. A.; Quigley, T. M.; and Marx, D. B.

Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, 1999. 19 p. General Technical Report.

http://www.fs.fed.us/pnw/pubs/gtr_459.pdf

Descriptors: forested watersheds/ grazing management strategies/ grazing intensity/ fisheries/ fish habitat/ chinook salmon/ steelhead trout/ cutthroat trout/ Dolly Varden trout
Abstract: Stream temperatures were measured during summer months, 1978 to 1984, at 12 forested watersheds near John Day, Oregon, to determine temperature characteristics and assess effects of three range management strategies of increasing intensity. Maximum temperatures in streams of the 12 watersheds ranged from 12.5 to 27.8 oC. Maximum stream temperatures on four watersheds exceeded 24 oC, the recommended short-term maximum for rainbow trout (*Oncorhynchus mykiss*) and chinook salmon (*O. tshawytscha*). Streams with greater than 75 percent stream shade maintained acceptable stream temperatures for rainbow trout and chinook salmon. Lowest temperatures were observed in streams from ungrazed watersheds. Although highest temperatures were observed in the most intensively managed watersheds (2.8 hectares per animal unit month), the effect of range management strategy was not definitive. It was confounded by watershed characteristics and about 100 years of grazing use prior to initiation of this study. This citation is from Treesearch.

505. Influences of continuous grazing and livestock exclusion on soil properties in a degraded sandy grassland, inner Mongolia, northern China.

Su, Yong Zhong; Li, Yu Lin; Cui, Jian Yuan; and Zhao, Wen Zhi

Catena 59(3): 267-278. (2005)

NAL Call #: GB400.C3; *ISSN:* 0341-8162

Descriptors: desertification/ livestock exclusion/ overgrazing/ respiration/ soil erosion

Abstract: Overgrazing is one of the main causes of desertification in the semiarid Horqin sandy grassland of northern China. Excluding grazing livestock is considered as an alternative to restore vegetation in degraded sandy grassland in this region. However, few data are available concerning the impacts of continuous grazing and livestock exclusion on soil properties. In this paper, characteristics of vegetation and soil properties under continuous grazing and exclusion of livestock for 5 and 10 years were examined in representative degraded sandy grassland. Continuous grazing resulted in a considerable decrease in ground cover, which accelerates soil erosion by wind, leading to a further coarseness in surface soil, loss of soil organic C and N, and a decrease in soil biological properties. The grassland under continuous grazing is in the stage of very strong degradation. Excluding livestock grazing enhances vegetation recovery, litter accumulation, and development of annual and perennial grasses. Soil organic C and total N concentrations, soil biological properties including some enzyme activities and basal soil respiration improved following 10-year exclusion of livestock, suggesting that degradation of the grassland is being reversed. The results suggest that excluding grazing livestock on the desertified sandy grassland in the erosion-

prone Horqin region has a great potential to restore soil fertility, sequester soil organic carbon and improve biological activity. Soil restoration is a slow process although the vegetation can recover rapidly after removal of livestock. A viable option for sandy grassland management should be to adopt proper enclosure in a rotation grazing system in the initial stage of grassland degradation. Copyright 2004 Elsevier B.V. All rights reserved. © The Thomson Corporation

506. Lag in stream channel adjustment to livestock enclosure, White Mountains, California.

Kondolf, G. M.

Restoration Ecology 1(4): 226-230. (1993)

NAL Call #: QH541.15.R45R515; *ISSN:* 1061-2971

Descriptors: riparian environments/ environmental restoration/ livestock/ grazing/ streams/ channels/ sediments/ erosion/ sedimentation/ vegetation/ channel morphology/ cross-sections/ habitat improvement/ vegetation cover/ USA, California/ enclosure/ channel morphology/ cross-sections/ habitat improvement/ vegetation cover/ riparian environments/ environmental restoration/ livestock/ streams/ vegetation

Abstract: Livestock have been excluded from riparian zones along many streams in western North America in an effort to restore aquatic and riparian habitat degraded by livestock grazing. Within these enclosures, channel adjustment to elimination of grazing pressure may lag behind plant recovery because of the time required to deposit sediment along the vegetated banks of the stream channel. Moreover, unless grazing is eliminated from the watershed, the channel within the enclosure must still accommodate increased runoff and sediment loads from upstream. This hydrologic regime may prevent a return to predisturbance channel morphology. Cross sections of the North Fork Cottonwood Creek in the White Mountains of California showed no significant difference in channel width within and downstream of a 24-year-old enclosure, despite a lush growth of stream bank vegetation that gives the impression of a narrower channel within the enclosure. © CSA

507. Livestock grazing impacts on infiltration rates in a temperate range of Pakistan.

Bari, F.; Wood, M. K.; and Murray, L.

Journal of Range Management 46(4): 367-372. (1993)

NAL Call #: 60.18 J82; *ISSN:* 0022-409X

<http://jrm.library.arizona.edu/data/1993/464/17bari.pdf>

Descriptors: grasslands/ grazing/ plant litter/ Pakistan
Abstract: This study was conducted in a temperate range of northern Pakistan in 1987 and 1988. The main purpose of the experiment was to determine a suitable residual phytomass level for the moist temperate ranges of Pakistan. Data were collected for 2 consecutive growing seasons. A completely randomized design, with 4 treatments and 2 replications, was used. The treatments were 4 different residual phytomass levels. A rainfall simulator applied rainfall to 48 flexible circular plots (1m²). Analysis of variance and the LSD multiple mean comparisons determined treatment differences, and stepwise multiple regression identified the important vegetation and soil variables affecting infiltration. The control (no grazing) resulted in the highest infiltration while the treatment having the lowest residual phytomass had the lowest infiltration. Among the independent variables,

standing phytomass was the most important variable affecting infiltration. Foliar and basal cover were also highly correlated to infiltration.

This citation is from AGRICOLA.

508. Livestock grazing impacts on interrill erosion in Pakistan.

Bari, F.; Wood, M. K.; and Murray, L.
Journal of Range Management 48(3): 251-257. (1995)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/1995/483/251-257_bari.pdf

Descriptors: watershed management/ grazing intensity/ rill erosion/ biomass/ water erosion/ *Pinus wallichiana*/ rainfall simulators/ soil water/ canopy/ Universal Soil Loss Equation/ sediments/ Pakistan

Abstract: This study was conducted for 2 consecutive growing seasons in a temperate region of Pakistan to determine a residual phytomass level necessary to adequately protect the soil against accelerated interrill erosion. A rainfall simulator was used to apply rainfall to 48 (1 m square) circular plots arranged in a completely randomized experimental design, with 4 residual phytomass levels and 2 replications. The residual treatment with 3,024 kg ha⁻¹ phytomass resulted in the lowest erosion rates, and the treatment with 624 kg ha⁻¹ phytomass produced the highest erosion. Standing phytomass was the most important variable affecting erosion with foliar cover and basal cover also highly correlated to erosion.

This citation is from AGRICOLA.

509. Long-term aquatic habitat restoration: Mahogany Creek, Nevada, as a case study.

Myers, T. J. and Swanson, S.

Water Resources Bulletin 32(2): 241-252. (1996)

NAL Call #: 292.9 Am34; ISSN: 0043-1370

Descriptors: grazing intensity/ overgrazing/ range management/ streams/ aquatic plants/ habitats/ watershed management/ sediment deposition/ Nevada

Abstract: We compared the recovery from abusive grazing of aquatic habitat due to different range management on two geomorphically similar rangeland streams in northwest Nevada. Managers excluded livestock from the Mahogany Creek watershed from 1976 to 1990 while allowing rotation of rest grazing on its tributary Summer Camp Creek. Bank stability, defined as the lack of apparent bank erosion or deposition, improved through the study period on both streams, but periodic grazing and flooding decreased stability more on Summer Camp Creek than flooding alone on Mahogany Creek. Pool quantity and quality on each stream decreased because of coarse woody debris removal and sediment deposition during a drought. Fine stream bottom sediments decreased five years after the removal of livestock, but sedimentation increased during low flows in both streams below road crossings. Tree cover increased 35 percent at both streams. Thus, recovery of stability and cover and decreased sedimentation are compatible with rotation of rest grazing on Summer Camp Creek. Width/depth ratio and gravel/cobble percent did not change because they are inherently stable in this stream type. Management activities such as coarse woody debris removal limited pool recovery, and road crossings increased sedimentation.

This citation is from AGRICOLA.

510. Long-term stocking rate effects on soil physical properties.

Greenwood, K. L.; MacLeod, D. A.; and Hutchinson, K. J.
Australian Journal of Experimental Agriculture 37(4):

413-419. (1997)

NAL Call #: 23 Au792; ISSN: 0816-1089

Descriptors: soil physical properties/ unsaturated hydraulic conductivity/ soil strength/ bulk density/ soil compaction/ sheep/ stocking rate/ grazing/ range management/ New South Wales

This citation is from AGRICOLA.

511. Management of Canadian prairie region grazed grasslands: Soil C sequestration, livestock productivity and profitability.

Lynch, D. H.; Cohen, R. D. H.; Fredeen, A.; Patterson, G.; and Martin, R. C.

Canadian Journal of Soil Science 85(2): 183-192. (2005)

NAL Call #: 56.8 C162; ISSN: 0008-4271

Descriptors: GrassGro model: mathematical and computer techniques/ productivity/ farm profitability/ prairie region grazed grassland/ soil sequestration/ complementary grazing/ reduced stocking density

Abstract: The GrassGro model (a computer simulation of management-induced changes in range and pasture forage and livestock productivity) was combined with spreadsheet analyses to estimate the influence of improved grazing practices on soil organic carbon (SOC), and farm profitability, across native rangelands and tame pastures of the southern Canadian Prairies. Improved practices included complementary grazing (CG) and reduced stocking density (RSD) on rangeland; and N fertilization (FERT), seeded grass/legumes grazed continuously (GLGC) or rotationally (GLGR), and RSD on tame pastures. The analysis was stratified into three ecoregions on the basis of similarities in climate and soil type. Averaged over 30 yr and ecoregions, SOC rates of gain through improved management were 5 (RSD) to 26 (CG) kg C ha⁻¹ yr⁻¹ for rangelands, and 86 (RSD), 75 (GLGC), 62 (GLGR) and 222 (FERT) kg C ha⁻¹ yr⁻¹ for tame pastures. Gains with FERT were considered largely negated by associated energy (C) costs, N₂O emissions, and shifts in grassland species. The CG system alone improved net returns to the producer. The estimated potential combined SOC gain on prairie grazinglands (11.5 Mha) was 1.63 MMT CO₂ yr⁻¹ (or 0.465 MMT C yr⁻¹), slightly less than the 1.70 MMT CO₂ yr⁻¹ currently emitted from agricultural soils in Canada.

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512. Microbiology and water chemistry of two natural springs impacted by grazing in south central Nevada.

Hall, D. A. and Amy, P. S.

Great Basin Naturalist 50(3): 289-294. (1990)

NAL Call #: 410 G79; ISSN: 0017-3614

Descriptors: *Crenicthys baileyi baileyi*/ *Lepidomeda mollispinis pratensis*/ *Pseudomonas aeruginosa*/ *Aeromonas hydrophila*/ cattle/ endangered fish/ population density/ fish/ pathogens/ conductivity/ pH level/ ammonium nitrite/ nitrate/ ammonia/ phosphorus/ dissolved oxygen content/ temperature/ climate

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513. Multi-decadal impacts of grazing on soil physical and biogeochemical properties in Southeast Utah.

Neff, J. C.; Reynolds, R. L.; Belnap, J.; and Lamothe, P.

Ecological Applications 15(1): 87-95. (2005)

NAL Call #: QH540.E23; ISSN: 1051-0761

Descriptors: arid zones/ carbon/ chemical composition/ grassland soils/ grasslands/ grazing/ magnesium/ magnetite/ manganese/ national parks/ natural grasslands/ nitrogen/ nonclay minerals/ phosphorus/ silt fraction/ sodium/ soil composition/ soil fertility/ soil organic matter/ soil physical properties/ soil texture/ sustainability/ wind erosion

Abstract: Many soils in southeastern Utah are protected from surface disturbance by biological soil crusts that stabilize soils and reduce erosion by wind and water. When these crusts are disturbed by land use, soils become susceptible to erosion. In this study, we compare a never-grazed grassland in Canyonlands National Park with two historically grazed sites with similar geologic, geomorphic, and geochemical characteristics that were grazed from the late 1800s until 1974. We show that, despite almost 30 years without livestock grazing, surface soils in the historically grazed sites have 38-43% less silt, as well as 14-51% less total elemental soil Mg, Na, P, and Mn content relative to soils never exposed to livestock disturbances. Using magnetic measurement of soil magnetite content (a proxy for the stabilization of far-traveled eolian dust) we suggest that the differences in Mg, Na, P, and Mn are related to wind erosion of soil fine particles after the historical disturbance by livestock grazing. Historical grazing may also lead to changes in soil organic matter content including declines of 60-70% in surface soil C and N relative to the never-grazed sites. Collectively, the differences in soil C and N content and the evidence for substantial rock-derived nutrient loss to wind erosion implies that livestock grazing could have long-lasting effects on the soil fertility of native grasslands in this part of southeastern Utah. This study suggests that nutrient loss due to wind erosion of soils should be a consideration for management decisions related to the long-term sustainability of grazing operations in arid environments.
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514. Non-selective grazing impacts on soil-properties of the Nama Karoo.

Beukes, P. C. and Cowling, R. M.

Journal of Range Management 56(5):

547-552. (Sept. 2003)

NAL Call #: 60.18 J82; ISSN: 0022-409X

Descriptors: range management/ grazing intensity/ mixed grazing/ cattle/ sheep/ goats/ stocking rate/ soil organic matter/ soil microorganisms/ cell respiration/ infiltration (hydrology)/ aggregate stability/ South Africa

Abstract: Non-selective grazing (NSG) is a relatively novel way of farming livestock in the Nama Karoo of South Africa. Our key question was how heavy grazing under this high-intensity, low-frequency grazing system would impact on certain soil properties. The study was designed to compare the impacts of NSG (treatment) with no grazing (control) in terms of: (1) amount of soil organic carbon (OC); (2) soil microbial respiration rates; (3) soil stability and infiltration properties. The treatment significantly lowered the amount of OC in the topsoil. Microbial respiration rates corresponded with the fertile patch matrix in both treatment and control with significantly higher respiration rates

measured under plants compared to open, unvegetated areas. Respiration rates in treatment open areas were significantly higher than in control open areas. There was a trend ($P < 0.1$) for higher aggregate stability, final infiltration rate and cumulative infiltration for treatment open soils compared to controls during an initial rain event of 44 mm hour⁻¹ in a rainfall simulator. During a second rain event on sealed soils only aggregate stability was significantly higher for treatment compared to control soils. We conclude that the short-duration, low-frequency, intensive herbivory by livestock under the non-selective grazing system resulted in a more active microbial community, which turned over organic matter more rapidly and led to higher soil stability and infiltration capacity of open, unvegetated soils. We present this as an example of conditions where herding by high densities of large herbivores can have positive impacts on soil quality.

This citation is from AGRICOLA.

515. Nutrient loss and water quality under extensive grazing in the upper Burdekin River catchment, North Queensland.

O'Reagain, P. J.; Brodie, J.; Fraser, G.; Bushell, J. J.;

Holloway, C. H.; Faithful, J. W.; and Haynes, D.

Marine Pollution Bulletin 51(1-4): 37-50. (2005)

NAL Call #: GC1000.M3; ISSN: 0025-326X

Descriptors: nutrient loss/ catchments/ nutrient loading/ runoff/ geology/ livestock/ marine pollution/ lagoons/ rainfall/ cattle/ grazing/ nutrients/ suspended sediments/ catchment areas/ water quality/ slopes/ watercourses/ land management/ river flow/ rainfall intensity/ pollution load/ monitoring/ sediment load/ reefs/ agriculture/ catchment area/ topographic effects/ vegetation cover/ water management/ slopes (topography)/ sediment transport/ river basin management/ pollution monitoring/ barrier reefs/ stormwater runoff/ nutrients (mineral)/ river water/ land use/ Australia, Queensland, Burdekin R./ Australia, Queensland, Charters Towers/ Australia, Queensland, Great Barrier Reef/ animal grazing

Abstract: Increased sediment and nutrient losses resulting from unsustainable grazing management in the Burdekin River catchment are major threats to water quality in the Great Barrier Reef Lagoon. To test the effects of grazing management on soil and nutrient loss, five 1 ha mini-catchments were established in 1999 under different grazing strategies on a sedimentary landscape near Charters Towers. Reference samples were also collected from watercourses in the Burdekin catchment during major flow events. Soil and nutrient loss were relatively low across all grazing strategies due to a combination of good cover, low slope and low rainfall intensities. Total soil loss varied from 3 to 20 kg ha super⁽⁻¹⁾ per event while losses of N and P ranged from 10 to 1900 g ha super⁽⁻¹⁾ and from 1 to 71 g ha super⁽⁻¹⁾ per event respectively. Water quality of runoff was considered moderate across all strategies with relatively low levels of total suspended sediment (range: 8-1409 mg l super⁽⁻¹⁾), total N (range: 101-4000 µg l super⁽⁻¹⁾) and total P (range: 14-609 µg l super⁽⁻¹⁾). However, treatment differences are likely to emerge with time as the impacts of the different grazing strategies on land condition become more apparent. Samples collected opportunistically from rivers and creeks during flow events displayed significantly higher levels of total suspended

sediment (range: 10-6010 mg l super(-1)), total N (range: 650-6350 μ g l super(-1)) and total P (range: 50-1500 μ g l super(-1)) than those collected at the grazing trial. These differences can largely be attributed to variation in slope, geology and cover between the grazing trial and different catchments. In particular, watercourses draining hillier, grano-diorite landscapes with low cover had markedly higher sediment and nutrient loads compared to those draining flatter, sedimentary landscapes. These preliminary data suggest that on relatively flat, sedimentary landscapes, extensive cattle grazing is compatible with achieving water quality targets, provided high levels of ground cover are maintained. In contrast, sediment and nutrient loss under grazing on more erodable land types is cause for serious concern. Long-term empirical research and monitoring will be essential to quantify the impacts of changed land management on water quality in the spatially and temporally variable Burdekin River catchment.

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516. Organic carbon composition in a northern mixed-grass prairie: Effects of grazing.

Ganjegunte, Girisha K.; Vance, George F.; Preston, Caroline M.; Schuman, Gerald E.; Ingram, Lachlan J.; Stahl, Peter D.; and Welker, Jeffrey M.

Soil Science Society of America Journal 69(6): 1746-1756. (2005)

NAL Call #: 56.9 So3; ISSN: 0361-5995

Descriptors: nuclear magnetic resonance: laboratory techniques, spectrum analysis techniques/ carbon sink/ grazing management/ mixed grass prairie

Abstract: Growing interest in the potential for soils to provide a sink for atmospheric C has prompted studies of effects of management on the amount and nature of soil organic C (SOC). In this study, we evaluated effects of different grazing management regimes (light grazing [LG], heavy grazing [HG], and non-grazed exclosures [EX]) on amount and composition of SOC at the USDA-ARS High Plains Grasslands Research Station (HPGRS), Cheyenne, WY. Soils (0-5 cm) from each treatment were analyzed for total C and N contents and lignin composition. Soil organic C and N contents were significantly greater in LG (SOC-13.8 Mg ha(-1); total N-1.22 Mg ha(-1)) than HG (SOC-10.9 Mg ha(-1); total N-0.94 Mg ha(-1)) or EX (SOC-10.8 Mg ha(-1); total N-0.94 Mg ha(-1)). From CuO oxidation studies, significantly greater ($P < 0.05$) total lignin (Vanillyl [V] + Syringyl [S] + Cinnamyl [C] compounds) contents were noted in EX (21 g kg(-1) SOC) than LG (12 g kg(-1) SOC) and HG (15 g kg(-1) SOC) soils. The lignin composition of humic (HA) and fulvic (FA) acids indicated that HA under LG contained significantly greater V and S than HG or EX. Fulvic acids contained S-depleted lignin compared with HAs and FAs from HG, which contained significantly greater V and C than FAs extracted from LG and EX. Nuclear magnetic resonance (NMR) spectra of HA and FA, however, did not vary significantly among the three grazing treatments. Results from CuO oxidation and NMR spectroscopy emphasized the familiar problem that determining the nature of soil organic matter (SOM) is a difficult task and sometimes different analytical techniques provide different information about the nature of SOM. Nonetheless, results of this study indicate that LG is the most sustainable grazing management system for northern mixed-grass prairies.

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517. Rangeland management impacts on soil biological indicators in southern Alberta.

Dormaar, J. F. and Willms, W. D.

Journal of Range Management 53(2): 233-238. (2000)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/2000/532/233-238_dormaar.pdf

Descriptors: abandoned land/ introduced grasses/ monoculture/ soil transformations/ steady state

Abstract: Quantitative techniques are needed to determine the effects of cultivation and livestock grazing on biological indicators of soils of the Northern Great Plains. Our objective was to determine how various management practices, which were representative of those used since European settlement in the 1880's, affected 3 biological indicators of soil quality. The study was conducted at 3 sites that are representative of the major grassland ecosystems in Canada: a Mixed Prairie site with *Stipa comata* Trin. and Rupr. dominant in the Brown (Aridic Haploboroll) Soil Zone, a Mixed Prairie site with *S. comata* Trin. and Rupr. and *S. viridula* Trin. dominant in the Dark Brown (Typic Haploboroll) Soil Zone, and a Fescue Prairie site with *Festuca campestris* Rydb. dominant in the Black (Udic Haploboron) Soil Zone. At each site, 6 treatments representing common production practices were imposed and compared with the native community in a randomized complete block design with 4 replicates and a plot size of 3 x 10 m. The treatments included: 1) monoculture seeding of 2 grass species; 2) alfalfa (*Medicago sativa* L. 'Beaver'); 3) continuous spring wheat (*Triticum aestivum* L. 'Katepwa'); 4) spring wheat and fallow rotation; and 5) abandoned cultivated land. Our hypothesis that mineralizable-N, and phosphatase and dehydrogenase activities would be influenced by cultivation was confirmed by significant changes in these indicators that were detected after only 180 days after treatment establishment. The pool of readily decomposable organic matter was reduced with cultivation and not replenished over the period of the study. The 3 biological indicators were sensitive to not only time following external management changes, but also to seasonal fluctuations. We conclude that soil biological indicators can be used to quantify temporal and botanical changes in diverse ecotypes within the Northern Great Plains.

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518. Recovery of cryptogamic soil crusts from grazing on Utah winter ranges.

Anderson, D. C.; Harper, K. T.; and Rushforth, S. R.

Journal of Range Management 35(3): 355-359. (1982)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1982/353/17ande.pdf>

Descriptors: Utah

This citation is from AGRICOLA.

519. Runoff and sediment yield under grazing in foothills fescue grassland of Alberta.

Naeth, M. A. and Chanasyk, D. S.

Water Resources Bulletin 32(1): 89-95. (1996)

NAL Call #: 292.9 Am34; ISSN: 0043-1370

Descriptors: snow/ erosion/ sediment yield/ grazing/ grasslands/ soil water balance/ runoff/ grazing systems/ grazing intensity/ continuous grazing/ short-duration grazing

Abstract: The effects of select grazing systems on rainfall and snowmelt induced runoff and sediment yield from

sloped areas of the foothills fescue grasslands (*Festuca campestris*) of Alberta, Canada were quantified. The effects of two grazing intensities (heavy and very heavy) for two durations (short duration and continuous throughout the growing season) were compared to an ungrazed control between June 1988 and April 1991. Runoff was measured using 1-msuperscript 2 runoff frames and collection bucket systems. Sediment yields were determined on samples from the collected runoff. Snowmelt was the dominant source of runoff. Snowmelt runoff was higher from the heavily grazed areas than from the very heavily grazed areas, due to the higher standing vegetation which accumulated snow in the former areas. Sediment yields as a result of snowmelt were generally low in all areas. Only a few summer storms caused runoff. Runoff volumes and sediment yields from summer rainstorms were low, due to low rainfall and to generally dry antecedent soil moisture conditions. The greatest risk of summer runoff, and thus sediment yield, occurred in August.

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520. Seasonal grazing affects soil physical properties of a montane riparian community.

Wheeler, M. A.; Trlica, M. J.; Frasier, G. W.; and Reeder, J. D.

Journal of Range Management 55(1): 49-56. (2002)

NAL Call #: 60.18 J82; ISSN: 0022-409X

Descriptors: grazing/ soil water content/ bulk density/ soil pore system/ soil density/ spring/ summer/ hydrology/ porosity/ Colorado

Abstract: The effects of seasonal grazing treatments (early spring and late summer) on soil physical properties were studied in a montane riparian ecosystem in northern Colorado. Infiltration rates and bulk density were used as primary indicators of responses to a 1-time heavy grazing event on previously protected paddocks. Soil bulk density, porosity, gravimetric water content, organic carbon concentration and texture were measured at 0-5 cm, 5-10 cm, and 10-15 cm depths to determine how these parameters affected infiltration rates. Assessment of initial changes and subsequent recovery of the soil properties in response to the grazing treatments was conducted by measuring these parameters before each grazing event and at 4 time periods following the grazing event. Few differences between spring or late summer grazing periods on soil physical properties were found. A stepwise multiple regression model for infiltration rate based on soil physical properties yielded a low R² (0.31), which indicated much unexplained variability in infiltration. However, infiltration rates declined significantly and bulk density increased at the 5-10 cm depth and 10-15 cm depth in grazed plots immediately following grazing, but the highly organic surface layer (0-5 cm) had no significant compaction. Infiltration rates and soil bulk densities returned to pre-disturbed values within 1 year after grazing events, suggesting full hydrologic recovery. This recovery may be related to frequent freeze-thaw events and high organic matter in soils.

This citation is from AGRICOLA.

521. Sediment from a small summer grazed watershed.

Fortier, D. H.; Molnau, M.; and Saxton, K. E.

In: Symposium on watershed management. (Held 21 Jul 1980 at Boise, Idaho.); Vol. 2.

New York: American Society of Civil Engineers; pp. 790-801; 1980.

NAL Call #: TC409.W3 1980

Descriptors: erosion/ water/ animal husbandry/ grazing
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522. Sediment movement and filtration in a riparian meadow following cattle use.

Mceldowney, R. R.; Flenniken, M.; Frasier, G. W.; Trlica, M. J.; and Leininger, W. C.

Journal of Range Management 55(4): 367-373. (2002)

NAL Call #: 60.18 J82; ISSN: 0022-409X

Descriptors: beef cattle/ grazing/ mowing/ rainfall simulators/ sediment deposition/ surface roughness/ overland flow/ plant density/ particle size/ water erosion/ sediments/ plant litter/ filter strips/ Colorado

Abstract: Improper livestock grazing practices in western U.S. riparian areas may reduce the nutrient and pollutant removal function of riparian communities, resulting in degradation of surface water quality. Short duration-high intensity cattle use in 3 x 10 m plots was evaluated in a montane riparian meadow in northern Colorado to quantify livestock effects on sediment movement and filtration under simulated rainfall (approximately equal to 100 mm hour⁻¹) plus overland flow (approximately equal to 25 mm hour⁻¹) conditions. Four treatments: 1) control, 2) mowed to 10 cm stubble height, 3) trampled by cattle, and 4) cattle grazed plus trampled (grazed) were evaluated. Sixty kg of sediment was introduced to overland flow in each plot. Sediment movement was evaluated using sediment traps positioned in microchannels and on vegetation islands at 5 distances downslope from the upper end of the plots and by sediment front advancement. Most sediment deposition occurred within the first meter downslope from application. About 90% of the applied sediment was filtered from runoff within 10 m in the control and mowed treatments, while approximately 84 and 77% of the applied sediment was trapped in the trampled and grazed treatment plots, respectively. The primary variables that influenced sediment filtration were stem density and surface random roughness. Stem density was the most influential variable that affected sediment filtration. Cattle grazing reduced the stem density by 40%. Monitoring of stem density should aid land managers in regulating cattle use of riparian communities and facilitate the protection of surface water quality from sediment in overland flow.

This citation is from AGRICOLA.

523. Sediment production as influenced by livestock grazing in the Texas Rolling Plains.

Wood, M. K. and Blackburn, W. H.

Journal of Range Management 34(3): 228-231. (1981)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1981/343/15wood.pdf>

Descriptors: mid grass/ short grass/ shrubs/ cow/ calf/ ground cover/ aggregate stability/ organic matter/ mulch/ bulk density/ deferred rotation

Abstract: The influence of livestock [cow, calf] on sediment production was evaluated on a Clay Flat range site with shrub canopy areas and midgrass and shortgrass interspace areas in the Rolling Plains near Throckmorton,

Texas. Sediment production in the shrub canopy areas was similar across grazing treatments of heavy and moderate stocking, continuous grazing; rested and grazed deferred-rotation; rested and grazed high intensity, low frequency (HILF); and 2 livestock exclosures which had not been grazed for 20 yr. Sediment production from the shortgrass interspace area was similar for all grazing treatments except from the heavily stocked, continuously grazed pasture, where sediment production exceeded that of the rested HILF treatment. The midgrass interspace sediment production for the heavily stocked, continuously grazed treatment exceeded that of the deferred-rotation treatments and the exclosures. Sediment production for the grazed HILF treatment was greater than that for the rested deferred-rotation treatment and exclosure. Soil and vegetation variables which significantly influenced sediment production included aggregate stability, organic matter content, mulch, standing crop, bulk density and ground cover.

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524. Short duration grazing in central New Mexico: Effects on infiltration rates.

Weltz, M. and Wood, M. K.

Journal of Range Management 39(4): 365-368. (1986)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1986/394/19welt.pdf>

Descriptors: grazing/ hydrology/ rangelands/ New Mexico

This citation is from AGRICOLA.

525. Short-duration grazing in central New Mexico: Effects on sediment production.

Weltz, M. and Wood, M. K.

Journal of Soil and Water Conservation 41(4):

262-266. (1986)

NAL Call #: 56.8 J822; ISSN: 0022-4561

Descriptors: cattle/ soil erosion/ stocking rate/ grazing/

environmental assessment/ range management/ arid

zones/ semiarid zones/ rangelands/ New Mexico

This citation is from AGRICOLA.

526. Soil bulk density and water infiltration as affected by grazing systems.

Abdel-Magid, A. H.; Schuman, G. E.; and Hart, R. H.

Journal of Range Management 40(4): 307-309. (1987)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1987/404/5abde.pdf>

Descriptors: rangelands/ grazing/ soil compaction/ bulk

density/ sandy loam soils/ soil water movement/ Wyoming

This citation is from AGRICOLA.

527. Soil bulk density as influenced by grazing intensity and soil type on a shortgrass prairie site.

Van Haveren, B. P.

Journal of Range Management 36(5): 586-588. (1983)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1983/365/11van.pdf>

Descriptors: Colorado

This citation is from AGRICOLA.

528. Soil carbon and nitrogen of Northern Great Plains grasslands as influenced by long-term grazing.

Frank, A. B.; Tanaka, D. L.; Hofmann, L.; and Follett, R. F.

Journal of Range Management 48(5): 470-474. (1995)

NAL Call #: 60.18 J82; ISSN: 0022-409X

[http://jrm.library.arizona.edu/data/1995/485/](http://jrm.library.arizona.edu/data/1995/485/470-474_frank.pdf)

[470-474_frank.pdf](http://jrm.library.arizona.edu/data/1995/485/470-474_frank.pdf)

Descriptors: Bouteloua gracilis/ botanical composition/ range management/ stocking rate/ prairie soils/ organic matter/ nitrogen content/ carbon/ grazing/ North Dakota

Abstract: Three mixed prairie sites at Mandan, N.D. were grazed heavily (0.9 ha steer-1), moderately (2.6 ha steer-1), or left ungrazed (exclosure) since 1916. These sites

provided treatments to study the effects of long-term grazing on soil organic carbon and nitrogen content and to relate changes in soil carbon and nitrogen to grazing

induced changes in species composition. Blue grama [Bouteloua gracilis (H.B.K) Lag. ex Griffiths] accounted for the greatest change in species composition for both grazing

treatment. Relative foliar cover of blue grama was 25% in 1916 and 86% in 1994 in the heavily grazed pasture and 15% in 1916 to 16% in 1994 in the moderately grazed

pasture. Total soil nitrogen content was higher in the exclosure (1.44 kg N ha⁻¹) than in either grazing treatment (0.92 and 1.07 kg N ha⁻¹ for moderately and heavily

grazed, respectively) to 107-cm depth. Soil organic carbon content avg 72, 6.4, and 7A kg m⁻² to 30.4 cm soil depth and 14.1, 11.7, and 14.0 kg m⁻² to 106.7 cm soil depth for the exclosure, moderately grazed, and heavily grazed

treatments, respectively. Compared to the exclosure the moderately grazed pasture contained 17% less soil carbon to the 106.7 cm depth. Heavy grazing did not reduce soil

carbon when compared to the exclosure. Based on 13C analysis and soil organic carbon data to 15.2 cm depth, blue grama or other C4 species contributed 24% or 12 kg

m⁻² of the total carbon in the heavily grazed and 20% or 0.8 kg m⁻² of the total carbon in the moderately grazed pastures during the 1916 to 1991 time period. The increase

in blue grama, a species with dense shallow root systems, in the heavily grazed pasture probably accounted for maintenance of soil carbon at levels equal to the exclosure.

These results suggest that changes in species composition from a mixed prairie to predominantly blue grama compensated for soil carbon losses that may result from grazing native grasslands.

This citation is from AGRICOLA.

Descriptors: soil compaction/ grazing/ grasslands/ animal husbandry

Abstract: The impacts of long-term grazing on compaction were assessed in mixed prairie and fescue grassland ecosystems of Alberta (Canada). Grazing regimes were of light to very heavy intensities, grazed early, late, and continuously during the growing season. Bulk density was measured with a surface moisture/density gauge and a combination moisture/density probe to 65 cm. Penetration resistance to 30 cm was measured with a cone penetrometer. Solonchic soils were less sensitive to compaction under grazing than Chernozemic soils. Heavy

This citation is from AGRICOLA.

529. Soil compacting impacts of grazing in mixed prairie and fescue grassland ecosystems of Alberta.

Naeth, M. A.; Pluth, D. J.; Chanasyk, D. S.; Bailey, A. W.; and Fedkenheuer, A. W.

Canadian Journal of Soil Science 70(2): 157-167. (1990)

NAL Call #: 56.8 C162; ISSN: 0008-4271

Descriptors: soil compaction/ grazing/ grasslands/

animal husbandry

Abstract: The impacts of long-term grazing on compaction were assessed in mixed prairie and fescue grassland ecosystems of Alberta (Canada). Grazing regimes were of light to very heavy intensities, grazed early, late, and continuously during the growing season. Bulk density was measured with a surface moisture/density gauge and a combination moisture/density probe to 65 cm. Penetration resistance to 30 cm was measured with a cone penetrometer. Solonchic soils were less sensitive to compaction under grazing than Chernozemic soils. Heavy

This citation is from AGRICOLA.

Descriptors: soil compaction/ grazing/ grasslands/ animal husbandry

Abstract: The impacts of long-term grazing on compaction were assessed in mixed prairie and fescue grassland ecosystems of Alberta (Canada). Grazing regimes were of light to very heavy intensities, grazed early, late, and continuously during the growing season. Bulk density was measured with a surface moisture/density gauge and a combination moisture/density probe to 65 cm. Penetration resistance to 30 cm was measured with a cone penetrometer. Solonchic soils were less sensitive to compaction under grazing than Chernozemic soils. Heavy

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intensity and/or early season grazing had greater impacts on compaction than light intensity and/or late season grazing. Under the former grazing regimes, bulk density increased to 7.5 cm at Kinsella and 65 cm at Stavely; penetration resistance increased to depths of 2.5 cm at Brooks, 15 cm at Kinsella, and 30 cm at Stavely. Heavy trampling versus regular grazing increased penetration resistance to depths of 30 and 10 cm under heavy intensity and/or early season and light intensity and/or late season grazing, resp. Late season grazing at Brooks and light to moderate grazing at Stavely can be used as management models to reduce compaction under grazing. Trends were not as clear at Kinsella, but light June and autumn grazing had the least compacting effect.

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530. Soil microbial population and enzyme activity related to grazing pressure in alpine meadows of Nanda Devi Biosphere Reserve.

Singh, Sanjeeva K. and Rai, J. P. N.

Journal of Environmental Biology 25(1): 103-107. (2004)

NAL Call #: QH540.J65; ISSN: 0254-8704

Descriptors: soil microbial analysis: laboratory techniques/ alpine meadows/ animal biodiversity/ grazing pressure/ intensively grazed meadow/ microbiological characteristics/ moderately grazed meadow/ physicochemical characteristics: cation exchange capacity, electrical conductivity, moisture/ plant biodiversity/ soil environment: biotic pressure/ soil fertility management/ soil fertility status/ soil respiration/ total viable count [TVC]

Abstract: The present study aims to analyze the interaction of prevailing biotic pressure on soil environment with emphasis on its physicochemical and microbiological characteristics determining soil fertility status and thus supporting plant and animal biodiversity in Nanda Devi Biosphere Reserve (NDBR) which is located in northern part of Uttaranchal hills between 79degree40'E to 80degree05'E longitude and 30degree17'N to 30degree41'E latitude. The experimental results revealed that the physico-chemical characteristics (viz., moisture, pH, EC, C, N, P, K, CEC) of soil were maximum in moderately grazed meadow and minimum in intensively grazed meadow. Soil microbial analysis measured in terms of total viable count (TVC) exhibited grazing sensitivity trend being maximum population of bacteria > fungi > actinomycetes. The soil microbial population was positively correlated with soil respiration, dehydrogenase activity, acid phosphatase and microbial biomass, which exhibited uneven trend with grazing pressure. Soil from moderately grazed meadow showed highest microbial count and enzyme activities, whilst intensively grazed meadow showed lowest microbial count and enzyme activities. This depicts the beneficial role of prescribed grazing upto limited extent in management of soil fertility, which might have supported luxuriant growth of a variety of grasses.

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531. Soil microtopography on grazing gradients in Chihuahuan desert grasslands.

Nash, M. S.; Jackson, E.; and Whitford, W. G.

Journal of Arid Environments 55(1): 181-192. (2003)

NAL Call #: QH541.5.D4J6; ISSN: 0140-1963

Descriptors: desertification/ erosion/ grasslands/ grazing/ height/ livestock/ mounds/ size/ spatial distribution/ topography

Abstract: The significant impacts of livestock in the creation of piospheres centred on water points is the loss of soil microtopography across a 'landscape' that has been influenced by many years of livestock grazing. The size, height, and spatial distribution of micromounds and surrounding depressions were measured by a modified erosion bridge at three distances (50, 450, and 1050 m) from water points in desert grassland pastures in the Jornada Basin, New Mexico, USA. Plots at 50 m had fewer micromounds and the mounds were smaller than those recorded on the more distant plots. Microtopography of plots at 450 m from water was not significantly different from that recorded at 50 m. Microtopography of plots that were 1050 m from water points was significantly different from that of plots nearer water points. Strong correlation between microtopography and the cover of long-lived perennial grasses ($R^2=91\%$) was found, such dependence could be used for assessing the trend in organic matter content that is in concordance with that of microtopography. Loss of microtopography from the impact of livestock in piospheres exacerbates erosion processes and contributes to desertification.

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532. Soil nutrients and salinity after long-term grazing exclusion in a Flooding Pampa grassland.

Chaneton, E. J. and Lavado, R. S.

Journal of Range Management 49(2): 182-187. (1996)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/1996/492/182-187_chaneton.pdf

Descriptors: soil organic matter/ topography/ soil chemistry/ grasslands/ grazing/ botanical composition/ salinity/ cycling/ nitrogen/ carbon/ population dynamics/ pampas

Abstract: Soil organic C, total N, extractable P, and salinity were evaluated after 12-16 years of protection from grazing in 2 native grassland sites which differed in frequency of soil waterlogging in the Flooding Pampa of Argentina. The hypothesis that flooding affects the impact of grazing on soil chemical properties was tested. Soil was sampled to 10-cm depth in adjacent grazed and ungrazed plots in each site, and the percentage dissimilarity (PD) was assessed in vegetation composition among pastures. Grazing condition significantly interacted with site ($P < 0.001$) in affecting topsoil C, N, and salinity. Soil C and N were higher in grazed grassland (C = 4.8%; N = 0.42%) than in long-term enclosure (C = 3.7%; N = 0.35%) for the more frequently flooded, lowland site, but did not vary between grassland plots in the upland site (C = 3.1%; N = 0.29%) Soil electrical conductivity (E.C.) was low in both ungrazed plots (< 2 dS/m), yet with grazing, salinization was higher in the upland (E.C. = 6.85 dS/m) than in the lowland site (3.88 dS/m). Soil extractable P did not change in any consistent way with grazing treatment. Grazing apparently amplified differences in soil chemistry between lowland and upland sites, while differences in botanical composition between topographical positions were smaller for grazed (PD = 44%) than for ungrazed (64%) grassland. Moreover, contrasting responses between sites occurred for various soil parameters, whereas compositional differences between grazed and ungrazed plots were

similar in each site (PD ~ 65%). Thus, soil-vegetation changes in response to grazing appeared to be loosely coupled in this rangeland ecosystem.

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533. Soil organic carbon composition in a northern mixed-grass prairie: Effects of grazing.

Ganjugunte, G. K.; Vance, G. F.; Preston, C. M.; Schuman, G. E.; Ingram, L. J.; Stahl, P. D.; and Welker, J. M.

Soil Science Society of America Journal 69(6): 1746-1756. (2005)

NAL Call #: 56.9 So3; ISSN: 0361-5995

Descriptors: atmosphere/ forbs/ fulvic acids/ grasslands/ grazing/ grazing intensity/ grazing systems/ humic acids/ lignin/ Mollisols/ nuclear magnetic resonance spectroscopy/ organic carbon/ organic nitrogen/ oxidation/ prairie soils/ prairies/ sandy loam soils/ soil organic matter/ soil types/ sustainability/ humic substances

Abstract: Growing interest in the potential for soils to provide a sink for atmospheric C has prompted studies of effects of management on the amount and nature of soil organic C (SOC). We evaluated effects of different grazing management regimes, such as light grazing (LG), heavy grazing (HG), and non-grazed exclosures (EX), on amount and composition of SOC at the USDA-ARS High Plains Grasslands Research Station (HPGRS), Cheyenne, Wyoming, USA. Vegetation in the area is dominated by grasses, forbs and sedges. Ascalon and Altvan sandy loams (mixed, mesic, aridic Argiustoll) are the dominant soil series on the landscape. Soils (0-5 cm) from each treatment were analysed for total C and N contents and lignin composition. Soil organic C and N contents were significantly greater in LG (SOC-13.8 t ha⁻¹; total N-1.22 t ha⁻¹) than HG (SOC-10.9 t ha⁻¹; total N-0.94 t ha⁻¹) or EX (SOC-10.8 t ha⁻¹; total N-0.94 t ha⁻¹). From CuO oxidation studies, significantly greater (P<0.05) total lignin (vanillyl [V]+syringyl [S]+cinnamyl [C] compounds) contents were noted in EX (21 g kg⁻¹ SOC) than LG (12 g kg⁻¹ SOC) and HG (15 g kg⁻¹ SOC) soils. The lignin composition of humic (HA) and fulvic (FA) acids indicated that HA under LG contained significantly greater V and S than HG or EX. Fulvic acids contained S-depleted lignin compared with HAs and FAs from HG, which contained significantly greater V and C than FAs extracted from LG and EX. Nuclear magnetic resonance (NMR) spectra of HA and FA, however, did not vary significantly among the three grazing treatments. Results from CuO oxidation and NMR spectroscopy emphasized the familiar problem that determining the nature of soil organic matter (SOM) is a difficult task and sometimes different analytical techniques provide different information about the nature of SOM. Nonetheless, results indicate that LG is the most sustainable grazing management system for northern mixed-grass prairies.

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534. Soil properties following cultivation and non-grazing of a semi-arid sandy grassland in northern China.

Su, Yong Zhong; Zhao, Ha Lin; Zhang, Tong Hui; and Zhao, Xue Yong

Soil and Tillage Research 75(1): 27-36. (2004)

NAL Call #: S590.S48; ISSN: 0167-1987

Descriptors: basal soil respiration [bsr]/ cultivated soils/ degraded grassland ecosystem/ desertification/

environmental conservation/ grassland soils/ grassland vegetation recovery/ overgrazing/ plow layer/ sandy grassland/ semi arid horqin sandy steppe/ semi arid region/ semi arid sandy grassland/ short term cultivation/ soil biological properties/ soil chemical properties/ soil particle size distribution/ soil physical properties/ soil resource management/ ungrazed exclosure/ wind erosion

Abstract: Cultivation and overgrazing are widely recognized as the primary causes of desertification of sandy grassland in the semi-arid region of northern China. Very little is known about the effect of cultivation and overgrazing on soil physical, chemical and biological properties in this region. The objective of this study was to quantitatively evaluate the magnitude of changes in soil properties due to 3 years of cultivation (3CGS) and 5 years of ungrazed exclosure (5RGS) in a degraded grassland ecosystem of the semi-arid Horqin sandy steppe. Short-term cultivation resulted in a 18-38% reduction in concentration of soil organic C, and total N and P in the 0-15 cm plow layer. Cultivation had a significant influence on N and P availability and soil biological properties, with lower basal soil respiration (BSR) and enzyme activities than the grassland soils. This was mostly due to strong wind erosion when sandy grassland was cultivated. Data indicated a considerable difference in soil particle size distribution between the cultivated and grassland soils, and fine fraction (<0.1 mm) in the cultivated soil was lower than that in the grassland soils. Moreover, grassland vegetation recovery in the 5RGS resulted in significant improvement in soil properties measured at the 0-7.5 cm depth. From the perspective of soil resource management and environmental conservation, a viable option for these sandy grasslands would be to stop conversion of grassland to cropland and adopt proper fencing practices to limit overgrazing.

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535. Soil properties on grazed and ungrazed plots of a grassland sodic soil.

Lavado, R. S. and Alconada, M.

Soil Technology 7(1): 75-81. (1994)

NAL Call #: S590.S65; ISSN: 0933-3630

Descriptors: soil physics/ soil chemistry/ reclamation/ controlled grazing/ soil types chemical/ sodic soils/ soil properties/ Pampas

Abstract: Soil structural improvement of the alkaline soils of the flooding Pampas of Argentina through grazing exclusion was investigated. A Typic Natraqualf near Veronica that had been kept free of grazing for three and twelve years was compared with adjacent plots. Total and water soluble organic matter, structural stability, bulk density, hydraulic conductivity, infiltration rate and the water easily dispersed fraction were not significantly different among treatments. The ungrazed soil did not accumulate soil organic matter and an important proportion of it was still water soluble. The absence of trampling, even after cattle exclusion for 12 yrs, did not improve the structural stability, clay dispersion and other properties. Sodium removal and flocculation would be a prerequisite for improvement of these sodic soils.

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536. Soil property comparisons in virgin grasslands between grazed and nongrazed management systems.

Bauer, A.; Cole, C. V.; and Black, A. L.

Soil Science Society of America Journal 51(1): 176-182. (1987)

NAL Call #: 56.9 So3; ISSN: 0361-5995

Descriptors: carbon/ nitrogen/ phosphorus/ nutrient cycling/ modeling/ bulk density

Abstract: Soil organic C and total N contents of grazed virgin grasslands have been used as the comparison standard to assess the change in soil organic matter (OM) generated by cultivation in the Northern Great Plains. The assumption has been that grassland soil properties were not altered by livestock grazing and therefore reflect the native grassland condition at the time man began cultivating for crop production. In this study, soil properties of grazed and nongrazed (relict) virgin grasslands are compared to assess the effect of grazing. Four sites each of moderately coarse-, medium-, and fine-textured soils under grazed and under relict management were sampled at 0- to 0.076, 0.076- to 0.152-, 0.152- to 0.305-, and 0.305- to 0.457-m depths. Analyses were made to compare organic C, total N, total P, organic P, and inorganic P contents, and bulk density between the management systems. Nutrient contents differed between the two management systems. The largest content was not exclusively associated with either system; neither was the difference the same among textural groups or sampling depth. When averaged over all soil textures and depths, organic C and total P contents showed opposite trends from total N. Organic C and total P contents to 0.45 m were larger in relict grasslands by about 1.27 and 0.029 kg m⁻², respectively, while the total N content was larger in grazed grasslands by about 0.163 kg m⁻². Since the fencing of grasslands for livestock control about 75-yr ago, differences between the two systems have developed at an average annual rate of about 165 kg C, 20 kg N, and 4 kg P ha⁻¹. Bulk densities were highest in grazed grassland in the uppermost 0.076 m. Based upon the organic C and total N contents in relict grasslands, reported losses of OM resulting from cultivation have been either over- or underestimated, depending on whether organic C or total N content in grazed grasslands has been used as the comparison standard.

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537. Soil response to trampling under intensive rotation grazing.

Warren, S. D.; Nevill, M. B.; Blackburn, W. H.; and Garza, N. E.

Soil Science Society of America Journal 50(5): 1336-1341. (1986)

NAL Call #: 56.9 So3; ISSN: 0361-5995

Descriptors: livestock/ rangeland/ aggregate stability/ impermeable/ stocking rate/ bulk density/ Texas/ USA

Abstract: The impact of short-term, high intensity livestock trampling on selected properties of a silty clay soil was determined at the Texas Agriculture Experiment Station located near Sonora, [Texas, USA]. Intensive livestock trampling typical of multi-pasture rotational grazing systems had a negative impact on soil physical properties. The deleterious effects tended to increase as stocking rate increased. Trampling on dry soil disruption of naturally occurring aggregates and compaction of the surface soil

layer. Trampling on moist soil deformed existing aggregates and led to the creation of a flat, comparatively impermeable surface layer composed of dense, unstable clods.

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538. Some responses of riparian soils to grazing management in northeastern Oregon.

Bohn, C. C. and Buckhouse, J. C.

Journal of Range Management 38(4): 378-381. (1985)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1985/384/23bohn.pdf>

Descriptors: range management/ riparian forests/ soil properties/ grazing/ Oregon

This citation is from AGRICOLA.

539. Steambank stability and cattle grazing in southwestern Montana.

Marlow, C. B.; Pogacnik, T. M.; and Quinsey, S. D.

Journal of Soil and Water Conservation 42(4): 291-296. (1987)

NAL Call #: 56.8 J822; ISSN: 0022-4561

Descriptors: bioturbation/ river banks/ erosion/ land use/ soil mechanics/ USA, Montana/ cattle grazing/ streamflow

Abstract: A 4-year grazing study in southwestern Montana indicated both streamflow and cattle use were highly correlated with the degree of change in stream channel profile. The greatest streambank change occurred during periods of high streamflow (positive correlation) and low cattle use (negative correlation). However, further statistical analysis of the data indicated that streamflow itself was not a major factor in bank erosion. Although not significant in all years, the decline in channel change appeared related to the seasonal trend in soil moisture. As streambank moisture levels declined, the extent of channel alteration also declined. Channel profile changes in paddocks grazed after early August when banks had dried were not significantly different ($P < 0.05$) from those in an ungrazed paddock.

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540. Stocking rate effect on soil carbon and nitrogen in degraded soils.

Potter, K. N.; Daniel, J. A.; Altom, W.; and Torbert, H. A.

Journal of Soil and Water Conservation 56(3):

233-236. (2001)

NAL Call #: 56.8 J822; ISSN: 0022-4561

Descriptors: cattle/ rotational grazing/ stocking rate/ soil organic matter/ carbon/ nitrogen content/ soil fertility/ loam soils/ disturbed soils/ soil degradation/ bulk density/ grazing

intensity/ carbon nitrogen ratio/ silt loam soils/ Oklahoma

This citation is from AGRICOLA.

541. Stream channel adjustments following elimination of cattle grazing.

Magilligan, F. J. and McDowell, P. F.

Journal of the American Water Resources Association

33(4): 867-878. (1997)

NAL Call #: GB651.W315; ISSN: 1093-474X

Descriptors: grazing/ cattle/ streams/ riverbank protection/ geomorphology/ riparian buffers/ Oregon

Abstract: Cattle grazing practices in the western United States have contributed to widespread riparian degradation resulting in unstable channel morphologies and the loss of fish habitat. Because of prolonged disturbance, numerous riparian areas on both public and private lands have been

fenced to exclude cattle in order to promote vegetation establishment and riparian improvement. We selected four gravel-bedded, steep alluvial streams in eastern Oregon with cattle exclosures greater than 14 years old for an analysis of geomorphic adjustments following the removal of cattle grazing. We compare channels inside exclosures and in adjacent grazed reaches to identify the salient stream channel properties that respond to the removal of riparian stresses and to document the magnitude of these changes. Results indicate that significant changes occur, with reductions in bankfull dimensions and increases in pool area being the most common and identifiable changes. At all four sites, bankfull widths are narrower by 10 to 20 percent, and the percentage of channel area occupied by pools is higher in the exclosure by 8 to 15 percent. The increase in pool area is primarily offset by a reduction in the percent glide area. Not all of the channel properties demonstrate adjustment, indicating that perhaps 14 years is an insufficient duration for these variables to adjust. This citation is from AGRICOLA.

542. Stream channel changes associated with mining and grazing in the Great Basin.

Sidle, Roy C. and Sharma, Ashish
Journal of Environmental Quality 25(5): 1111-1121. (1996)
 NAL Call #: QH540.J6; ISSN: 0047-2425
 Descriptors: biobusiness/ conservation/ environmental quality/ freshwater ecology/ grazing/ Great Basin/ mining/ stream channel changes

Abstract: Characteristics of channel morphology and streambed sediment were sampled at 5- and 10-m intervals, respectively, along a 6.4-km reach of Birch Creek in 1989 and 1992. In this case study we evaluate changes in these channel features using kernel regression analysis. The watershed is located high in the Toiyabe Mountains of central Nevada and has experienced historical grazing and more recent (1986-1989) mining for gold. Exclusion of grazing in the incised lower 1 km of the channel since 1990 did not lead to substantial geomorphic recovery by 1992. The bankfull width did decrease a bit in the grazing exclosure, but baseflow width increased. In both years, bankfull width was about 4 m greater in the exclosure compared with the upstream reaches, reflecting the long-term grazing influences. The shift of grazing pressure into wet riparian areas upstream apparently caused decreases in thalweg depth, increases in fine sediment deposition in the channel, and loss of pool volume in these upstream areas. Some of these changes in substrate sediment could be attributed to inputs from the mine dumps; however, since either fine sediment did not increase or D-50 did not decrease in the vicinity of the mines, the changes appear to be more related to recent changes in grazing patterns. Increased fine deposition also occurred in reaches with high volumes of large woody debris. Because of the episodic nature of peakflows that occur in the Great Basin, it may take many years for the full impacts of mining and grazing to be assimilated by the fluvial and riparian systems.

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543. Stream chemistry responses to four range management strategies in eastern Oregon.

Tiedemann, A. R.; Higgins, D. A.; Quigley, T. M.; and Sanderson, H. R.
 Portland, Or.: U.S. Dept. of Agriculture, Forest Service,

Pacific Northwest Research Station; PNW-RP-413, 1989. 9 p.

Notes: ISSN 0882-5165

NAL Call #: A99.9 F7625Uni no.413

http://www.fs.fed.us/pnw/pubs/pnw_rp413.pdf

Descriptors: grazing--environmental aspects--Oregon/ water chemistry/ range management--Oregon
 This citation is from AGRICOLA.

544. Stream water quality as influenced by beaver within grazing systems in Wyoming.

Skinner, Q. D.; Speck, J. E.; Smith, M.; and Adams, J. C.
Journal of Range Management 37(2): 142-146. (1984)
 NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1984/372/12skin.pdf>

Descriptors: livestock/ fecal coliforms/ fecal streptococci/ fluorescing bacteria/ nonpoint pollution/ damming/ stream flow

Abstract: Stream water flowing from watersheds subjected to continuous and deferred rotation grazing by livestock was sampled to enumerate bacteria to detect differences between grazing treatments and streams. Fecal coliforms, fecal streptococci, total counts at 20 degree C and bacteria capable of fluorescing under long wave radiation were selected as indicators of pollution. The study was conducted over the 2 summers of 1979 and 1980 on mountain rangeland near Laramie, Wyoming. Bacteria counts for different indicator groups varied in their ability to detect change between grazing treatments and streams. Fluorescing bacteria and total counts were of little value in explaining nonpoint source pollution; fecal coliform and streptococci were. Variation in counts of fecal coliform and streptococci could not be fully accounted for by differences in grazing management but was partially explained by beaver damming of stream flow. Given that beaver impoundment of selected stream reaches is equal, variation in nonpoint pollution may be caused by differences in grazing treatments.

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545. Streambank erosion and ungulate grazing relationships.

Buckhouse, J. C.; Skovlin, J. M.; and Knight, R. W.
Journal of Range Management 34(4): 339-340. (1981)
 NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1981/344/21buck.pdf>

Descriptors: Oregon

This citation is from AGRICOLA.

546. Structural stability changes in a grazed grassland Natraquoll of the Flooding Pampa (Argentina).

Taboada, M. A.; Lavado, R. S.; Svartz, H.; and Segat, A. M. L.

Wetlands 19(1): 50-55. (1999)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: grasslands/ grazing/ soil structure/ ranching/ agriculture/ wetlands/ flooding/ man-induced effects/ soils/ water content/ soil stability/ cattle/ moisture content/ Argentina/ grazing/ trampling/ Flooding Pampa

Abstract: Several factors affecting soil structural stability interact in the natural grasslands of the Flooding Pampa (Argentina). This seasonal and flat wetland (usually ponded in winter-spring and dry in summer) has swelling soils, which are affected by seasonal increases in sodium, and continuous grazing by cattle. Our study aimed to determine

the period of structural deterioration, the magnitude of deterioration, and the time for recovery in a widely distributed soil of the region. The mean weight diameter of wet-sieved aggregates (MWD) was determined in grazed and ungrazed (exclosure) plots. Aggregate MWD was often lower in the soil under grazing (from 4.4 to 5.1 mm) than in that of the exclosed area (from 4.7 to 5.4 mm). This reduction in aggregate size was attributable to the mechanical shearing action of trampling. Soil water content accounted for 74% of the variation in aggregate MWD under grazing. At low soil water contents, the structure of the grazed soil became less stable. Grazing effects on soil structural stability are significant only in periods when the soil dries. Stocking rates must be regulated at those dry periods.

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547. Water quality of surface runoff from grazed fescue grassland watershed in Alberta.

Mapfumo, E.; Willms, W. D.; and Chanasyk, D. S.
Water Quality Research Journal of Canada 37(3): 543-562. (2002); ISSN: 1201-3080

Descriptors: nutrients (mineral)/ carbon/ pathogens/ parasites/ environmental impact/ agricultural runoff/ Giardia/ Cryptosporidium/ Canada, Alberta

Abstract: A study was conducted at Stavely Research Station, Alberta, to determine the quantity and quality of surface runoff from small grassland watersheds under three grazing intensities, viz. ungrazed, heavy grazing and very heavy grazing. The volume of surface runoff varied each year (1998, 1999 and 2000) and also differed across watersheds, with lower runoff in the ungrazed compared with the heavy and very heavy grazed watersheds. Total dissolved solids in surface runoff water ranged between 34 to 360 mg L super(-1), and that for runoff from the very heavy grazed watershed was greater than that from other watersheds. Electrical conductivity increased with increased grazing intensity on the watershed. In two of three years the very heavy grazed watershed had greater nitrate concentrations than the other two watersheds. In all three years the levels of nitrate were lower than the maximum acceptable level for drinking water. Levels of orthophosphate in surface runoff from all three watersheds and the three years of study were less than 1 mg L super(-1), and mostly within the range considered typical for rivers and streams. Total carbon was greater than the amounts

considered typical for streams and rivers, and most of it was organic carbon. Nuisance organisms such as algae, nematodes, Giardia spp., Cryptosporidium spp. and rotifers were detected in some surface runoff samples. However, no crustaceans were detected. The results of a canonical correlation analysis indicated that the dominant external forcing factors (meteorological and management) in influencing water quality were year of study, water temperature and grazing. Surface runoff discharge did not influence water quality measurements. The dominant water quality parameters were found to be total carbon, organic carbon, total dissolved solids and electrical conductivity. Overall, this study indicated that during the three years, the surface runoff volumes from the watersheds were small and grazing of these watersheds posed little risk of nutrient contamination of adjacent streams, but organic carbon loading and dissolved solids may be of concern. The presence of parasites was detected in two or less runoff water samples each year, and thus pose little risk of contamination of adjacent streams. However, it may be necessary to monitor parasites especially in areas under cow-calf operations.

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548. Water quality within lightly-grazed and protected isolated wetlands in south-central Florida.

Tanner, G. W. and Terry, W. S.
In: Fiftieth Annual Meeting of the Soil and Crop Science Society of Florida. (Held 26 Sep 1990-28 Sep 1990 at Daytona Beach, Florida, USA.); Vol. 50.; pp. 80-84; 1991.
Notes: ISSN: 0096-4522
NAL Call #: 56.9 So32

Descriptors: cattle resource management

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549. Watershed responses to grazing management.

Gifford, G. F.
In: Interior west watershed management: Proceedings of a Symposium. (Held 8 Apr 1980-10 Apr 1980 at Spokane, Wash.) Baumgartner, David M. (eds.)
Pullman, Wash.: Washington State University, Cooperative Extension; pp. 147-159; 1981.
NAL Call #: TC423.6.15

Descriptors: watersheds/ grazing management

This citation is from AGRICOLA.

Fish and Wildlife Effects

550. Allocating forage among wild and domestic ungulates: A new approach.

Johnson, B. K.; Ager, A.; Crim, S. A.; Wisdom, M. J.; Findholt, S. L.; and Sheehy, D.

In: Proceedings of a symposium on sustaining rangeland ecosystems. (Held 29 Aug 1994-31 Aug 1994 at Eastern Oregon State College, La Grande, Oregon.) Edge, W. D. and Olsen-Edge, S. L. (eds.); Vol. Special Report 953. Corvallis, Ore.: Oregon State University Extension Service; pp. 166-169; 1996.

NAL Call #: 100 Or3M no.953

Descriptors: resource allocation/ stocking rate/ computer software/ simulation models/ geographical information systems/ grazing/ wild animals/ grasslands/ rangelands/ range management/ models/ grazing behaviour

Abstract: The allocation of rangeland forage between

domestic and wild ungulates is discussed and none of the methods tried are considered satisfactory. The difficulty of combining static and dynamic environmental factors on a seasonal basis to quantify and predict the distribution of ungulates and vegetation is described. A case study is presented using computer-aided spatial analysis models and linear programming formulation to allocate forage among elk (*Cervus elaphus*), mule deer (*Odocoileus hemionus*) and cattle. The results were displayed on 3-dimensional computer-generated images to show where forage was removed by each animal species on a monthly basis.

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551. An annotated bibliography on the interaction of range management (livestock grazing, brush management and prescribed burning) or nonmanagement with wildlife habitat and wildlife.

Kozicky, Edward L.; Fulbright, Timothy E.; and Texas. Fisheries & Wildlife Division. Wildlife Section Austin, Tex.: Texas Parks & Wildlife Dept., 1991. 293 p.
NAL Call #: SF85.K69 1991
Descriptors: bibliographies/ fires/ burns/ grazing/ habitat alterations/ management/ range management/ wildlife/ abstracts/ bibliography/ wildlife management/ range ecology/ wildlife habitat improvement/ natural resources
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552. Avian community responses to fire, grazing, and drought in the tallgrass prairie.

Zimmerman, John L.
In: Ecology and conservation of Great Plains vertebrates/ Knopf, Fritz L. and Samson, Fred B.; Series: Ecological Studies 125.
New York: Springer-Verlag, 1997; pp. 167-180.
Notes: ISBN 0387948023; ISSN 0070-8356
NAL Call #: QH540.E288 v.125
Descriptors: conservation/ drought/ fire/ forest fragment/ grazing/ Great Plains/ tallgrass prairie/ terrestrial ecology
© The Thomson Corporation

553. Avian nest success in relation to past grazing regimes in a montane riparian system.

Ammon, Elisabeth and Stacey, Peter B.
Condor 99(1): 7-13. (1997)
NAL Call #: QL671.C6; ISSN: 0010-5422
Descriptors: livestock grazing regime/ montane riparian system/ nest predation rates/ nest success/ terrestrial ecology/ vegetation composition/ vegetation structure
Abstract: One possible link between livestock grazing and bird population declines is variation in nest predation rates. To explore this possibility we documented vegetational differences in a montane riparian community subdivided by a fence, one side of which traditionally has been summer-grazed, and the other side rested from grazing for 30 years. We found that ground vegetation was more abundant, willows (*Salix* spp.) less abundant, and vertical vegetational diversity was lower on the grazed relative to the rested side. Predation rates on real nests were higher on the grazed side compared to the rested side. Artificial nests were placed (1) in mixed conifer vegetation to mimic the most common nest types currently present in the riparian zone, (2) in streamside willows that differed in abundance across the fence, and (3) in old-willow remnants distant from the stream, which were equally abundant on both sides of the fence. All artificial above-ground nests, and ground nests in the old-willow experiment, suffered greater predation rates on the grazed compared to the rested side. Thus, livestock grazing may not only affect availability of nesting substrates for riparian birds by reducing streamside vegetation, but could influence bird populations by facilitating nest predation, possibly by increasing detectability of nests or through changes in predator assemblage.
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554. Avian responses to late-season grazing in a shrub-willow floodplain.

Stanley, Thomas R. and Knopf, Fritz L.
Conservation Biology 16(1): 225-231. (2002)
NAL Call #: QH75.A1C5; ISSN: 0888-8892
Descriptors: late season grazing: avian response/ shrub willow floodplain: habitat
Abstract: Riparian vegetation in western North America provides important habitat for breeding birds and valuable forage for grazing livestock. Whereas a number of studies have documented the response of riparian vegetation to the removal of cattle, few have experimentally evaluated specific grazing systems. We evaluated the responses of vegetation and breeding birds to two cycles of late-season (August-September) grazing followed by 34 months of rest on the Arapaho National Wildlife Refuge, Colorado. We used a before-and-after control-impact (BACI) design, with two control (ungrazed) and two treatment (grazed) pastures composing the experimental units. Vegetation characteristics and bird densities were quantified on sample plots prior to and following two cycles of the treatment. We found no statistical differences in vegetation change and few differences in bird-density change among pastures. Inspection of means for pastures, however, suggests that changes in shrub vigor and spatial pattern differed among ungrazed and grazed pastures and that changes in population density for three of the nine bird species and three guilds studied differed among pastures. Our results suggest that habitat for grazing-sensitive birds may be restored while still allowing late-season grazing, although the rate at which species are recovered will be slower than if all cattle are removed.
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555. Bird and small mammal populations in a grazed and ungrazed riparian habitat in Idaho.

Medin, D. E. and Clary, W. P.
Ogden, Utah: US Department of Agriculture, Forest Service, Intermountain Research Station; Research Paper INT-425, 1990. 10 p.
Notes: ISSN 0886-7380
NAL Call #: A99.9 F764U
Descriptors: wildlife/ birds/ mammals/ habitats/ rangelands/ riparian buffers/ grazing/ Idaho
This citation is from AGRICOLA.

556. Bird community changes in gray alder forests due to grazing by cattle.

Pettersen, R.
Fauna Norvegica Series C Cinclus 10(1): 1-6. (1987);
ISSN: 0332-7701
Descriptors: *Alnus incana*/ *Anthus trivialis*/ *Emberiza citrinella*/ population census/ Norway
Abstract: The composition of the breeding passerine bird community in a grey alder *Alnus incana* forest in Central Norway was censused in 1981, 1982 and 1984. One part of the forest has been intensively grazed for years. The second part was grazed for the first time in 1983. A lower density was found in the grazed plot compared to the ungrazed plot. All bird species reduced their densities, with the exception of two pioneer species, *Anthus trivialis* and *Emberiza citrinella*, which had their greatest densities in the grazed area. The diversity of the bird species (H') was slightly greater in the grazed area than in the ungrazed area. The bird density in the formerly ungrazed area was

reduced by 46% (adjusted for control plot) after one year of grazing. All species present reduced their densities. A significant difference was found in the composition of birds in the ungrazed plot compared to the grazed plot. The difference was not significant after one year of grazing in the ungrazed plot.

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557. Bird-habitat relationship in semi-arid natural grasslands and exotic pastures in the west pampas of Argentina.

Isacch, J. P.; Maceira, N. O.; Bo, M. S.; Demaria, M. R.; and Peluc, S.

Journal of Arid Environments 62(2): 267-283. (2005)

NAL Call #: QH541.5.D4J6; ISSN: 0140-1963

Descriptors: Argentina/ commercial enterprises/ communities/ disturbances/ ecosystems/ farming and agriculture/ grasslands/ habitat use/ land zones/ natural grassland replacement by exotic pasture/ neotropical region/ San Luis Province/ semi arid grassland/ South America/ species diversity/ wildlife/ human relationships
Abstract: In the semi-arid grasslands of the west pampas, in Argentina, extended natural grasslands still persist only with cattle grazing. However, in the last years there has been an important increase in the cultivation of African pasture species. We evaluated the incidence of the replacement of natural grasslands by exotic pastures on bird diversity in spring summer and in winter. In five different grassland habitats (two native and three sown pastures), we sampled bird populations using the strip transect method and vegetation variables simultaneously at the same sites. We used multiple regressions to examine the relative importance of habitat variables on richness, abundance and presence of bird species. The replacement of native grasslands (Sorgastral) by sown pastures results in habitat modifications such as changes in green vegetation, percentage of bare ground and distance to trees. When native grasslands are moderately grazed (mixed grassland) plant species richness increases notably relative to other native and exotic pastures. Some vegetation variables were correlated with bird species richness or with some bird populations. However, the habitat variable that best described bird species richness and bird abundance was plant species richness, which varied both with the grazing history of the native grassland and with the type of pasture used as replacement. Consequently, grassland replacement by sown pastures in the west pampas results in changes in bird alpha diversity; decreasing diversity with respect to mixed grasslands, but favoring it in relation to the climax grassland (Sorgastral). The composition of grassland bird communities in natural grasslands would be little affected by exotic pastures replacement. However, since some vegetation variables best represented in some habitats had particular effects on the abundance and presence of specific grassland birds, managers and policy makers should take into account the complexity of the processes associated with changes in land use of the west pampas. This would not only decrease the probability of negative effects on the total bird diversity but also would decrease the risk of local extinction of declining species. [copyright] 2005 Elsevier Ltd. All rights reserved.

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558. Bird numbers in relation to grazing on a grouse moor from 1957-61 to 1988-98.

Jenkins, David and Watson, Adam

Bird Study 48(1): 18-22. (2001); ISSN: 0006-3657

Descriptors: behavior/ birds/ bogs/ farmland/ grazing/ habitat alterations/ habitat use/ sheep/ status/ wildlife/ livestock relationships/ peregrine/ willow grouse/ black grouse/ partridge/ domestic sheep/ census/ population ecology/ interspecies relations/ population size: local/ trends/ moorland/ oystercatcher/ lapwing/ curlew/ red grouse/ grey partridge/ golden plover/ ring ouzel/ whinchat/ European whinchat/ European wheatear/ northern wheatear/ wheatear/ common cuckoo/ cuckoo/ Eurasian cuckoo/ European cuckoo/ European grey cuckoo/ grey cuckoo/ short-eared owl/ moorhen/ common gallinule/ common moorhen/ Eurasian curlew/ European curlew/ western curlew/ redshank/ common redshank/ common snipe/ Eurasian oystercatcher/ European oystercatcher/ European golden-plover/ greater golden-plover/ white wagtail/ meadow pipit/ northern lapwing/ mallard/ mallard duck/ common teal/ Europe/ United Kingdom/ Scotland
Abstract: Birds were counted before and after heavy grazing on a Scottish grouse moor. Oystercatchers *Haematopus ostralegus*, lapwings *Vanellus vanellus* and curlews *Numenius arquata* increased where high sheep stocks and grass seeding converted much ling *Calluna vulgaris* to smooth grass, but not where heath remained. A healthy part that held many gamebirds in 1957-61 but later became short grass had no red grouse *Lagopus lagopus scoticus*, black grouse *Tetrao tetrix* or grey partridge *Perdix perdix* in 1989-98. The study area held many golden plover *Pluvialis apricaria* in 1957-61 but none in 1989-98.

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559. Birds as grazing indicator species in southeastern Arizona.

Bock, C. E. and Webb, B.

Journal of Wildlife Management 48(3): 1045-1049. (1984)

NAL Call #: 410 J827; ISSN: 0022-541X

Descriptors: *Eremophila alpestris*/ *Aimophila cassinii*/ *Chondestes grammacus*/ *Ammodramus savannarum*/ grassland/ density/ habitat/ environmental condition

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560. Bobwhite habitat use under short duration and deferred-rotation grazing.

Wilkins, R. N. and Swank, W. G.

Journal of Range Management 45(6): 549-553. (1992)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1992/456/9wilk.pdf>

Descriptors: *Colinus virginianus*/ habitats/ grazing/ semiarid zones/ rangelands/ wildlife management/ population density/ Texas

Abstract: A study was conducted in the South Texas Plains to contrast the short-term impacts of short duration grazing (SDG) and deferred-rotation grazing (DG) systems on habitats for northern bobwhites (*Colinus virginianus*). Foliar cover, species richness, and structural attributes of the vegetation were compared at radio-location sites (quail-used) and sites along random transects (available) within and between the 2 grazing systems. Quail-used sites were characterized by increased species richness, forb cover, and bare ground and decreased plant height and litter accumulations. Principal components analysis revealed that available sites on the SDG during the fall and winter were

scored higher along a habitat gradient which had greater species richness and forb cover combined with diminished litter accumulations. This habitat gradient explained 41% of the variation in the ground layer variables. In addition, mark-recapture studies suggested positive population responses on the SDG during the first year following its initiation. Short-term improvements in bobwhite habitats may be realized by initiating SDG on some semiarid rangelands.

This citation is from AGRICOLA.

561. Breeding bird abundance and habitat on two livestock grazing regimes in North Dakota.

Buskness, Natoma A.; Murphy, Robert K.; Higgins, Kenneth F.; and Jenks, Jonathan
South Dakota Academy of Science Proceedings 80(2001)
 NAL Call #: 500 SO82; ISSN: 0096-378X
 Abstract: [unedited] To help sustain prairie wildlife habitat on privately owned lands in North Dakota, prescribed rotational grazing (RG) systems have been implemented as part of the Prairie Pothole Joint Venture (PPJV) of the North American Waterfowl Management Plan. However, impacts of these systems on nongame breeding birds are unmeasured. During 1996 and 1997 we assessed the relative abundance, species richness, and habitat of breeding birds especially passerines on five PPJV-prescribed RG pastures in central and northwestern North Dakota. Each RG pasture was paired with a nearby traditional, continuous-grazed (CG) pasture for comparison. Using 5-minute point counts on 100-m radius plot to survey breeding birds, we recorded 30 species in 1996 and 29 species in 1997. We detected no differences in relative abundance or species richness between grazing regimes in 1996 ($P = 0.29$ and 0.58), but relative abundance and species richness were greater on RG pastures than on CG pastures in 1997 ($P = 0.08$ and 0.04), a relatively dry year. A group of five species (savannah sparrow [*Passerculus sandwichensis*], grasshopper sparrow [*Ammodramus saviannarum*], western meadowlark [*Sturnella neglecta*], bobolink [*Dolichonyx oryzivorus*], Baird's sparrow [*Ammodramus bairdii*]) considered sensitive to heavy grazing in previous studies had a higher collective mean abundance on RG than on CG in 1997 (bar $x = 4.29$ and 2.75 breeding pairs/point count, $P = 0.03$). Litter depth also was greater on RG than on CG in 1997 (bar $x = 2.4$ and 1.4 cm, $P = 0.04$). PPJV grazing systems help conserve native prairie by improving its economic viability without diminishing habitat values for grassland passerines, and in dry years may enhance breeding bird habitat compared to that on traditional grazing systems especially for grazing-sensitive species such as bobolink and Baird's sparrow.
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562. Can cows and fish co-exist?

Fitch, L. and Adams, B. W.
Canadian Journal of Plant Science 78(2): 191-198. (1998)
 NAL Call #: 450 C16; ISSN: 0008-4220
 Descriptors: agriculture/ grazing management/ riparian ecosystem
 Abstract: Our paper provides an ecological perspective on the interrelationship between livestock grazing and riparian areas through a review of topical literature. We also describe the Alberta Riparian Habitat Management Project (also known as "Cows and Fish"), and draw upon our experience to provide a perspective on future riparian

management actions. Those actions should begin with an understanding that prairie landscapes evolved with herbivores, in a grazing regime timed and controlled by season and climatic fluctuations where grazing by native grazers was followed by variable rest periods. Prevailing range management principles represent an attempt to imitate the natural system and describe ecologically based grazing systems. Traditionally, range management guidelines have focused on grazing practices and impacts in upland, terrestrial rangelands, with a lack of attention devoted to riparian areas. Three decades of riparian investigation have quantified the effect unmanaged livestock grazing can have on range productivity and watershed function. We contend that suitable grazing strategies for riparian areas will be developed first by understanding the function of riparian systems and then by applying range management principles to develop riparian grazing strategies. A key step towards determining the fit of livestock grazing is an understanding of the formation of riparian systems and their ecological function. We describe riparian structure, function and process to provide linkages between livestock grazing, riparian vegetation health and stream channel dynamics. We summarize the effects of unmanaged livestock grazing on riparian habitats and fish and wildlife populations. The general conclusion is that unmanaged grazing results in overuse and degradation of riparian areas. The literature provides several options for the development of riparian grazing strategies. We provide an overview of strategies suitable for riparian areas in Southern Alberta which should maintain ecological function and sustained use.

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563. Can livestock be used as a tool to enhance wildlife habitat?

Severson, Kieth E.
 Fort Collins, Colo.: Rocky Mountain Forest and Range Experiment Station, US Department of Agriculture, Forest Service; Series: General Technical Report RM-194; 123 p. (1990)
 Notes: 43rd Annual Meeting of the Society for Range Management, Reno, Nev., February 13, 1990
 NAL Call #: aSD11.A42 no.194
 Descriptors: livestock/ *Cervus elaphus*/ *Antilocapra americana*/ *Odocoileus hemionus*/ forage/ grazing/ *Cervus elaphus nelsoni*/ *Centrocercus urophasianus*
 This citation is from AGRICOLA.

564. Cattle grazing and sharp-tailed grouse nesting success.

Kirby, D. R. and Grosz, K. L.
Rangelands 17(4): 124-126. (1995)
 NAL Call #: SF85.A1R32; ISSN: 0190-0528
 Descriptors: Phasianidae/ nesting/ rangelands/ nests/ rotational grazing/ cattle/ grazing/ North Dakota
 This citation is from AGRICOLA.

565. Cattle management to enhance wildlife habitat in south Texas.

Ortega, S. J. Alfonso and Bryant, Fred C.
Wildlife Management Bulletin of the Caesar Kleberg Wildlife Research Institute 6: 1-11. (2005)
 Descriptors: animals and man/ disturbance by man/ commercial activities/ conservation/ conservation measures/ habitat/ land zones/ Nearctic Region/ USA/

North America/ comprehensive zoology: farming and agriculture/ cattle management strategies/ rangeland habitat management applications/ habitat management/ terrestrial habitat/ rangeland habitat/ Texas/ south/ cattle management strategies applications/ rangelands/ Phasianidae/ Galliformes/ Aves/ birds/ chordates/ mammals/ ungulates/ vertebrates

Abstract: For cattle ranching operations in South Texas, wildlife recreation can be a very important source of income for those who choose to diversify. In many cases, income from wildlife such as hunting leases is higher than the income obtained from cattle. Range, cattle, and wildlife management practices need to be adjusted to achieve rangeland sustainability, fulfill the requirements of multiple animal species, and optimize economic output. Under the climatic conditions of South Texas, specific strategies to adjust cattle stocking rates at the first signs of drought are required if valuable range plants and wildlife productivity are to be maintained. We discuss strategies of cattle grazing, including rates of use, grazing systems, stocking rate adjustments based on range condition, calculation of correct stocking rate, and guidelines to adjust livestock numbers based on spring and fall moisture availability. In South Texas, all wildlife species are important to consider in the context of total ranch management. We offer these guidelines to those who are interested in fostering compatible cattle and wildlife operations while protecting the integrity of rangeland, watershed, habitat, and soil resources. We use South Texas as a model to encourage the development of similar strategies and prescriptions for other arid and semiarid regions to help preserve rangeland habitat integrity and optimize biological and economic output.

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566. Cattle trampling of simulated ground nests under short duration and continuous grazing.

Koerth, B. H.; Webb, W. M.; Bryant, F. C.; and Guthery, F. S.

Journal of Range Management 36(3): 385-386. (1983)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1983/363/27koer.pdf>

Descriptors: bird

Abstract: Trampling by cattle on simulated ground nests [of birds] were compared between continuous (CONT) grazing at 8.0 ha/steer and short duration grazing (SDG) at 5.3 ha/steer. Trampling losses were similar under CONT grazing (15%) and SDG (9%) at a nest density of 1/ha. Percentage trampling loss did not increase at higher nest densities under either grazing regime. Nest survival curves indicated a loss rate of 2.21%/wk under CONT grazing and 2.09%/wk under SDG. SDG with cattle will probably not increase trampling loss of ground nests over CONT grazing.

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567. Changes in abundance and diversity of microarthropods associated with fescue prairie grazing regimes.

Clapperton, M. Jill; Kanashiro, Derrick A.; and Behan Pelletier, Valerie M.

Pedobiologia 46(5): 496-511. (2002)

NAL Call #: 56.8 P343; ISSN: 0031-4056

Descriptors: field experiment: experimental method/ livestock grazing: plant community structure influence, soil

health influence, soil quality influence/ orthic black chernozemic: udic haploboroll/ disturbance severity/ fescue prairie grazing regimes/ grassland productivity/ grazing recovery exclosure/ heavy grazing regime/ light grazing regime/ soil bulk density/ soil depth/ soil moisture/ soil temperature

Abstract: Livestock grazing influences plant community structure, soil quality and health, and is likely to also affect the populations and diversity of soil biota. In our study, we determined the abundance and family level diversity of soil mites under very heavy and light grazing regimes, and a very heavy grazing exclosure, and asked whether there were differences in abundance of mite taxa that reflected the severity of disturbance. The field experiment we sampled was established in 1949 on a Rough Fescue Prairie with Orthic Black Chernozemic (Udic Haploboroll) soils near Stavely Alberta Canada. Soil cores were taken from the light (L)(1.2 AUM (animal unit month) ha⁻¹) and very heavy (VH) (4.8 AUM ha⁻¹) grazing regimes and the grazing recovery exclosure (Ex) in the very heavy grazing site in June and October 1999. The results showed that the soil temperature, moisture and bulk density varied between the grazing regimes, soil depth and the sampling times. Collembola were not abundant at any of the sites compared with Acari. Among Acari, prostigmatid mites were significantly more abundant in VH site and all the grazing treatments at both depths and sampling times. Oribatida, and to a lesser extent Mesostigmata, were more closely associated with reduced and undisturbed habitats than the Prostigmata, and there was a positive relationship between increased grassland productivity and the abundance and diversity of soil microarthropods. Our results suggest that Acari are sensitive to soil disturbance.

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568. Changes in breeding wader populations on lowland wet grasslands in England and Wales: Causes and potential solutions.

Wilson, Andy M.; Ausden, Malcolm; and Milsom, Tim P.

Ibis 146(Suppl. 2): 32-40. (2004); ISSN: 0019-1019

Descriptors: breeding wader populaiton/ climate change/ conservation concern/ drainage/ grassland management/ grazing regime/ lowland wet grassland/ nature reserve/ reseedling

Abstract: Populations of waders breeding on lowland wet grassland in England and Wales have declined markedly in recent decades; the loss of once widespread species such as Lapwing *Vanellus vanellus*, Snipe *Gallinago gallinago* and Redshank *Tringa totanus* from many areas is of particular conservation concern. These declines are due to loss of grassland to other land uses, and to significant changes in grassland management. Drainage, reseeding and changes in grazing regimes have all been particularly detrimental to lowland wet grassland in terms of a breeding habitat for waders. Careful management of key sites, many of them managed as nature reserves, has shown that wader declines can be halted or even reversed. Aspects of this management can be applied to larger areas through agri-environment schemes, such as the Environmentally Sensitive Areas (ESA) scheme, Tir Gofal (in Wales) and Countryside Stewardship (in England) but these need be carefully targeted to ensure that the benefits for waders are maximized. In particular, it has been shown that higher tier management options within the ESA scheme (those that enhance the landscape) are more cost-effective than lower

tier options (those that maintain the landscape). The extent and suitability of lowland wet grassland will face further pressure in years to come as a result of climate change, the impacts of which need to be assessed and mitigated against.

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569. Channelization and livestock impacts on salmonid habitat and biomass in western Washington.

Chapman, D. W. and Knudsen, E.

American Fisheries Society: Transactions 109(4): 357-363. (1980)

NAL Call #: 414.9 Am3; ISSN: 0002-8487

Descriptors: channelization/ grazing/ habitat alterations/ management/ research--rivers and streams/ riparian habitat/ fish/ ecology/ flowing waters/ rivers/ streams/ salmonids/ North America/ United States/ Washington/ Salmonidae

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570. Characterization of soil mesofauna in a xero-Mediterranean ecosystem after a 3-year grazing management.

Cancela Da Fonseca, J.; Ghabbour, S. I.; and Hussein, A. K. M.

Ecologia Mediterranea 10(1-2): 121-132. (1984); ISSN: 0153-8756

Descriptors: *Anabasis articulata*/ *Thymelaea hirsuta*/ *Messor* spp./ *Heterogamia syriaca*/ detritivore/ herbivore/ soil fertility/ ascending hierarchic classification/ correspondence analysis/ prescribed burning

Abstract: A plot of 47.6 ha at the Omayed Biosphere Reserve, 83 km west of Alexandria [Egypt] and 10 km south of the seashore, was subjected to varying intensities of grazing pressure [GP] by sheep and goats since 1977, as follows: F1, 50% GP preceded by complete protection from 1974 to 1977; F2, completely protected since 1974; F3, 50% GP; F4, 25% GP; while FO is the outside free-grazing areas with 100% GP. Soil mesofauna were sampled from July 1979-July 1980 under *Anabasis articulata* and *Thymelaea hirsuta*, from windward and leeward sides, making a total of 30 samples for each habitat type. The compositional relation of taxa was investigated by the ascending hierarchic classification (AHC) and correspondence analysis (CA) methods. Results indicate the effect of proximity, but the main controlling factor in ordination is the intensity of GP, so that the faunal assemblages of all F2 habitats are on one side of the factorial axis and the assemblages of the FO habitats on the other, with the F1 and F3 (including F4) occupying intermediate positions. Some detritivores are disfavored by complete protection, while some herbivores (or phytophages, or pests), like the seed harvester ants (*Messor* spp.), are clearly favored. Accumulation of undercomposed organic matter may eventually lead to deterioration in soil fertility as detritivores (e.g., the sand roach *Heterogamia syriaca*) are gradually being eliminated. Prescribed burning may be advisable to overcome some shortcomings of complete and prolonged protection.

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571. Collembola of loess grassland: Effects of grazing and landscape on community composition.

Dombos, Miklos

Soil Biology and Biochemistry 33(15): 2037-2045. (2001)

NAL Call #: S592.7.A1S6; ISSN: 0038-0717

Descriptors: animals and man/ disturbance by man/ commercial activities/ ecology/ habitat/ terrestrial habitat/ land and freshwater zones/ Palaearctic Region/ Europe/ Collembola: farming and agriculture/ sheep grazing pressure/ biomass/ community structure/ effects of grazing and landscape/ grassland/ soil habitat/ loess grassland soil/ Hungary/ Budapest/ mezofold/ effects of sheep grazing pressure and landscape/ loess grassland/ Collembola/ Insecta/ arthropods/ insects/ invertebrates

Abstract: In loess grasslands, grazing by sheep is responsible for changes in the composition of vegetation and controls on secondary successional processes. Grazing has a very complex effect on the soil by altering its physical, chemical and biological properties, which makes it difficult to distinguish the underlying mechanisms. Landscape heterogeneity also influences soil and vegetation processes, having a greater effect on environmental factors than sheep grazing. To compare the relative effects of sheep grazing and one aspect of landscape heterogeneity on the collembolan community, four valleys with two grazing treatments were selected. The sides of each valley had SW and NE aspects resulting in two types of landscape heterogeneity. In a split-plot experimental design, the effects of grazing pressure and aspect were examined in relation to the relative abundance, species richness, evenness and composition of the collembolan community. Grazing pressure had a positive effect on total abundance and a negative effect on species richness of Collembola. Aspect did not significantly influence total abundance but valley sides exposed to SW had a higher species richness. Grazing changed the dominance structure, reduced the evenness and strongly influenced the composition of the collembolan community. Due to grazing xerotherm epedaphic species disappeared resulting a less diverse Collembola fauna. Aspect had a lesser effect on collembolan community composition than grazing. The results suggest that the diversity of springtails maintained by landscape heterogeneity in loess valley sides is reduced by sheep grazing. Further, differences in soil humidity could not explain the changes in structure and abundance of the collembolan community alone, sheep grazing may drive changes in collembolan community through mechanisms of biotic effects.

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572. Comparative effects of sheep and cattle grazing on an anadromous fish stream in central Idaho.

May, B. E. and Somes, W. L.

In: Proceedings of the Annual Conference of the Western Association of Fish and Wildlife Agencies. (Held 19 Jul 1982-22 Jul 1982 at Las Vegas, Nevada.); Vol. 62.; pp. 490-500; 1982.

NAL Call #: SK351.W47

Descriptors: habitat alterations/ grazing/ management/ research--rivers and streams/ riparian habitat/ North America/ United States/ Idaho

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573. A comparison of the Coleoptera, Araneae and Formicidae fauna in a grazed native grassland remnant of Victoria.

Hadden, Susan A. and Westbrooke, Martin E.
 In: The other 99%: The conservation and biodiversity of invertebrates. (Held December 09-12, 1997 at Sydney, NSW, Australia.) Ponder, W. F. and Lunney, Daniel (eds.) Mosman, NSW, Australia: Royal Zoological Society of New South Wales; pp. 101-106; 1999.
Notes: Transactions of the Royal Zoological Society of New South Wales; ISBN 0958608512
NAL Call #: QL362.45 .O83 1999
Descriptors: biomass/ botanical composition/ community structure/ grazing/ invertebrate conservation/ management implications/ native grassland remnants/ species abundance/ book chapter/ meeting paper
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574. Conservative and moderate grazing effects on Chihuahuan desert wildlife sightings.

Joseph, Jamus; Collins, Michelle; Holechek, Jerry; Valdez, Raul; and Steiner, Robert
Western North American Naturalist 63(1): 43-49. (2003)
NAL Call #: QH1 .G7; ISSN: 1527-0904
Descriptors: Antilocapra americana/ Antilocapridae/ Artiodactyla/ Lepus californicus/ Sylvilagus auduboni/ Leporidae/ Lagomorpha/ Bos taurus/ Mammalia/ Zenaida macroura/ Columbiformes/ Callipepla squamata/ Galliformes/ Aves
Abstract: Seasonal wildlife observations were made along transects on 2 pastures conservatively grazed (36% use of perennial grasses) and 2 pastures moderately grazed (47% use of perennial grasses) in south central New Mexico in non-drought (1997) and drought years (1998). Experimental pastures were similar in soils, terrain, spacing of watering points, and brush cover. Average ecological condition score for the conservatively grazed pastures was 60% compared with 64% for moderately grazed pastures. Throughout the study total standing vegetation understory herbage levels were higher ($P < 0.05$) on conservatively grazed than moderately grazed pastures. Total wildlife, total gamebird, and total songbird sightings did not differ ($P > 0.05$) between conservatively and moderately grazed pastures. Black-tailed jackrabbit (*Lepus californicus*) sightings were higher ($P < 0.05$) on moderately grazed than conservatively grazed pastures. Sightings of pronghorn (*Antilocapra americana*), scaled quail (*Callipepla squamata*), mourning doves (*Zenaida macroura*), and desert cottontails (*Sylvilagus auduboni*) showed no differences ($P > 0.05$) between conservatively and moderately grazed pastures. Dry conditions in 1998 depressed total wildlife sightings by $> 50\%$ compared to 1997. Both songbird and gamebird (particularly mourning dove) sightings were severely reduced in the dry compared to wet year ($P < 0.05$). Our results are consistent with Nelson et al. (1997) that livestock grazing at intermediate levels had no effect on most Chihuahuan Desert upland wildlife species, and that drought years severely depress wildlife sightings.
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575. Cover for wildlife after summer grazing on Sandhills rangeland.

Reece, Patrick E.; Volesky, Jerry D.; and Schacht, Walter H.
Journal of Range Management 54(2): 126-131. (2001)
NAL Call #: 60.18 J82; ISSN: 0022-409X
http://jrm.library.arizona.edu/data/2001/542/126-131_reece.pdf
Descriptors: Bos taurus/ Galliformes/ Phasianidae/ tympnanuchus phasianellus/ birds/ ecosystems/ grasslands/ habitat use/ livestock/ nests/ nesting/ rangeland/ wildlife/ habitat relationships/ wildlife/ livestock relationships/ cattle/ sharp-tailed grouse/ foods/ feeding/ interspecies relations/ cover/ Aves/ USA/ Nebraska
Abstract: Livestock production and wildlife habitat objectives become antagonistic on grasslands when the architecture of standing herbage needed for key wildlife species limits the amount of forage that can be used by livestock. However, quantitative information needed to achieve cover objectives for wildlife is not available for summer-grazed grasslands. Three replicates of seven grazing treatments were applied to the same 1.0-ha pastures for three years. Treatments included ungrazed control, and grazing at 16, 32, or 48 animal unit days (AUD) ha⁻¹ for five to seven days during mid-June or mid-July. Cover was estimated after killing frost in September by measuring the average height below which complete visual obstruction occurred. Cumulative grazing pressure (AUD Mg⁻¹) was used to describe grazing effects because of measurable differences in herbage among pastures and dates. Grazing in June reduced the average height of autumn cover at a constant rate from 11.0 to 7.0 cm ($R^2 = 0.34$) as cumulative grazing pressure increased from 16 to 90 AUD Mg⁻¹. In contrast, declines in cover after grazing in July were about 2.6 times greater for cumulative grazing pressures up to 40 AUD Mg⁻¹ ($R^2 = 0.62$), indicating a measurable decline in plant growth and an increasing dependence of autumn cover on the remaining herbage when grazing ended. Relatively low predictability of autumn cover after June compared to July grazing was offset by more plant growth during the balance of the growing season. Frequency of low-cover patches (< 5.0 cm) within pastures was highly correlated ($R^2 = 0.94$) with mean estimates of autumn cover. Consequently, the quality of cover near potential nesting sites also declined as the average height of cover declined, regardless of grazing date. The interdependence of low-cover patches and mean visual obstruction indicates that either variable could be the primary criterion for nest site selection up to 12 cm in visual obstruction.
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576. Densities of brown-headed cowbirds in riparian and rangeland areas, with and without cattle present, along the Middle Rio Grande, New Mexico.

Tisdale Hein, Rinda E. and Knight, Richard L.
Studies in Avian Biology(26): 152-156. (2003)
NAL Call #: QL671.S8; ISSN: 0197-9922
Descriptors: brood parasitism/ cowbird management/ grazing/ habitat suitability/ livestock management/ rangeland habitat/ riparian habitat/ species density/ species distribution
Abstract: We compared the densities of total Brown-headed Cowbirds (*Molothrus ater*), female cow-birds, and potential hosts during the morning hours on grazed and

ungrazed riparian sites along the Rio Grande, New Mexico, in an attempt to evaluate the influence of the physical presence of cattle on these variables. In addition, we compared the densities of all cowbirds, female cowbirds, and potential hosts between morning and afternoon hours at riparian and rangeland sites, both with and without cattle present. We found no significant differences in total cowbird, female cowbird, or potential host densities during morning hours between riparian sites with and without cattle, indicating that the physical presence of cattle alone did not influence cowbird abundance or potential host abundance at our study sites. Cowbirds were absent from all of our riparian sites during the afternoon hours, indicating that habitat type and/or alternative feeding/congregation opportunities may have been more important in influencing cowbird densities during afternoon feeding periods than was the mere presence of cattle. Cowbird numbers in rangeland sites were low during both morning and afternoon periods, reflecting the low suitability of rangeland as cowbird breeding, and possibly feeding, habitat regardless of the presence of cattle. The lack of afternoon cowbird detections in both riparian and rangeland sites suggests that alternative feeding resources and/or congregation areas existed within the cowbird's commuting range. These findings have implications for current livestock management efforts to reduce cowbird parasitism of imperiled songbird species.
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577. Density and success of bird nests relative to grazing on western Montana grasslands.

Fondell, Thomas F. and Ball, I. J.
Biological Conservation 117(2): 203. (2004)
NAL Call #: S900.B5; ISSN: 0006-3207
Descriptors: brown-headed cowbird/ grassland/ grazing/ ground-nesting birds/ nest density/ prairie/ agriculture/ habitat/ habitat change/ change in vegetation/ brood/ egg/ fertility/ recruitment/ reproduction/ density
Abstract: Grassland birds are declining at a faster rate than any other group of North American bird species. Livestock grazing is the primary economic use of grasslands in the western United States, but the effects of this use on distribution and productivity of grassland birds are unclear. We examined nest density and success of ground-nesting birds on grazed and ungrazed grasslands in western Montana. In comparison to grazed plots, ungrazed plots had reduced forb cover, increased litter cover, increased litter depth, and increased visual obstruction readings (VOR) of vegetation. Nest density among 10 of 11 common bird species was most strongly correlated with VOR of plots, and greatest nest density for each species occurred where mean VOR of the plot was similar to mean VOR at nests. Additionally, all bird species were relatively consistent in their choice of VOR at nests despite substantial differences in VOR among plots. We suggest that birds selected plots based in part on availability of suitable nest sites and that variation in nest density relative to grazing reflected the effect of grazing on availability of nest sites. Nest success was similar between grazed plots and ungrazed plots for two species but was lower for nests on grazed plots than on ungrazed plots for two other species because of increased rates of predation, trampling, or parasitism by brown-headed cowbirds (*Molothrus ater*). Other species nested almost exclusively on ungrazed plots (six species) or grazed plots (one species), precluding

evaluation of the effects of grazing on nest success. We demonstrate that each species in a diverse suite of ground-nesting birds preferentially used certain habitats for nesting and that grazing altered availability of preferred nesting habitats through changes in vegetation structure and plant species composition. We also show that grazing directly or indirectly predisposed some bird species to increased nesting mortality. (Copyright 2004 Elsevier)
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578. Desert grassland canopy arthropod species richness: Temporal patterns and effects of intense, short-duration livestock grazing.

Forbes, G. S.; Van Zee, J. W.; Smith, W.; and Whitford, W. G.
Journal of Arid Environments 60(4): 627-646. (2005)
NAL Call #: QH541.5.D4J6; ISSN: 0140-1963
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579. Desert mule deer use of grazed and ungrazed habitats.

Ragotzkie, K. E. and Bailey, J. A.
Journal of Range Management 44(5): 487-490. (1991)
NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1991/445/15rago.pdf>
Descriptors: animals and man/ disturbance by man/ commercial activities/ nutrition/ feeding behaviour/ behaviour/ ecology/ habitat/ terrestrial habitat/ land and freshwater zones/ Nearctic Region/ North America/ USA/ *Odocoileus hemionus crooki* (Cervidae): farming and agriculture/ cattle grazing effects on habitat use within home ranges/ foraging/ home range/ habitat utilization/ grass/ shrubland habitats/ cattle grazing relationship/ grassland/ scrub/ grass/ shrubland/ Arizona/ Santa Rita Experimental Range/ habitat use in relation to cattle grazing/ grass/ shrublands/ Cervidae/ Artiodactyla/ Mammalia/ chordates/ mammals/ vertebrates
© The Thomson Corporation

580. Development of fall cattle grazing prescriptions to improve deer and elk forage.

Short, Jeffrey J. and Knight, James E.
Intermountain Journal of Sciences 5(1-4): 72. (1999); ISSN: 1081-3519
Abstract: [unedited] Cattle (*Bos taurus*) and wild ungulates have long been viewed as competitors. In the future the best method of preserving wildlife and cattle will be to manage them cooperatively. The objective of this project was to examine the use of fall cattle grazing to improve wildlife forage. We looked at the effects of four fall cattle grazing levels on elk (*Cervus elaphus*), mule deer (*Odocoileus hemionus*) and white-tailed deer (*Odocoileus virginianus*) forage. The hypothesis of this study is that fall cattle grazing will improve the quality of elk and deer forage the following spring and summer. The effects of fall foraging on wildlife forage were examined on the Blackfoot Clearwater Wildlife Management area in west central Montana. A randomized complete block design with five replications was used. Cattle were grazed in enclosures during the fall of 1997 and 1998. Grazing levels were zero percent removal (control) 50% removal, 70% removal, and 90% removal. During spring and summer we measured plant species composition, plant diversity, dead plant material, green forb biomass, and green grass biomass to evaluate quality of elk and deer forage. Preliminary data

from the first year of this two-year study suggests significant positive differences in wildlife forage due to cattle grazing intensity. Information generated will be useful in making management decisions on ranges that are important spring and summer wildlife habitat.
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581. Differential indirect effects of excluding livestock and rabbits from chalk heath on the associated leafhopper (Hemiptera: Auchenorrhyncha) fauna.

Barham, David Fisher and Stewart, Alan J. A
Journal of Insect Conservation 9(4): 351-361. (2005)
NAL Call #: QL362.J68; ISSN: 1366-638X
Descriptors: biogeography/ chalk heath vegetation/ grassland invertebrate assemblage

Abstract: Preliminary results are presented of sampling the leafhopper assemblages on a field experiment designed to examine the differential effects of rabbits and livestock (mainly sheep) on the vegetation of chalk heath in southern England. Experimental plots that excluded livestock either allowed entry by rabbits or excluded them. Results were compared with those from plots grazed by both livestock and rabbits. After 7 years, exclusion of grazing herbivores had resulted in predictable increases in vegetation height, but no major changes were detected in the species composition of the vegetation. As expected, ungrazed plots had higher species richness and greater abundances of several individual leafhopper species. However, plots grazed only by rabbits had a leafhopper assemblage that was distinct from either ungrazed or mixed grazing plots. It is suggested that rabbit grazing may have subtle effects on grassland invertebrate assemblages that are not necessarily predictable from an examination of the species composition of the vegetation. Chalk heath vegetation contains an unusual mixture of calcicole and calcifuge plant species, but the leafhopper assemblage included a restricted number of calcareous grassland specialist species and only one species strongly associated with acidic grasslands; most leafhoppers recorded were generalist grassland species.

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582. Direct impacts of cattle grazing on grassland nesting birds.

Churchwell, Roy; Davis, Craig A.; Fuhlendorf, Sam D.; and Engle, David M.

Bulletin of the Oklahoma Ornithological Society 38(4): 25-32. (2005); ISSN: 0474-0750

Descriptors: animals and man/ disturbance by man/ commercial activities/ reproduction/ reproductive behaviour/ ecology/ population dynamics/ habitat/ terrestrial habitat/ land zones/ nearctic region/ USA/ North America/ Aves: farming and agriculture/ cattle grazing/ direct impacts on nesting success/ breeding site/ nesting site/ reproductive productivity/ mortality/ trampling by cattle/ nesting on grassland/ grassland/ Oklahoma/ Osage County/ tallgrass prairie preserve/ nesting success/ direct impacts of cattle grazing/ Aves/ birds/ chordates/ vertebrates

Abstract: We used nest success data from a 2003 field season to examine the direct impacts of cattle grazing on grassland nesting birds. We found that 7% of nest loss was due directly to cattle through trampling of nests (6%) and abandonment (1%). We conclude that changes in grazing

management could mitigate the degree to which cattle directly impact nesting success of grassland birds, and discuss these suggestions in light of our results.
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583. Distribution of elk and cattle in a rest-rotation grazing system.

Knowles, C. J. and Campbell, R. B.
In: Proceedings of the Wildlife-Livestock Relationships Symposium. (Held 20 Apr 1981-22 Apr 1981 at Coeur D'alene, Idaho.) Peek, James M. and Dalke, P. D. (eds.) Moscow, Idaho: Forest, Wildlife & Range Experiment Station, University of Idaho; pp. 47-60; 1982.
NAL Call #: SF84.84.W5 1981

Descriptors: Montana

This citation is from AGRICOLA.

584. Diversity and guild structure of insect assemblages under grazing and exclusion regimes in a montane grassland from central Argentina.

Cagnolo, L.; Molina, S. I.; and Valladares, G. R.
Biodiversity and Conservation 11(3): 407-420. (2002)
NAL Call #: QH75.A1B562; ISSN: 0960-3115

Descriptors: assemblage diversity/ biomass/ disturbance regimes/ exclusion regime/ grazing regime/ guild structure/ montane grassland/ species abundance/ species diversity/ species richness

Abstract: The effects of grazing disturbance on insect communities were examined at a montane grassland in Central Argentina, by comparing two grazed sites differing in cattle load (heavy and continuous or moderate and discontinuous) and two cattle exclusions differing in age (7 and 19 years). Two aspects of insect diversity (taxonomic and guild structure) and two levels of taxonomic resolution (family and species) were considered. Four monthly samples were taken with a suction sampler in two 1 m² areas at each site. Collected specimens were counted, identified to family (all insects) or species (Coleoptera) level, and allocated to trophic guilds. Abundance, richness, diversity and biomass of the insect assemblages had minimum values in the most intensely grazed habitat, which also differed from the other sites in terms of insect families and Coleoptera species composition. It also showed a distinct guild structure, with fewer secondary consumers, and chewers replacing suckers as the most abundant herbivore group. According to these observations, intense grazing in montane grasslands in Central Argentina could result in taxonomic and guild changes in the associated insect communities, but such effects would not be noticeable with less intensive use. Moreover, using family taxonomic level could be as or even more appropriate than species level in order to characterize insect communities in the studied habitats under varying disturbance regimes.

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585. Does extensive grazing benefit butterflies in coastal dunes?

Wallisdevries, Michiel F. and Raemakers, Ivo
Restoration Ecology 9(2): 179-188. (2001)
NAL Call #: QH541.15.R45R515; ISSN: 1061-2971
Descriptors: biodiversity/ coastal dunes/ grazing/ habitat quality/ management practices

Abstract: Grazing at low stocking rates has become a common management practice in nature restoration projects in the Netherlands. However, detailed knowledge

of grazing impact is often poor, in particular for invertebrates. This study addressed the impact of extensive grazing on butterflies. Butterflies are critical indicators of habitat quality for many plant and animal species. We compared monitoring data from 1992 to 1996 for calcareous coastal dune areas in the Netherlands with different management: 11 grazed areas, 7 ungrazed areas and 4 areas managed by annual cutting. Grazing typically concerned year-round grazing by cattle and/or ponies, at low stocking rates (0.05-0.26 head ha⁻¹ yr⁻¹). Butterfly abundance was related to species composition and structure of the vegetation. Changes in butterfly abundance were positive in grazed and ungrazed areas compared to cut areas. Species richness was not affected by management, but individual species differed in their response. Species from open grassland benefited most from grazing, particularly *Issoria lathonia* (Queen of Spain Fritillary) and *Lycaena phlaeas* (Small Copper). No clear negative effects of grazing were observed, but species occurrence was not always positively related to the environmental characteristics associated with grazing. In the long run, even lower stocking rates might prove more beneficial to the butterfly community as a whole. Four of the more frequently observed species, *I. lathonia*, *Hipparchia semele* (Grayling), *Pyrgus malvae* (Grizzled Skipper) and *Aricia agestis* (Brown Argus), are listed as threatened to susceptible in the Netherlands. All were apparently favored by grazing. It is concluded that extensive grazing has good potential to enhance butterfly diversity in restoration projects.

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586. Does grazing influence bee diversity?

Mayer, Carolin

In: African biodiversity: Molecules, organisms, ecosystems/ Huber, B. A.; Sinclair, B. J.; and Lampe, K. H. New York: Springer, 2005; pp. 173-179.

Notes: Meeting Information: 5th International Symposium on Tropical Biology, Bonn, GERMANY; 200405; ISBN 0387243151

NAL Call #: QH194 .I497 2004

Descriptors: species diversity/ species abundance/ livestock grazing

Abstract: In Namaqualand, the north-western part of the Succulent Karoo of South Africa, a study was conducted to investigate the influence of livestock grazing on the abundance and diversity of bees (superfamily Apoidea). Bees were collected on adjacent rangeland sites which are characterized by a significant fence line contrast, one site showing effects of heavy grazing. Application of different sampling methods (Malaise and colour plate trapping) reveal different results, indicating that methodological influences are significant. Colour traps, in particular, may provide poor estimates of bee abundance due to their apparent sensitivity to competition from surrounding flowers for insect attraction.

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587. Duck nesting on rotational and continuous grazed pastures in North Dakota.

Murphy, Robert K.; Schindler, Darrell J.; and Crawford, Richard D.

Prairie Naturalist 36(2): 83-94. (2004)

NAL Call #: QH540 .P7; ISSN: 0091-0376

Descriptors: visual obstruction reading: VOR, applied and

field techniques/ Prairie Pothole Joint Venture [PPJV]/ continuous grazed pastures/ nest density/ nest success/ nesting habitat/ prairie habitat conservation/ rotational cattle grazing/ rotational grazed pastures

Abstract: To improve the economic viability of grazed prairie and thus conserve it as wildlife habitat, the Prairie Pothole Joint Venture (PPJV) cost-shares establishment of rotational cattle grazing on privately owned, native rangeland. During 1996 and 1997 we evaluated duck nest density, nest success, and nesting habitat on six PPJV rotational grazed pastures on the Missouri Coteau landform in central and northwestern North Dakota. Each rotational pasture was paired with a traditional, continuous grazed pasture for comparison. We located 444 nests of eight duck species. We detected no differences ($P > 0.1$) between rotational and continuous grazed pastures in apparent nest density of ducks ($\bar{x} \pm SD$ nests/ha, all species combined, 1996: 0.26 \pm 0.09 and 0.31 \pm 0.12; 1997: 0.38 \pm 0.14 and 0.25 \pm 0.12), although a grazing type \times year interaction suggested rotational pastures might be more attractive to ducks in a dry spring (1997). No differences in duck nest success were detected between rotational and continuous pastures (% Mayfield estimate, 1996: 27.2 \pm 12.6 and 15.5 \pm 11.0; 1997: 21.6 \pm 10.0 and 16.7 \pm 13.7), but varied occurrence of canid species could have obscured differences. We detected no differences in vegetation height-density indices as measured by visual obstruction readings (VORs) between rotational and continuous pastures in 1996. VORs were greater on rotational pastures, however, in the relatively dry spring of 1997. Our findings suggested that rotational grazing systems can serve as a prairie conservation tool on private rangelands without altering habitat values for nesting ducks, and in relatively dry springs might provide more attractive nesting cover for ducks than prairie under continuous grazing.

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588. Economic tradeoffs between livestock grazing and wildlife habitat: A ranch-level analysis.

Bernardo, Daniel J.; Boudreau, Gregory W.; and Bidwell, Terrance C.

Wildlife Society Bulletin 22(3): 393-402. (1994)

NAL Call #: SK357.A1W5; ISSN: 0091-7648

Descriptors: habitat/ hunting lease/ land resources/ modeling framework/ public grazing lands/ vegetation management

Abstract: Multiple-use management of land resources for domestic livestock and wildlife is becoming an increasingly important issue on private and public lands. A modeling framework is presented to develop production plans which maximize returns from livestock grazing and meet deer and quail habitat constraints on private rangelands in Oklahoma. In the initial solution of the model, net returns are maximized from cattle grazing without concern for wildlife habitat. An intensive vegetation management program involving herbicides and prescribed burning is used to reduce forage diversity (forbs, legumes, and woody shrubs) and maximize grass production for cattle grazing. Low to moderate deer and quail habitat ratings are associated with this plan. Optimal plans to achieve incremental increases in target quail and deer habitat ratings include strip application of herbicide, fall burning, and some mechanical removal of hardwoods to produce a mosaic of small open prairie areas and wooded areas.

Brush piles and disking of small portions of the prairie areas are used to improve food diversity and protective cover. Only small reductions in income from livestock production are required to attain initial improvements in quail and deer habitat ratings; however, further improvements translate to more significant income reduction. While habitat appraisal models provide means of quantifying habitat considerations in economic optimization models, several limitations still exist. First, additional research is needed to verify the positive relationship between wildlife habitat and population and to determine the relationship between hunting lease values and habitat quality. Application of the model requires rather meticulous detail in specifying the effects of various management practices on forage production and wildlife habitat. These data are not available for all areas; however, such information is required to develop efficient multiple-use management strategies (Matulich and Adams 1987). Also, the analysis does not consider the influence of dynamics or risk on decision making. Manipulation of vegetation is a dynamic process that may occur over several years and is significantly influenced by climatic events. Risk caused by price volatility and other sources of uncertainty may also influence ranch plans. Improvements to the model should focus on these considerations. While the findings are somewhat site specific, the study does present a useful and transferable framework for simultaneously analyzing livestock management and wildlife habitat decisions. The model can be specified to accommodate alternative livestock enterprises, vegetation management treatments, and habitat improvement practices for which the required technical data are available. The model may be expanded to incorporate additional wildlife species and is adaptable to accommodate alternative wildlife habitat evaluation systems. While probably more applicable to decision making on private lands, this model could also be applied to public grazing lands.

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589. Effect of cattle grazing on the density and species of grasshoppers (Orthoptera: Acrididae) of the Central Plains Experimental Range, Colorado: A reassessment after two decades.

Welch, J. L.; Redak, R.; and Kondratieff, B. C.
Journal of the Kansas Entomological Society 64(3): 337-343. (1991)
 NAL Call #: 420 K13; ISSN: 0022-8567
 Descriptors: animals and man/ disturbance by man/ commercial activities/ ecology/ habitat/ terrestrial habitat/ land and freshwater zones/ Nearctic Region/ North America/ USA/ Acrididae (Saltatoria): farming and agriculture/ cattle grazing effects on community structure/ community structure/ cattle grazing effects/ grassland/ Colorado/ Nunn/ grassland community structure/ effect of cattle grazing/ long term changes/ Saltatoria/ Orthoptera/ Insecta/ arthropods/ insects/ invertebrates

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590. Effect of cattle stocking rate on the nutritional ecology of white-tailed deer in managed forests of southeastern Oklahoma and southwestern Arkansas.

Jenks, Jonathan Oklahoma State University, 1992.
 Descriptors: *Odocoileus virginianus*/ livestock/ food supply/ interspecific relations/ feeding behavior/ nutrition/ grazing/

habitat alterations/ wildlife/ livestock relationships/ North America/ United States/ Arkansas: Pike County/ Arkansas: Howard County/ Oklahoma: McCurtain County
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591. Effect of grazing by sheep on the quantity and quality of forage available to big game in Oregon's Coast Range.

Rhodes, B. D. and Sharrow, S. H.
Journal of Range Management 43(3): 235-237. (1990)
 NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1990/433/13rhod.pdf>
 Descriptors: sheep/ digestibility/ *Odocoileus*/ *Cervus elaphus*/ forest plantations/ *Pseudotsuga menziesii*/ grazing/ *Odocoileus hemionus*/ Oregon
 This citation is from AGRICOLA.

592. The effect of grazing on the abundance and diversity of birds in scrub vegetation at Nathdwara Rajasthan.

Gaston, A. J.
Journal of the Bombay Natural History Society 83(1): 214-217. (1986)
 NAL Call #: 513 B63; ISSN: 0006-6982
 Descriptors: pasture/ species richness
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593. The effect of grazing on the land birds of a western Montana riparian habitat.

Mosconi, S. L. and Hutto, R. L.
 In: Proceedings of the Wildlife-Livestock Relationships Symposium. (Held 20 Apr 1981-22 Apr 1981 at Coeur D'alene, Idaho.) Peek, James M. and Dalke, P. D. (eds.) Moscow, Idaho: Forest, Wildlife & Range Experiment Station, University of Idaho; pp. 221-233; 1982.
 NAL Call #: SF84.84.W5 1981
 This citation is from AGRICOLA.

594. The effect of heather fragmentation and mixed grazing on the diet of sheep *Ovis aries* and red deer *Cervus elaphus*.

Cuartas, Paloma; Gordon, Iain J.; Hester, Alison J.; Perez Barberia, F. Javier; and Hulbert, Ian A. R.
Acta Theriologica 45(3): 309-320. (2000)
 NAL Call #: 410 AC88; ISSN: 0001-7051
 Descriptors: fecal cuticle analysis: analytical method/ diet composition/ heather moorland: habitat/ mixed grazing/ mosaic pattern/ vegetation fragmentation
 Abstract: The effects of vegetation fragmentation and mixed grazing (ie mono- or multi-species animal group) on the diet composition of sheep and red deer grazing mosaics of grassland and heather moorland was studied, using faecal cuticle analysis, in two experimental sites in Scotland during the summer of 1992 and 1993. On Site A, the influence of grassland fragmentation on diet composition was estimated for sheep and deer grazing together in plots where the grassland (20% of the area) was artificially distributed as one large, four medium or twelve small patches within a homogeneous moorland matrix (80% of the area). On Site B, differences in diet composition between animals grazing within mono-species (sheep or deer) and multi-species groups (sheep and deer together) were examined for each animal species. In this site all plots used contained a similar natural mosaic pattern of grass and heather (ie similar mixtures of patch sizes, with about

20% grass and 80% heather cover). On Site A, the proportions of grass in the diet of sheep (73%) and deer (27%) were found to be similar across all levels of grass fragmentation. A significant interaction was found between the pattern of fragmentation and the three periods in which the experiment was carried out. On Site B in 1992, sheep had more grass in their diet than did deer (52% vs 46%), and the diets of both sheep and deer responded in the same fashion when the species were grazing in mono- or multi-species groups. The consumption of grass decreased in both species throughout the period studied. Deer showed no change in the proportion of grass in their diet in the presence or absence of sheep in 1992 (deer 48% vs sheep 50%). But on Site B in 1993, the diet of sheep contained a significantly higher proportion of grasses when they were grazing with red deer (52%) than when they were grazing alone (38%). These results suggest that on grassland/heather moorland mosaics sheep may suffer intraspecies competition to a greater extent than do red deer, particularly where grass is in relatively low supply.
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595. The effect of livestock grazing upon abundance of the lizard, *Sceloporus scalaris*, in southeastern Arizona.

Bock, Carl E.; Smith, Hobart M.; and Bock, Jane H. *Journal of Herpetology* 24(4): 445-446. (1990)
NAL Call #: QL640.J6; ISSN: 0022-1511
Descriptors: *Sceloporus scalaris*/ amphibians/ reptiles/ behavior/ grazing/ habitat alterations/ habitat use/ predator/ prey relationships/ predators
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596. Effect of sheep grazing and fire on sage grouse populations in southeastern Idaho.

Pedersen, E. K.; Connelly, J. W.; Hendrickson, J. R.; and Grant, W. E. *Ecological Modelling* 165(1): 23-47. (2003)
NAL Call #: QH541.15.M3E25; ISSN: 0304-3800
Descriptors: difference equation: mathematical and computer techniques/ discrete time stochastic compartment model: mathematical and computer techniques/ simulation model: mathematical and computer techniques/ biomass/ breeding habitats/ canopy growth/ community ecology/ fire frequency/ grazing effects/ habitat mosaics/ historical environmental conditions/ long term trends/ population dynamics/ sagebrush vegetation/ seasonal dynamics
Abstract: This paper describes the development, evaluation, and use of a model that simulates the effect of grazing and fire on temporal and spatial aspects of sagebrush community vegetation and sage grouse population dynamics. The model is represented mathematically as a discrete-time, stochastic compartment model based on difference equations with a time interval of 1 week. In the model, sheep graze through sage grouse breeding habitat during spring and fall, and different portions of the area can burn at different frequencies, creating a habitat mosaic of burned and unburned areas. The model was evaluated by examining predictions of (1) growth of sagebrush canopy cover after fire, (2) seasonal dynamics of grass and forb biomass under historical environmental conditions, and (3) sage grouse population dynamics associated with selected sagebrush canopy covers. Simulated changes in sagebrush canopy cover following fire correspond well with qualitative reports of

long-term trends, simulated seasonal dynamics of herbaceous biomass correspond well with field data, and simulated responses of sage grouse population size and age structure to changing sagebrush canopy cover correspond well to qualitative field observations. Simulation results suggest that large fires occurring at high frequencies may lead to the extinction of sage grouse populations, whereas fires occurring at low frequencies may benefit sage grouse if burned areas are small and sheep grazing is absent. Sheep grazing may contribute to sage grouse population decline, but is unlikely to cause extinction under fire regimes that are favorable to sage grouse.
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597. The effect of two years of livestock grazing enclosure upon abundance in a lizard community in Baja California Sur, Mexico.

Romero-Schmidt, Heidi; Ortega-Rubio, Alfredo; Arguelles-Mendez, Cerafina; Coria-Benet, Rocio; and Solis-Marin, Francisco
Chicago Herpetological Society Bulletin 29(1): 245-248. (1994); ISSN: 0009-3564
Descriptors: North America/ Mexico: Baja California Sur
© NISC

598. Effect of water and nitrogen, and grazing on nematodes in a shortgrass prairie.

Smolik, J. D. and Dodd, J. L. *Journal of Range Management* 36(6): 744-748. (1983)
NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1983/366/17smol.pdf>
This citation is from AGRICOLA.

599. Effects of a savory grazing method on big game: A final report.

Brown, R. L. Arizona Game and Fish Dept., 1990. 58 p. Arizona Game and Fish Department Wildlife Bulletin.
Notes: ISSN: 0518-5467
Descriptors: cattle/ deer, mule/ elk/ feeding method/ fences/ food habits/ food supply/ game, big/ grazing/ history/ hunting/ movements/ population density/ pronghorn/ wildlife-habitat relationships/ wildlife-livestock relationships
Abstract: Elk, mule deer, and pronghorn antelope use levels were monitored within a radial design holistic resource management cell, and an adjacent set of rest-rotation pastures that were grazed by cattle during the summer months. A discussion of requirements for effective wildlife goals is included.
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600. Effects of an 11-year livestock enclosure on rodent and ant numbers in the Chihuahuan Desert, southeastern Arizona.

Heske, E. J. and Campbell, M. *Southwestern Naturalist* 36(1): 89-93. (1991)
NAL Call #: 409.6 SO8; ISSN: 0038-4909
Descriptors: small mammals/ livestock/ pastures/ ecology/ trampling/ grazing/ interactions
Abstract: Rodents were censused, ant colonies counted, and vegetative structure measured along 11 pairs of transects at a Chihuahua Desert study site in southeastern Arizona. One member of each pair of transects was inside and one was outside of a 20-ha livestock enclosure that had been in place for 11 years. Vegetative structure did not

differ between transects exposed to or protected from cattle grazing, but significantly more rodents were captured inside the enclosure. However, only a subset of the rodent species present, primarily *Dipodomys*, were negatively affected by the presence of cattle. Ant colonies were equally abundant on transects inside and outside of the enclosures, indicating that ants are more resistant than rodents to trampling and potential competition for food with cattle.

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601. The effects of burning and grazing on habitat use by whooping cranes and sandhill cranes on the Aransas National Wildlife Refuge.

Hunt, Howard Emery Texas A&M University, 1987.

Descriptors: *Grus canadensis/ Grus americana/ habitat disturbance [fire]/ livestock/ Texas*

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602. Effects of cattle grazing on ecology and habitat of Columbia Basin pygmy rabbits (*Brachylagus idahoensis*).

Thines, Nicole J. Siegel; Shipley, Lisa A.; and Saylor, Rodney D.

Biological Conservation 119(4): 525-534. (2004)

NAL Call #: S900.B5; *ISSN:* 0006-3207

Descriptors: Columbia Basin/ commercial enterprises/ conservation/ disturbances/ ecosystems/ endangered/ threatened species/ farming and agriculture/ grasslands/ habitat use/ land zones/ nearctic region/ North America/ shrub grasslands/ shrub-steppe habitat/ USA/ Washington/ wildlife management/ wildlife/ human relationships/ Columbia Basin pygmy rabbit

Abstract: Dramatic declines in the endangered Columbia Basin pygmy rabbit, a genetically unique population of small, burrowing rabbits in Northwestern United States, are likely the combined results of habitat degradation and fragmentation, disease, and predation. A critical component of pygmy rabbit habitat includes big sagebrush (*Artemisia tridentata*), which constitutes 82-99% of their winter diet and 10-50% of their summer diet. Sagebrush also forms the bulk of hiding cover around burrow sites. Across the range of pygmy rabbits, sagebrush habitat is grazed extensively by cattle. However, grazing has unknown effects on pygmy rabbits inhabiting the remaining, fragmented shrub-steppe habitat. We evaluated the effects of four grazing treatments on the distribution of pygmy rabbit burrows, diets of pygmy rabbits, and quality and quantity of vegetation at Sagebrush Flat in central Washington. Ungrazed areas contained significantly more burrows per unit area than did grazed areas. Vegetation composition and structure differed little among treatments in early summer before annual grazing by cattle. However, cattle grazing in late summer through winter removed about 50% of the grass cover, and reduced the nutritional quality (e.g., increased fiber and decreased protein) of the remaining grass. Although pygmy rabbits ate <2% grasses in winter, grasses and forbs comprised 53% of late summer diets. Because these endangered rabbits avoided grazed areas, removing cattle grazing from key habitat locations may benefit efforts to restore this rabbit in Washington. Copyright 2004 Elsevier Ltd. All rights reserved.

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603. Effects of cattle grazing on mule deer diet and area selection.

Austin, Dennis D. and Urness, Philip J.

Journal of Range Management 39(1): 18-21. (1986)

NAL Call #: 60.18 J82; *ISSN:* 0022-409X

<http://jrm.library.arizona.edu/data/1986/391/5aust.pdf>

Descriptors: *Odocoileus hemionus/ grazing/ habitat alterations/ habitat use/ wildlife/ livestock relationships/ deer, mule/ enclosures and exclosures/ food habits/ grasses/ habitat/ production/ proteins/ utilization/ vegetation/ wildlife-livestock relationships/ North America/ United States/ Utah/ western region/ Sheeprock Mountains*
Abstract: Split enclosures, half grazed and half ungrazed by cattle in summer, were compared for mule deer habitat use in late summer using tame deer. Diet composition, dietary nutrition, and area selected for grazing were used as criteria.

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604. The effects of cattle grazing on optimal foraging in mule deer (*Odocoileus hemionus*).

Kie, John G.

Forest Ecology and Management 88(1-2): 131-138. (1996)

NAL Call #: SD1.F73; *ISSN:* 0378-1127

Descriptors: animal husbandry/ climate/ competition/ ecology/ foraging/ grazing/ stocking level

Abstract: A previous study of different cattle stocking rates on activity patterns of female mule deer (*Odocoileus hemionus*) on summer range in California found that deer spent more time feeding and less time resting with increased cattle stocking rates (Kie et al., 1991). During a year of normal precipitation, deer spent more time feeding per day in late summer than in early summer in pastures grazed by cattle. In a drier year, deer spent less time feeding per day in late summer in grazed pastures. Deer increased their time spent feeding by including more feeding bouts each day, not by increasing the length of each foraging bout. Deer were also reluctant to forage at night, particularly when there was a full moon. Based on these results, we hypothesized that female mule deer act as time-minimizers when forage conditions are good, but shift to a energy-maximizing strategy when forage conditions are poor (Kie et al., 1991). Preliminary results from subsequent research on black-tailed deer (*O. h. columbianus*) on Mediterranean-climate, foothill winter range found that deer acted as energy-maximizers and spent less time feeding with increasing cattle stocking rates during the fall and early winter when herbaceous forage was in limited supply. After mid-January when herbaceous plants began growing rapidly there appeared to be no competition for forage between deer and cattle, and increased cattle stocking rates had no effect on the time spent foraging by deer. These results were consistent with the original hypothesis.

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605. Effects of cattle grazing on passerine birds nesting in riparian habitat.

Taylor, D. M.

Journal of Range Management 39(3): 254-258. (1986)

NAL Call #: 60.18 J82; *ISSN:* 0022-409X

<http://jrm.library.arizona.edu/data/1986/393/16tayl.pdf>

Descriptors: grazing/ cattle/ birds/ habitats/ population density/ *Salix/ riparian buffers/ Oregon*

This citation is from AGRICOLA.

606. Effects of cattle grazing on salt desert rodent communities.

Jones, Allison L. and Longland, William S.
American Midland Naturalist 141(1): 1-11. (1999)
NAL Call #: 410 M58; ISSN: 0003-0031
Descriptors: live trapping: monitoring method/ grazing/ home range size/ microhabitat use/ relative abundance/ salt desert shrub community
Abstract: Cattle grazing has been shown to alter various features of desert communities that may impact microhabitats required by various species of desert rodents, with unknown implications for desert rodent communities. We conducted a series of studies at heavily and lightly grazed sites to investigate effects of cattle grazing on desert rodent relative abundances, home range sizes and microhabitat use in salt desert shrub communities of the western Great Basin Desert. Monitoring of rodent populations with repeated live trapping showed that different levels of grazing were associated with differences in relative abundances of some species of rodents. Specifically, *Dipodomys merriami* was significantly more abundant in heavily grazed areas, and *Perognathus longimembris* was significantly more abundant in lightly grazed areas. Our studies showed that cattle, by preferentially feeding on certain plants, can create conditions that are more suitable for some species of rodents, while reducing important microhabitat for other species.
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607. Effects of cattle grazing systems on shrub-grassland birds in south Texas.

Swanson, Douglas Wayne Texas A&M University, 1988.
Descriptors: behavior/ birds/ communities/ ecosystems/ habitat alterations/ grazing/ habitat use/ shrub grasslands/ North America/ United States/ Texas/ Texas, southern
© NISC

608. Effects of cattle grazing upon chemical constituents within important forages for elk.

Dragt, W. J. and Havstad, K. M.
Northwest Science 61(2): 70-73. (1987)
NAL Call #: 470 N81; ISSN: 0029-344X
Descriptors: *Agropyron spicatum*/ *Festuca scabrella*/ *Festuca idahoensis*/ *Cervus elaphus Nelsoni*/ deferred rotation/ cattle management/ forage management/ seasonality/ indirect competition/ amensalism/ elkhorn/ mountains/ Montana/ USA
Abstract: On many western rangelands, cattle and elk use the same forages but during different seasons. This can place these species into indirect competition or amensalism. The objective of this study was to examine the effects of summer grazing by cattle upon the winter forage quality for elk. Individual plants of bluebunch wheatgrass (*Agropyron spicatum*), rough fescue (*Festuca scabrella*), and Idaho fescue (*Festuca idahoensis*) were monitored for phenological stage when summer grazed by cattle on a Rocky Mountain elk (*Cervus elaphus nelsoni*) wintering range in the Elkhorn Mountains, Montana. Assessment of winter chemical composition of these three key forage species indicated no deleterious effects of summer grazing by cattle stocked at 3.7 ha/AUM upon the winter forage quality. In general, rough fescue and Idaho fescue had lower average fiber fractions and higher crude protein than

bluebunch wheatgrass. Under deferred rotation cattle management, the primary winter elk forage management concern appears to be forage quantity rather than quality.
© The Thomson Corporation

609. Effects of continuous grazing on habitat and density of ground-foraging birds in south Texas.

Baker, D. L. and Guthery, F. S.
Journal of Range Management 43(1): 2-5. (1990)
NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1990/431/1bake.pdf>
Descriptors: cattle/ habitats/ birds/ *Colinus virginianus*/ population density/ grazing/ sandy loam soils/ clay soils/ grazing intensity/ Texas
This citation is from AGRICOLA.

610. Effects of distance from cattle water developments on grassland birds.

Fontaine, A. L.; Kennedy, P. L.; and Johnson, D. H.
Journal of Range Management 57(3): 238-242. (May 2004)
NAL Call #: 60.18 J82; ISSN: 0022-409X
Descriptors: songbirds/ population density/ population dynamics/ cattle production/ range management/ water distribution/ prairies/ grazing intensity/ *Eremophila*/ *Passeriformes*/ plant strata/ height/ canopy/ plant litter/ botanical composition/ North Dakota
Abstract: Many North American grassland bird populations appear to be declining, which may be due to changes in grazing regimes on their breeding areas. Establishment of water developments and confining cattle (*Bos taurus* L.) to small pastures often minimizes spatial heterogeneity of cattle forage consumption, which may lead to uniformity in vegetative structure. This increased uniformity may provide suitable habitat for some bird species but not others. We assessed how cattle use, vegetative structure, and bird population densities varied with increasing distance from water developments (0-800 m) on the Little Missouri National Grassland (LMNG) in North Dakota. Lark buntings (*Calamospiza melancorys Stejneger*), which are typically associated with low vegetative cover, decreased with increasing distance from water developments. Horned larks (*Eremophila alpestris* L.), also a low-cover associate, followed a similar but weaker trend. Densities of another low-cover associate as well as moderate- and high-cover associates were not related to distance from water. Vegetative height-density and litter depth increased by 50 and 112%, respectively, while cowpie cover and structural variability decreased by 51 and 24%, respectively, with distance from water. Confidence interval overlap was common among all measures, showing substantial variability among study sites. Our results indicate cattle use is higher closer to water developments, and this pattern may positively affect the densities of lark buntings and horned larks. The absence of density gradients in the other bird species may be due to the paucity of locations > 800 m from water on the LMNG.
This citation is from AGRICOLA.

611. The effects of fall grazing or burning bluebunch wheatgrass range on forage selection by deer and cattle in spring.

Willms, W.; Bailey, A. W.; McLean, A.; and Tucker, R.
Canadian Journal of Animal Science 60(1): 113-122. (1980)
NAL Call #: 41.8 C163; ISSN: 0008-3984

Descriptors: *Odocoileus hemionus hemionus/ Odocoileus hemionus/ fires/ burns/ grazing/ habitat alterations/ mule deer/ food*

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612. Effects of fire management and grazing by cattle on ant communities in south-east Queensland open forests.

Vanderwoude, Cas and Johnson, Kym M.
In: *Conservation of Australia's forest fauna/ Lunney, Daniel. Mosman: Royal Zoological Society of New South Wales, 2004; pp. 860-874.*

Notes: ISBN: 095860858X

Descriptors: *animals and man/ disturbance by man/ commercial activities/ conservation/ conservation measures/ ecology/ habitat/ terrestrial habitat/ abiotic factors/ physical factors/ land zones/ Australasian Region/ Australasia/ Australia/ Formicidae: farming and agriculture/ cattle grazing/ habitat management/ open forests management/ community structure/ fire management and cattle grazing effects/ forest and woodland/ fire/ Queensland/ Bauple State Forest/ fire management and cattle grazing effects on communities/ open forests/ Formicidae/ Formicoidea/ Aculeata/ Apocrita/ Hymenoptera/ Insecta/ arthropods/ hymenopterans/ insects/ invertebrates*

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613. Effects of forest management and grazing on breeding bird communities in plantations of broadleaved and coniferous trees in western England.

Donald, P. F.; Fuller, R. J.; Evans, A. D.; and Gough, S. J.
Biological Conservation 85(1-2): 183-197. (1998)
NAL Call #: S900.B5; ISSN: 0006-3207

Descriptors: *bird abundance/ breeding bird communities/ forest management/ grazing pressure/ plantation forestry/ species richness/ stand age/ stand size/ tree species composition*

Abstract: Management options in commercial forestry include choice of conifers or broadleaves, rotation length, stand size and grazing regime. Each factor potentially affects the conservation value of woodland for birds. Relationships between these factors and the structure and composition of breeding bird communities were examined in 69 stands distributed across a range of plantations composed of predominantly native broadleaved and non-native coniferous trees in the Forest of Dean, western England, in 1992 and 1993. Each stand was classified as one of three high forest types: broadleaved, coniferous or mixed broadleaves and conifers. Stand size had no effect on bird communities. Species richness and overall bird abundance increased with forest age when all forest types were combined. Within stands of similar ages, there were no consistent differences in species richness or overall bird abundance between the three forest types or between grazed and ungrazed stands. However, bird communities in mixed stands were intermediate in their overall species composition to those in broadleaved and coniferous stands. Regression and gradient analyses (CCA and PCA)

revealed that major gradients in the species composition of the bird communities were associated with stand age and with tree species composition. The proportion of individuals contributed by hole-nesting species was higher in broadleaved than coniferous stands and increased with stand age. The proportion of individuals contributed by migrants was higher in especially the early years, but also in the late years of the rotation. The proportion of migrants was higher in ungrazed than in grazed stands and increased with openness of the canopy and development of low vegetation. The diversity of stands in terms of tree sizes and tree species was positively correlated with both number of bird species and overall bird abundance. The relevance of these findings is discussed in relation to the integration of bird conservation into coniferous forestry, focusing particularly on the value of broadleaved stands and the effects on bird communities of stand structure and grazing pressure.

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614. The effects of grassland management using fire on habitat occupancy and conservation of birds in a mosaic landscape.

Pons, Pere; Lambert, Bernard; Rigolot, Eric; and Prodon, Roger

Biodiversity and Conservation 12(9): 1843-1860. (2003)
NAL Call #: QH75.A1B562; ISSN: 0960-3115

Descriptors: *canonical correspondence analysis: mathematical and computer techniques/ prescribed burning: applied and field techniques/ conservation biology/ cover types/ environmental variables/ grassland management/ grazing intensity/ habitat occupancy/ habitat selection/ habitat structure/ mosaic landscapes/ mountain rangelands: habitat/ pastoral value/ shrub volume/ species composition*

Abstract: Prescribed burning is routinely used to improve grazing in Pyrenean rangelands affected by an overall trend of land abandonment. This study considers the environmental variables influencing habitat occupancy by birds and the consequences of the use of fire in range management for bird conservation. Bird use and habitat structure of 11 cover types, the result of specific management regimes, were monitored for two breeding seasons in a mosaic landscape. Three main gradients of avian composition, corresponding to tree cover, shrub volume and grazing intensity, were identified from canonical correspondence analysis. The structure of the bird community seemed more intensely affected by species-specific selection of cover types than by the birds' use of multiple patches. Out of a total of 10 bird species analysed by a simultaneous confidence intervals procedure, four species with an unfavourable conservation status in Europe (*Emberiza cia*, *Lullula arborea*, *Saxicola torquata* and *Lanius collurio*) preferred managed grassland. Three types of grassland with shrubs (derived from single or repeated burning) had the highest bird conservation index (taking into account specific status and abundance of the bird assemblage), whereas forests showed middle or low values. The relation ($P=0.054$) of this index to the logarithm of the pastoral value (which includes density and grazing quality of grasses) in currently managed cover types suggests that the objectives of grassland recovery by appropriate management practices and those of bird conservation coincide in our study area.

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615. The effects of grazing and browsing animals on wildlife habitats.

Urness, P. J. and Austin, D. D.

Utah Science 50(2): 104-107. (1989)

NAL Call #: 100 Ut1F

Descriptors: grassland management/ grasslands/ rangelands/ grazing/ nature conservation

Abstract: The effects of stocking different species of animal on rangelands in Utah, USA, is discussed, with particular reference to the possible impact on wildlife through alteration of their habitat.

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616. Effects of grazing and burning on densities and habitats of breeding ducks in North Dakota.

Kruse, Arnold D. and Bowen, Bonnie S.

Journal of Wildlife Management 60(2): 233-246. (1996)

NAL Call #: 410 J827; ISSN: 0022-541X

Descriptors: land use/ Lostwood National Wildlife Refuge/ native grasslands/ nest density/ nest success/ seasonality/ wildlife management

Abstract: Native grassland communities controlled by public agencies become increasingly important to the maintenance of many wildlife species as privately owned grasslands are destroyed or degraded for farming, mining, and development. In turn, wildlife on publicly owned grasslands are affected by the management techniques practiced by local managers. We studied the effects of grazing and prescribed burning on upland-nesting ducks and the structure and type of vegetation from 1980 to 1988 at the Lostwood National Wildlife Refuge (NWR) in northwestern North Dakota. Mallard (*Anas platyrhynchos*), the most abundant species at Lostwood NWR, had lower ($P < 0.05$) annual nest densities on experimental and control fields in the later years than in the early years of the study. Spring burning reduced ($P = 0.016$) nest densities of gadwall (*A. strepera*). Spring grazing reduced nest densities of gadwall ($P = 0.014$), and blue-winged teal (*A. discors*, $P = 0.023$). Nest density of gadwall increased ($P = 0.018$) after spring grazing was terminated. On the summer burn/spring graze fields, blue-winged teal had lower ($P = 0.010$) nest densities after treatments (1987-88) than before treatments (1980-81). Nest success was high (mallard 34%, gadwall 45%, blue-winged teal 31%) but was not influenced ($P > 0.16$) by the burning and grazing treatments. During the study, the amount of grass/brush increased, whereas the amount of brush and brush/grass decreased on control and treatment fields. During the years with burning and grazing, short vegetation increased and tall vegetation decreased. On the spring graze fields, 1 year after grazing ended the vegetation was similar to that on the control fields. The spring burn and summer burn/spring graze fields recovered more slowly. Brushy species such as western snowberry (*Symphoricarpos occidentalis*) provided attractive nesting habitat for many upland-nesting waterfowl species, especially mallard, gadwall, American wigeon (*A. americana*), and northern pintail (*A. acuta*). Habitat needs of additional species of wildlife that depend on grasslands may need to be considered when deciding how to manage habitat.

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617. Effects of grazing intensity and temporal application of grazing treatments of nongame birds in North Dakota mixed-grass prairie.

Salo, Eric D. South Dakota State University, 2003.

Notes: A thesis submitted in partial fulfillment of the requirements for the degree Master of Science Major in Wildlife and Fisheries Sciences (Wildlife Option), South Dakota State University

<http://wfs.sdstate.edu/wfsdept/Publications/Theses/Salo,%20Eric%20D.%20MS-2003.pdf>

618. Effects of grazing intensity on small mammal population ecology in wet meadows.

Schmidt, Niels M.; Olsen, Henrik; Bildsoe, Mogens; Sluydts, Vincent; and Leirs, Herwig

Basic and Applied Ecology 6(1): 57-66. (2005)

NAL Call #: QH540 .B37; ISSN: 1439-1791

Descriptors: animals and man/ disturbance by man/ commercial activities/ reproduction/ reproductive productivity/ ecology/ habitat/ land zones/ Palaearctic Region/ Eurasia/ Europe/ Mammalia: farming and agriculture/ grazing intensity/ effects on population dynamics/ embryo number/ biomass/ population dynamics/ semiaquatic habitat/ Denmark/ Funningo Manor/ wet meadows/ biomass and foetal number/ effects of grazing intensity/ small taxa/ Mammalia/ chordates/ mammals/ vertebrates

Abstract: Livestock grazing is common management practice in wet grasslands. However, knowledge of its effects on small mammals is limited. We studied the influence of grazing intensity on small mammals in general and field votes *Microtus agrestis* in particular in two Danish wet meadows, 1998-2000. Generally, grazing livestock had a negative effect on the peak biomass of small mammals, and the negative effect increased with grazing intensity, irrespective of whether pens were grazed by cattle or by sheep. More detailed analyses, however, revealed that an intermediate grazing as maximum livestock biomass actually seemed intensity (approximately 400 kg ha⁻¹ to benefit small mammals. This grazing intensity generally held small mammal biomasses and field vote population sizes that were similar to or larger than those on the ungrazed control, and markedly larger than those on the more heavily grazed pens. Additionally, field votes in the intermediate grazing intensity had more foetuses. Though a number of parameters may contribute to the observed patterns, we suggest that these primarily are caused by the livestock removing vegetation cover, thereby influencing the number and size of patches with high, dense vegetation in the vicinity of grass that is rejuvenated by grazing.

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619. Effects of grazing management treatment on grassland plant communities and prairie grouse habitat.

Manske, L. L.; Barker, W. T.; and Biondini, M. E.

In: *Prairie chickens on the Sheyenne National Grasslands*. (Held 18 Sep 1987 at Crookston, Minn.)

Bjugstad, Ardell J. (eds.)

Fort Collins, Colo.: Rocky Mountain Forest and Range Experiment Station, US Department of Agriculture, Forest Service; 58-72; 1988.

Notes: Paper presented at a "Symposium on Prairie Chickens on the Sheyenne National Grasslands," September 18, 1987, Crookston, Minnesota. Includes references.

NAL Call #: aSD11.A42

Descriptors: birds/ wildlife/ grasslands/ range management/ grazing/ North Dakota
This citation is from AGRICOLA.

620. Effects of grazing on long-billed curlew (*Numenius americanus*) breeding behavior and ecology in southwestern Idaho.

Bicak, T. K.; Redmond, R. L.; and Jenni, D. A.
In: Proceedings of the Wildlife-Livestock Relationships Symposium. (Held 20 Apr 1981-22 Apr 1981 at Coeur D'alene, Idaho.) Peek, James M. and Dalke, P. D. (eds.) Moscow, Idaho: Forest, Wildlife & Range Experiment Station, University of Idaho; pp. 74-85; 1982.
NAL Call #: SF84.84.W5 1981

621. Effects of grazing on nesting by upland sandpipers in southcentral North Dakota.

Bowen, Bonnie S. and Kruse, Arnold D.
Journal of Wildlife Management 57(2): 291-301. (1993)
NAL Call #: 410 J827; ISSN: 0022-541X
Descriptors: endangered species/ field method/ marshland management/ protection
Abstract: Grazing by livestock is often used to reduce litter, improve plant vigor, and alter plant species composition, but additional information is needed on the effects of these management practices on upland-nesting birds. Thus, we conducted an experimental study of the effect of grazing on nest density and nest success of upland sandpipers (*Bartramia longicauda*) in southcentral North Dakota from 1981 to 1987. Our experimental design consisted of 4 treatments and 1 control, each applied to 1 field in each of 3 study areas. The treatments represented options available to grassland managers: spring grazing, autumn grazing, autumn-and-spring grazing, season-long grazing, and control (ungrazed during the study). Nests (n = 342) were found by searching study areas with a cable-chain drag. Nest density was lower (P = 0.006) for treatments where cattle were present (spring, autumn-and-spring, and season-long) than where cattle were not present (autumn and control) during the nesting season. We concluded that grazing during the nesting season reduced the nest density of upland sandpipers. Nest success varied among years (P = 0.01) and was low in the first year of grazing and higher at the end of the study period. We found little evidence that the grazing treatment influenced nest success. We recommend that public lands with breeding populations of upland sandpipers include a complex of fields under various management practices, including fields undisturbed during the nesting season.
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622. Effects of grazing on the demography and growth of the Texas tortoise.

Kazmaier, Richard T.; Hellgren, Eric C.; Ruthven, Donald C.; and Synatzske, David R.
Conservation Biology 15(4): 1091-1101. (2001)
NAL Call #: QH75.A1C5; ISSN: 0888-8892
Descriptors: demography/ disturbance tolerance/ grazing effects/ growth/ species management
Abstract: Considerable effort has been exerted in attempts

to understand the complex ecological effects of grazing. North American tortoises, by virtue of their distribution, provide a good model taxon through which to study how grazing effects vary with grazing regime, habitat, and climate. We studied the Texas tortoise (*Gopherus berlandieri*), which is restricted primarily to privately owned rangelands of southern Texas and northeastern Mexico. Management of this species is hampered by a lack of information on the effects of common land-use practices. We evaluated the effects of moderate grazing by cattle (short-duration, winter-spring rotational grazing regime; 6-28 animal-unit days/ha/year) on this tortoise by comparing two grazed and two ungrazed sites in the Western Rio Grande Plains, Texas (U.S.A.), from April 1994 to October 1997. We made 132 captures of 106 individuals in the ungrazed pastures and 324 captures of 237 individuals in the grazed pastures. We also radiotracked 22 tortoises in the ungrazed pastures and 25 tortoises in the grazed pastures. Comparisons of relative abundance, body-size distribution, age distribution, body mass, sex ratio, adult survival, proportion of juveniles, and growth rates revealed no differences (p>0.05 for all parameters) between tortoises on grazed and ungrazed areas. Based on these results, we suggest that moderate grazing by cattle is not incompatible with maintenance of Texas tortoise populations. Our data were consistent with a general model of tortoise biogeography and tolerance of disturbance which suggests that Texas tortoises are tolerant to intermediate levels of disturbance. Generalities about the effect of cattle grazing on the four North American tortoises should be avoided unless they can be placed in the context of grazing regime, precipitation, habitat quality, and tortoise requirements.

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623. Effects of grazing practices and fossorial rodents on a winter avian community in Chihuahua, Mexico.

Desmond, M.
Biological Conservation 116(2): 235-242. (2004)
NAL Call #: S900.B5; ISSN: 0006-3207
Descriptors: deserts/ grasslands/ grazing/ land use/ natural grasslands/ population density/ species diversity/ wild birds/ winter/ *Dipodomys spectabilis*
Abstract: Chihuahuan Desert grasslands are important wintering grounds for grassland and shrub-adapted birds. Many species belonging to these assemblages are currently exhibiting population declines. One area recognized for its importance to biological diversity, including grassland birds, is the Janos-Nuevo Casas Grandes black-tailed prairie dog (*Cynomys ludovicianus*) complex in northwestern Chihuahua, Mexico, an area containing 58 colonies with 30,000 ha of prairie dogs. This is one of the largest remaining prairie dog complexes and the only intact complex in the Chihuahuan Desert. In its current condition, a large percentage of this complex is of reduced value to wildlife. Overgrazing on communal (ejido) lands has resulted in areas being comprised of annual grasses and forbs. The density of active prairie dog burrows and banner-tailed kangaroo rat (*Dipodomys spectabilis*) mounds as well as avian diversity and abundance were lower on ejido lands than an adjacent private ranchland with and without prairie dogs. Few avian species used overgrazed portions of the prairie dog colony. Community similarity among plot types was low due to different management practices and differences on and off

colony. To retain, and in many instances restore the biological diversity of this important region it is essential to work with local ejidos on grazing management.

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624. Effects of grazing systems on sharp-tailed grouse habitat.

Mattise, S. N.; Linder, R. L.; and Kobriger, G. D.
In: Proceedings of the Wildlife-Livestock Relationships Symposium. (Held 20 Apr 1981-22 Apr 1981 at Coeur D'alene, Idaho.) Peek, James M. and Dalke, P. D. (eds.)
Moscow, Idaho: Forest, Wildlife & Range Experiment Station, University of Idaho; pp. 124-132; 1982.
NAL Call #: SF84.84.W5 1981

625. Effects of land management on nesting success of sandhill cranes in Oregon.

Littlefield, C. D. and Paullin, D. G.
Wildlife Society Bulletin 18(1): 63-65. (1990)
NAL Call #: SK357.A1W5; ISSN: 0091-7648
Descriptors: Grus canadensis tabida/ cattle grazing/ habitat/ refuge/ wetland
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626. Effects of land use on nongame wetland birds in western South Dakota stock ponds, U.S.A.

May, Shawn M.; Naugle, David E.; and Higgins, Kenneth F.
Waterbirds 25(Special Publication 2): 51-55. (2002)
NAL Call #: QL671; ISSN: 1524-4695
Descriptors: Landsat TM imagery data/ National Wetlands Inventory maps/ cattle grazing/ cropland landscapes/ grasslands/ habitat use/ land use change/ landscape types/ nesting habitat/ prairie landscapes/ stock ponds/ tillage agriculture/ vegetation cover/ wetlands
Abstract: Tillage agriculture is expanding into western prairie landscapes without knowledge of the effects of land use change on habitats used by nongame wetland birds. In 1999-2000, we surveyed 196 stock ponds within grassland (>95% grass) and cropland (>75% tillage) landscapes to evaluate effects of land use on nongame wetland bird densities in western South Dakota. Land use and wetlands were delineated from Landsat TM imagery and National Wetlands Inventory maps. Sixteen nongame wetland bird species used stock ponds in western South Dakota, of which nine species were obligate wetland-nesting species. Although densities of seven nongame obligate wetland bird species were similar between landscape types, abundance of Wilson's Phalarope (*Phalaropus tricolor*) was greater in grassland study areas where cattle grazing limited growth of thick-stemmed emergent vegetation and reduced overall vegetative cover in stock ponds. In contrast, the Red-winged Blackbird (*Agelaius phoeniceus*) and Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*) were more abundant in cropland landscapes where stock ponds provide abundant over-water nesting habitat (e.g., cattail). If grasslands continue to be converted to cropland, Wilson's Phalarope numbers will likely decrease as blackbird densities increase in stock ponds dominated by monotypic stands of cattail. To circumvent such changes, we recommend that resource managers conserve large tracts of grassland through aggressive easement programs in landscapes at highest risk of agricultural tillage.
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627. The effects of large storm events on basin-range riparian stream habitats.

Platts, W. S.; Gebhardt, K. A.; and Jackson, W. L.
In: Riparian ecosystems and their management: Reconciling conflicting uses. (Held 16 Apr 1985-18 Apr 1985 at Tuscon, Ariz.) Johnson, R. Roy; Ziebell, Charles D.; Patton, David R.; Ffolliott, Peter F.; and Hamre, R. H. (eds.)
Fort Collins, Colo.: Rocky Mountain Forest and Range Experiment Station, United States, Forest Service; pp. 30-34; 1985.
NAL Call #: aSD11.A42
Descriptors: stream erosion/ storms/ riparian buffers/ grazing/ streams/ Nevada/ Utah
This citation is from AGRICOLA.

628. Effects of livestock grazing enclosure on aquatic macroinvertebrates in a montane stream New Mexico.

Rinne, J. N.
Great Basin Naturalist 48(2): 146-153. (1988)
NAL Call #: 410 G79; ISSN: 0017-3614
Descriptors: mammal/ biomass/ habitat/ watershed/ population density/ chi square
Abstract: Aquatic macroinvertebrate populations inhabiting reaches of a stream within areas excluded from livestock grazing for a decade were markedly different from those in grazed areas when density, biomass, biotic condition indices, and mean chi square indices of the two populations were compared. Increased densities and biomasses of more tolerant forms of macroinvertebrates were observed in grazed reaches. Because pretreatment data were not available, differences in macroinvertebrate populations and relative tolerances of taxa in grazed and ungrazed areas could be as easily attributed to linear changes in stream habitat as to removal of domestic livestock. Results of this study have implications for the design of futur research on the effects of livestock grazing on stream environments and biota: (1) baseline/pretreatment information is prerequisite, and (2) the study should take a watershed (ecosystem) approach.
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629. Effects of livestock grazing on benthic invertebrates from a native grassland ecosystem.

Scrimgeour, Garry J. and Kendall, Sharon
Freshwater Biology 48(2): 347-362. (2003)
NAL Call #: QH96.F6; ISSN: 0046-5070
Descriptors: biomass/ cattle grazing/ community structure/ livestock grazing/ native grassland ecosystem/ pH/ riparian vegetation/ riparian zones/ rotational grazing/ stream bank stability/ stream channel/ turbidity
Abstract: 1. The effects of cattle grazing on stream bank stability, biomass of riparian vegetation, instream vegetation cover, biomass of coarse particulate organic matter (CPOM) and epilithon and benthic invertebrate community structure were investigated over a 2-year period using: (i) enclosures containing different cattle grazing treatments and (ii) by comparing streams with different grazing intensities in the Cypress Hills Provincial Park, Alberta, Canada. 2. Livestock enclosure experiments comprised four treatments of: (1) early season cattle grazing (June-August), (2) late season cattle grazing (August-September), (3) all season cattle grazing (June-September) and (4) cattle-absent controls. All four treatments were replicated in two streams while two

treatments (i.e. cattle-absent controls, early season cattle grazing) were established in a third stream. 3. Bank stability, estimated visually based on sediment inputs to the stream channel, increased significantly in cattle-absent treatments compared with cattle-present enclosures over the 2-year study period. 4. Epilithic chlorophyll a was significantly affected by time, but neither cattle nor the interaction of time and treatment were significant. 5. At the end of the experiment, total invertebrate biomass in the late and all-season treatment exceeded that in the early and cattle-absent treatments. However, excluding cattle from the streams, at any of the different treatments, had little clear impact on the total benthic invertebrate abundance or the abundance of the predominant functional feeding groups over the 2-year study period. 6. In contrast, comparisons of benthic assemblages from streams with different grazing intensities showed that the non-grazed reach of Storm Creek contained significantly higher biomass of CPOM and shredders compared with the cattle-absent enclosures in Battle, Graburn and Nine Mile creeks. Redundancy analysis showed that benthic communities from all enclosures and Storm Creek in summer and autumn 2000 were affected primarily by CPOM biomass, pH, nitrate, turbidity and benthic chlorophyll a. Construction of a 99% probability ellipse from enclosure sites showed that invertebrate communities from livestock enclosures differed from that in the non-grazed Storm Creek. 7. Results from stream-scale comparisons indicate that current livestock grazing practices in the Cypress Hills significantly impact riparian zones, stream channels and benthic invertebrate community structure and that alternative practices, such as rotational grazing, need to be developed.

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630. Effects of livestock grazing on bird abundance and vegetation structure in shortgrass prairie.

Reinking, Dan L.; Wolfe, Donald H.; and Wiedenfeld, David A.

Oklahoma Ornithological Society Bulletin 33(4): 29-36. (2000); ISSN: 0474-0750

Descriptors: agricultural practices/ birds/ communities/ ecosystems/ grazing/ habitat alterations/ prairies/ wildlife/ livestock relationships/ horned lark/ western meadowlark/ grasshopper sparrow/ mourning dove/ common nighthawk/ killdeer/ Aves/ North America/ United States/ Texas/ Rita Blanca Natl. Grasslands

Abstract: The authors studied the present avian community composition in a shortgrass prairie ecosystem and determined the effects of differing grazing regimes on this composition. Six species of birds were recorded in the study area. Horned larks and western meadowlarks made up 49% and 40% of the birds observed, respectively.

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631. Effects of livestock grazing on mearns quail in southeastern Arizona.

Brown, R. L.

Journal of Range Management 35(6): 727-732. (1982)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1982/356/13brow.pdf>

Descriptors: *Cyrtonyx montezumae mearnsi*/ census-survey methods/ changes detrimental to wildlife/ cover/ food supply/ grassland/ grazing/ habitat/ livestock/ nests and nesting/ population density/ quail, Mearns harlequin/

wildlife-livestock relationships/ woodland climax/ North America/ United States/ Arizona/ Santa Cruz County/ Southeastern District

Abstract: The mechanics of the relationship between livestock grazing and quail densities are determined and estimates of the level of grazing intensity that is limiting to local quail populations are presented. Effects of cover removal on Mearns quail populations are examined: quail food supply was not reduced, but the elimination of escape cover and nesting grass was detrimental, especially to breeding populations.

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632. Effects of livestock grazing on neotropical migratory landbirds in western North America.

Bock, C. E.; Sabb, V. A.; Rich, T. D.; and Dobkin, D. S.

In: Status and management of neotropical migratory birds. (Held 21 Sep 1992-25 Sep 1992 at Estes Park, Colorado.) Finch, D. M. and Stangel, P. W. (eds.)

Fort Collins, Colo.: Rocky Mountain Forest and Range Experiment Station, U.S. Dept. of Agriculture; pp. 263-309; 1993.

NAL Call #: aSD11.A42

Descriptors: Conservation Reserve Program/ regional conservation programs

Abstract: Examined the idea that moderate haying/grazing of CRP coupled with livestock enclosures on public land could enhance the value of public rangelands for wildlife.

633. Effects of livestock grazing on rangeland grasshopper (Orthoptera: Acrididae) abundance.

O'Neill, Kevin M.; Olson, Bret E.; Rolston, Marni G.; Wallander, Roseann; Larson, Deanna P.; and Seibert, Catherine E.

Agriculture, Ecosystems & Environment 97(1-3): 51-64. (2003)

NAL Call #: S601 .A34; ISSN: 0167-8809

Descriptors: food availability/ grazing impacts/ grazing intensity/ grazing management/ habitat characteristics/ habitat quality/ heavily grazed areas/ livestock grazing/ microclimate alteration/ microhabitats/ plant cover impacts/ potential oviposition sites/ ungrazed pastures

Abstract: Livestock may impact habitat quality for grasshoppers by reducing food availability and by altering microclimate and potential oviposition sites. A 5-year study was conducted to create consistent grazing impacts on replicated plots and measure their effects on plant cover, microclimate, and grasshopper abundance. Cattle were used to produce two levels of grazing intensity that were compared to ungrazed controls. Differences in plant cover were greatest immediately after grazing each summer, grasshopper microhabitats tending to be shadier, cooler, less windy, and more humid in the ungrazed plots. The grasshopper assemblage included five of the worst pest grasshopper species in North America: *Ageneotettix deorum*, *Aulocara elliotti*, *Melanoplus sanguinipes*, *M. packardii*, and *Camnula pellucida*. Most species had greater abundance on ungrazed pastures, particularly during the 4-6 weeks after grazing each year. However, *A. elliotti* was often more abundant in heavily grazed areas early in the year when early instars were present and in late summer when adults were predominant. There was no strong evidence that the effect of grazing on grasshopper abundance increased over the 5-year study. At this time, all changes in grasshopper numbers cannot be directly

attributed to particular habitat characteristics that changed after grazing, but the results suggest that grazing management could be used to reduce pest grasshopper densities.

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634. Effects of livestock grazing on small mammals at a desert cienaga.

Hayward, Bruce; Heske, Edward J.; and Painter, Charles W.

Journal of Wildlife Management 61(1): 123-129. (1997)
NAL Call #: 410 J827; ISSN: 0022-541X

Descriptors: conservation/ desert cienaga/ livestock grazing/ population abundance/ resource base/ small/ trophic level interaction

Abstract: Livestock in arid regions often concentrate their grazing in riparian areas, and this activity can have strong effects on native vegetation and wildlife. Small mammals at a desert wetland (cienaga) in southwestern New Mexico were more abundant on 2 1-ha plots from which livestock were excluded over a 10-year period than on 2 similar grazed plots ($P = 0.025$). However, species of small mammals differed in the direction and degree of their responses to livestock exclusion. Differences in mean abundance between grazed versus ungrazed plots could not be demonstrated for any species of small mammal individually because of strong annual variation in abundance and low statistical power of tests. However, the cumulative effect was that small mammals were 50% more abundant on plots from which livestock were excluded. Because small mammals provide an important resource base for many animals at higher trophic levels, even a few livestock exclosures of moderate size could benefit a variety of species of wildlife in desert wetlands.

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635. Effects of livestock grazing on the invertebrate prey base and on the survival and growth of larvae of the Columbia spotted frog, *Rana luteiventris*.

Howard, Amy and Munger, James C., 2003. 28 p. Idaho Bureau of Land Management Technical Bulletin.

http://www.id.blm.gov/techbuls/03_07/SPOTTED%20FROG%20REPORT.pdf

Descriptors: animals and man/ disturbance by man/ commercial activities/ nutrition/ diet/ life cycle and development/ development/ ecology/ population dynamics/ predators/ habitat/ freshwater habitat/ lentic water/ lotic water/ land zones/ Nearctic Region/ USA/ North America/ Invertebrata: biomass/ community structure/ amphibian predators/ *Rana luteiventris*/ livestock grazing effects on prey base/ streams and ponds/ pond/ stream/ biomass and community structure/ livestock grazing effects/ significance for amphibian predator/ Idaho/ Owyhee Mountains/ livestock grazing effects on amphibian predator prey base/ ponds and streams/ Ranidae/ Anura/ Lissamphibia/ Amphibia/ amphibians/ chordates/ invertebrates/ vertebrates

Abstract: This report discusses results primarily from the second of two field seasons in which two aspects of grazing were examined for possible effects on Columbia spotted frogs (*Rana luteiventris*). First, exclosures were used to prevent grazing on portions of the streams and ponds to ascertain the effects of grazing on the invertebrate prey base utilized by the frogs. Although we found no statistically significant effect of grazing on either biomass or diversity of

invertebrate prey, care must be taken in the interpretation of these results. While it is possible that there was no effect of the specific grazing regimes of these sites on the invertebrate community, the small sample size, the very general taxonomic identification used, and weaknesses in study design may have masked any true differences. Adult spotted frogs were apparently not actively feeding during late August to late September. Metamorphs and subadults, however, would need to forage at that time to accumulate necessary fat reserves and would therefore be affected by changes in the invertebrate community. Further work is needed to more solidly document the effects of grazing on invertebrates. Second, spotted frog larvae were raised in microcosms located at the Mudflat Guard Station and were subjected to four levels of cattle waste. During the first year, survival of larvae was very low and growth was stunted, indicating that the experimental design needed modification for the second year's experiment. During the second year, we found that addition of waste negatively affected survival rate. We also found that cattle waste does not appear to be directly toxic, nor does the decreased survival seem to be due to decreased dissolved oxygen levels. The cause of decreased survival is probably an indirect effect of addition of waste, such as an increased ammonia concentration. We also found that addition of waste led to an increased growth rate of larvae. Further study is needed to determine whether, in the more natural conditions of the field, cattle waste affects survival and growth in the same way as was observed in the microcosms.

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636. The effects of livestock on California ground squirrels (*Spermophilus beecheyii*).

Fehmi, J. S.; Russo, S. E.; and Bartolome, J. W.

Rangeland Ecology and Management 58(4): 352-359. (2005)

NAL Call #: SF85 .J67; ISSN: 1550-7424

Descriptors: burrow patterns/ California grasslands/ cattle grazing/ oak savanna

Abstract: Understanding the impacts of livestock grazing on wildlands is important for making appropriate ecosystem management decisions. Using livestock exclosures, we examined the effects of moderate cattle grazing on the abundance of California ground squirrels (*Spermophilus beecheyii* Richardson) and the spatial distribution of active burrows within their colonies in grassland and blue oak (*Quercus douglasii* Hook. & Arn.) savanna habitats in the coastal range of California over a 3-year period (1991-1994). Overall, relative population densities of California ground squirrels declined significantly throughout the experiment, but did not differ between grazed and ungrazed colonies or between habitats. There was also no significant interaction between these 2 factors. The spatial distribution of burrows, as measured by the mean nearest neighbor distance of active entrances within a colony, did not differ significantly between grazed and ungrazed colonies or between habitats, nor was the interaction significant. Thus, low to moderate levels of cattle grazing did not appear to have a strong effect on the population dynamics of California ground squirrels, and grazing may be compatible with maintenance of ground squirrel populations. Based on multivariate analysis of variance of 1994 data, live plant cover, native plant cover, and standing biomass were lower where the number of burrows was higher on grazed colonies but were little affected on ungrazed colonies.

Ground squirrels may increase the impact of livestock grazing and thus reduce the capacity of the land to support other activities. However, it is clear that the effects of livestock grazing are complex and that detailed studies of potential mechanisms by which grazing impacts California ground squirrel populations are necessary.

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637. Effects of livestock removal and perennial grass recovery on the lizards of a desertified arid grassland.

Castellano, M. J. and Valone, T. J.

Journal of Arid Environments 66(1): 87-95. (2006)

NAL Call #: QH541.5.D4J6; ISSN: 0140-1963

Descriptors: desertification/ livestock grazing/ shrub encroachment/ tail autotomy

Abstract: We sampled lizards inside and outside of a 9.3 ha livestock enclosure in a desertified arid grassland in southeastern Arizona with pitfall traps and mark-recapture. Lizard community composition was significantly different inside versus outside of the enclosure. Analysis of tail-break frequencies suggests that higher predation rates outside the enclosure may contribute to increased abundance of *Sceloporus undulatus* and *Uta stansburiana* following livestock removal and associated changes in grass cover and vegetation complexity. In contrast, *Phrynosoma modestum* was significantly less abundant inside the enclosure. These results indicate that lizard abundance can increase and community composition can change in desertified arid grasslands following livestock removal that results in increased grass cover and vegetation complexity.
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638. Effects of protective fencing on birds, lizards, and black-tailed hares in the western Mojave Desert.

Brooks, M.

Environmental Management 23(3): 387-400. (1999)

NAL Call #: HC79.E5E5; ISSN: 0364-152X

Descriptors: grasslands/ deserts/ plant communities/ prey/ seeds/ species diversity/ nature reserves/ fencing/ ground cover/ wild birds/ wild animals/ grazing/ range management/ revegetation/ *Hymenoclea salsola*/ *Achnatherum spinosa*/ *Achnatherum hymenoides*/ grazing behaviour/ *Hymenoclea*/ *Achnatherum*

Abstract: Effects of protective fencing on wild birds, lizards, black-tailed hares (*Lepus californicus*), perennial plant cover, and structural diversity of perennial plants were evaluated during spring 1994 to winter 1995 at the Desert Tortoise Research Natural Area (DTNA), in the Mojave Desert, California, USA. At the northern study site the plant cover consisted of *Larrea tridentata*, *Ambrosia dumosa*, *Hymenoclea salsola*, *Achnatherum spinosa* and *A. hymenoides* and at the southern study site of *Atriplex polycarpa* and *H. salsola*. Abundance and species richness of birds were higher inside than outside the DTNA, and effects were larger during the breeding than during the wintering seasons and during a high rainfall than during a low rainfall year. Ash-throated flycatchers (*Myiarchus cinerascens*), cactus wrens (*Campylorhynchus brunneicapillus*), LeConte's thrashers (*Toxostoma lecontei*), loggerhead shrikes (*Lanius ludovicianus*), sage sparrows (*Amphispiza belli*), and verdins (*Auriparus flaviceps*) were more abundant inside than outside the DTNA. Nesting activity was also more frequent inside. Total abundance and species richness of lizards and individual abundances of western whiptail lizards (*Cnemidophorus tigris*) and

desert spiny lizards (*Sceloporus magister*) were higher inside than outside. In contrast, abundance of black-tailed hares was lower inside. Structural diversity of the perennial plant community did not differ due to protection, but ground cover was 50% higher in protected areas. Black-tailed hares generally preferred areas of low perennial plant cover, which may explain why they were more abundant outside than inside the DTNA. Habitat structure may not affect bird and lizard communities as much as availability of food at this desert site, and the greater abundance and species richness of vertebrates inside than outside the DTNA may correlate with abundances of seeds and invertebrate prey.

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639. Effects of rangeland fires and livestock grazing on habitat for nongame wildlife.

Ivey, G. L.

In: Proceedings of a symposium on sustaining rangeland ecosystems. (Held 29 Aug 1994-31 Aug 1994 at Eastern Oregon State College, La Grande, Oregon.) Edge, W. D. and Olsen-Edge, S. L. (eds.); Vol. Special Report 953. Corvallis, Ore.: Oregon State University Extension Service; pp. 130-139; 1996.

NAL Call #: 100 Or3M no.953

Descriptors: regrowth/ seed output/ wild birds/ wild animals/ vegetation/ ground cover/ range management/ grassland management/ endangered species/ grasslands/ rangelands/ nature conservation/ grazing/ burning/ plant succession/ species diversity

Abstract: Non-game wildlife (including wild birds and rodents) has a wide variety of requirements that may be influenced by burning or livestock grazing. These practices generally reduce ground cover and cause retrogression to an earlier seral stage, consequently favouring species that prefer short cover or bare areas and disadvantaging species requiring ground cover or vegetation structure. Degradation of riparian zones by burning or grazing generally reduced species diversity and populations. Species dependent on ungrazed habitat may be at risk of local extinction as a result of grazing in some areas. Using management techniques to provide a mosaic of habitats is recommended to preserve species diversity. Some non-game wildlife benefited from fire because of an increase in the growth of herbaceous and seed-producing plants.

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640. The effects of rest-rotation grazing of mule deer and elk populations inhabiting the Herd Creek Allotment, East Fork Salmon River, Idaho.

Yeo, Jeffrey J. University of Idaho, 1981.

Descriptors: *Cervus elaphus*/ *Odocoileus hemionus*/ behavior/ grazing/ fires/ burns/ habitat alterations/ interspecies relationships/ land use/ mammals/ wildlife/ livestock relationships/ North America/ United States/ Idaho

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641. The effects of rest-rotation grazing on the distribution of sharp-tailed grouse.

Nielsen, L. S. and Yde, C. A.
In: Proceedings of the Wildlife-Livestock Relationships Symposium. (Held 20 Apr 1981-22 Apr 1981 at Coeur D'alene, Idaho.) Peek, James M. and Dalke, P. D. (eds.) Moscow, Idaho: Forest, Wildlife & Range Experiment Station, University of Idaho; pp. 147-165; 1982.
NAL Call #: SF84.84.W5 1981

642. Effects of rest, season-long, and delayed grazing of wetlands and adjacent uplands on cattle and waterfowl use.

Ruyle, G. B. University of California, Berkeley, 1980.
Descriptors: habitat management/ grazing/ thesis
© NISC

643. Effects of short-duration and continuous grazing on bobwhite and wild turkey nesting.

Bareiss, L. J.; Schulkz, P.; and Guthery, F. S.
Journal of Range Management 39(3): 259-260. (1986)
NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1986/393/17bare.pdf>
Descriptors: turkeys/ nests/ nesting/ grazing/ livestock/ pastures/ Texas
This citation is from AGRICOLA.

644. Effects of short duration grazing on bobwhites and wild turkeys in south Texas.

Schulz, P. A. Texas A&M University, 1986.
Descriptors: *Colinus virginianus*/ *Meleagris gallopavo intermedia*/ livestock/ habitat disturbance/ land use/ Texas
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645. Effects of short duration grazing on deer home ranges.

Kohl, Timothy F.; DeYoung, Charles A.; and Garza, Andres
Proceedings of the Annual Conference: Southeastern Association of Fish and Wildlife Agencies 41: 299-302. (1987)
NAL Call #: SK1.S6; ISSN: 0276-7929
Descriptors: animals and man/ disturbance by man/ commercial activities/ reproduction/ sex differences/ behaviour/ land and freshwater zones/ Nearctic Region/ North America/ USA/ *Odocoileus virginianus* (Cervidae): farming and agriculture/ short term and continuous cattle grazing/ home range size relationships/ behavioural sex differences/ home range/ size/ short term and continuous cattle grazing effect/ Texas/ Brooks County/ King Ranch/ home range size/ sex differences/ short term and continuous cattle grazing effects/ Cervidae/ Artiodactyla/ Mammalia/ chordates/ mammals/ vertebrates
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646. Effects of short duration grazing on wild turkey home ranges.

Schulz, P. A. and Guthery, F. S.
Wildlife Society Bulletin 15(2): 239-241. (1987)
NAL Call #: SK357.A1W5; ISSN: 0091-7648
Descriptors: *Meleagris gallopavo intermedia*/ grazing management/ rangeland management/ habitat quality/ Texas/ USA
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647. Effects of specialized grazing systems on waterfowl production in southcentral North Dakota.

Barker, W. T.; Sedivec, K. K.; Messmer, T. A.; Higgins, K. F.; and Hertel, D. R.
In: Transactions of the North American Wildlife and Natural Resources Conference. (Held 16 Mar 1990-21 Mar 1990 at Denver, CO (USA).) McCabe, R. E. (eds.); Vol. 55.; pp. 462-474; 1990.

Notes: ISSN 0078-1355

NAL Call #: 412.9 N814

Descriptors: aquatic birds/ population dynamics/ agriculture/ grazing/ USA, North Dakota/ ducks/ livestock
Abstract: The recent decline in numbers of several waterfowl species and poor nesting success indicates that there is insufficient production of ducks in the prairie pothole region to maintain populations at desirable levels. About 50 percent of the ducks in North America are produced in the prairie pothole region and about 95 percent of the production occurs on private lands. Thus, a major effort to reverse the decline in duck numbers should emphasize the use of new and improved management techniques on private lands, particularly the use of new rangeland grazing systems. Numerous studies have evaluated the effects of grazing on duck production in North America. However, most of these evaluations were designed to compare differences of duck production between grazed lands and idle lands or among different land uses. Also, nearly all of the earlier studies of grazing effects involved seasonlong grazing treatments with occasional differences in grazing intensities. Seasonlong grazing has been shown to be detrimental to production of most upland nesting birds and also to maximum livestock production. A study of livestock and waterfowl relationships was initiated in 1982 on the Central Grasslands Research Center.
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648. Effects of summer sheep grazing on browse nutritive quality in autumn and winter.

Alpe, Michael J.; Kingery, James L.; and Mosley, Jeffrey C.
Journal of Wildlife Management 63(1): 346-354. (1999)
NAL Call #: 410 J827; ISSN: 0022-541X
Descriptors: acid detergent fiber/ acid detergent lignin/ browse nutritive quality/ neutral detergent fiber/ seasonality
Abstract: Prescribed livestock grazing in summer may improve the nutritive quality of autumn and winter browse for wild ungulates. We examined the effects of early-summer versus late-summer sheep grazing on autumn and winter browse quality in northern Idaho. Nutritive quality of 6 shrub species collected in September (autumn) and November (winter) was measured following early-summer (May-June) sheep grazing, late-summer (August) sheep grazing, and no grazing in 1993 and 1994. Shrub samples were analyzed for crude protein (CP), available protein, neutral detergent fiber (NDF), acid detergent fiber (ADF), and acid detergent lignin. Relative to the ungrazed control, early-summer sheep grazing improved both autumn and winter browse quality in redstem ceanothus (*Ceanothus sanguineus*), ninebark (*Physocarpus malvaceus*), rose (Rose spp.), and snowberry (*Symphoricarpos* spp.). Early-summer sheep grazing improved browse quality of thimbleberry (*Rubus parviflorus*) in autumn but had no effect on its nutritive quality in winter. In contrast, late-summer sheep grazing reduced both autumn and winter browse quality in redstem ceanothus and ninebark. Late-

summer grazing reduced autumn browse quality in snowberry and rose but improved browse quality of rose in winter. Scouler willow (*Salix scouleriana*) was not readily selected by sheep in either grazing season, which explains why the nutritive quality of Scouler willow in autumn and winter was unaffected by the grazing treatments. For most browse species, fiber content in autumn and winter was higher in 1993 than 1994, due to weather conditions. We conclude that prescribed sheep grazing can either improve or reduce autumn and winter browse nutritive quality for wild ungulates, depending upon weather conditions and the intensity of sheep browsing. For transitory ranges of the Inland Northwest, we suggest browse quality will likely improve if moderate sheep grazing (40-55% relative utilization) in summer ceases by mid- to late June. Autumn and winter browse quality should be largely unaffected if moderate sheep grazing in summer ceases by mid-August. Browse quality in autumn will probably be lowered if sheep grazing occurs in late August, but moderate sheep grazing in late August will have relatively minor effects on browse quality in winter.

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649. The effects of varied grazing management on epigeal spiders, harvestmen and pseudoscorpions of *Nardus stricta* grassland in upland Scotland.

Dennis, Peter; Young, Mark R.; and Bentley, Christopher
Agriculture, Ecosystems & Environment 86(1): 39-57. (2001)

NAL Call #: S601 .A34; ISSN: 0167-8809

Descriptors: grassland/ micro habitat/ plant litter/ species composition/ species diversity/ species dominance/ spider web count/ varied grazing management/ vegetation structure

Abstract: A hypothesis that epigeal arachnid assemblages benefit more from greater vegetation structure than botanical species composition in upland grasslands was tested. The test was carried out within a grazing experiment, initiated in 1991, to investigate vegetation dynamics in response to stocking with mixed livestock at varied rates. The experimental treatments comprised: no livestock, sheep only or sheep with cattle. Livestock treatments were grazed to maintain either 4.5 or 6.5 cm average sward heights between tussocks. Two replicates of each treatment were used and allocated to 10 plots across 22ha of *Nardus stricta*-dominated grassland. The effects on epigeal arachnids (excluding acarines) of the botanical and structural differences of the grassland between treatments during April-October 1993 and 1994 were assessed. Epigeal arachnid species composition was estimated using continuous pitfall trapping and the densities of mainly money spiders (Araneae: Linyphiidae) were estimated from monthly suction sampling and visual counts of spider webs in micro-habitats. These data were later compared with stocking rate, botanical species composition and vegetation structure. Forty of the 84 sampled species occurred in all experimental treatments. There was a significant effect of treatment on the number of arachnid species in suction but not in pitfall samples. There was also a significant effect of treatment on the relative abundance of 26% of these arachnid species. For most species of spider, harvestmen and pseudoscorpion, abundance was greater in the ungrazed and taller, grazed swards although a few species were captured in greater numbers in the treatments with shorter swards. Botanical composition, mean vegetation

height and grazing intensity accounted for 48.5-53.2% of the variability in the species composition/relative abundance of these arachnids, calculated by direct gradient analysis. Almost half of the species were randomly distributed across the experimental treatments and are recorded as widespread in upland heathland or grassland habitats and lowland grassland. More spider webs were counted during July-September 1993-1994, with greater numbers (dominated by the linyphiid species, *Lepthyphantes mengii*) counted in tall, ungrazed swards compared with taller grazed swards created by sheep alone or sheep with cattle. In the treatments with fewer webs, these were occupied by more linyphiid species. Suction sampling detected greater diversity of arachnids in the ungrazed *N. stricta*. This was related to increased plant litter below the leaf stratum where webs were counted. Vegetation structure and not botanical species composition within the *N. stricta* plant community determined arachnid species composition and abundance. Furthermore, no single grazing treatment supported the total number of arachnid species represented across the entire grazing experiment. It is concluded that varied grazing management, including some temporary ungrazed areas, is necessary to maintain the structural variability of grassland patches so as to maintain a spatial mosaic that favours the optimum arachnid fauna of upland grasslands.

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650. Elk (*Cervus elaphus nelsoni*) use of winter range as affected by cattle grazing fertilizing and burning in southeastern Washington.

Skovlin, J. M.; Edgerton, P. J.; and Mcconnell, B. R.
Journal of Range Management 36(2): 184-189. (1983)
NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1983/362/14skov.pdf>

Descriptors: bunch grass

Abstract: A study of ways to increase winter use by elk of Pacific bunchgrass foothill range in southeastern Washington employed fertilizing and rangeland burning, with and without spring cattle grazing. First-year response of elk to fertilizer applied in fall (56 kg N/ha) was a 49% increase in use; but no significant carry-over effect was noted in subsequent years. Fall burning to remove dead standing litter and enhance forage palatability provided no increase in elk use in winter. Intensive cattle grazing in spring to promote regrowth did not increase elk use. In fact, cattle grazing decreased winter elk use by 28% in 1 of the 3 yr studied. The cost effectiveness of increasing elk use by fertilizing appeared marginal except perhaps in special situations. A discussion of forage allocation to both elk and cattle is presented.

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651. Elk forage utilization within rested units of rest-rotation grazing systems.

Werner, Scott J. and Urness, Philip J.
Journal of Range Management 51(1): 14-18. (1998)
NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/1998/511/014-018_werner.pdf

Descriptors: *Cervus elaphus*/ *Cervus canadensis*/ *Bos taurus*/ behavior/ foods/ feeding/ grazing/ habitat management/ mammals/ management/ wildlife/ wildlife/

livestock relationships/ wapiti/ cattle/ competition/
vegetation/ rest-rotation grazing/ elk/ North America/ United
States/ Utah: Fish Lake Natl. Forest

Abstract: Researchers determined elk forage utilization during the summers of 1994 and 1995 at the forest-grassland ecotone of three rest-rotation grazing allotments in Fishlake National Forest, Utah. klf.

© NISC

652. Elk use of winter range as affected by cattle grazing, fertilizing, and burning in southeastern Washington.

Skovlin, Jon M.; Edgerton, Paul J.; and McConnell, Burt R.
Journal of Range Management 36(2): 184-189. (1983)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1983/362/14skov.pdf>

Descriptors: Cervus elaphus nelsoni/ Cervus canadensis/
fertilization/ soil and water/ fires/ burns/ grazing/ habitat
alterations/ habitat use/ wildlife/ livestock relationships/
wapiti/ home-range/ winter/ agriculture/ habitat/
disturbance/ fire/ ecology/ ethology/ prairie/ fertilizer/ North
America/ United States/ Washington/ Washington,
southeastern/ USA

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653. Evaluating grazing strategies for cattle: Nutrition of cattle and deer.

Ortega, I. M.; Soltero-Gardea, S.; Drawe, D. L.; and
Bryant, F. C.

Journal of Range Management 50(6): 631-637. (1997)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/1997/506/631-637_ortega.pdf

Descriptors: coastal bend of Texas/ continuous grazing/
crude protein/ digestibility/ IVDOM/ Odocoileus virginianus/
short-duration grazing

Abstract: We studied cattle and deer diet quality within replicated grazing treatments of continuous and short-duration grazing at heavy and moderate stocking rates. The study was conducted at the Welder Wildlife Refuge, Sinton, Tex. from October 1987 to July 1989. We obtained cattle diet samples from esophageally fistulated steers. Deer diets were reconstructed using data obtained through the bite-count technique. Digestibility (IVDOM) and crude protein (CP) of cattle diets were similar between grazing systems and stocking rates. Digestibility of deer diets was affected by both grazing systems and stocking rates. Dietary CP and IVDOM of deer and rattle diets both differed among seasons. Dietary CP levels met maintenance requirements for deer throughout the study. Also, CP levels were high enough to meet low- to mid-gestation requirements. Deer dietary protein requirements for growth and lactation were never met regardless of grazing strategy. Although protein content of cattle diets was relatively low, these values satisfied cattle maintenance needs. Nursing cows, however, would not have met their requirement in any season sampled regardless of grazing system or stocking rate. Continuous grazing and moderate stocking rates may provide white-tailed deer the opportunity for selecting diets containing more desirable forbs and greater nutrient concentration. Less intensive rotational grazing at moderate rates may be preferred to maintain a relatively high seral stage.

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654. Fall cattle grazing versus mowing to increase big-game forage.

Taylor, Nancy; Knight, James E.; and Short, Jeffrey J.

Wildlife Society Bulletin 32(2): 449-455. (2004)

NAL Call #: SK357.A1W5; ISSN: 0091-7648

Descriptors: Blackfoot Clearwater Wildlife Management
Area/ nutrition/ seasons/ vegetation removal

Abstract: The effects of 3 levels of mowing and cattle (*Bos taurus*) grazing were examined on rough fescue (*Festuca scabrella*) range on the Blackfoot Clearwater Wildlife Management Area in west-central Montana. Treatments were implemented in enclosures during the fall of 1997 and 1998 at 50%, 70%, and 90% removal of herbaceous standing crop. Elk (*Cervus elaphus*) and mule deer (*Odocoileus hemionus*) forage measurements were obtained in spring and summer on standing dead vegetation, green grass and forb biomass, total biomass, and percent live vegetation, and compared between mowing and prescribed cattle grazing at the same removal level. At the 50% mowing level, there was increased ($P<0.05$) availability of grass and biomass in the spring, with increased standing dead and decreased percent live vegetation in the summer. At the 70% mowing level, there was increased standing dead and grass and decreased percent live vegetation available to elk and mule deer in the spring when compared with the same level of grazing ($P<0.05$). At the 90% mowing level, there was decreased availability of grass and total biomass during spring and summer ($P<0.05$). Results indicated that at moderate (50%) levels of vegetation removal, fall mowing might be adequate to increase grass and total biomass availability in the spring, but fall grazing by cattle might remove more standing dead material, leaving more nutritious plants available to wildlife in the summer. Fall mowing at 70% removal might provide more grass for wildlife in the spring, but reduces percent live vegetation and leaves more standing dead when compared to fall cattle grazing. This would make it more difficult for wildlife to select preferred forage in the spring, when nutrition is needed for calf and fawn production. Fall cattle grazing might be a better tool to use at the 90% level, since mowing removes more grass and total biomass, leaving reduced vegetation for elk and mule deer.

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655. Fall grazing affects big game forage on rough fescue grasslands.

Short, J. J. and Knight, J. E.

Journal of Range Management 56(3): 213-217. (2003)

NAL Call #: 60.18 J82; ISSN: 0022-409X

Descriptors: cattle/ rotational grazing/ grazing intensity/
wildlife management/ Cervus elaphus/ Odocoileus/ range
management/ Festuca altaica/ biomass/ spring/ summer/
botanical composition/ forbs/ wildlife-livestock relations/
Montana

Abstract: Prescribed cattle grazing is often used to purposely enhance wildlife habitat. This study investigated the effects of fall cattle (*Bos taurus*) grazing intensity on elk (*Cervus elaphus*) and deer (*Odocoileus* spp.) forage in the following spring and summer. These effects were examined on rough fescue (*Festuca scabrella* Torr.) range on the Blackfoot Clearwater Wildlife Management Area in west central Montana. Cattle were grazed in enclosures during the fall of 1997 and 1998. A randomized complete block design with 5 replications of enclosures per year was used.

Grazing levels were 0% removal (control), 50% removal, 70% removal, and 90% removal of herbaceous standing crop. To evaluate elk and deer forage, measurements were obtained in spring and summer on green grass standing crop, green forb standing crop, percent green vegetation, species richness, and plant species composition. There were no differences among grazing levels for plant species composition based on canopy coverage, species richness, and green forb standing crop variables ($P > 0.10$). The 50% and 90% treatments reduced green standing crop in spring ($P = 0.07$) but not in summer ($P > 0.10$). Grazing treatments increased percent green vegetation ($P < 0.01$). Fall cattle grazing can be used as a wildlife habitat improvement tool to reduce unpalatable standing dead material. The 70% removal treatment was the most favorable for habitat improvement without degrading the range.

This citation is from AGRICOLA.

656. Fencing to control livestock grazing on riparian habitats along streams: Is it a viable alternative?

Platts, W. S. and Wagstaff, F. J.

North American Journal of Fisheries Management 4(3): 266-272. (1984)

NAL Call #: SH219.N66; ISSN: 0275-5947

Descriptors: habitat alterations/ management/ research--rivers and streams/ riparian habitat

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657. Fire and cattle grazing on wintering sparrows in Arizona grasslands.

Gordon, C. E.

Journal of Range Management 53(4): 384-389. (2000)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/2000/534/384-389_gordon.pdf

Descriptors: wild birds/ beef cattle/ grazing/ prescribed burning/ grazing intensity/ wildlife management/ Arizona
Abstract: This paper reports on the results of a 3-year field study of the effects of spring/summer burning and cattle grazing on wintering sparrows in the grasslands of southeastern Arizona. The effects of fire were studied with 1 year of pre-burn data and 1 year of post-burn data from 1 fire, plus limited sampling from a second fire at Buenos Aires National Wildlife Refuge in Pima County, Ariz. The effects of grazing were studied by comparing study plots at a site that has not been grazed by cattle since 1968 with a nearby grazed pasture in Santa Cruz County, Ariz. Sparrow abundance was measured as the number of captures from flush-netting sessions conducted by groups of 13-30 volunteers. Vesper (Poecetes gramineus (Gmelin)) and Savannah (Passerculus sandwichensis (Gmelin)) Sparrows responded positively to fire, while Cassin's Sparrows (Aimophila cassinii (Woodhouse)) responded negatively. The ecologically and geographically restricted Baird's (Ammodramus bairdii (Audubon)) and Grasshopper (A. savannarum (Gmelin)) Sparrows utilized burned areas during the first post-burn winter and did not significantly respond to fire. Both Ammodramus sparrows also utilized the grazed pasture; they were more abundant there than in the ungrazed study area in 1 year. While field observations and a prior study suggest that heavy grazing can have a

strong detrimental effect on Ammodramus sparrows, the results of this study suggest that moderate cattle grazing may be compatible with the conservation of these species. This citation is from AGRICOLA.

658. Food of vagrant shrews Sorex vagrans from Grant County, Oregon as related to livestock grazing pressures.

Whitaker, J. O.; Cross, S. P.; and Maser, C.

Northwest Science 57(2): 107-111. (1983)

NAL Call #: 470 N81; ISSN: 0029-344X

Descriptors: earthworm/ spider/ cricket/ caterpillar/ june bug/ moth/ slug/ snail/ trampling/ compression

Abstract: Major foods of the vagrant shrew (*S. vagrans*) in a relatively non-grazed portion of a mountain meadow in Grant County were earthworms, spiders, crickets, caterpillars, moths, slugs and snails and June beetles and their larvae. In 2 similar areas subjected to greater recent grazing, flightless forms (except caterpillars) were much less used; they were replaced primarily by caterpillars and flying insects. The hypothesized cause for these changes was that grazing trampled and compressed the ground, thus decreasing the populations of some forms.

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659. Foraging behavior by mule deer: The influence of cattle grazing.

Kie, J. G.; Evans, C. J.; Loft, E. R.; and Menke, J. W.

Journal of Wildlife Management 55(4): 665-674. (1991)

NAL Call #: 410 J827; ISSN: 0022-541X

Descriptors: Odocoileus hemionus/ reproductive energy demand/ activity pattern/ seasonality/ home range size/ wildlife management/ California/ USA

Abstract: We studied the effects of different cattle stocking rates on activity patterns of female mule deer (*Odocoileus hemionus*) on a summer range in the Sierra Nevada of California [USA]. Using an automated telemetry system, we determined that deer averaged 32 \pm 2.2 (SE)% of the time feeding, 8 \pm 1.1% traveling, and 60 \pm 2.4% resting per 24-hour period. Deer spent more time feeding and less time resting with increased cattle stocking rates. During 1984, a year of average precipitation, deer spent more time feeding per day in late summer than in early summer in range units grazed by cattle but did not do so in ungrazed range units. In 1985, a drier year, deer spent less time feeding per day in late summer in grazed range units. Time spent feeding by deer was negatively correlated with standing crop of herbaceous forage in meadow-riparian habitats. Deer increased their time spent feeding by shortening the length of resting bouts and including more feeding bouts each day, not by increasing the length of each foraging bout. Companion studies indicated that with cattle grazing, deer home-range sizes were larger (Loft 1988), and hiding cover for fawns was reduced (Loft et al. 1987). The results are consistent with the hypothesis that cattle competed with deer, particularly at high stocking rates and during a year of below-average precipitation. We suggest that female mule deer were acting as time-minimizers to meet the high energetic demands of lactation while minimizing their exposure to predators. Management options to reduce adverse effects include reducing or eliminating cattle grazing during early summer on all or part of the grazing allotment.

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660. Frog communities and wetland condition: Relationships with grazing by domestic livestock along an Australian floodplain river.

Jansen, A. and Healey, M.

Biological Conservation 109(2): 207-219. (2003)

NAL Call #: S900.B5; ISSN: 0006-3207

Descriptors: man-induced effects/ wetlands/ environmental factors/ plant populations/ community composition/ water quality/ agriculture/ river basin management/ flooding/ habitat/ nature conservation/ flood plains/ management/ conservation/ Anura/ Australia, Murrumbidgee R./ Australia/ livestock grazing intensity/ frogs/ toads

Abstract: Frogs are in decline worldwide, and are known to be sensitive indicators of environmental change.

Floodplains of the Murray-Darling Basin in southeastern Australia have been altered in many ways by livestock grazing, by the introduction of exotic fish, and by changes to flooding regimes. These changes have led to declines in wetland condition and hence to the availability of habitat for wetland frogs. This study examined relationships between frogs, wetland condition and livestock grazing intensity at 26 wetlands on the floodplain of the Murrumbidgee River. Frog communities, species richness, and some individual species of frogs declined with increased grazing intensity. Wetland condition also declined with increased grazing intensity, particularly the aquatic vegetation and water quality components. There were clear relationships between frog communities and wetland condition, with several taxa responding to aquatic and fringing vegetation components of wetland condition. Thus, grazing intensity appeared to influence frog communities through changes in wetland habitat quality, particularly the vegetation. Reduced stocking rates may result in improved wetland condition and more diverse frog communities. River management to provide natural seasonal inundation of floodplain wetlands may also enhance wetland condition, frog activity and reproductive success.

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661. Grasshopper densities on grazed and ungrazed rangeland under drought conditions in southern Idaho.

Fieldin, Dennis J. and Brusven, Marilyn A.

Great Basin Naturalist 55(4): 352-358. (1995)

NAL Call #: 410 G79; ISSN: 0017-3614

Descriptors: livestock grazing/ population density/ range management

Abstract: Low-density grasshopper populations were sampled at 15 pairs of rangeland sites in south central Idaho. One site of each pair had not been grazed by livestock for at least 10 years. Grazed sites were managed under normal grazing regimes established by the Bureau of Land Management. Mean grasshopper density was higher on ungrazed sites than on grazed sites. Proportions of *Melanoplus sanguinipes* were higher on ungrazed sites than on grazed sites and were higher on annual grasslands than on other vegetation types. Effects of grazing appeared to be independent of vegetation type. Proportions of Gomphocerinae, a subfamily of grasshoppers that feeds almost exclusively, on grasses, were affected by vegetation type, but not grazing. Crested wheatgrass seedlings supported the highest proportions of Gomphocerinae. Proportions of Oedipodinae were affected by grazing and vegetation type. Higher proportions of Oedipodinae were found on grazed sites than on ungrazed sites, and on sagebrush/grass sites than on annual grasslands. Results

indicate that livestock grazing during drought conditions tends to reduce grasshopper populations on southern Idaho rangeland.

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662. Grassland birds and habitat structure in Sandhills prairie managed using cattle or bison plus fire.

Griebel, Randall L.; Winter, Stephen L.; and Steuter, Allen A.

Great Plains Research 8(2): 255-268. (1998)

NAL Call #: QH104.5.G73 G755; ISSN: 1052-5165

Descriptors: Bison bison/ birds/ communities/ ecosystems/ fires/ burns/ grasslands/ grazing/ habitat alterations/ interspecies relationships/ mammals/ prairies/ bison/ Nebraska

Abstract: The authors provide information on bird abundance, distribution, and habitat structure from similar sandhill prairie landscapes managed traditionally with grazing by cattle and by a dynamic bison plus fire regime in the Great Plains. Specific habitat patches produced by fire and intensive bison grazing appear to have different bird communities and habitat structure at the local scale.

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663. Grassland management impacts on small mammals.

Adhikari, T. R.

In: Grassland ecology and management in protected areas of Nepal: Proceedings of a workshop. (Held 15 Mar 1999-19 Mar 1999 at Royal Bardia National Park, Thakurdwara, Bardia, Nepal.); Vol. Volume 2: Terai protected areas.; pp. 92-97; 2000.

NAL Call #: QH193.N4 G73 2000

Descriptors: grasslands/ environmental degradation/ cutting/ fires/ grazing/ nature reserves/ burning/ controlled burning/ grassland management/ wild animals/ small mammals/ wetlands/ floodplains/ nature conservation

Abstract: Grasslands cover more than 13% of the total area of Nepal. They have declined very rapidly in area, however, and are now mostly confined to protected areas. Nepal has established 15 protected areas, however, excessive grass cutting, fire, and grazing continues. Villagers are allowed into the protected areas to harvest thatch grasses and reeds for 10 days annually. In Royal Bardia National Park, 21 000, 45 000, and 57 000 people entered the park in 1983, 1993, and 1999, respectively, to harvest grass. Grazing is rampant in the protected areas. Both park staff and local people set fire to the Terai grasslands in winter burning 70-90% of the total area. This form of management, however, has been shown to have deleterious effects on disturbance-intolerant and cover-dependent small mammals.

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664. Grazing and passerine breeding birds in a Great Basin low-shrub desert.

Medin, D. E.

Great Basin Naturalist 46(3): 567-572. (1986)

NAL Call #: 410 G79; ISSN: 0017-3614

Descriptors: animals and man/ habitat modification/ ecology/ population dynamics/ habitat/ terrestrial habitat/ land and freshwater zones/ Nearctic Region/ North America/ USA/ Passeriformes: agricultural activity/ sheep grazing effects on breeding populations and community/ biomass/ community structure/ population density/ breeding

populations/ UT/ desert habitat/ low shrub/ breeding populations and community structure/ effects of sheep grazing/ Utah/ Millard County/ desert xperimental range/ breeding community structure and populations in relation to sheep grazing/ Passeriformes/ Aves/ birds/ chordates/ vertebrates

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665. Grazing effects on nutritional quality of bluebunch wheatgrass for elk.

Wambolt, Carl L.; Frisina, Michael R.; Douglass, Kristin S.; and Sherwood, Harrie W.

Journal of Range Management 50(5): 503-506. (1997)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/1997/505/503-506_wambolt.pdf

Descriptors: Cervus elaphus nelsoni/ Cervus canadensis/ Bos taurus/ behavior/ ecosystem/ foods/ feeding/ grazing/ mammals/ nutrients/ overwintering/ rangeland/ wildlife/ habitat relationships/ wapiti/ cattle/ interspecies relations/ nutrition [physio./ biochem./] elk/ North America/ United States/ Montana

Abstract: The authors studied the nutrient content of bluebunch wheatgrass in a three-pasture rest-rotation grazing system and in an enclosure on the elk winter range in southwestern Montana. The wheatgrass was cattle-grazed in the spring, ungrazed by cattle for a year, or given a long-term rest. Nitrogen and phosphorus were greater in the spring-grazed pasture, but regrowth of wheatgrass in this plot did not improve the nutrient content for wildlife over the non-grazed plots. Elk were not likely to eat enough bluebunch wheatgrass to meet their protein maintenance requirements during winter. lgh.

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666. Grazing effects on stream habitat and fishes: Research design considerations.

Rinne, J. N.

North American Journal of Fisheries Management 8(2): 240-247. (1988)

NAL Call #: SH219.N66; ISSN: 0275-5947

Descriptors: grazing/ river banks/ erosion control/ vegetation cover/ habitat improvement (biological)/ fishery management/ research programs/ environmental impact/ environmental conditions/ population levels/ Salmonidae/ population levels/ USA, New Mexico, Vacas R./ vegetation cover/ habitat improvement (biological)

Abstract: A 4-year study of a montane stream from which cattle grazing had been excluded for 10 years indicated that stream bank vegetation and stability were markedly improved and that stream substrate fines were somewhat reduced, but it indicated that fish populations were unaffected. Shortcomings of this case history study are common to past similarly designed studies of grazing effects on fishes and their habitats. Three major deficiencies in research design are (1) lack of pretreatment data, (2) improper consideration of fishery management principles, and (3) linear positioning of treatments along a stream. Future research on riparian grazing effects must address these factors in addition to designs of long-term (10+ years) ecosystem (watershed) studies.

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667. Grazing impacts on soil mites of semi-arid chenopod shrublands in western Australia.

Kinnear, Adrienne and Tongway, David

Journal of Arid Environments 56(1): 63-82. (2004)

NAL Call #: QH541.5.D4J6; ISSN: 0140-1963

Descriptors: animals and man/ disturbance by man/ commercial activities/ ecology/ population dynamics/ habitat/ terrestrial habitat/ land zones/ Australasian Region/ Australasia/ Australia/ Acari: farming and agriculture/ sheep grazing/ community structure/ population density/ terrestrial habitat/ chenopod shrublands/ impact of sheep grazing on soil fauna/ soil habitat/ Western Australia/ Boolethana Station/ chenopod shrubland/ population densities and community structure/ impact of sheep grazing/ soil fauna/ Acari/ Arachnida/ arachnids/ arthropods/ chelicerates/ invertebrates

Abstract: This research describes the effects on the soil mite fauna of two sheep-grazing intensities applied to chenopod shrublands in both good and poor conditions. Soil was sampled from within and between bluebush (*Maireana polypterygia*) accretion mounds, 9 and 18 months following a 10-year grazing trial. There were major differences in the mite assemblages associated with the grazing treatments. Heavily grazed sites had reduced abundances of most mite species and substantially reduced diversity. In this ecosystem, soil accretion mounds below bluebush are important sites of acarine diversity and abundance. Of a total of 75 species, 49% were found only in this habitat. The decline of mite assemblages associated with vegetation degradation and mound decay mirrors declining soil properties, which have been described for these sites. These soils have particularly high species richness, with broad similarities in mite composition (at family and generic levels) with similar environments elsewhere in the world, continuing the trends found by other researchers.

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668. Grazing in the Sierra Nevada: Home range and space use patterns of mule deer as influenced by cattle.

Loft, Eric R.; Kie, John G.; and Menke, John W.

California Fish and Game 79(4): 145-166. (1993)

NAL Call #: 410 C12; ISSN: 0008-1078

Descriptors: Odocoileus hemionus/ Bos taurus/ behavior/ grazing/ habitat use/ mammals/ home range/ territory/ wildlife/ livestock relationships/ mule deer/ cattle/ home-range/ food/ competition/ cover/ dispersion/ habitat/ North America/ United States/ California: Sierra Nevada/ USA

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669. Grazing management impacts on quail during drought in the northern Rio Grande Plain, Texas.

Campbell Kissock, L.; Blankenship, L. H.; and White, L. D.

Journal of Range Management 37(5): 442-446. (1984)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1984/375/13kiss.pdf>

Descriptors: Colinus virginianus/ Callipepla squamata/ grass

Abstract: Relationships between the abundance of 2 quail species [*Colinus virginianus*, *Callipepla squamata*] and range site and grazing management during drought were evaluated in the northern Rio Grande Plain of Texas. Clay loam range sites provided better nesting cover and greater abundance of forbs for quail than sandy loam and shallow

ridge range sites. Foliar cover and aboveground standing crop of grass were greater on the 3 range sites within the short duration and deferred rotation systems as compared with the yearlong system. During drought, grazing systems provided better nesting and protective cover for quail than yearlong grazing.

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670. Grazing management in Texas and its impact on selected wildlife.

Bryant, F. C.; Guthery, F. S.; and Webb, W. M.
In: Proceedings of the Wildlife-Livestock Relationships Symposium. (Held 20 Apr 1981-22 Apr 1981 at Coeur D'alene, Idaho.) Peek, James M. and Dalke, P. D. (eds.) Moscow, Idaho: Forest, Wildlife & Range Experiment Station, University of Idaho; pp. 94-112; 1982.

NAL Call #: SF84.84.W5 1981

Descriptors: Texas

This citation is from AGRICOLA.

671. Grazing management influences on two brook trout streams in Wyoming.

Hubert, W. A.; Lanka, R. P.; Wesche, T. A.; and Stabler, F.
In: Riparian ecosystems and their management: Reconciling conflicting uses. (Held 16 Apr 1985-18 Apr 1985 at Tuscon, Ariz.) Johnson, R. Roy; Ziebell, Charles D.; Patton, David R.; Ffolliott, Peter F.; and Hamre, R. H. (eds.)

Fort Collins, Colo.: Rocky Mountain Forest and Range Experiment Station, United States, Forest Service; pp. 290-294; 1985.

NAL Call #: aSD11.A42

Descriptors: riparian environments/ grazing/ environment management/ environmental impact/ habitat/ abundance/ *Salvelinus fontinalis*/ USA, Wyoming/ cattle grazing

Abstract: Brook trout (*Salvelinus fontinalis*) abundance and instream habitat characteristics were evaluated in two rangeland streams. Heavily grazed and lightly grazed reaches of two streams with different grazing management were compared. Relationships between stream morphology, riparian zone characteristics, and trout abundance were observed.

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672. Grazing management strategies for Lahontan Cutthroat trout stream habitats.

Coffin, P. D.

In: Proceedings of a symposium on sustaining rangeland ecosystems. (Held 29 Aug 1994-31 Aug 1994 at Eastern Oregon State College, La Grande, Oregon.) Edge, W. D. and Olsen-Edge, S. L. (eds.); Vol. Special Report 953. Corvallis, Ore.: Oregon State University Extension Service; pp. 150-152; 1996.

NAL Call #: 100 Or3M no.953

Descriptors: grassland management/ grazing systems/ damage/ grasslands/ riparian grasslands/ grazing/ management/ plant height/ grazing intensity/ nature conservation/ soil conservation

Abstract: Recommended grazing management practices for the maintenance of the Lahontan cutthroat trout in Nevada, California and Oregon included maximum allowable use of 20% of the annual growth of woody species and 30% of the annual growth of other key riparian species; >6 inches grazing height left at the end of the season; limiting streambank damage to 10%; introducing

grazing rest periods preferably annually; limiting livestock access to the stream; and monitoring of hot season grazing use.

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673. Grazing pressure impacts on potential foraging competition between angora goats and white-tailed deer.

Ekblad, R. L.; Stuth, J. W.; and Owens, M. K.

Small Ruminant Research 11(3): 195-208. (1993)

NAL Call #: SF380.I52; *ISSN:* 0921-4488

Descriptors: *Capra hircus*/ *Odocoileus virginianus*/ grazing/ foods/ feeding/ habitat alterations/ habitat use/ wildlife/ livestock relationships/ white-tailed deer/ domestic goat/ experiment/ food/ North America/ United States/ Texas: Zavala County/ USA

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674. Grazing regime as a tool to assess positive side effects of livestock farming systems on wading birds.

Tichit, Muriel; Renault, Olivier; and Potter, Thomas

Livestock Production Science 96(1): 109-117. (2005)

NAL Call #: SF1.L5; *ISSN:* 0301-6226

Descriptors: wet grassland/ grazing regime/ livestock fanning system/ wader

Abstract: Wet grasslands support large populations of waders. As these birds are very sensitive to sward height and heterogeneity, grazing management is a key issue to their conservation. On a French coastal marsh consisting of 816 fields of wet grasslands, birds were monitored in spring and grazing regimes were assessed at three periods: year, spring, autumn. Each species was associated with a particular annual grazing index lower than the mean for all grazed fields. During spring, grazing intensity was significantly lower for fields occupied by birds than for those of the entire landscape. Different species of waders showed different preferences to grazing intensity with redshanks and curlews representing two extremes of a gradient going from low to high intensity. In early spring, the more precocious species selected fields with a significantly higher mean and variance in autumn stocking rate than for all grazed fields in previous autumn. These results highlight the need to maintain a variety of grazing regimes if conservation of the waders is to be achieved at the community level. On the basis of our analysis, useful indicators related to thresholds on livestock density and turn-out date can be derived to assess positive side effects of livestock fanning systems. (c) 2005 Elsevier B.V. All rights reserved.

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675. Grazing to improve wader habitat on alkaline meadows in eastern Austria.

Kohler, Bernhard and Rauer, Georg

Wader Study Group Bulletin 61(Suppl.): 82-85. (1991).

Notes: Place of Publication: Bournville, Birmingham, England

Descriptors: birds, shore/ *Tringa totanus*/ *Limosa limosa*/ breeding/ ecosystems/ grazing/ habitat alterations/ meadows/ wildlife/ livestock relationships/ wildlife/ habitat relationships/ habitat: description/ interactions with man: conservation measures/ redshank/ common redshank/ black-tailed godwit/ Europe/ Austria

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676. Guild structure of a riparian avifauna relative to seasonal cattle grazing.

Knopf, F. L.; Sedgwick, J. A.; and Cannon, R. W.

Journal of Wildlife Management 52(2): 280-290. (1988)

NAL Call #: 410 J827; ISSN: 0022-541X

Descriptors: Salix spp./ Dendroica petechia/ Passerculus sandwichensis/ Melospiza melodia/ Melospiza lincolni/ Empidonax traillii/ Zonotrichia leucophrys/ Turdus migratorius/ Agelaius phoeniceus/ Molothrus ater/ habitat/ generalist/ specialist/ population density/ community structure/ vegetation structure/ Arapaho National Wildlife Refuge/ Colorado, USA

Abstract: The avifauna within the willow (*Salix* spp.) community on the Arapaho National Wildlife Refuge [Colorado, USA] (NWR) was dominated (96% of all observations each year) by 11 species of passerine birds during the summers of 1980-81. Using 28 vegetation variables measured or calculated for randomly selected points and points where birds were sighted, we assigned the species to 3 distinct response guilds relative to historical patterns of seasonal grazing. A eurytopic response guild (habitat generalists) included yellow warblers (*Dendroica petechia*) (YEWA), savannah sparrows (*Passerculus sandwichensis*) (SASP), and song sparrows (*Melospiza melodia*) (SOSP). A stenotopic response guild (habitat specialists) included willow flycatchers (*Empidonax traillii*) (WIFL), Lincoln's sparrows (*Melospiza lincolni*) (LISP), and white-crowned sparrows (*Zonotrichia leucophrys*) (WCSP). The intermediate, mesotopic response guild included American robins (*Turdus migratorius*) (AMRO), red-winged blackbirds (*Agelaius phoeniceus*) (RWBL), and brown-headed cowbirds (*Molothrus ater*) (BHCO). Population densities of the eurytopic response guild differed little between healthy (historically winter-grazed) and decadent (historically summer-grazed) willow communities within a year. Densities of species in the mesotopic response guild differed more dramatically, and stenotopic response-guild species were absent or accidental in decadent willows. Information on habitat use patterns of the individual species between years supported the definition of response guilds; vegetation structure was most variable in habitats of eurytopic species and least variable in habitats of stenotopic species. Comparisons between used and available vegetation features indicated that species in the stenotopic response guild used locations that differed from random on the basis of bush spacing. We hypothesize that the response-guild structure primarily reflects the impact of cattle upon the horizontal patterning of the vegetative community.

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677. Habitat and avifaunal recovery from livestock grazing in a riparian meadow system of the northwestern Great Basin.

Dobkin, David S.; Rich, Adam C.; and Pyle, William H.

Conservation Biology 12(1): 209-221. (1998)

NAL Call #: QH75.A1C5; ISSN: 0888-8892

Descriptors: avifaunal composition/ avifaunal recovery/ habitat recovery/ livestock grazing/ riparian meadow system/ species abundance/ species richness

Abstract: Riparian habitats are centers of biological diversity in arid and semiarid portions of western North America, but despite widespread loss and degradation of these habitats there is little quantitative information

concerning restoration of native riparian biota. We examined the recovery of a riparian meadow system in the context of long-term versus short-term release from livestock grazing. We compared the structure and dynamics of plant and avian communities on 1.5-ha plots inside a long-term (>30 years) livestock enclosure ("enclosure plots"), with adjacent plots outside the enclosure ("open plots") for 4 years following removal of livestock from open plots. Throughout the study, sedge cover, forb cover, and foliage height diversity of herbs were greater on enclosure plots, bare ground, litter cover, shrub cover, and shrub foliage height diversity were greater on open plots. Forb, rush, and cryptogamic cover increased on open plots but not on enclosure plots. Grass cover increased, whereas litter and bare ground decreased on all plots in conjunction with increased availability of moisture. Sedge cover did not change. Avian species richness and relative abundances were greater on enclosure plots, species composition differed markedly between enclosure and open plots (Jaccard Coefficient = 0.23-0.46), with enclosure plots dominated by wetland and riparian birds and open plots dominated by upland species. The appearance of key species of wet-meadow birds on open plots in the third and fourth years following livestock removal signaled the beginning of restoration of the riparian avifauna. We interpret the recovery of riparian vegetation and avifaunal composition inside the enclosure as a consequence of livestock removal, which led to a rise in the water table and an expansion of the byporheic zone laterally from the stream channel. The lack of change in sedge and shrub cover on open plots suggests that restoration to a sedge-dominated meadow will not happen quickly.

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678. Habitat quality and management for the northern brown argus butterfly *Aricia artaxerxes* (Lepidoptera: Lycaenidae) in north east England.

Ellis, S.

Biological Conservation 113(2): 285-294. (2003)

NAL Call #: S900.B5; ISSN: 0006-3207

Descriptors: grazing management/ grazing pressure/ habitat management/ habitat quality/ population dynamics/ species abundance

Abstract: An experimental study at four North East England sites, was used to examine ovipositing preferences in the scarce northern brown argus butterfly *Aricia artaxerxes*. The impact of grazing management on habitat quality and adult population dynamics was examined using transect counts over a 10-year period at Thrislington Plantation NNR. The selection of ovipositing sites was not dependent upon the abundance of the hostplant, common rock-rose *Helianthemum nummularium*, or on the presence of bare ground. Eggs were frequently laid on the younger, second and third pair of leaves from the tip of the hostplant shoot and selected leaves were larger than leaves of randomly selected plants. In a laboratory experiment, hostplants treated with nitrogen, with larger and thicker leaves were selected for ovipositing most frequently. Fewer eggs were laid in managed (shorter vegetation) than unmanaged (taller vegetation) experimental plots and similarly, adults were much less abundant in grazing compartments subjected to higher grazing pressures, although recoveries were apparent once these were relaxed. *A. artaxerxes* is able to survive in a range of sward heights, but population densities were lowest in short vegetation (<5 cm) and

increased in medium (6-10 cm) to tall (>10 cm) swards. Grazing pressures less than about 0.2 Livestock Units appeared to be most beneficial. The implications of these results for the conservation *A. artaxerxes* sites are discussed.

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679. Habitat selection by the Texas tortoise in a managed thornscrub ecosystem.

Kazmaier, Richard T.; Hellgren, Eric C.; and Ruthven, Donald C.

Journal of Wildlife Management 65(4): 653-660. (2001)
NAL Call #: 410 J827; ISSN: 0022-541X

Descriptors: radiotelemetry: monitoring method/ Tamaulipan Biotic Province/ brush invasion [brush encroachment]/ canopy cover/ community ecology/ conservation biology/ grazing pastures/ habitat change/ habitat management/ habitat selection/ land use/ old field pastures/ riparian habitats/ semiarid shrublands: habitat/ thornscrub ecosystems/ vegetation types

Abstract: Brush encroachment on semiarid shrublands resulting from livestock grazing has created global concern. Southern Texas is dominated by *Prosopis-Acacia* mixed brush communities typical of the Tamaulipan Biotic Province, and the geographic range of the state-threatened Texas tortoise (*Gopherus berlandieri*) is nearly identical to the boundaries of this biotic province in Texas. In light of the perceived threat to Texas tortoises because of habitat change caused by brush encroachment, we monitored 36 Texas tortoises by radiotelemetry during 1994-1996 to assess habitat selection on a site containing grazed and ungrazed pastures. Tortoises did not exhibit habitat selection at the level of locations within home ranges. Differential habitat selection at the level of home ranges within study areas was not apparent for sex, but was evident for treatment (grazed or ungrazed). Analysis of pooled data indicated that tortoises exhibited broad-scale selection for home ranges within study areas. Selection was expressed as preferential avoidance of old-field and riparian habitats, which represented vegetational extremes of canopy cover. However, tortoises tolerated the broad continuum of other brush communities on the study site. Apparent treatment differences may be an artifact of our inability to adequately pair study areas given the scale of tortoise movement. Our data indicate that increases in the extent of woody canopy cover resulting from grazing-induced brush encroachment will not be detrimental to Texas tortoises. Furthermore, large-scale range improvement practices, such as root-plowing, create unsuitable habitats for this species.

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680. Habitat shifts by mule deer the influence of cattle grazing.

Loft, E. R.; Menke, J. W.; and Kie, J. G.

Journal of Wildlife Management 55(1): 16-26. (1991)
NAL Call #: 410 J827; ISSN: 0022-541X

Descriptors: *Odocoileus hemionus*/ *Populus tremuloides*/ riparian habitat/ competition

Abstract: We studied the effects of cattle on selection of home ranges and habitats by female mule deer (*Odocoileus hemionus*) on summer range in the Sierra Nevada, California. Three grazing levels (no grazing, moderate grazing, and heavy grazing) were imposed on 3 fenced range units over 3 years. Habitat selection by 13

radio-collared female mule deer was estimated each summer; habitat selection by radio-collared cattle was estimated at the 2 grazing levels. In the absence of grazing, meadow-riparian habitat comprised a greater proportion of deer home ranges than during grazing. During moderate and heavy grazing, a greater proportion of montane shrub habitat was included within deer home ranges than when ungrazed. Within home ranges, deer preferred meadow-riparian habitat at all grazing levels, whereas aspen (*Populus tremuloides*) habitat was preferred only during no grazing. Deer preference for meadow-riparian habitat declined over the summer, more so with cattle grazing. Cattle also preferred meadow-riparian and aspen habitat. The greatest effect of cattle on habitat selection by female mule deer occurred during late summer with heavy grazing when forage and cover were at a minimum in preferred habitats. Female mule deer shifted habitat use by reducing their use of habitats preferred by cattle and increasing their use of habitats avoided by cattle. These results were consistent with expectations of competition and habitat selection theory.

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681. Historical and present impacts of livestock grazing on fish and wildlife resources in Western riparian habitats.

Ohmart, Robert D.

In: *Rangeland wildlife*/ Krausman, Paul R.
Denver, Colo.: Society of Range Management, 1996;
pp. 245-279

NAL Call #: SK361.R36 1996

Descriptors: animals and man/ disturbance by man/ commercial activities/ documentation/ publications/ habitat/ terrestrial habitat/ land and freshwater zones/ comprehensive zoology: farming and agriculture/ literature review/ riparian habitat/ livestock grazing/ biological effects/ N. America/ Nearctic Region/ North America/ west/ biological effects of livestock grazing/ past and present/ review/ riparian habitats

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682. Impact of cattle grazing on prostigmatid mite densities in grassland soils of southern interior British Columbia.

Battigelli, J. P.; McIntyre, G. S.; Broersma, K.; and Krzic, M.
Canadian Journal of Soil Science 83(5): 533-535. (2003)

NAL Call #: 56.8 C162; ISSN: 0008-4271

Descriptors: cattle grazing/ cattle grazing impacts/ grassland ecosystems/ grassland soils/ range management/ sample depth/ sampling season/ soil mesofauna: soil ecosystem component

Abstract: Soil mesofauna are an important part of soil ecosystems, but little is known about them in grassland ecosystems of southern interior British Columbia. In this study, 12 300 organisms were examined and prostigmatid mites were most abundant, representing 95% of the total collection. Cattle grazing, sample depth and season of sampling influenced prostigmatid mite densities. However, grazing was the most significant factor, explaining 29% of the variation in prostigmatid mite density.

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683. Impact of cattle on two isolated fish populations in Pahrangat Valley, Nevada.

Taylor, Frances R.; Gillman, Leah A.; and Pedretti, John W. *Great Basin Naturalist* 49(4): 491-495. (1989)
 NAL Call #: 410 G79; ISSN: 0017-3614
Descriptors: habitat alterations/ grazing/ management/ research/ nitrogen/ pollution/ rivers and streams/ North America/ United States/ Nevada/ Nevada: Ash Springs/ Nevada: Brownie Spring/ Cichlasoma/ Cichlidae/ Cyprinidae/ Gambusia/ Poecilia/ Poeciliidae/ Rhinichthys/ Cichlasoma nigrofasciatum/ Crenichthys baileyi baileyi/ Gambusia affinis/ Poecilia mexicana/ Rhinichthys osculus
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684. Impact of grassland management on avian fauna.
 Baral, H. S.

In: Grassland ecology and management in protected areas of Nepal: Proceedings of a workshop. (Held 15 Mar 1999-19 Mar 1999 at Royal Bardia National Park, Thakurdwara, Bardia, Nepal.); Vol. Volume 2: Terai protected areas.; pp. 98-113; 2000.
 NAL Call #: QH193.N4 G73 2000
Descriptors: wetlands/ wild birds/ nature conservation/ burning/ controlled burning/ flooding/ grazing/ species diversity/ grassland management/ grasslands/ lowland grasslands
Abstract: Tall moist lowland grasslands are by far the most threatened habitat in Nepal and probably in the entire Indian subcontinent. More than one third of globally threatened bird species in Nepal live in lowland grasslands. Tall moist grasslands were surveyed at different times of the year for three consecutive years in three protected areas of lowland Nepal. A total of 219 species of birds were found to be using lowland grasslands at different times of year. The effects of management regimes such as fire, floods, and grazing were studied. The grassland management in lowland protected areas differed in space, time, and habitat scale. The effects of grassland management on avian fauna were studied. Better understanding of grassland dynamics is recommended to facilitate effective grassland management.
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685. The impact of grassland management on threatened butterflies in ESA's.

Warren, M. S. and Bourn, N. A. D.
 In: Grassland management in environmentally sensitive areas. (Held 23 Sep 1997-25 Sep 1997 at Lancaster, United Kingdom.) Sheldrick, R. D. (eds.); pp. 138-143; 1997.
 NAL Call #: SB197.B7; ISBN: 0905944542

686. The impact of grazing on spider communities in a mesophytic calcareous dune grassland.

Bonte, D.; Maelfait, J. P.; and Hoffmann, M.
Journal of Coastal Conservation 6(2): 135-144. (2000)
 NAL Call #: GC1080; ISSN: 1400-0350
Descriptors: twinspace: two way indicator species analysis, computer software/ pitfall traps: field sampling equipment/ ecological differentiation/ grazing impacts/ habitat preferences/ habitat variables/ juvenile development/ mesophytic calcareous dune grassland/ overwintering/ species diversity
Abstract: During 1994-1995 and 1997-1998 spiders were sampled with pitfall traps in a botanically rich, mesophytic,

calcareous dune grassland in Belgium. As a consequence of intensive cattle grazing, vegetation variation in a large part of the area had diminished. The study area was also patchily grazed by rabbits. Community analysis with TWINSpan revealed five distinct spider communities. Ecological differentiation was best explained by combination of the habitat variables: distance from grazed or non-grazed vegetation, *Rosa pimpinellifolia* cover and grass cover in both summer and winter. Species diversity was highest in the border zone between the cattle-grazed and non cattle-grazed sites. Correlation of the most abundant spider species with the vegetation determinants explains the ecological differentiation between the spider communities. Species were classified into seven major groups that reflect the species' habitat preferences. The group showing clear association with non cattle-grazed, tall vegetation consists of common species. Characteristic species for the intensively cattle-grazed sites are common aeronauts and rare species such as *Walckenaeria stylifrons*, *Mastigusa arietina*, *Ceratinopsis romana* and *Pardosa monticola*. The latter are shown to be dependent on ungrazed vegetation for juvenile development and overwintering. Intensive grazing results in homogeneous short vegetation, which can only be colonized by 'open ground' species with a well-developed dispersal capacity, or by species which are not dependent on litter-rich situations for juvenile development. An extensive cattle grazing regime results in a patchy mosaic grassland where, in addition to the above mentioned groups of species, other species survive by migrating between the buffered litter rich ungrazed vegetation and the short vegetation. Additionally, some typical and rare species prefer the transition zone between the grazed and the ungrazed vegetation because they are associated with specific habitat structures or inhabiting ant-species.

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687. Impact of livestock grazing on birds of a Colombian cloud forest.

Martin, T. E.
Tropical Ecology 25(2): 158-171. (1984)
 NAL Call #: 451 IN85; ISSN: 0564-3295
Descriptors: abundance/ understory/ density/ diversity/ rare species/ extinction/ susceptibility
Abstract: Mist-net lines were established in the understory of a secondary Colombian cloud forest, in areas where grazing pressure varied from none to severe, to examine the influence of grazing on abundance and diversity of birds. Increased grazing pressure resulted in decreased foliage density; ungrazed and lightly grazed areas had similar foliage densities while medium and severely grazed areas had much less foliage. Capture rates of birds (an index of abundance) were correlated with changes in foliage density; capture rates were similar between ungrazed and lightly grazed areas, but were much lower in medium and severely grazed areas. Numbers of captured bird species declined with increased grazing pressure and associated decreased understory vegetation density. In a comparison of this study with one by Ridgely and Gaulin (198) in an adjacent ungrazed primary forest, I found 7 species they did not record and they found 14 species that I did not record on my site. Many of these species were missed due to their rarity, but also because of effects of

grazing. I suggest the rarity and habitat specificity of tropical birds make them susceptible to increased extinctions from reduction of foliage due to grazing.

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688. The impact of livestock on lapwing *Vanellus vanellus* breeding densities and performance on coastal grazing marsh.

Hart, J. D.; Milsom, T. P.; Baxter, A.; Kelly, P. F.; and Parkin, W. K.

Bird Study 49(1): 67-78. (2002); ISSN: 0006-3657

Descriptors: grazing/ livestock/ marshes/ population density/ breeding sites/ breeding success/ agriculture/ environmental impact/ nature conservation/ population dynamics/ *Vanellus vanellus*/ northern lapwing/ livestock grazing/ aquatic birds

Abstract: Even at very low stocking densities, livestock reduce breeding densities of adult Lapwings and increase the risk of nest loss due to predation. To assess the effects of livestock on Lapwings breeding on coastal grazing marshes. Densities of breeding adults, clutch sizes, laying dates, incubation schedules, clutch and chick survival were compared between marshes grazed at low stocking densities (0.2-0.51 livestock units/ha) and marshes where livestock had been excluded. Repeated measurements of sward heights were also made. Breeding densities in 1995 and 1997, but not 1996, were negatively correlated with the presence of livestock. Though few nests were trampled, livestock disrupted incubation schedules and increased the risk of nest predation. Clutches were smaller on grazed marshes than on ungrazed marshes, while more clutches were also laid later on grazed marshes. Grazed swards remained shorter, and more suitable for nesting, longer than ungrazed swards but clutches laid later in the season were more likely to be predated. The exclusion of livestock from selected areas to increase the nesting success of lapwings is a desirable option on coastal grazing marshes where the rate of grass growth is slow in spring. Grazing regimes are suggested that would maintain relatively short swards, provide refuge to Lapwings from livestock during the peak nesting period, and allow grazers to exploit all of their marshes.

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689. Impact of precipitation and grazing on the water vole in the Beartooth Mountains of Montana and Wyoming, U.S.A.

Klaus, M.; Moore, R. E.; and Vyse, E.

Arctic, Antarctic, and Alpine Research 31(3): 278-282. (1999)

NAL Call #: GB395.A73; ISSN: 1523-0430

Descriptors: grazing/ mountain grasslands/ precipitation/ indicators/ survival/ watersheds/ nature conservation/ *Microtus richardsoni*

Abstract: The influence of increased precipitation levels and grazing on the demographics of *Microtus richardsoni* was examined. Water voles were trapped and marked during the summers of 1990, 1991 and 1992 along four headwater watersheds of the Clark's Fork of the Yellowstone River in Wyoming and Montana. The summer of 1992 had more than double the precipitation of either 1990 or 1991. During the wet summer of 1992, capture success was significantly greater, as was the proportion of young voles captured. In 1992, several factors contributed to increased water vole populations. There were

significantly more indications of male reproductive activity. Class I water voles (13-49 g) of both sexes showed signs of reproductive activity indicating they were reaching sexual maturity at smaller body mass. Significantly more embryos/trap-killed female were found. In 1995, the water vole was listed as a sensitive species because it is rare and requires specific alpine riparian habitat that is declining and may be damaged by poor grazing practices. Capture success was significantly greater, and there were significantly more young water voles in ungrazed drainages. Measured indicators of reproductive activity did not vary significantly between grazed and ungrazed drainages. It is concluded that grazing might affect survival of young water voles and should be studied further.

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690. The impact of recreational trails and grazing on small mammals in the Colorado piedmont.

Meaney, Carron A.; Ruggles, Anne K.; Clippinger, Norman W.; and Lubow, Bruce C.

Prairie Naturalist 34(3-4): 115-136. (2002)

NAL Call #: QH540 .P7; ISSN: 0091-0376

Descriptors: Akaiki's information criteria: mathematical and computer techniques/ analysis of variance: mathematical and computer techniques/ grazing/ recreational trails/ relative abundance/ species diversity/ species richness

Abstract: We conducted a three-year study of the impact of recreational trails and grazing on species richness, relative abundance, and species diversity of small mammals at six paired sites with and without trails along South Boulder Creek, Boulder, Colorado. In our analysis, we used a set of alternative models, which we evaluated using Akaiki's Information Criteria (AIC) to compute strength of evidence supporting each alternative and then made all inferences based on weighted averages of these model results. Our data provided strong evidence for an increase (2.0 individuals per 100 trap nights \pm 0.51 SE) of deer mice (*Peromyscus maniculatus*) on the grazed sites, but little evidence for effects on relative abundance of other species or on species richness or diversity. Repeated measures ANOVA results for paired trail and non-trail sites showed only weak evidence for a negative effect of trails on species richness, species diversity, and relative abundance. In addition to small mammal trapping, we employed mark-recapture techniques on Preble's meadow jumping mouse (*Zapus hudsonius preblei*), a federally listed threatened subspecies of the meadow jumping mouse, to determine linear population density estimates of this subspecies on the trail and non-trail sides of the creek. Repeated measures ANOVA for these density estimates provided weak evidence for a possible negative trail effect (-11.6 individuals/km \pm 9.5 SE) that was greater in males than females. Although the low precision of these estimates makes the results inconclusive, the magnitude of the estimated effect (a 31% lower population density of Preble's meadow jumping mice on sites with trails) highlights the need for careful management and additional research. Our data revealed large natural temporal and spatial variation in these populations that resulted in poor precision of estimated effects of interest.

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691. Impacts of a late season grazing scheme on nongame wildlife in a Wallowa Mountain riparian ecosystem.

Kauffman, J. B.; Kreuger, W. C.; and Vavra, M.
 In: Proceedings of the Wildlife-Livestock Relationships Symposium. (Held 20 Apr 1981-22 Apr 1981 at Coeur D'alene, Idaho.) Peek, James M. and Dalke, P. D. (eds.)
 Moscow, Idaho: Forest, Wildlife & Range Experiment Station, University of Idaho; pp. 208-220; 1982.
 NAL Call #: SF84.84.W5 1981

692. The implications of grassland and heathland management for the conservation of spider communities: A review.

Bell, J. R.; Wheeler, C. P.; and Cullen, W. R.
Journal of Zoology 255(3): 377-387. (2001)
 NAL Call #: QL1.J68; ISSN: 0952-8369
Descriptors: grassland management/ grasslands/ grazing/ habitats/ wildlife conservation
Abstract: Both intensity and type of habitat management in grasslands and heathlands affect spider communities. With high intensity management, spider communities often lack diversity and are dominated by a few r-selected species affiliated with bare ground. Low intensity management produces more complex communities introducing more niches for aerial web spinners and climbing spiders. The preferred management will be site-dependent and may not be appropriate for all spiders in all situations, particularly for some rare or threatened species. Providing natural cover is recommended when using extreme forms of management or intensive grazing (particularly by sheep). In extreme cases, or where trampling is heavy, the litter layer should be conserved. We advocate research and survey before and after major management implementation. Habitat management for spiders should not be considered alone, but integrated into a holistic plan. Management for spiders may conflict with rare plant conservation and small reserves should examine the viability of providing two contrasting regimes.
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693. Implications of grazing and burning of grasslands on the sustainable use of francolins (*Francolinus* spp.) and on overall bird conservation in the highlands of Mpumalanga Province, South Africa.

Jansen, R.; Little, R. M.; and Crowe, T. M.
Biodiversity and Conservation 8(5): 587-602. (1999)
 NAL Call #: QH75.A1B562; ISSN: 0960-3115
Descriptors: annual burning: management method/ conservation implications/ grasslands: habitat/ grazing intensity/ land use/ landscape scale/ species density/ species distribution/ species richness/ stocking rate/ sustainable use
Abstract: We investigated the densities of the Redwing *Francolinus levaillantii* and Greywing *Francolinus* *F. africanus* and the diversity of grassland birds in general along a land-use gradient in the highlands of Mpumalanga province, South Africa. Redwing *Francolins* cannot tolerate intensive grazing and frequent burning and are confined largely to unburnt, ungrazed grasslands. Their density and the species richness of grassland birds in general are negatively correlated with grazing intensity. Redwing populations drop to densities that cannot be utilised by hunters on a sustainable basis in grasslands that are grazed at even moderate levels or burned annually.

Nineteen bird species (including five threatened species) were confined to essentially pristine grassland and were never observed in grazed/annually burned grasslands. The Greywing *Francolin* is more evenly distributed (although always at sub-utilisation densities) along the grassland land-use gradient, and its density is positively correlated with grazing intensity. There are two assemblages of grassland bird species that appear to be indicative of the intensity of habitat utilisation. Populations of grassland birds in the study area are becoming increasingly dependent on isolated patches of pristine grassland and are threatened by management involving annual burning and high stocking rates on a landscape scale.
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694. The implications of grazing and predator management on the habitats and breeding success of black grouse *Tetrao tetrix*.

Baines, David
Journal of Applied Ecology 33(1): 54-62. (1996)
 NAL Call #: 410 J828; ISSN: 0021-8901
Descriptors: moorland
Abstract: 1. Data on black grouse densities and breeding success were collected from five blocks of moorland, each consisting of four moors, between 1991 and 1993. Moors within a block differed in grazing intensity of either sheep or red deer and the presence of a gamekeeper. Results obtained were related to differences in grazing and predator management. 2. Moors with higher intensities of grazing had vegetation, on average, 32% shorter and had 36% less vertical vegetation cover. Grazing had no significant effect on species composition. 3. Heavily grazed moors supported 41% fewer invertebrates; threefold fewer Lepidoptera larvae and half as many Araneae and Hemiptera. 4. Highest densities of male (2-1 km⁻²) and female black grouse (3.4 km⁻²) were found on lightly grazed moors. Density did not differ between kept and unkept moors. 5. Black grouse breeding success not only differed between years and regions, but also between managements, being 37% lower on heavily grazed moors. The presence of a gamekeeper was not associated with higher breeding success. 6. The presence of a gamekeeper was associated with three times fewer carrion crows. 7. The results suggest that lower numbers of large herbivores allow the development of good ground cover with high numbers of preferred insects, which may permit black grouse to survive in situations where they would otherwise be severely reduced by predators.
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695. Improvement of Great Basin deer winter range with livestock grazing.

Neal, D. L.
 In: Proceedings of the Wildlife-Livestock Relationships Symposium. (Held 20 Apr 1981-22 Apr 1981 at Coeur D'alene, Idaho.) Peek, James M. and Dalke, P. D. (eds.)
 Moscow, Idaho: Forest, Wildlife & Range Experiment Station, University of Idaho; pp. 61-73; 1982.
 NAL Call #: SF84.84.W5 1981

696. Influence of cattle grazing on population density and species richness of granivorous birds (Emberizidae) in the arid plain of the Monte, Argentina.

Marcelo Gonnet, Jorge

Journal of Arid Environments 48(4): 569-579. (2001)

NAL Call #: QH541.5.D4J6; ISSN: 0140-1963

Descriptors: animals and man/ disturbance by man/ commercial activities/ ecology/ community structure/ population dynamics/ habitat/ terrestrial habitat/ land and freshwater zones/ Neotropical Region/ South America/ Emberizidae: farming and agriculture/ cattle grazing/ species diversity/ population density/ grassland/ scrub/ Argentina/ Mendoza/ population density and species diversity/ cattle grazing effects/ arid shrub grassland/ Emberizidae/ Passeriformes/ Aves/ birds/ chordates/ vertebrates

Abstract: Cattle grazing is an important disturbance in the Monte plain, reducing grass biomass and rates of fruit setting. Grass seeds are the most important food for granivorous birds (Emberizidae) during winter. The objective of this study was to test whether granivorous bird populations (Emberizidae), grass seed production, and vegetation structure differed at sites with different intensities of grazing. Emberizid density and species richness were higher in the ungrazed site than in the two grazed paddocks. Seed abundance was also higher in ungrazed vs. grazed sites. Woody vegetation, that serve as safe nest sites, did not differ among treatments.

Granivorous bird populations seemed to be affected by cattle grazing; however, the main mechanisms of this process remain unknown.

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697. The influence of cattle grazing on xerotherm grasshopper populations of river dunes near Overasselt, the Netherlands.

Offereins, H. R. and Wingerden, W. K. R. E.

Proceedings of the Section Experimental and Applied Entomology of the Netherlands Entomological Society 6: 59-64. (1995)

NAL Call #: QL461.P76

Descriptors: grazing/ effects/ heathlands/ grassland management/ grasslands/ nature conservation/ wild plants/ agricultural entomology/ Myrmeleotettix maculatus/ Netherlands Entomological Society/ Myrmeleotettix

Abstract: Comparison of grasshopper populations of parts of a heathland nature reserve near Nijmegen, Netherlands, grazed or ungrazed by cattle, showed a higher number of Myrmeleotettix maculatus on grazed parts. Four other acridid species were found in such small numbers that analysis of relations with grazing intensity was impossible.

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698. Influence of cattle stocking rate on the structural profile of deer hiding cover.

Loft, E. R.; Menke, J. W.; Kie, J. G.; and Bertram, R. C.

Journal of Wildlife Management 51(3): 655-664. (1987)

NAL Call #: 410 J827; ISSN: 0022-541X

Descriptors: Odocoileus hemionus californicus/ Odocoileus hemionus hemionus/ Populus tremuloides/ Salix spp./ Veratrum californicum/ fawn/ meadow/ riparian habitat/ grazing habitat deterioration/ Sierra Nevada/ California/ USA

Abstract: Hiding cover available for California (Odocoileus hemionus californicus) and Rocky Mountain (O. h. hemionus) mule deer was monitored during summer under no, moderate, and heavy cattle stocking rates in quaking aspen (Populus tremuloides) and meadow-riparian habitats in the central Sierra Nevada, California [USA]. Use of willow (Salix spp.) and herbaceous vegetation in meadow-riparian habitat was also measured using exclosure plots. Hiding cover in aspen and corn lily (Veratrum californicum) vegetation types was not reduced through mid-season in ungrazed treatments but was significantly ($P < 0.05$) reduced under moderate and heavy grazing. Increases in cover of aspen understory were detected after 2 years of cattle exclusion. Willow vegetation was resilient to the impacts of cattle under moderate grazing, but hiding cover was significantly ($P < 0.05$) reduced with heavy stocking rates. Browsing of willows by deer was light in ungrazed treatments but increased as the season progressed in cattle-grazed areas and as stocking rate increased. Natural weathering was partly responsible for overall hiding cover lost during the summer but reductions prior to mid-summer were attributed to cattle. The high proportion of hiding cover lost early in the season coincided with the 1st 2 months of life for fawns.

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699. Influence of grazing by bison and cattle on deer mice in burned tallgrass prairie.

Matlack, Raymond S.; Kaufman, Donald W.; and

Kaufman, Glennis A.

American Midland Naturalist 146(2): 361-368. (2001)

NAL Call #: 410 M58; ISSN: 0003-0031

Descriptors: animals and man/ disturbance by man/ commercial activities/ nutrition/ diet/ ecology/ population dynamics/ habitat/ terrestrial habitat/ abiotic factors/ physical factors/ land and freshwater zones/ Nearctic Region/ North America/ USA/ Bos bison (Bovidae): food plants/ impact on habitat/ grassland/ Kansas/ Flint Hills/ Konza Prairie Biological Station/ grazing impact on small mammalian population size/ tallgrass prairie habitat/ Bovidae/ Artiodactyla/ Mammalia/ chordates/ mammals/ vertebrates

Abstract: We studied the influence of grazing by bison (Bos bison) and by cattle (B. taurus) on deer mice (Peromyscus maniculatus) in tallgrass prairie at the Konza Prairie Biological Station in 1997 and 1998. Small mammals were sampled by one 10-station trapline in each of four bison-grazed enclosures, four cattle-grazed enclosures and four ungrazed sites. Enclosures were 4.9 ha and the biomass of grazers in each was similar. All sites were burned annually. We sampled small mammals for 4 consecutive nights in spring before fire, in spring after fire and in autumn. Deer mice were the most abundant species ($n=285$; 83% of all small mammals) captured in all treatments and in each trapping period. Deer mice were significantly more abundant in bison-grazed and cattle-grazed sites than in ungrazed sites in spring before fire ($P < 0.01$ and $P < 0.05$, respectively), but were similar in abundance in grazed and ungrazed sites following fire. Abundance of deer mice was significantly higher in bison-grazed sites than in cattle-grazed and ungrazed sites in autumn ($P < 0.05$ and $P < 0.001$, respectively). Bison and cattle differ in grazing and nongrazing behaviors (e.g., wallowing by bison) that result in differences in vegetation structure. It is likely that differences in deer mouse abundance between bison-

grazed and cattle-grazed treatments were due to differences in vegetation structure caused by the two types of grazers.

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700. Influence of grazing systems on waterfowl production.

Hertel, D. and Barker, W. T.

Proceedings of the North Dakota Academy of Science 41(79): 6. (1987)

NAL Call #: 500 N813; ISSN: 0096-9214

Descriptors: cattle/ waterfowl/ grazing/ range management/ wildlife management/ North Dakota

This citation is from AGRICOLA.

701. Influence of grazing treatments on nongame birds and vegetation structure in south central North Dakota.

Messmer, Terry Allan North Dakota State University, 1991.

Descriptors: behavior/ breeding/ birds/ habitat use/ habitat alterations/ grazing/ livestock/ habitat disturbance/ habitat changes/ *Ammodramus savannarum*/ food supply/ North America/ United States/ North Dakota/ North Dakota, Southcentral

© NISC

702. Influence of livestock grazing on grasshopper (Orthoptera: Acrididae) diversity in the Inner Mongolian steppes.

Kang Le

Chinese Biodiversity 2(Supplement): 9-17. (1994)

Descriptors: insect pests/ plant pests/ species diversity/ habitats/ grazing intensity/ indicator species/ plant communities/ ecology/ grasslands/ steppes/ nature conservation/ grazing/ fodder plants/ biology/ geographical distribution/ agricultural entomology

Abstract: Vegetation and Acrididae community variables were monitored on natural steppes grazed by livestock in Inner Mongolia [Nei Menggu], China. Species richness, diversity and evenness of acridids on the plots under different grazing intensities were compared. Change in plant community directly affected the species composition of acridids. However, floral parameters were not entirely parallel to characteristics of the acridid community. Moderate grazing could preserve a greater diversity of acridids with a lower proportion of pest species. The importance of some acridid indicators to grassland change was discussed.

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703. Influence of livestock grazing on the capybara's trophic niche and forage preferences.

Quintana, Ruben Dario

Acta Theriologica 47(2): 175-183. (2002)

NAL Call #: 410 AC88; ISSN: 0001-7051

Descriptors: animals and man/ disturbance by man/ commercial activities/ nutrition/ diet/ feeding behaviour/ ecology/ land and freshwater zones/ Neotropical Region/ South America/ *Hydrochaeris hydrochaeris* (*Hydrochaeridae*): farming and agriculture/ livestock grazing/ food plants/ food availability/ food preferences/ foraging/ trophic structure/ ecological niche/ trophic niche/ effect of livestock grazing/ Argentina/ east central/ livestock grazing effect on foraging/ *Hydrochaeridae*/ *Rodentia*/ *Mammalia*/ chordates/ mammals/ vertebrates

Abstract: Trophic niche parameters and forage preferences

of capybara *Hydrochaeris hydrochaeris* Linnaeus, 1766 were studied at three areas of east-central Argentina: Lower Delta Islands (LDI), only capybara present; Puerto Constanza (PC), capybara and cattle, and Villaguay (VI), capybara, cattle and sheep. Significant correlation was found in the annual botanical composition of capybara faeces at LDI and PC, but no correlation was found between faecal composition at these two areas and those at VI. The narrowest trophic niche corresponded to LDI, while the widest corresponded to VI, with significant differences in the values among the three areas. Capybara consumed *Carex riparia*, *Cynodon dactylon* and *Panicum grumosum* in LDI, and *P. milioides* in VI in proportion greater than availability. Three and eight food items were consumed less than availability in VI and PC, respectively. The greater the species number and density of livestock animals, the more generalist the behavior of capybara, possibly due to direct interaction in the use of grazing resources. Changes in availability of foraging species may influence the capybara's preference patterns and the consumption of suboptimal feeding items may indicate a greater pressure on foraging resources in the areas where capybaras share their habitat with livestock.

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704. The influence of management practises on the microarthropod community of grassland.

Siepel, H. and Bund, C. F. van de

Pedobiologia 31(5/6): 339-354. (1988)

NAL Call #: 56.8 P343; ISSN: 0031-4056

Descriptors: *Collembola*/ *Acari*/ arthropods/ soil fauna/ grassland soils/ population dynamics/ range management/ grazing/ mowing/ fertilizer application

This citation is from AGRICOLA.

705. Influence of rest-rotation cattle grazing on mule deer and elk habitat use in east-central Idaho.

Yeo, J. J.; Peek, J. M.; Wittinger, W. T.; and Kvale, C. T.

Journal of Range Management 46(3): 245-250. (1993)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1993/463/10yeo.pdf>

Descriptors: grazing systems/ selective grazing/ wild animals/ rest rotation grazing/ grazing behaviour

Abstract: Elk (*Cervus elaphus*), mule deer (*Odocoileus hemionus*) and cattle (*Bos taurus*) distributions were determined year round from 1975 to 1979 on a rest-rotation grazing system established in steep mountainous terrain. Following implementation of the grazing system, cattle progressively used higher altitudes and steeper slopes in each succeeding year. Elk preferred rested pastures during the grazing season (June-Oct.) and avoided habitat frequented by cattle by using higher altitudes and steeper slopes. Few mule deer used the allotment during summer, but during the winter, deer selected habitats grazed previously by cattle. Elk appeared to adjust to the grazing system by making greater use of pastures with cattle present, although preference for pastures without cattle continued.

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706. Influences of livestock grazing on sage grouse habitat.

Beck, Jeffrey L. and Mitchell, Dean L.

Wildlife Society Bulletin 28(4): 993-1002. (2000)

NAL Call #: SK357.A1W5; ISSN: 0091-7648

Descriptors: habitat/ livestock grazing

Abstract: Livestock grazing has been identified as one factor associated with the widespread decline and degradation of sage grouse (*Centrocercus urophasianus*) habitat. We identified $n = 17$ positive and negative impacts of livestock on sage grouse and habitat. Little information is currently available concerning the direct impacts of livestock grazing on sage grouse habitat. Indirect impacts are better understood than direct impacts. Chemical and mechanical treatments intended to provide increased quantities of grass forage for livestock have indirectly reduced the acceptability of sagebrush (*Artemisia* spp.) rangelands for sage grouse. Our paper examines: 1) potential mechanisms whereby livestock grazing in big sagebrush (*A. tridentata*) communities can modify sage grouse habitat and 2) the indirect influences of livestock production on sage grouse habitat. Overall, livestock grazing appears to most affect productivity of sage grouse populations. Residual grass cover following grazing is essential to conceal sage grouse nests from predators. Future research needs are identified and management implications related to livestock grazing in sage grouse habitats are included.

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707. Insect diversity in two burned and grazed grasslands.

Fay, Philip A.

Environmental Entomology 32(5): 1099-1104. (2003)

NAL Call #: QL461.E532; ISSN: 0046-225X

Descriptors: Sorensen's Similarity Index: mathematical and computer techniques/ sweep sampling: applied and field techniques/ burning/ grazing/ species diversity/ species richness/ tallgrass prairie

Abstract: This study examined insect diversity in two native grassland ecosystems undergoing burning and grazing by bison and cattle, the Niobrara Valley Preserve (Nebraska) and the Tallgrass Prairie Preserve (Oklahoma). Sweep-sampling for insects was conducted during July 1994 and 1995 along transects in management units that were grazed by bison and partially burned, grazed by cattle and either burned (Tallgrass) or unburned (Niobrara), or ungrazed and unburned. At both sites, species richness (S) and diversity (log series alpha) were higher and similarity (Sorensen's index) lower for bison than for cattle or ungrazed management units. High bison management unit diversity was associated with significantly higher S and alpha in burned (Tallgrass) and unburned (Niobrara) portions of bison units compared with their respective cattle units, suggesting that habitat heterogeneity in terms of plant productivity, composition, and structure were higher in bison versus cattle and ungrazed management units. Replicated factorial experiments and sampling of additional taxa and time points are needed to verify how fire and grazing management impacts insect diversity in these grasslands.

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708. Is the density of redshank *Tringa totanus* nesting on saltmarshes in Great Britain declining due to changes in grazing management?

Norris, Ken; Brindley, Emma; Cook, Tony; Babbs, Stephen; Brown, Christopher Forster; and Yaxley, Robert

Journal of Applied Ecology 35(5): 621-634. (1998)

NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: multiple regression modeling: statistical method/ grazing intensity: conservation implications/ saltmarsh: grazing management, habitat

Abstract: 1. Saltmarsh habitats support c. 50% of the population of redshank *Tringa totanus* breeding in Britain. Between 1985 and 1996, breeding densities declined significantly by 23%. This paper tests the hypothesis that this decline resulted from changes in the extent of important saltmarsh habitats for nesting redshank, and/or a change in the intensity of grazing. 2. We surveyed breeding redshank densities, the extent of saltmarsh habitats, and the intensity of grazing on a sample of 77 saltmarsh sites around the coast of Britain in 1985 and 1996. From these data, we constructed statistical models that described breeding densities in relation to a range of habitat and grazing variables for each of the surveys, and examined changes in breeding density between the surveys, in relation to changes in the important habitat and grazing variables included in these models. 3. During both surveys, breeding densities were lowest on heavily grazed plots, and there was some evidence, from the larger number of survey sites for which data were available in 1985, that breeding densities tended to be highest on lightly grazed saltmarsh. Multiple regression modelling, incorporating a range of habitat variables and grazing intensity, also showed this effect, although in 1996 interpretation of the relationship between breeding density and grazing intensity was complicated because both grazing intensity and a habitat variable accounted for a similar component of the variance in breeding density. These models also showed that certain habitat variables were significant correlates of breeding density, particularly the extent of seacouch grass, which was positively correlated with breeding density in both survey years. During 1985, breeding densities were also correlated with the extent of a number of other saltmarsh habitats, which did not significantly correlate with breeding densities in 1996. In addition to the measured habitat and grazing variables, densities also showed significant regional variation in Britain during both surveys. 4. Of the habitat and grazing variables included in the multiple regression models of breeding density, only the intensity of grazing changed between 1985 and 1996, showing a significant increase. Breeding densities declined most markedly on sites that had experienced an increase in the intensity of grazing from ungrazed/lightly grazed to moderate/heavily grazed. This suggests that an increase in the intensity of grazing was the most likely explanation for the decline in breeding densities observed between 1985 and 1996. Causal explanations for the increase in grazing intensity are discussed. 5. Assuming that the grazing intensity data were representative of grazing management on saltmarshes throughout Britain, then we estimate that 1665 ha of saltmarsh experienced an increase from ungrazed/light grazing to moderate/heavy grazing over the 11 years between 1985 and 1996. This is comparable to the 2100 ha of saltmarsh that are expected to be lost to erosion over the next 20 years. We also estimate that 6388 ha, or 14.6%, of saltmarsh in Britain was heavily grazed in 1996. 6. Our analysis of the redshank survey data, together with these

figures, suggest that heavy grazing is a significant threat to saltmarsh habitats and its breeding redshank, on a national scale at present. We urgently need a detailed assessment of the grazing management of saltmarshes in Britain, and how grazing management is affected by agricultural policy, as a precursor for the introduction of provisions to ensure that the decline in breeding redshank does not continue.

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709. Leaf miner assemblies effects of plant succession and grazing management.

Sterling, P. H.; Gibson, C. W. D.; and Brown, V. K.

Ecological Entomology 17(2): 167-178. (1992)

NAL Call #: QL461 .E4; ISSN: 0307-6946

Descriptors: insect/ secondary succession/ calcareous grassland

Abstract: Changes in leaf-miner assemblies during 4 years of secondary succession, under different controlled sheep-grazing treatments, are described and compared to the miner fauna of older grazed grassland nearby. 2.

Multivariate analyses were used in conjunction with examination of individual common species to assess the independent effects of time, grazing treatment, plant species composition and architecture on the leaf-miner assemblies. 3. Leaf-miner species composition was strongly related to plant species composition, but was modified by plant structure under different grazing treatments. There was a strong successional trend in miner assemblies, even when the effects of changes in plant composition had been taken into account. Conversely, local variation in miner species composition generally reflected foodplant distribution alone. 4. Grazed treatments had fewer mines than controls, but there were also species specializing in grazed areas, despite the abundance of their foodplants elsewhere. There was a weak indication that miner species in grazed treatments were more likely to fluctuate in abundance than those in controls. 5. The results are discussed in relation to the assembly of grassland insect communities during succession, and the use of 'indicator groups' in management for nature conservation.

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710. A literature review of insect responses to fire, compared to other conservation managements of open habitat.

Swengel, Ann B.

Biodiversity and Conservation 10(7): 1141-1169. (2001)

NAL Call #: QH75.A1B562; ISSN: 0960-3115

Descriptors: haying: management method/ mowing: management method/ conservation management/ ecological adaptations/ grasslands/ grazing intensity/ insect responses/ niche diversity/ open habitats: burning/ recolonization/ savannas/ vegetational composition/ vegetational structure/ wildfires

Abstract: This literature review concerns insect responses to fire, compared to other feasible and appropriate conservation managements of open habitats. Many insect groups decline markedly immediately after fire, with the magnitude of reduction related to the degree of exposure to the flames and mobility of the insect. Niche diversity is lower in recently burned habitat, and the rate of insect increase following fire also relates to the species' ability to gain access to the regrowing vegetation. Postburn flora can be quite attractive to some recolonizing insects, possibly to some degree a result of fire-caused insect mortality which

provides plants with short-term release from insect herbivory. Insect declines may follow immediately after mowing, but usually of lesser degree and shorter duration than after a fire of comparable timing and size. Season and scale of cutting may affect how much and which species showed positive or negative responses. Cut areas offer the vegetational structure and composition preferred by some insects, but cutting-or cutting at certain scales, seasons, or frequencies-may also be unfavorable for some species.

Heavy grazing results in niche and assemblage simplification. Nonetheless, some invertebrates prefer the short turfs and bare ground resulting from heavier grazing. Other species vary in whether they peak in abundance and diversity in intermediate, light, or no grazing. In comparisons of mowing/haying and grazing regimes of similar compatibility with maintenance of the same habitat types, responses of particular species and species groups varied as to whether they had a preference for one or the other. Characteristics associated with insect responses to fire related to the degree of exposure to lethal temperature and stress experienced in the post-fire environment, suitability of post-treatment vegetation as habitat, and ability to rebuild numbers in the site (from survivors and/or colonizers). These factors appear equally useful for explicating insect responses to other managements such as haying, mowing, and grazing. By contrast, the assumption that the most habitat-restricted species will be most adapted to ecological forces believed to be prevalent in that ecosystem appears less efficacious for predicting insect management preferences.

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711. Livestock as manipulators of mule deer winter habitats in northern Utah.

Urness, P. J.

In: Can livestock be used as a tool to enhance wildlife habitat? (Held 13 Feb 1990 at Reno, Nev.)

Severson, Kieth E. (eds.)

Fort Collins, Colo.: Rocky Mountain Forest and Range Experiment Station, US Department of Agriculture, Forest Service; pp. 25-40; 1990.

Notes: 43rd Annual Meeting of the Society for Range Management

NAL Call #: aSD11.A42 no.194

Descriptors: animals and man/ disturbance by man/ commercial activities/ conservation/ conservation measures/ nutrition/ diet/ habitat/ terrestrial habitat/ land and freshwater zones/ Nearctic Region/ North America/ USA/ *Odocoileus hemionus* (Cervidae): farming and agriculture/ livestock grazing/ conservation aspects/ habitat management/ food plants/ important species changes/ conservation role of livestock grazing/ grassland/ heathland/ Utah/ north/ winter habitat manipulation by livestock grazing/ Cervidae/ Artiodactyla/ Mammalia/ chordates/ mammals/ vertebrates

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712. Livestock as tools for managing big game winter range in the intermountain West.

Urness, P. J.

In: Proceedings of the Wildlife-Livestock Relationships Symposium. (Held 20 Apr 1981-22 Apr 1981 at Coeur D'alene, Idaho.) Peek, James M. and Dalke, P. D. (eds.) Moscow, Idaho: Forest, Wildlife & Range Experiment Station, University of Idaho; pp. 20-31; 1982.
NAL Call #: SF84.84.W5 1981

713. Livestock effects on reproduction of the Columbia spotted frog.

Bull, E. L. and Hayes, M. P.

Journal of Range Management 53(3): 291-294. (2000)
NAL Call #: 60.18 J82; ISSN: 0022-409X
http://jrm.library.arizona.edu/data/2000/533/291-294_bull.pdf

Descriptors: Rana/ ponds/ oval/ grazing/ cattle/ aquatic plants/ surface area/ altitude/ depth/ fish/ habitats/ algae and seaweeds/ dissolved oxygen/ Oregon
This citation is from AGRICOLA.

714. Livestock exclusion: Consequences on nocturnal rodents in Baja California Sur.

Ortega Rubio, Alfredo; Romero Schmidt, Heidi; Arguelles Mendez, Cerafina; Coria Benet, Rocio; and Solis Marin, Francisco

Revista de Biología Tropical 41(3B): 907-909. (1994)
NAL Call #: 442.8 R328; ISSN: 0034-7744

Descriptors: animals and man/ disturbance by man/ commercial activities/ biometrics/ ecology/ population dynamics/ land and freshwater zones/ Nearctic Region/ North America/ Perognathus spinatus (Heteromyidae)/ Neotoma lepida/ Peromyscus eva (Muridae): farming and agriculture/ livestock grazing exclusion/ size and weight relationships/ size/ weight/ population density/ Mexico/ Baja California Sur/ La Sierra de la Laguna/ size and weight/ livestock grazing exclusion effects/ Heteromyidae/ Rodentia/ Mammalia/ chordates/ mammals/ vertebrates
© The Thomson Corporation

715. Livestock grazing.

Platts W. S. and Meehan W. R.

In: Influences of forest and rangeland management on salmonid fishes and their habitats.
Bethesda: American Fisheries Society, 1991; pp. 389-423
NAL Call #: SH167.S17I53 1991
Descriptors: pollution/ sewage/ ecological/ fishes
© NISC

716. Livestock grazing: A tool to improve wildlife habitat.

Severson, Kieth E. and Urness, Philip J.

In: Ecological implications of livestock herbivory in the West/ Vavra, Martin; Laycock, William A.; and Pieper, Rex D.
Denver, Colo.: Society for Range Management, 1994; pp. 232-249
NAL Call #: SF85.35.A17E28 1994
Descriptors: animals and man/ disturbance by man/ commercial activities/ conservation/ conservation measures/ land and freshwater zones/ Nearctic Region/ North America/ comprehensive zoology: farming and

agriculture/ habitat management/ livestock grazing use/ USA/ west/ livestock grazing use to improve wildlife habitat/ review

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717. Livestock grazing affects the egg size of an insectivorous passerine.

Evans, Darren M.; Redpath, Stephen M.; Evans, Sharon A.; Elston, David A.; and Dennis, Peter

Biology Letters 1(3): 322-325. (2005); ISSN: 1744-9561
Descriptors: animals and man/ disturbance by man/ commercial activities/ biometrics/ reproduction/ land zones/ Palaearctic Region/ Eurasia/ United Kingdom/ Europe/ Anthus pratensis (Motacillidae): farming and agriculture/ sheep grazing pressure/ effects on egg size and reproductive productivity/ size/ volume/ weight/ egg/ egg size/ reproductive productivity/ Scotland/ Glen Finglas/ effects of sheep grazing pressure on egg size and reproductive productivity/ Motacillidae/ Passeriformes/ Aves/ birds/ chordates/ vertebrates

Abstract: Livestock grazing is a major driver of ecosystem change, and has been associated with significant declines in various bird species worldwide. In Britain, there is particular concern that severe grazing pressure is deleteriously affecting vegetation and birds in upland regions. However, the mechanism by which grazing affects birds is unclear. Here, we report for the first time, to our knowledge, that sheep grazing pressure affects the egg size of a common upland passerine: the meadow pipit *Anthus pratensis*. We manipulated sheep stocking densities in a replicated field experiment, and found that plots with the highest stocking density contained nests with the smallest eggs, and that plots with low stocking density contained nests with the largest eggs. However, eggs laid in ungrazed plots were also small, suggesting that either too many sheep or their removal from upland areas might have a detrimental effect on pipit egg size. We found no significant effect on fledging success but the reduced post-fledging survival of young from smaller eggs, as seen in other studies, could partly explain declines in upland birds.
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718. Livestock grazing effects on ant communities in the Eastern Mojave Desert, USA.

Nash, Maliha S.; Bradford, David F.; Franson, Susan E.; Neale, Anne C.; Whitford, Walter G.; and Heggem, Daniel T.

Ecological Indicators 4(3): 199-213. (2004); ISSN: 1470-160X

Descriptors: animals and man/ disturbance by man/ commercial activities/ ecology/ habitat/ terrestrial habitat/ land zones/ Nearctic Region/ North America/ Formicidae: farming and agriculture/ livestock grazing/ community structure/ livestock grazing effect/ environmental indicator significance/ environmental indicators/ desert habitat/ USA/ Mojave Desert/ effect of livestock grazing/ environmental indicator significance/ Formicidae/ Formicoidea/ Aculeata/ Apocrita/ Hymenoptera/ Insecta/ arthropods/ hymenopterans/ insects/ invertebrates
Abstract: The effects of livestock grazing on composition and structure of ant communities were examined in the eastern Mojave Desert, USA for the purpose of evaluating ant communities as potential indicators of rangeland condition. Metrics for ant communities, vegetation, and other ground-cover elements were evaluated as a function

of distance from livestock water tanks, which represents a gradient in level of livestock activity in desert settings. Data were collected at six isolated water tanks used by cattle during early summer, with seven plots (90 m + 90 m; 100 pitfall traps) per tank. Thirty-eight species of ants were recorded, with an average of 14 ant species per plot. Ant species richness did not differ as a function of distance from the water tank. Also, overall species composition, as measured by a similarity index for species presence/absence for paired-comparisons of plots, did not show differences attributable to the gradient in grazing impact. In contrast, the relative abundance of several taxa and functional groups was significantly related to distance from the water tank. The predominant pattern was for the greatest abundance to occur at the water tank, with little difference in ant abundance among plots away from the water tank. This pattern was shown by the abundant ants species, *Conomyrma bicolor* and *Pheidole tucsonica*, and the groups *Conomyrma* spp., *Pheidole* spp., homopteran tenders, and plant foragers. However, two species, *Aphaenogaster megommata* and *Monomorium wheelerorum* showed the greatest relative abundance at a distance away from the water tank. A number of ant metrics were significantly related to ground-cover metrics ($R^2 > 0.5$). Organic debris was the variable most frequently related significantly to ant abundance metrics, always in a positive direction, followed by cover for perennial grasses, annual forbs, and shrubs, and bare patch size. Ant community metrics in the study region appear to have little potential to serve as indicators of rangeland condition because differences were evident primarily in severely degraded localized conditions rather than in intermediate widespread conditions.

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719. Livestock grazing effects on forage quality of elk winter range.

Clark, P. E.; Krueger, W. C.; Bryant, L. D.; and Thomas, D. R.

Journal of Range Management 53(1): 97-105. (2000)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/2000/531/97-105_clark.pdf

Descriptors: sheep/ grazing/ *Pseudoroegneria spicata*/ *Carex*/ *Festuca idahoensis*/ stocking rate/ *Cervus elaphus*/ rain/ stems/ in vitro digestibility/ crude protein/ biomass/ canopy/ savannas/ shrubs/ forage/ Oregon

Abstract: Carefully-managed livestock grazing has been offered as a tool to improve the forage quality of graminoids on big game winter range. Formal testing of this theory has thus far been done using hand clippers rather than livestock grazing. We report winter standing reproductive culm, crude protein, in vitro dry matter digestibility, and standing crop responses of bluebunch wheatgrass (*Agropyron spicatum* [Pursh] Scribn. & Smith), Idaho fescue (*Festuca idahoensis* Elmer), and elk sedge (*Carex geyeri* Boott) to late-spring domestic sheep grazing. The study was conducted in 1993 and 1994 on a big game winter range in the Blue Mountains of northeastern Oregon. Sheep grazing and exclusion treatments were applied to 20-ha plots at 3 sites on the study area Targeted utilization for grazed plots was 50% graminoid standing crop removal during the boot stage of bluebunch wheatgrass. Grazing did not influence the number of standing reproductive culms per plant in bluebunch wheatgrass. Crude protein and in vitro dry

matter digestibility of bluebunch wheatgrass in grazed plots increased by 1.0 and 4.3 percentage points, respectively over ungrazed plots. Grazing reduced the standing crop of bluebunch wheatgrass by 116.9 kg ha⁻¹ DM. Standing Idaho fescue reproductive culms decreased by 0.7 culms plant⁻¹ under grazing. Crude protein of Idaho fescue in grazed plots was 1.3 percentage points greater than in ungrazed plots. Crude protein and in vitro dry matter digestibility responses of elk sedge were inconsistent between years and may be related to utilization or growth differences between years. The levels of forage quality improvement in bluebunch wheatgrass and Idaho fescue obtained in this study could benefit the nutritional status of wintering Rocky Mountain elk (*Cervus elaphus nelsoni* Bailey). More research is needed regarding the effects of grazing on the winter forage quality of elk sedge. This citation is from AGRICOLA.

720. Livestock grazing, golden trout, and streams in the Golden Trout Wilderness, California: Impacts and management implications.

Knapp, R. A. and Matthews, K. R.

North American Journal of Fisheries Management 16(4): 805-820. (1996)

NAL Call #: SH219.N66; ISSN: 0275-5947

Descriptors: freshwater fish/ population density/ water quality/ land use/ USA, California/ canopy shading/ livestock/ grazing/ trout/ ecological effects/ resources management/ freshwater fish/ fluvial morphology/ plant populations/ vegetation cover/ fishery management/ predators/ *Oncorhynchus aguabonita*/ degradation/ physical properties/ environmental effects

Abstract: Impacts of livestock grazing on California golden trout *Oncorhynchus mykiss aguabonita* and their habitat were studied inside and outside of livestock exclosures in the Golden Trout Wilderness, California. In two consecutive years, the majority of stream physical characteristics showed large differences between grazed and ungrazed areas, and the directions of these differences were consistent with the recovery of exclosed streams and riparian areas from impacts caused by livestock grazing. Ungrazed areas consistently had greater canopy shading, stream depths, and bank-full heights and smaller stream widths than grazed areas. California golden trout were very abundant in the study sites; their densities and biomasses were among the highest ever recorded for stream-dwelling trout in the western United States. California golden trout density and biomass per unit area were significantly higher in ungrazed than in grazed areas in three of four comparisons. Differences between grazed and ungrazed areas were less consistent when density and biomass were calculated on the basis of stream length. Our results suggest that current levels of livestock grazing are degrading the stream and riparian components of the study meadows to the detriment of golden trout populations.

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721. Livestock grazing interactions with sage grouse.

Klebenow, D. A.

In: Proceedings of the Wildlife-Livestock Relationships Symposium. (Held 20 Apr 1981-22 Apr 1981 at Coeur D'alene, Idaho.) Peek, James M. and Dalke, P. D. (eds.) Moscow, Idaho: Forest, Wildlife & Range Experiment Station, University of Idaho; pp. 113-123; 1982.

NAL Call #: SF84.84.W5 1981

Descriptors: Nevada

This citation is from AGRICOLA.

722. Livestock grazing relationships with fisheries.

Burton, T. A. and Kozel, S. J.

In: Proceedings of a symposium on sustaining rangeland ecosystems. (Held 29 Aug 1994-31 Aug 1994 at Eastern Oregon State College, La Grande, Oregon.) Edge, W. D. and Olsen-Edge, S. L. (eds.); Vol. Special Report 953. Corvallis, Ore.: Oregon State University Extension Service; pp. 140-145; 1996.

NAL Call #: 100 Or3M no.953

Descriptors: forest ecology/ forest management/ water quality/ grassland management/ riparian forests/ riparian vegetation/ grasslands/ riparian grasslands/ management/ environmental degradation/ erosion/ grazing/ grazing intensity/ fisheries/ vegetation types

Abstract: The importance of appropriate management of riparian grasslands for maintaining the quality of aquatic habitats is emphasized. Recent estimates for W. USA have indicated that 66% of Bureau of Land Management riparian areas are not functioning properly or are functioning at risk and that 22% of US Forest Service riparian areas are not meeting forest plant objectives for proper condition. Grazing management may have a major effect on aquatic ecosystems. In the Bear Valley Basin, Idaho, use of early-season low intensity grazing by cattle reversed the downward trend in stream bank stability and substrate sedimentation, increasing the survival of the endangered chinook salmon (*Oncorhynchus tshawytscha*).

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723. Livestock impacts on the herbaceous components of sage grouse habitat: A review.

Hockett, Glenn A.

Intermountain Journal of Sciences 8(2): 105-114. (2002); ISSN: 1081-3519

Descriptors: animals and man/ disturbance by man/ commercial activities/ conservation/ conservation measures/ documentation/ publications/ habitat/ terrestrial habitat/ *Centrocercus urophasianus* (Phasianidae): farming and agriculture/ livestock impacts on herbaceous components of sagebrush habitat/ review and management implications/ habitat management/ literature review/ grassland/ scrub/ sagebrush habitat/ Phasianidae/ Galliformes/ Aves/ birds/ chordates/ vertebrates

Abstract: Sage grouse are a bird of climax vegetation. Productive sage grouse habitat is more than a "sea of sagebrush." The grass/forb understory supplies food and cover components seasonally. Within the sagebrush community, a dense, residual herbaceous understory increases the likelihood of sage grouse nest success. Forbs and insects are essential foods for sage grouse from early spring to early fall. Although riparian areas typically make up less than 2 percent of the sagebrush landscape, interspersed springs, streams, and meadows offer watering and feeding sites for sage grouse during summer and early

fall. Livestock selectively remove grasses and forbs within the sagebrush landscape while showing a strong preference for riparian meadows once upland vegetation cures. Livestock use can impact the amount and composition of herbaceous understory depending on the class of livestock, season of use, and grazing intensity. I reviewed the literature regarding sage grouse habitat and livestock impacts to the herbaceous understory. Ungrazed comparison areas, based on the seasonal needs of sage grouse, are lacking. Controls are recommended to advance our understanding of grazing impacts.

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724. Livestock management and productivity of willow flycatches in the central Sierra Nevada.

Valentine, B. E.; Roberts, T. A.; Boland, S. P.; and Woodman, A. P.

Transactions of the Western Section of the Wildlife Society 24: 105-114. (1988)

NAL Call #: SK351.W523; ISSN: 0893-214X

Descriptors: Passeriformes/ wildlife management/ animal husbandry/ wildlife-livestock relations/ grazing/ California

This citation is from AGRICOLA.

725. Macroinvertebrate assemblage change in a small eastern Oregon stream following disturbance by grazing cattle.

Reed, T.

Journal of Freshwater Ecology 18(2): 315-320. (2003)

NAL Call #: QH541.5.F7J68; ISSN: 0270-5060

Descriptors: zoobenthos/ macrofauna/ grazing/ sampling/ ecosystem disturbance/ aquatic insects/ community composition/ population structure/ rivers/ biotic factors/ herbivores/ Chironomidae/ Ephemeroptera/ USA, Oregon/ cattle/ midges/ mayflies

Abstract: Badger Creek (Ochoco National Forest, Oregon) was sampled before and after cattle arrived and on July 31 in a reach of stream where cattle were present and a reach where they were not. Index values and ordination of these samples indicates that seasonality and local conditions are important drivers in macroinvertebrate community composition. In both a three month survey and the single date sampling, disturbance by grazing cattle was correlated with more Chironomidae larvae and fewer mayflies, indicating that cattle create an environment conducive to the macroinvertebrate assemblage compositions found in low oxygen, organically enriched systems.

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726. Macroinvertebrate response to cattail management at Cheyenne Bottoms, Kansas, USA.

Kostecke, R. M.; Smith, L. M.; and Hands, H. M.

Wetlands 25(3): 758-763. (2005)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: recruitment/ biomass/ wetlands/ head/ hydrology/ food/ basins/ typha/ chironomidae

Abstract: Cheyenne Bottoms, Kansas, USA has been designated by the Ramsar convention as a Wetland of International Importance. However, since that 1988 designation, cattail (*Typha* spp.) has become the dominant plant within the basin, and migratory bird use has decreased. We examined the effects of different cattail-management treatments (burned, disked, and grazed by 5 and 20 head of cattle) on macroinvertebrates used as food resources by migratory birds. We found few differences in

diversity, biomass, or density of macroinvertebrates among treatments. When differences existed, diversity, biomass, and density were greater within the control or more heavily vegetated treatments (e.g., burned) than within less vegetated treatments (e.g., disked). Macroinvertebrate densities, particularly Chironomidae, ranged from 154 to 681/m super(2); however, they were up to seven times lower than historic densities and well below the 5000/m super(2) that has been suggested for supporting large numbers (0.5 million) of migratory waterbirds. Thus, Cheyenne Bottoms' capacity to support migratory waterbirds may currently be reduced due to low macroinvertebrate densities in areas where cattail has invaded, as well as in areas where cattail has been managed. Research and management should be targeted at restoring the hydrology and dependent biotic communities that support migratory birds.

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727. Management of livestock to improve and maintain prairie chicken habitat on the Sheyenne National Grasslands.

Eng, R. L.; Toepfer, J. E.; and Newell, J. A.
In: *Prairie chickens on the Sheyenne National Grasslands.* (Held 18 Sep 1987 at Crookston, Minn.)

Bjugstad, Ardell J. (ed.)

Fort Collins, Colo.: Rocky Mountain Forest and Range Experiment Station, US Department of Agriculture, Forest Service; pp. 55-57; 1988.

Notes: ISSN: 0277-5786

NAL Call #: aSD11.A42

Descriptors: birds/ wildlife/ grasslands/ grazing/ range management/ North Dakota

This citation is from AGRICOLA.

728. Managing livestock grazing for mule deer (Odocoileus hemionus) on winter range in the Great Basin.

Austin, Dennis D.

Western North American Naturalist 60(2): 198-203. (2000)

NAL Call #: QH1 .G7; ISSN: 1527-0904

Descriptors: environmental management/ livestock grazing effects/ winter range habitat

Abstract: History and technical literature describing potential effects of livestock grazing on mule deer (*Odocoileus hemionus*) populations and winter range habitat are reviewed. Recommendations for livestock grazing on winter ranges within the Great Basin are advanced.

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729. Mule deer fawn survival on cattle-grazed and ungrazed desert ranges.

Horejsi, R. G., 1982. 47 p. *Arizona Game and Fish Department Wildlife Bulletin.*

Notes: ISSN: 0518-5467

Descriptors: cattle/ coyote/ deer, mule/ deserts/ female/ food habits/ grazing/ interspecies relationships/ population density/ predation/ production/ rodents/ shrubs/ survival/ trees/ vegetation/ North America/ United States/ Arizona/ Central Region/ Tonto Basin

Abstract: Study areas were the Three Bar Wildlife Area (closed to grazing in 1947) and the Tonto Basin Study Area (under National Forest cattle grazing permit). Data were collected on: rodent and rabbit populations; cover, density

and frequency of trees, shrubs, and half shrubs; fruit, nut, berry, and spring mean forage production; nutritional quality of key forage species; deer population densities; buck(doe)fawn ration in mid-winter; predator populations; coyote, deer, and cattle food habits; and vegetation mapping of TBWA.

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730. Nest sites of ducks in grazed mixed-grass prairie in North Dakota.

Duebbert, H. F.; Lokemoen, J. T.; and Sharp, D. E.

Prairie Naturalist 18(2): 99-108. (1986)

NAL Call #: QH540 .P7; ISSN: 0091-0376

Descriptors: *Symphoricarpos occidentalis*/ *Anas platyrhynchos*/ *Anas strepera*/ *Rosa woodsii*/ *Anas discors*/ *Anas clypeata*/ *Stipa viridula*/ *Agropyron smithii*/ habitat use/ nesting success/ seasonal wetland/ grazing pressure management

Abstract: Habitat use and nesting success of seven species of dabbling ducks were evaluated in five vegetative associations within grazed mixed-grass prairie in central North Dakota. During 1976-80, 548 nests were found on 412 ha of grazed prairie for an annual average density of 27 nests/100 ha. Numbers of nests found ranged from 1/100 ha in 1977 (a drought year) to 58/100 ha in 1979 (a very wet year), reflecting the variability that may be expected in a dynamic prairie wetland environment. Nesting success ranged from an average of 23% in the western snowberry (*Symphoricarpos occidentalis*) association to 34% in the mixed-grass association. Forty-two percent of the mallard (*Anas platyrhynchos*) nests and 35% of the gadwall (*A. strepera*) nests were in patches of western snowberry and/or Wood's rose (*Rosa woodsii*) that made up 2% of the available cover. Numbers of nests of blue-winged teal (*A. discors*) and northern shoveler (*A. clypeata*) were highest in cool-season grasses, especially green needlegrass (*Stipa viridula*) and western wheatgrass (*Agropyron smithii*). Height/density (HD) of residual cover decreased exponentially with increased grazing pressure. Use of grazed prairie by blue-winged teal was maximized when the HD of residual cover was 0.5 dm or higher, as could be maintained under light grazing. Results of this study indicated that properly grazed mixed-grass prairie can provide adequate nesting habitat for dabbling ducks. We recommend that preservation and sound ecological management be focused on large tracts of mixed-grass prairie with complexes of seasonal and semipermanent wetlands.

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731. Nest success of ducks on rotational and season-long grazing systems in Saskatchewan.

Ignatiuk, Jordan B. and Duncan, David C.

Wildlife Society Bulletin 29(1): 211-217. (2001)

NAL Call #: SK357.A1W5; ISSN: 0091-7648

Descriptors: grazing system: rotational, season long/ nest success/ nest survival/ residual vegetation cover

Abstract: Rotational grazing systems have been implemented to increase duck production in the prairie pothole region, although evidence to support the contention of increased duck production is scant at best. We examined duck nest success on 12 once-over rotational grazing systems and 12 season-long pastures in southern Saskatchewan. Analysis of 617 nests from 23 pastures failed to reveal a difference in nest survival between

rotational and season-long grazing systems (20.2% versus 25.1%), although there was a year X treatment effect interaction wherein nest success differed between years on rotational pastures but not on season-long pastures. Residual vegetation cover from randomly clipped plots did not differ between grazing treatments but did differ between years. Nest success on pastures within years was not related to vegetative carryover. Although we did not detect greater duck nest success on rotational grazing systems compared to season-long pastures, rotational systems could be beneficial if they preserve or improve grassland areas, attract more ducks from less productive habitats, or increase duckling survival. Our study provides strong additional evidence of the high nest success on pastures compared to most other habitat types, including small plots of planted cover. Converting cropland to pastures and retaining existing pastures are recommended to maintain and improve duck production in the prairie pothole region.
© The Thomson Corporation

732. Nesting success of upland nesting waterfowl and sharp-tailed grouse in specialized grazing systems in southcentral North Dakota.

Sedivec, K. K.; Messmer, T. A.; Barker, W. T.; Higgins, K. F.; and Hertel, D. R.
In: Can livestock be used as a tool to enhance wildlife habitat? (Held 13 Feb 1990 at Reno, Nev.)
Severson, Kieth E. (eds.)
Fort Collins, Colo.: Rocky Mountain Forest and Range Experiment Station, US Department of Agriculture, Forest Service; pp. 71-92; 1990.
Notes: 43rd Annual Meeting of the Society for Range Management
NAL Call #: aSD11.A42 no.194
Descriptors: animals and man/ disturbance by man/ commercial activities/ conservation/ conservation measures/ reproduction/ ecology/ population dynamics/ land and freshwater zones/ Nearctic Region/ North America/ USA/ Anas/ Aythya (Anatidae)/ Tympanuchus phasianellus (Phasianidae): farming and agriculture/ livestock grazing systems effects on nesting success/ habitat management/ livestock grazing system recommendations for increasing nesting success/ reproductive productivity/ population density/ nesting density/ North Dakota/ south central/ nesting success/ effects of livestock grazing systems/ Anatidae/ Anseriformes/ Aves/ birds/ chordates/ vertebrates
© The Thomson Corporation

733. Nongame wildlife communities in grazed and ungrazed montane riparian sites.

Schulz, T. T. and Leininger, W. C.
Great Basin Naturalist 51(3): 286-292. (1991)
NAL Call #: 410 G79; ISSN: 0017-3614
Descriptors: Zapus princeps/ bird/ small mammal/ Wilson's warbler/ western jumping mouse/ cattle grazing/ wildlife management/ Rocky Mountains/ Colorado/ USA
© The Thomson Corporation

734. Observations of pronghorn distribution in relation to sheep grazing on the Desert Experimental Range.

Clary, W. P. and Holmgren, R. C.
In: Proceedings of the Wildlife-Livestock Relationships Symposium. (Held 20 Apr 1981-22 Apr 1981 at Coeur D'alene, Idaho.) Peek, James M. and Dalke, P. D. (eds.)

Moscow, Idaho: Forest, Wildlife & Range Experiment Station, University of Idaho; pp. 581-592; 1982.
NAL Call #: SF84.84.W5 1981
Descriptors: Utah
This citation is from AGRICOLA.

735. Observations of white-tailed deer and cattle diets in Mexico.

Martinez M, Alfonso; Molina, Victor; Gonzalez S. Fernando; Marroquin, Jorge S.; and Navar Ch, Jesus
Journal of Range Management 50(3): 253-257. (1997)
NAL Call #: 60.18 J82; ISSN: 0022-409X
http://jrm.library.arizona.edu/data/1997/503/253-257_martinez.pdf
Descriptors: nutrition/ diet/ feeding behaviour/ ecology/ competition/ habitat/ terrestrial habitat/ man made habitat/ land and freshwater zones/ Nearctic Region/ North America/ Odocoileus virginianus texanus (Cervidae): food plants/ food preferences/ interspecific competition/ Bos indicus and B. taurus (Mammalia) grazing resources/ dietary structure and selectivity implications/ rangeland/ grassland/ rangeland pasture/ cultivated land habitat/ pasture/ Mexico/ Nuevo Leon/ anahuac/ dietary composition and sympatric species overlap/ faecal analysis/ Cervidae/ Artiodactyla/ Mammalia/ chordates/ mammals/ vertebrates
© The Thomson Corporation

736. Observations on white-tailed deer and habitat response to livestock grazing in south Texas.

Cohen, W. E.; Drawe, D. L.; Bryant, F. C.; and Bradley, L. C.
Journal of Range Management 42(5): 361-365. (1989)
NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1989/425/2cohe.pdf>
Descriptors: Odocoileus virginianus/ rotational grazing/ Texas
Abstract: Since short duration grazing (SDG) was introduced to Texas, concern for white-tailed deer (Odocoileus virginianus) has magnified because they are a species of major economic importance to ranchers. The objective of this study was to observe the effects of SDG and continuous yearlong grazing (CG) on home ranges and movement indices of female deer, and on forage availability. The study was conducted on the Rob and Bessie Welder Wildlife Refuge, near Sinton, Texas. The study area included a 10-pasture SDG cell and a CG pasture, each stocked at 2.8 ha/auy. Cattle grazed each SDG paddock 2 to 8 days; paddocks were rested 32 to 47 days. A total of 3,961 radio-fixes from 11 does was collected over an 11-month study period in 1983. Monthly and annual home ranges of does were similar ($P > 0.05$) between SDG (207 ha) and CG (229 ha). However, white-tailed deer traveled 35% more ($P < 0.05$) between fixes in SDG (449 m) than in CG (332 m) from May to August, a time of greatest physiological and nutritional stress for female deer in south Texas. Also, does avoided ($P < 0.05$) cattle during 2 cycles of the SDG rotation. The primary trend observed was for the deer under SDG to avoid cattle concentrations by alternating between preferred habitats rather than a predictable paddock-to-paddock movement. In general, there were few differences in total grass and

forb cover between SDG and CG. However, several forage species important to deer were less frequent ($P < 0.05$) under SDG than CG.

This citation is from AGRICOLA.

737. Odonates as biological indicators of grazing effects on Canadian prairie wetlands.

Foote, Alee and Hornung, Christine L. Rice
Ecological Entomology 30(3): 273-283. (2005)

NAL Call #: QL461 .E4; ISSN: 0307-6946

Descriptors: wetlands/ grazing/ vegetation/ prairies/ abundance/ indicator species/ reproductive effort/ water quality/ biodiversity/ agriculture/ aquatic insects/ emergent vegetation/ lentic environment/ ecosystem disturbance/ *Scirpus acutus*/ *Zygoptera*/ *Odonata*/ Canada, Alberta/ damselflies/ dragonflies

Abstract: 1. Aquatic macro-invertebrates have frequently been used as biological indicators in lotic environments but much less commonly so in lentic habitats. Dragonflies and damselflies (Order Odonata) satisfy most selection criteria for lentic bioindicators of grazing impacts. 2. Intensive cattle grazing affects most of the Canadian prairie pothole region but the effects of grazing on wetlands are poorly understood. 3. Here the vegetation structure and invertebrate community composition of 27 prairie potholes in Alberta, Canada were studied and compared. Wetlands were evenly divided into three treatments of different grazing regimes. 4. Removal of emergent vegetation by cattle grazing decreased odonate abundance and reproductive effort. Shorter *Scirpus acutus* stems resulted in significantly fewer damselflies (Suborder Zygoptera) and lower reproductive efforts. 5. Overall odonate diversity was affected by the height of key plant species, highlighting the importance of the vegetation structure of both emergent vegetation for breeding and adjacent upland vegetation for nocturnal roosts. Wetland vegetation structure was more important than vegetation composition to the life history of odonates. 6. Wetland water quality parameters of nitrogen, phosphorus, total dissolved solids (TDS), and chlorophyll-a concentration did not change due to the presence of grazing cattle at wetlands so water quality influences were rejected as mechanisms of change. 7. Larval odonate diversity and abundance was positively correlated with overall aquatic macro-invertebrate diversity and abundance, hence it was concluded that the larval odonate community can be an accurate bioindicator of intactness and diversity of overall aquatic macro-invertebrate communities in Canadian prairie wetlands.

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738. Potential uses of cattle grazing to manage waterfowl nesting cover on Turnbull National Wildlife Refuge.

Rees, J. R.

In: Proceedings of the Wildlife-Livestock Relationships Symposium. (Held 20 Apr 1981-22 Apr 1981 at Coeur D'alene, Idaho.) Peek, James M. and Dalke, P. D. (eds.) Moscow, Idaho: Forest, Wildlife & Range Experiment Station, University of Idaho; pp. 86-93; 1982.

NAL Call #: SF84.84.W5 1981

Descriptors: Washington

This citation is from AGRICOLA.

739. Practices for livestock grazing and aquatic habitat protection on Western rangelands.

May, B. E. and Davis, B.

In: Proceedings of the Wildlife-Livestock Relationships Symposium. (Held 20 Apr 1981-22 Apr 1981 at Coeur D'alene, Idaho.) Peek, James M. and Dalke, P. D. (eds.) Moscow, Idaho: Forest, Wildlife & Range Experiment Station, University of Idaho; pp. 271-278; 1982.

NAL Call #: SF84.84.W5 1981

740. Predicting the impact of livestock grazing on birds using foraging height data.

Martin, Tara G. and Possingham, Hugh P.

Journal of Applied Ecology 42(2): 400-408. (2005)

NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: species diversity/ habitat structure/ livestock grazing/ foraging height data

Abstract: 1. Habitat structure is a major determinant of bird species diversity. One process by which habitat structure is altered is livestock grazing, the most extensive land use across most continents. While the impacts of grazing on vegetation have received much attention, the effects on avifauna are less well known. 2. Predictions of the impact of grazing on Australian woodland and riparian bird assemblages were formulated. We used available information on the vegetation strata utilized by each species for foraging and the strata most affected by grazing. 3. We compared predictions based on foraging height preferences with differences in bird density in grassy eucalypt woodland and riparian habitats subject to three levels of grazing. We found that foraging height preference was a good predictor of species' susceptibility to grazing. Birds exhibited both monotonic and non-monotonic responses to grazing, with the majority of bird species declining with increasing grazing pressure. 4. Synthesis and applications. Existing information on foraging behaviour can be used to make predictions of the impact of any threat on birds where that threat alters habitat structure. While the approach is simple, it is a point of departure for more complex predictive models, and avoids the circularity of post hoc interpretation of impact data. This approach can be used to guide management decisions where landscapes are in a state of transition and species conservation is a priority.

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741. Preliminary evaluation of elk habitat use within a three-pasture rest-rotation grazing system.

Frisina, M. R.

Proceedings of the Montana Academy of Sciences 46: 27-36. (1986)

NAL Call #: 500 M762

Descriptors: *Cervus elaphus canadensis*/ grazing/ habitats/ livestock/ range management/ resource management/ rotational grazing/ wildlife management/ plant protection/ wildlife-livestock relations/ Montana

This citation is from AGRICOLA.

742. A preliminary report on the effects of a deferred-rotation grazing system on wildlife at the Sheldon National Wildlife Refuge.

Oldemeyer, J. L.; Martin, S. J.; and Woodis, S. G.

Cal-Neva Wildlife Transactions: 26-42. (1983)

NAL Call #: SK351.W523; ISSN: 0095-3601

This citation is from AGRICOLA.

743. Prescribed fire and cattle grazing on an elk winter range in Montana.

Jourdonnais, C. S. and Bedunah, D. J.
Wildlife Society Bulletin 18(3): 232-240. (1990)
 NAL Call #: SK357.A1W5; ISSN: 0091-7648
Abstract: Burn and cattle-grazing treatments reduced rough fescue *Festuca scabrella* standing crop, the preferred winter elk *Cervus elaphus* forage, during the initial growing season. By the 2nd growing season, the rough fescue standing crop was similar to the control in all treatments. Cattle grazing maintained more down litter accumulations than the burn treatments, were similar for all treatment in the second and third growing seasons after treatment. Elk use of the study area was limited to late fall, winter, and early spring and was greater in the burn and cattle-grazed treatments compared with the control. Elk use of rough fescue was concentrated on plants without heavy litter. Idaho fescue *F. idahoensis* received significant use by elk only after rough fescue was heavily utilized. Other native species received little or no use. -from Authors
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744. Prescribed sheep grazing to enhance wildlife habitat on North American rangelands.

Mosley, J. C.
Sheep Research Journal Special Issue: 79-91. (1994)
 NAL Call #: SF371.R47; ISSN: 1057-1809
Descriptors: sheep/ grazing/ species diversity/ botanical composition/ habitats/ wildlife management/ *Ovis canadensis*/ plant litter
 This citation is from AGRICOLA.

745. Pronghorn reactions to winter sheep grazing, plant communities, and topography in the Great Basin.

Clary, W. P. and Beale, D. M.
Journal of Range Management 36(6): 749-752. (1983)
 NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1983/366/18clar.pdf>
Descriptors: Utah
 This citation is from AGRICOLA.

746. Reproductive success and brood survival of bobwhite quail as affected by grazing practices.

Cantu, R. and Everett, D. D.
 In: *Proceedings, Second National Bobwhite Quail Symposium*. Schitoskey, F.; Schitoskey, E. C.; and Talent, L. G. (eds.)
 Stillwater, Okla.: Oklahoma State University;
 pp. 79-83; 1982.
 NAL Call #: QL696.G27N3 1982
Descriptors: Texas
 This citation is from AGRICOLA.

747. Response of bobwhites to cover changes within three grazing systems.

Hammerquist-Wilson, M. M. and Crawford, J. A.
Journal of Range Management 34(3): 213-215. (1981)
 NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1981/343/11hamm.pdf>
Descriptors: Texas
 This citation is from AGRICOLA.

748. The response of small mammal communities to cattle grazing on a coastal meadow.

Schmidt, Niels M. and Olsen, Henrik
Polish Journal of Ecology 51(1): 79-84. (2003)
 NAL Call #: 512 W263; ISSN: 1505-2249
Descriptors: animals and man/ disturbance by man/ commercial activities/ ecology/ habitat/ terrestrial habitat/ land and freshwater zones/ Palaearctic Region/ Europe/ Mammalia: farming and agriculture/ cattle grazing intensity/ community structure effects/ community structure/ grassland/ coastal meadow/ Denmark/ western amager/ Klydeso Bird Reserve/ cattle grazing intensity effects/ small taxa/ Mammalia/ chordates/ mammals/ vertebrates
Abstract: The response of small mammals to cattle grazing on a coastal meadow with three different grazing intensities was evaluated. Grazed areas tended to hold fewer small mammals than the ungrazed control area, though the variation was high. The negative effect of grazing increased with grazing intensity. Small mammals were caught almost exclusively in patches of high, dense vegetation, and it is suggested that the negative effect of grazing results from the reduced number of such patches. Grazing also affected small mammal species richness, where richness was generally lower in the area of high grazing intensity than in areas with low grazing intensity or without grazing.
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749. Response of small mammals to livestock grazing in southcentral Idaho.

Johnson, M. K.
Journal of Range Management 35(1): 51-53. (1982)
 NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1982/351/14john.pdf>
Descriptors: Idaho
 This citation is from AGRICOLA.

750. Response of vertebrates to fenceline contrasts in grazing intensity in semi-arid woodlands of eastern Australia.

James, Craig D.
Austral Ecology 28(2): 137-151. (2003)
 NAL Call #: QH540 .A8; ISSN: 1442-9985
Descriptors: assemblage composition/ fauna change/ fenceline contrasts/ grazing intensity/ ground cover/ pastoral industry/ semi arid woodland/ species abundance/ species richness/ vertebrate response/ water source introduction
Abstract: Changes in the abundance, species richness and assemblage composition of vertebrates due to grazing by domestic stock were investigated in the semi-arid woodlands of eastern Australia. Analyses were based on the differences found at 10 fenceline contrast sites. Two species of amphibians, 22 species of reptiles and two species of small mammal were captured in pit traps during the surveys. Kangaroos (red and eastern grey), sheep, goats and 66 species of birds were recorded along line transects. Analyses revealed that abundance of diurnal reptiles and species richness of diurnal reptiles and birds were significantly lower on heavily grazed sites than they were on lightly grazed sites. At a local scale, the gecko, *Gehyra variegata*, was more abundant where grazing was heavier, while *Diplodactylus conspicillatus*, *Diplodactylus steindachneri* and *Rhynchoedura ornata* responded to variables indirectly related to grazing intensity (kangaroo density, sheep and goat dung mass and sheep density,

respectively). Birds more commonly sighted on lightly grazed areas than heavily grazed areas were the apostlebird, brown treecreeper, crested bellbird, grey butcherbird, hooded robin, jacky winter, little woodswallow, Australian magpie-lark, mulga parrot, splendid wren, white-browed treecreeper and yellow-rumped thornbill. Birds more commonly sighted on heavily grazed areas than on lightly grazed areas were the Australian raven and chestnut-crowned babbler. Most variation in species composition between sites was due to spatial separation and no regional-level indicator species of grazing were evident. A combination of direct grazing-related changes (e.g. loss of ground cover) and indirect effects of the pastoral industry (e.g. introduction of artificial sources of water) lead to changes in fauna at different scales of analysis across regions.

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751. Response of winter birds to drought and short-duration grazing in southeastern Arizona.

Bock, Carl E. and Bock, Jane H.

Conservation Biology 13(5): 1117-1123. (1999)

NAL Call #: QH75.A1C5; ISSN: 0888-8892

Descriptors: canopy cover/ cattle ranch/ drought/ grassland oak savanna/ grazing/ livestock exclosure/ short duration grazing/ species abundance/ vegetative ground cover

Abstract: In a grassland-oak savanna in southeastern Arizona, we compared vegetative ground cover and bird populations between a 29-year livestock exclosure and an adjacent cattle ranch that was managed according to the principles of holistic resource management, including short-duration rotational grazing. The study took place in the winter after a 2-year drought and 1 year after the drought ended and stocking densities were reduced. During the first winter, grasses on the livestock exclosure were taller (4.4 times) and had higher basal area ground cover (2.5 times), canopy cover (2.2 times), and reproductive canopy cover (10 times) than in the grazed area. These differences persisted into the second winter but at lower levels. As a group, 19 species of ground-foraging, seed-eating birds (e.g., doves, quail, sparrows, towhees) were 2.7 times more abundant on the exclosure than on adjacent grazed grasslands during the first winter. These same species were 1.7 times more abundant on the exclosure during the second winter and were 2.9 times more abundant on both sites combined after the drought had ended. A second group of 24 avian species with different foraging ecologies (e.g., predators, frugivores, arboreal insectivores) did not differ between treatments or years. High-density, short-duration rotational grazing, coupled with a drought, left the land in a substantially denuded condition through two winters and negatively affected a variety of resident and migratory birds dependent on ground cover and seed production for over-winter survival.

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752. Responses of bobwhite to short duration and continuous grazing in south Texas.

Bareiss, Laura J.

Texas Tech University, 1985.

Descriptors: *Colinus virginianus*/ food supply/ habitat disturbance/ interspecific relations/ land use/ livestock/ mortality/ Texas

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753. Responses of grasshopper assemblages to long-term grazing management in a semi-arid African savanna.

Gebeyehu, Solomon and Samways, Michael J.

Agriculture, Ecosystems & Environment 95(2-3): 613-622. (2003)

NAL Call #: S601 .A34; ISSN: 0167-8809

Descriptors: continuous grazing: applied and field techniques/ long term grazing management: applied and field techniques/ rotational grazing: applied and field techniques/ seasonal grazing: applied and field techniques/ bare ground gradients/ continuous resting/ continuously grazed sites/ environmental variables/ rotationally grazed sites/ semi arid savanna/ shrub cover gradients/ soil temperature gradients/ vegetation density

Abstract: A study on grasshopper assemblage response to seasonal grazing, rotational grazing, continuous resting and continuous grazing was undertaken in the eastern Karoo, South Africa. Rotationally-grazed sites supported the highest number and abundance of grasshopper species while continuously-grazed sites had the lowest. Spring-grazed and winter-grazed sites were the most similar, with continuously-rested sites being the next similar to these. Rotationally-grazed sites showed the least similarity to the other sites. There were clear groupings of sites and grasshopper species, with most species associated with rotationally-grazed sites. Continuously-grazed sites had a different grasshopper assemblage. The assemblages followed definite gradients of measured environmental variables. Rotationally-grazed sites occurred along gradients of increasing bare ground, while continuously-grazed and summer-grazed sites occurred along increasing gradients of shrub cover and soil temperature. Spring-grazed, autumn-grazed, winter-grazed and rotationally-grazed sites were characterized by high vegetation density. Grasshopper dominance differed between sites. Summer-grazed sites had high dominance of *Pseudodictya flavipes* (40%), winter-grazed sites of *Pseudodictya* sp. (32%). The significance of variable grazing management systems for maintaining floral and grasshopper diversity is discussed. Rotational grazing in this arid system is most suited to maintaining plant and insect diversity.

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754. Responses of raptors to livestock grazing in the western USA.

Kochert, M. N.

In: Proceedings of the Western Raptor Management Symposium and Workshop. (Held 26 Oct 1987-28 Oct 1987 at Boise, Idaho, USA.) Pendleton, B. G. (eds.)

Washington, D.C., USA: Institute for Wildlife Research and National Wildlife Federation; pp. 194-203; 317 p.; 1989.

Notes: ISSN: 1044-4971

NAL Call #: QL696.F3W47 1989; ISBN: 0945051026

Descriptors: review/ mammal/ grazing system/ plant population change/ habitat destruction/ nesting/ prey availability/ diversity/ population/ conservation

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755. Restoring wetland habitats with cows and other livestock: A prescribed grazing program to conserve bog turtle habitat in New Jersey.

Tesauro, J.

Conservation Biology in Practice 2(2): 26-30. (2001); ISSN: 1526-4629.

Notes: Publication URL: <http://www.conbio.org/CIP/>

Descriptors: Bos taurus/ reptiles/ cattle/ wetland/ habitat management/ agriculture/ USA/ New Jersey

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756. Reverting Conservation Reserve Program lands to wheat and livestock production: Effects on ground beetle (Coleoptera: Carabidae) assemblages.

French, B. Wade; Elliott, Norman C.; and Berberet, Richard C.

Environmental Entomology 27(6): 1323-1335. (1998)

NAL Call #: QL461.E532; ISSN: 0046-225X

Descriptors: agricultural lands/ grazing lands/ Conservation Reserve Program

Abstract: Highly erodible lands enrolled in the Conservation Reserve Program soon will revert to agricultural production. This study was designed to determine the effects of reversion of Conservation Reserve Program lands to wheat and livestock production on ground beetle assemblages. Reversion strategies included no reversion of Conservation Reserve Program grass (unmanaged bluestem), simulated grazing of Conservation Reserve Program grass (managed bluestem), minimum-tillage practices for wheat production, and no-tillage practices for wheat production. A randomized block experimental design was established with 4 replicates. More ground beetles were captured in pitfall traps in 1995 than in 1996, and abundances within years differed among reversion strategies. Of the 73 ground beetle species collected, 9 species accounted for 61.7% of total abundance. Abundances of these 9 species differed with respect to reversion strategy. Species diversity and evenness differed among the reversion strategies in 1995, but only evenness differed in 1996. Canonical correspondence analysis showed that annual and monthly variation were the predominant factors in separating ground beetle assemblages. Lack of rainfall may have accounted for a large portion of differences in abundances between years. A partial canonical correspondence analysis showed that simulated grazing and no-tillage wheat were the predominant reversion strategies in separating ground beetle assemblages. These treatments represent disturbance levels intermediate to unmanaged bluestem and minimum-tillage wheat.

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757. Riparian fencing, grazing, and trout habitat preference on Summit Creek, Idaho.

Keller, C. R. and Burnham, K. P.

North American Journal of Fisheries Management 2(1): 53-59. (1982)

NAL Call #: SH219.N66; ISSN: 0275-5947

Descriptors: grazing/ control/ abundance/ land use/ watersheds/ body size/ habitat selection/ electric fishing/ salmonidae/ Salvelinus fontinalis/ effects on/ riparian environments/ fencing/ electric fishing/ Salmo gairdneri/ USA, Idaho, Summit Creek

Abstract: In 1975, 3.2 km of Summit Creek, Idaho were fenced by the Bureau of Land Management to exclude

livestock from the riparian area. Six stream sections were electrofished in 1979 to determine differences in trout abundance, size, and growth between grazed and ungrazed stream sections. Electrofishing stations were paired by habitat type. There were more trout in ungrazed sections than in grazed sections in all three habitat types sampled. With one exception, there were more catchable-sized (200 mm long or longer) rainbow trout (*Salmo gairdneri*) and brook trout (*Salvelinus fontinalis*) in the ungrazed area than in the grazed area. There was also evidence that the average size of the fish was less in grazed sections. Fish population data were not collected prior to fencing; therefore it cannot be firmly concluded that the trout population increased within the livestock enclosure as a result of fencing the riparian area. However, the combined results of previous trout habitat improvements documented for Summit Creek, as a result of the fencing, and this study support the conclusion that trout prefer stream areas in ungrazed habitat over grazed habitat.

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758. Rodent communities in a grazed and ungrazed Arizona grassland, and a model of habitat relationships among rodents in southwestern grass/shrublands.

Jones, Zach F.; Bock, Carl E.; and Bock, Jane H.

American Midland Naturalist 149(2): 384-394. (2003)

NAL Call #: 410 M58; ISSN: 0003-0031

Descriptors: *Baiomys taylori*/ *Reithrodontomys fulvescens*/ *Reithrodontomys megalotis*/ *Sigmodon flaviventris*/ *Cricetidae*/ *Rodentia*/ *Chaetodipus hispidus*/ *Dipodomys merriami*/ *Perognathus flavus*/ *Heteromyidae*/ *Muridae*

Abstract: We live-trapped rodents in 2000-2001 at eight sites on a 3160 ha grassland and mesquite-oak savanna in southeastern Arizona that had been ungrazed since 1968, and on eight paired sites on adjacent cattle ranches. There were 917 captures of 14 species during 5760 trap-nights. Four species of *Muridae* (*Sigmodon flaviventris*, *Baiomys taylori*, *Reithrodontomys megalotis* and *R. fulvescens*) were significantly more common on ungrazed plots, while no species was more abundant on grazed plots. However, *Heteromyidae* as a group (especially *Chaetodipus hispidus* and *Perognathus flavus*) comprised a significantly higher proportion of total captures on grazed plots, and heteromyids as a percentage of total captures was positively correlated across all plots with amount of bare ground. One of the eight cross-fence sites also had been trapped in 1981-1983. In the 17 y between trapping events at this site: (1) the grass canopy on both grazed and ungrazed plots had become dominated by taller species, (2) a kangaroo rat (*Dipodomys merriami*) that had been the second most common species in grazed areas disappeared from both plots, (3) pocket mice increased on the grazed plot and declined on the ungrazed plot and (4) *Muridae* (excluding *Peromyscus*) as a percent of all captures increased by greater than 1.5-fold on both plots. Based on these results, and those from other field studies, we propose a model for the composition of rodent communities in grass/shrublands of the Southwest and Intermountain West, based on ground cover. Kangaroo rats (*Dipodomys* spp.) are abundant in areas with the most bare soil, *Muridae* (specifically, *Sigmodon*, *Baiomys* and *Reithrodontomys*) dominate areas with the most and tallest ground cover, and pocket mice (*Chaetodipus* and *Perognathus*) are common in areas of intermediate cover. In relatively mesic grasslands, livestock grazing and fire

drive the rodent community toward one dominated by heteromyids instead of murids. In more arid landscapes, grazing and fire favor kangaroo rats over pocket mice.
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759. Rotational management of grasslands and invertebrate diversity.

Morris, M. G. and Rispin, W. E.
In: Grassland management and nature conservation: Proceedings of a joint meeting between the British Grassland Society and the British Ecological Society. (Held 27 Sep 1993-29 Sep 1993 at Leeds University, UK.); pp. 205-209; 1994.

NAL Call #: SB197.B7 no.28

Descriptors: nature reserves/ grassland management/ grazing systems/ rotational grazing/ grasslands/ chalk grasslands/ species diversity/ plant height/ management/ aspect/ nature conservation

Abstract: Invertebrates were sampled from 1982 until 1985 in a rotational sheep-grazing trial on chalk grassland at Old Winchester Hill National Nature Reserve. Details of Heteroptera and Auchenorrhyncha caught are given. Differences between years, between plots and between positions on the S.-facing hillside were important as were differences in the sward due to grazing treatment. The abundance of many invertebrate species was positively correlated with vegetation height. The study confirmed much previous work which shows that tall grassland is important for the conservation of insects. The rotational system allowed several structural types of grassland to be maintained for a range of plants and animals at one site and is recommended to maintain insect diversity.

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760. Rough-legged hawk habitat selection in relation to livestock grazing on Malheur National Wildlife Refuge, Oregon.

Littlefield, Carroll D.; Thompson, Steven P.; and Johnstone, Richard S.

Northwestern Naturalist 73(3): 80-84. (1992)

NAL Call #: QL671.M8; ISSN: 1051-1733

Descriptors: Accipitridae/ Ciconiiformes/ Buteo lagopus/ birds/ behavior/ grazing/ habitat use/ habitat alterations/ mowing/ overwintering/ wildlife/ livestock relationships

© NISC

761. The selection of grazing marshes by breeding birds.

Peel, S.; Milsom, T. P.; and Langton, S. D.

In: Grassland management in environmentally sensitive areas. (Held 23 Sep 1997-25 Sep 1997 at Lancaster, United Kingdom.) Sheldrick, R. D. (eds.); pp. 144-149; 1997.

NAL Call #: SB197.B7; ISBN: 0905944542

762. Sharp-tailed grouse and range management practices in western rangelands.

Kessler, W. B. and Bosch, R. P.

In: Proceedings of the Wildlife-Livestock Relationships Symposium. (Held 20 Apr 1981-22 Apr 1981 at Coeur D'alene, Idaho.) Peek, James M. and Dalke, P. D. (eds.) Moscow, Idaho: Forest, Wildlife & Range Experiment Station, University of Idaho; pp. 133-146; 1982.

NAL Call #: SF84.84.W5 1981

763. The shorebirds and waterbirds on some grazed and ungrazed islands on the Finnish west coast.

Ulfvens, J.

Ornis Fennica 68(1): 26-32. (1991)

NAL Call #: 413.8 OR66; ISSN: 0030-5685

Descriptors: breeding population density/ conservation/ topography/ open area/ Finland

Abstract: The study deals with the shore- and waterbirds on 12 low moraine islands (areas 2.0-23.6 ha) on the Finnish east coast. Five of the islands were still grazed during the study year or until very recently, while the other seven were mostly covered with forest. Of the shore- and waterbirds counted, 86% nested on the grazed islands. The density of breeding birds was significantly higher on the grazed islands than on the ungrazed ones, but there was no statistically significant difference in the number of species or pairs. Although many topographic features of the island may influence the composition of the bird fauna, there was a significant correlation between the proportion of open areas (i.e. low grass meadows and areas with scanty bushes) and the density of the shore- and waterbirds. The bird density was 1.5-3.3 pairs/ha on the ungrazed islands (13-26% open areas), and 10.6-74.5 pairs/ha on the grazed islands (28-100% open areas). I suggest that continuation of grazing for keeping at least 40% of the grazed island open would be a practical and cost-effective method of ensuring a fairly rich shore- and water bird fauna.
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764. Shrub-grassland small mammal and vegetation responses to rest from grazing.

Rosenstock, S. S.

Journal of Range Management 49(3): 199-203. (1996)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/1996/493/199-203_rosenstock.pdf

Descriptors: small mammals/ grazing/ microhabitats/ canopy/ species diversity/ habitats/ grasses/ shrubs/ plant communities/ Utah

Abstract: Between 1989-1991, I studied the effects of livestock grazing on vegetation and small mammals in semiarid shrub-grassland habitats of south-central Utah. Responses were measured at 2 spatial habitat scales; patches and macrohabitats. Patch-scale data were obtained from 4 small (<1 ha) livestock exclosures and nearby grazed areas. Macrohabitat-scale data were collected at 4 actively grazed sites and 4 comparable, excellent condition sites, ungrazed for 30+ years. Ungrazed patch and macrohabitat sites had more surface litter, greater perennial grass cover, and taller perennial grass plants, but treatment response varied among sites. Small mammal responses were apparent only at the macro-habitat scale, where ungrazed sites had 50% greater species richness and 80% higher abundance. Small mammal reproductive activity and biomass were not affected by rest from grazing at either scale. Small mammal community composition varied greatly among sites and within treatments. This variability has important implications for ecological monitoring efforts involving these species. This citation is from AGRICOLA.

765. Simulation of host-parasite-landscape interactions: Influence of season and habitat on cattle fever tick (*Boophilus* sp.) population dynamics in rotational grazing systems.

Teel, P. D.; Marin, S.; Grant, W. E.; and Stuth, J. W. *Ecological Modelling* 97(1-2): 87-97. (1997)
 NAL Call #: QH541.15.M3E25; ISSN: 0304-3800
 Descriptors: cattle fever/ cattle fever tick/ models and simulations/ parasite/ pest management/ population dynamics/ primary/ rotational grazing system/ vector
 Abstract: Explicit consideration of spatial and temporal factors regulating host-parasite-landscape interactions is basic to understanding systems perspectives for the management of animal parasites. A simulation model of cattle fever tick, *Boophilus annulatus* and *B. microplus*, population dynamics on rangelands of the northeastern Mexico-United States border region was modified to examine spatial and temporal dynamics of ticks in rotational grazing systems. Five short-duration grazing rotations in an eight-pasture system were evaluated on rangeland landscapes dominated by uncanopied grass, mesquite canopied grass and mixed-brush canopied grass. Infestations of the grazing system were initiated by introducing infested cattle in either fall or spring. Grazing system infestations in mesquite and mixed brush canopied grass persisted longer than those in uncanopied grass and were characterized by more frequent reinfestations of both pastures and cattle over the two-year simulations. Infestations initiated in fall were generally of longer duration than those initiated in spring due in part to longer incubation periods for tick eggs. Temporal dynamics of infestations by pasture were evaluated numerically and graphically. These analyses show that gaps and discontinuities of infestations within individual pastures over the course of the fall- and spring-initiated simulations reflect host-parasite-landscape interactions affecting tick distribution and survival.

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766. Small mammal populations in a grazed and ungrazed riparian habitat in Nevada.

Medin, D. E. and Clary, W. P. *Research Paper Int - US Department of Agriculture, Forest Service, Intermountain Research Station*(413): 6 p. (Oct. 1989)

NAL Call #: A99.9 F764U; ISSN: 0886-7380
 Descriptors: wildlife/ mammals/ habitats/ *Populus tremuloides*/ *Salix*/ population dynamics/ riparian buffers/ grazing/ Nevada

This citation is from AGRICOLA.

767. Small mammals in tall-grass prairie: Patterns associated with grazing and burning.

Clark, Bryon K.; Kaufman, Donald W.; Finck, Elmer J.; and Kaufman, Glennis A.

Prairie Naturalist 21(4): 177-184. (1989)
 NAL Call #: QH540 .P7; ISSN: 0091-0376

Descriptors: *Blarina hylophaga*/ *Microtus ochrogaster*/ *Peromyscus maniculatus*/ *Peromyscus leucopus*/ ecosystems/ grasslands/ fires/ burns/ grazing/ habitat alterations/ prairies/ wildlife/ livestock relationships/ North America/ United States/ Kansas: Geary County/ Kansas: Riley County

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768. Soil microarthropods as indicators of exposure to environmental stress in Chihuahuan desert rangelands.

Kay, F. R.; Sobhy, H. M.; and Whitford, W. G. *Biology and Fertility of Soils* 28(2): 121-128. (1999)
 NAL Call #: QH84.8.B46; ISSN: 0178-2762

Descriptors: bulldozing/ desert grassland/ desertification/ environmental stress indicators/ grazing/ habitat/ microclimate/ rainfall/ rangeland/ soil communities/ vegetation damage

Abstract: We studied soil microarthropod communities along livestock grazing disturbance gradients, inside and outside grazing exclosures, and on areas subjected to restoration efforts (herbicide and bulldozing) in order to test the suitability of mites as indicators of rangeland soil quality. We found that mite numbers generally increased with decreased grazing disturbance. Soil microarthropods appeared to respond to a complex of factors including soil compaction, depth to an impervious soil layer, below-ground vegetative biomass, and residual effects of herbicide. All of our study plots, except those that had been herbicide treated, were dominated by microbivorous mites of the family Nanorchestidae. The numerical responses of mites, especially nanorchestids, appeared to provide a sensitive indicator of ecosystem health in a Chihuahuan Desert grassland.

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769. Spatial and temporal differences in the abundance of black grouse and other moorland birds in relation to reductions in sheep grazing.

Baines, D.; Warren, P.; and Calladine, J. *Aspects of Applied Biology*(67): 245-252. (2002)

NAL Call #: QH301.A76; ISSN: 0265-1491
 Descriptors: grazing/ moorlands/ spatial variation/ species diversity/ species richness/ temporal variation/ wildlife conservation

Abstract: The effect of agri-environment schemes introduced to promote heather regeneration in moorland habitats on breeding birds was assessed at 12 pairs of sites in northern England. Sheep reductions were associated with increases in "heath" species and cotton grass *Eriophorum* spp., but less heath rush *Juncus squarrosus*. Plots with reduced sheep supported 59% fewer breeding waders, particularly lapwing *Vanellus vanellus*, and 60% fewer grey partridge *Perdix perdix*. Sheep reduction probably benefited black grouse *Tetrao tetrix*, which showed an increase in lekking males of 4.6% (SE=2.1) per annum following stock reduction compared to a decline of 1.7% (SE=1.4) per annum on plots without stock reduction. Sheep removal in autumn and winter was associated with the presence of large (up to 40) flocks of black grouse. Sheep reduction had conservation benefits, at least for black grouse, but may negatively affect overall avian biodiversity if implemented on large spatial scales. Development of appropriate scales of habitat mosaics is essential for optimizing bird conservation in the uplands.

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770. Spatial heterogeneity of low-density populations of *Melanoplus sanguinipes* (Orthoptera: Acrididae) associated with grazing and vegetation treatments.

Fielding, Dennis J.; Brusven, M. A.; Shafii, Bahman; and Price, William J.

Canadian Entomologist 133(6): 843-855. (2001)
 NAL Call #: 421 C16; ISSN: 0008-347X

Descriptors: animals and man/ disturbance by man/ commercial activities/ ecology/ population dynamics/ habitat/ terrestrial habitat/ abiotic factors/ physical factors/ land and freshwater zones/ Nearctic Region/ North America/ USA/ *Melanoplus sanguinipes* (Saltatoria): farming and agriculture/ livestock grazing/ population density/ low density populations/ distribution within habitat/ spatial heterogeneity of low density populations/ grassland/ climate and weather/ Idaho/ south/ spatial distribution of low density populations/ effects of grazing and vegetation/ rangelands/ Saltatoria/ Orthoptera/ Insecta/ arthropods/ insects/ invertebrates

Abstract: The objectives of this study were to determine whether the spatial distribution of *Melanoplus sanguinipes* F., the most abundant species of grasshopper on rangeland in southern Idaho, varied annually in response to changing patterns of grazing and to investigate how vegetation affects the spatial distribution of low-density populations of *M. sanguinipes* at scales relevant to most rangeland-management activities. A lattice of 72 sites was established across nine pastures, covering approximately 5000 ha. At each site, densities of *M. sanguinipes*, percent canopy coverage by plant species, and percent forage utilization by livestock were estimated twice per year, in June when *M. sanguinipes* was in the nymphal stage and in August during the adult stage, for 4 years, 1991-1994. Spatial analyses of variance were used to evaluate the influence of grazing and vegetation type on densities of *M. sanguinipes*. In August of each year, densities of *M. sanguinipes* were lower on heavily grazed sites than on lightly grazed sites, except in 1993, when the opposite trend was observed. Above-normal precipitation in 1993 resulted in abundant growth of annual forbs and regrowth of grazed plants. The distribution of nymphs in June of 1993 and 1994 reflected the grazing patterns of the previous summer. Densities of *M. sanguinipes* were lower on crested wheatgrass habitats than on annual grasslands for every sampling period from June 1991 to June 1993, after which no differences were observed. We interpret the results to suggest that grazing effects on low-density populations of *M. sanguinipes* were contingent on weather conditions; under dry conditions, grazed habitats were less favorable to *M. sanguinipes* but, during relatively cool wet summers, grazing created conditions that were more favorable to *M. sanguinipes*.
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771. Species diversity and habitat of grassland passerines during grazing of a prescribe-burned, mixed-grass prairie.

Danley, Robert F.; Murphy, Robert K.; and Madden, Elizabeth M.

Western North American Naturalist 64(1): 72-77. (2004)
NAL Call #: QH1 .G7; ISSN: 1527-0904

Descriptors: prescribed burning: applied and field techniques/ rotation grazing: applied and field techniques/ grazing/ habitat management/ mixed grass prairie: prescribe burned/ species diversity/ stocking rates

Abstract: No published data exist on responses of grassland passerines and their habitat to combined grazing and burning treatments in northern mixed-grass prairie. At Lostwood National Wildlife Refuge (LNWR) in northwestern North Dakota, we monitored breeding bird occurrence, abundance, and habitat during successive annual grazing treatments (1998-2000) on 5 prescribe-burned, mixed-grass prairie management units (range=50-534 ha, each

burned 3-6 times in the previous 10-20 years). All breeding passerine species characteristic of upland, northern mixed-grass prairie were common (>10% occurrence) during at least 1 of 3 years on burned and grazed units, except Chestnut-collared Longspur (*Calcarius ornatus*), which was uncommon. Vegetation was generally shorter and sparser than that found on 4 nearby units treated by fire only (1999; density, visual obstruction, and height, all $P < 0.01$). Regardless, occurrences of individual bird species resembled those previously documented on prairie units at LNWR with similar fire histories but no grazing; however, Brown-headed Cowbird (*Molothrus ater*) occurred 2.4 times more frequently on burned and grazed units studied. Our data suggest that species diversity of breeding grassland passerines changes little during initial years of rotation grazing at moderate stocking rates in fire-managed, northern mixed-grass prairie at LNWR.
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772. Spring livestock grazing affects crested wheatgrass regrowth and winter use by mule deer.

Austin, D. D.; Urness, P. J.; and Fierro, L. C.

Journal of Range Management 36(5): 589-593. (1983)
NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1983/365/12aust.pdf>

Descriptors: Utah

This citation is from AGRICOLA.

773. The status, habitat, and response to grazing of water vole populations in the Big Horn Mountains of Wyoming, U.S.A.

Klaus, Marion

Arctic Antarctic and Alpine Research 35(1): 100-109. (2003)

NAL Call #: GB395.A73; ISSN: 1523-0430

Descriptors: USDA Forest Service/ altitude/ bank structure/ channel types/ conservation status/ creeks/ dry weight biomass/ grazing responses/ habitat profiles/ habitat requirements/ historical records/ percent plant cover/ precipitation/ riparian environments/ soils/ species abundance/ stream depth/ temperature

Abstract: *Microtus richardsoni*, the water vole, was listed as a sensitive species in Region 2 of the USDA Forest Service in 1994. Historical records indicate water voles were found in the Big Horn Mountains, but little was known about their current status. The purpose of this study was to locate water voles in the Big Horn Mountains of Wyoming, develop a habitat profile, and evaluate the extent to which livestock grazing affects them. Accessible creeks with habitat requirements for water voles were surveyed. Water voles were not captured below 2440 m. Grazed and ungrazed sites occupied by water voles were matched and analyzed for percent plant cover, dry weight biomass, riparian classification, mean stream depth, channel type, elevation, precipitation, and temperature. Capture success was significantly greater in ungrazed areas. Percent cover by ferns and thallophytes was significantly greater in areas where water voles were more abundant, and bare ground was significantly greater at grazed locations. Water voles were most abundant on Rosgen B or E streams with a willow/wet *Carex* riparian class that is found on relatively undisturbed sites with stable, well-developed soils and bank structure. In the Big Horn Mountains, water vole captures

were low in comparison to the Beartooth Mountains and synergistic effects of grazing and drying might negatively impact this species.

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774. Stream habitat and fisheries response to livestock grazing and instream improvement structures, Big Creek, Utah.

Platts, W. S. and Nelson, R. L.

Journal of Soil and Water Conservation 40(4): 374-379. (1985)

NAL Call #: 56.8 J822; ISSN: 0022-4561

Descriptors: environmental degradation/ fisheries/ grazing/ habitat destruction/ livestock/ rangelands/ streams/ Utah

This citation is from AGRICOLA.

775. Summer grassland cover on cattle farms in Kwazulu-Natal: Does it limit nesting habitat for helmeted guineafowl?

Malan, G.

South African Journal of Wildlife Research 28(4): 105-109. (1998)

NAL Call #: SK575.S6S6; ISSN: 0379-4369

Descriptors: Galliformes/ Numididae/ Numida meleagris

Abstract: The author studied the potential temporal bottleneck for nesting helmeted guineafowl on cattle farms in KwaZulu-Natal, South Africa. After the first summer rains and at the start of the guineafowl breeding season, grassland cover is at a minimum because of intensive winter burning and summer cattle grazing programs. The termination of sheep farming in the area and how it could have contributed to the decline in guineafowl numbers are also discussed. slj.

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776. Suppression of grasshoppers in the Great Plains through grazing management.

Onsager, J. A.

Journal of Range Management 53(6): 592-602. (2000)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/2000/536/592-602_onsager.pdf

Descriptors: Melanoplus sanguinipes/ insect control/ rotational grazing/ canopy/ rain/ heat sums/ biomass/ prairies/ Agropyron cristatum/ population density/ Acrididae/ mortality/ life cycle/ range management/ North Dakota

This citation is from AGRICOLA.

777. Trout habitat, abundance, and fishing opportunities in fenced vs unfenced riparian habitat along Sheep Creek, Colorado.

Stuber, R. J.

In: Riparian ecosystems and their management: Reconciling conflicting uses. (Held 16 Apr 1985-18 Apr 1985 at Tuscon, Ariz.) Johnson, R. Roy; Ziebell, Charles D.; Patton, David R.; Ffolliott, Peter F.; and Hamre, R. H. (eds.)

Fort Collins, Colo.: Rocky Mountain Forest and Range Experiment Station, United States, Forest Service; pp. 310-314; 1985.

NAL Call #: aSD11.A42

Descriptors: riparian environments/ livestock/ river banks/ grazing/ abundance/ Salmo/ standing stock/ USA, Colorado, Sheep Creek/ livestock

Abstract: Fencing was used to protect 40 hectares of

riparian stream habitat along 2.5 km of Sheep Creek, Colorado, from adverse impacts due to heavy streamside recreation use and cattle grazing. Fish habitat within the fenced area was narrower, deeper, had less streambank alteration, and better streamside vegetation than comparable unfenced sections. Estimated trout standing crop was twice as great, and proportional stock density (PSD) was higher than in unfenced sections. There was a higher proportion of nongame fish present in unfenced sections. Projected fishing opportunities within the fenced sections were double those estimated for a comparable length of unfenced habitat along the same stream.

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778. Upland bird research: Evaluation of livestock grazing and residual herbaceous cover on sage grouse nest success.

Giesen, K. M. Colorado Division of Wildlife, 1995. 16 pp. Job Final Report.

Notes: Period Covered: 1 January 1993 - 31 December 1994

Descriptors: telemetry/ habitat/ female/ vegetation/ size/ sagebrush/ predation/ trapping/ marking/ North America/ United States/ Colorado/ western region/ Jackson County

Abstract: Six strutting grounds in North Park, Colorado (Boettcher Junction, Coalmont, Delaney Butte, Lost Creek, Raven, and Spring Creek) were selected for documentation of hen movements to nests. Nesting habitat adjacent to each study lek was identified, and nest success and causes of failures were ascertained. Vegetative structure at nest sites was measured to determine possible selection for specific nesting habitats. Grazing from a portion of the nesting habitat associated with each strutting ground studied was experimentally excluded, and subsequent nest success between nests in grazing exclosures and control areas was compared.

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779. The use of cattle as a management tool for wildlife in shrub-willow riparian systems.

Krueger, H. O. and Anderson, S. H.

In: Riparian ecosystems and their management: Reconciling conflicting uses. (Held 16 Apr 1985-18 Apr 1985 at Tuscon, Ariz.) Johnson, R. Roy; Ziebell, Charles D.; Patton, David R.; Ffolliott, Peter F.; and Hamre, R. H. (eds.)

Fort Collins, Colo.: Rocky Mountain Forest and Range Experiment Station, United States, Forest Service; pp. 300-304; 1985.

NAL Call #: aSD11.A42

Descriptors: cattle/ grazing/ wildlife/ habitats/ resource management

This citation is from AGRICOLA.

780. The use of domestic herbivores in the management of wetlands for waterbirds in the Camargue, France.

Duncan, P. and D'Herbes, J. M.

In: Managing wetlands and their birds: A manual of wetland and waterfowl management/ Scott, D. A., 1982; pp. 51-66.

Notes: Publisher: International Waterfowl Research Bureau

Descriptors: Equus caballus/ Bos taurus/ Ciconiiformes/

Anseriformes/ Ardeidae/ birds, water/ ecosystems/ grazing/ habitat alterations/ management/ wetlands/ waterfowl/ horse/ cattle/ wetland/ vegetation
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781. Using short duration grazing to accomplish wildlife habitat objectives.

Guthery, F. S.; DeYoung, C. A.; Bryant, F. C.; and Drawe, D. L.

In: Can livestock be used as a tool to enhance wildlife habitat? (Held 13 Feb 1990 at Reno, Nev.)

Severson, Kieth E. (eds.)

Fort Collins, Colo.: Rocky Mountain Forest and Range Experiment Station, US Department of Agriculture, Forest Service; pp. 41-55; 1990.

Notes: 43rd Annual Meeting of the Society for Range Management

NAL Call #: aSD11.A42 no.194

Descriptors: animals and man/ disturbance by man/ commercial activities/ conservation/ conservation measures/ ecology/ habitat/ terrestrial habitat/ abiotic factors/ physical factors/ Aves/ Mammalia: farming and agriculture/ short duration grazing use as habitat management tool/ habitat management/ short duration grazing use/ population dynamics/ short duration grazing effects/ habitat management aspects/ grassland/ habitat management by short duration grazing/ review/ aridity/ desertification reversal due to livestock watering/ conservation aspects/ birds/ chordates/ mammals/ vertebrates

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782. Utilisation of Wadden Sea salt marshes by geese in relation to livestock grazing.

Bos, Daan; Loonen, Maarten J. J. E.; Stock, Martin; Hofeditz, Frank; Van Der Graaf, Alexandra J.; and Bakker, Jan P.

Journal for Nature Conservation 13(1): 1-15. (2005); ISSN: 1617-1381

Descriptors: sandy soil/ salt marsh/ livestock grazing/ canopy height/ goose dropping density/ spring feeding/ habitat use

Abstract: To arctic breeding geese, the salt marshes of the International Wadden Sea are important spring staging areas. Many of these marshes have always been grazed with livestock (mainly cattle and sheep). To evaluate the influence of livestock grazing on composition and structure of salt-marsh communities and its consequences for habitat use by geese, a total of 17 pairs of grazed and ungrazed marshes were visited both in April and May 1999, and the accumulated grazing pressure by geese was estimated using dropping counts. Observed grazing pressure was related to management status and to relevant vegetation parameters. The intensity of livestock grazing influences the vegetation on the marsh. Salt marshes that are not grazed by livestock are characterised by stands with a tatter canopy, a lower cover of grasses preferred by geese, and a higher cover of plants that are not preferred. Overall goose-dropping densities are significantly tower in ungrazed marshes compared to marshes grazed by livestock. Some ungrazed marshes had comparatively high goose grazing pressure, and these were all natural marshes on a sandy soil, or artificial mainland marshes with a recent history of intensive livestock grazing. Goose grazing is associated with a short canopy. The plant communities with short

canopy, dominated by *Agrostis stolonifera*, *Festuca rubra* and *Puccinellia maritima*, together account for 85% of all goose droppings in our data. The sites that were not visited by geese differed very little from those that were visited, in the parameters we measured. This might indicate that there was no shortage of available habitat for spring staging geese in the Wadden Sea, in the study period (C) 2005 Elsevier GmbH. All rights reserved.

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783. Vegetation cover and forb responses to cattle exclusion: Implications for pronghorn.

Loeser, Matthew R.; Mezulis, Sharon D.; Sisk, Thomas D.; and Theimer, Tad C.

Rangeland Ecology and Management 58(3): 234-238. (2005)

NAL Call #: SF85 .J67; ISSN: 1550-7424

Descriptors: animals and man/ disturbance by man/ commercial activities/ nutrition/ diet/ ecology/ habitat/ land zones/ Nearctic Region/ USA/ North America/ *Antilocapra americana* (Bovidae): farming and agriculture/ cattle exclusion/ implications for fawn hiding cover and forb availability on rangeland/ food plants/ food availability/ habitat utilization/ terrestrial habitat/ rangeland habitat/ Arizona/ Anderson Mesa/ fawn hiding cover and forb availability on rangeland in response to cattle exclusion/ Bovidae/ Artiodactyla/ Mammalia/ chordates/ mammals/ ungulates/ vertebrates

Abstract: Cattle grazing is often implicated as a factor that reduces vegetative cover and the abundance of important forage plants for wildlife. Recent declines in northern Arizona populations of pronghorn (*Antilocapra americana* Ord) have focused public and scientific attention on the factors contributing to low fawn recruitment and the potential benefits of cattle removal. To further understand the effects of cattle grazing, we studied the potential hiding cover provided by standing live and dead herbaceous matter as well as forb richness and canopy cover following 5 years of cattle removal. Cattle removal increased horizontal hiding cover by 8% at a distance of 5 in ($P = 0.025$), but had no statistically significant effect on the potential hiding cover at distances of 10 in ($P = 0.105$) or 25 in ($P = 0.746$). Forb species richness was 16% lower in exclosures than in an adjacent grazed pasture in 2001 ($P = 0.036$), but no differences were observed in 2002 ($P = 0.636$). The canopy cover of forbs was generally unaffected by cattle removal. These results suggest that curtailing or removing cattle is unlikely, by itself, to lead to rapid improvements in the hiding cover or forb availability for pronghorn on similar rangelands in northern Arizona. In this region, where immediate improvements in fawn survival and recruitment are important to population persistence, additional management actions should be considered.

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784. Vole mound effects and disturbance rate in a Mediterranean plant community under different grazing and irrigation regimes.

Rebollo, S.; Perez Camacho, L.; Valencia, J.; and Gomez Sal, A.

Plant Ecology 169(2): 227-243. (2003)

NAL Call #: QK900.P63; ISSN: 1385-0237

Descriptors: Mediterranean plant community/ abandoned cropland/ disturbance rate/ early succession/ forage resource availability/ grazing regime/ ground disturbance/

irrigation regime/ mound building activity/ plant species conservation/ plant succession/ small scale disturbance/ species richness/ trophic resources/ vole mound effects
Abstract: A factorial field experiment was used to assess the influence of soil-disturber mammals in the structure of a 9-year-old Mediterranean annual plant community subjected to different sheep grazing and irrigation regimes. We estimated the disturbance rate (mound building activity) by Mediterranean voles, their effects on vegetation and the mechanisms of these effects during a period of vole outbreak. The effects on vegetation were analysed at the levels of species, functional groups and plant community. Disturbance rate was high and voles can disturb the entire soil surface once every four or five years. The availability of certain trophic resources (perennial plants) appeared to drive vole expansion in the experimental plots and it was independent of the irrigation and grazing treatments. Mound building activities largely affected vegetation but conserved plot differences. Total vegetation cover, absolute cover of all functional groups, mean vegetation height and species richness were less on mounds than on undisturbed ground. These effects did not change the relative abundance of annuals, perennials, grasses and forbs. Only the relative abundance of small-seeded species decreased on mounds. As the proportion of these seeds was similar in both types of patches, we suggest that small-seeded species had more difficulties for germinating or emerging when they are buried during mound formation. Irrigation and sheep grazing promoted large changes in the vegetation parameters but these effects were, in general, similar on mounds and undisturbed ground. Our results show that the availability of germinable seeds may be the major limitation for mound revegetation, probably due to the scarcity of seeds existing at the depths from which soils are excavated. Our results also suggested a resource limitation on mounds. The results provide additional evidence that soil disturbances by small herbivore mammals exert relevant ecological effects on abandoned Mediterranean croplands. We discuss the ecological implications of vole mound-building activities for plant succession, plant species conservation and forage resource availability for livestock.
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785. Wildlife and livestock grazing alternatives in the Sierra Nevada.

Kie, John G.

Transactions of the Western Section of the Wildlife Society 27: 17-29. (1991)

NAL Call #: SK351.W523; ISSN: 0893-214X

Descriptors: animals and man/ disturbance by man/ commercial activities/ conservation/ conservation measures/ habitat/ land and freshwater zones/ Nearctic Region/ North America/ USA/ comprehensive zoology/ *Strix nebulosa* (Strigidae)/ *Molothrus ater* (Icteridae)/ *Empidonax traillii* (Tyrannidae)/ Mammalia: farming and agriculture/ alternative livestock grazing strategies/ habitat conservation benefit/ habitat management/ benefit of alternative livestock grazing strategies/ review/ terrestrial habitat/ conservation benefit of alternative livestock grazing strategies/ USA/ California/ Sierra Nevada/ habitat conservation benefit of alternative livestock grazing strategies/ Strigidae/ Strigiformes/ Aves/ birds/ chordates/ mammals/ vertebrates
© The Thomson Corporation

786. Wildlife habitat on grazed or ungrazed small pond shorelines in south Texas.

Whyte, R. J. and Cain, B. W.

Journal of Range Management 34(1): 64-68. (1981)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1981/34/1/18whytpdf>

Descriptors: grazing/ littoral zone/ vegetation/ ponds/ community composition/ vegetation cover/ Aves/ USA, Texas/ effects on/ environmental effects/ vegetation cover/ vegetation

Abstract: Three man-made ponds constructed in 1956 and fenced to exclude cattle from the shoreline were selected to study the effects of cattle on shoreline vegetation. These ponds were partially opened in 1977 to allow grazing on one-half of the shoreline. In most areas the foliar cover and vegetation height were reduced by cattle pressure. The stable Longtom Community and the Knotgrass-Smartweed Community were more affected by cattle pressure than the Transition Community which changed as the water level rose or dropped. The seasonal Aquatic Community was least affected by cattle pressure and thus maintained good stands of waterfowl food plants. Carefully planned grazing which allows key rest and grazing periods will control the impact of grazing on the shoreline vegetation.
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787. Wildlife on ungrazed and grazed bottomlands on the South Platte River, northeastern Colorado.

Crouch, G. L.

In: Proceedings of the Wildlife-Livestock Relationships Symposium. (Held 20 Apr 1981-22 Apr 1981 at Coeur D'alene, Idaho.) Peek, James M. and Dalke, P. D. (eds.) Moscow, Idaho: Forest, Wildlife & Range Experiment Station, University of Idaho; pp. 186-197; 1982.

NAL Call #: SF84.84.W5 1981

788. Wildlife responses to grazing management and habitat manipulation: The Welder Wildlife Refuge experience.

Drawe, D. L.

In: Proceedings of a conference on multispecies grazing. (Held 25 Jun 1985-28 Jun 1985 at Winrock International, Morrilton, Arkansas.) Baker, Frank H. and Jones, R. Katherine (eds.)

Morrilton, Ark.: Winrock International Institute for Agricultural Development; pp. 93-108; 1985.

NAL Call #: SF85.3.P76

Descriptors: range management/ objectives/ United States
This citation is from AGRICOLA.

789. Wildlife use of livestock water under short duration and continuous grazing.

Prasad, N. L. N. S. and Guthery, F. S.

Wildlife Society Bulletin 14(4): 450-454. (1986)

NAL Call #: SK357.A1W5; ISSN: 0091-7648

Descriptors: *Odocoileus virginianus*/ *Procyon lotor*/ *Canis latrans*/ *Meleagris gallopavo*/ *Zenaid macroura*/ *Tayassu tajacu*/ *Molothrus ater*/ cattle/ grazing management/ Texas/ USA
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790. Willow flycatcher and yellow warbler response to cattle grazing.

Taylor, D. M. and Littlefield, C. D.
American Birds 40(5): 1169-1173. (1986)
NAL Call #: QL671.A32; ISSN: 0004-7686
Descriptors: Empidonax traillii/ Dendroica petechia/ human activity/ habitat protection
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Plant Ecology, Biodiversity, and Other Environmental Effects

791. 14 vs. 42-paddock rotational grazing aboveground biomass dynamics forage production and harvest efficiency.

Heitschmidt, R. K.; Dowhower, S. L.; and Walker, J. W.
Journal of Range Management 40(3): 216-223. (1987)
NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1987/403/6heit.pdf>
Descriptors: cattle/ Texas/ USA/ stocking densities/ growing season
Abstract: Research was initiated at the Texas Experimental Ranch in 1981 to quantify the effects of 2 stocking densities, equivalent to 14- and 42-paddock rotational grazing (RG) treatments, on aboveground biomass dynamics, aboveground net primary production (ANPP), and harvest efficiency of forage. Baseline data were collected in 1981 from 3 adjacent 30-ha paddocks in a 14-paddock, cell designed RG treatment. Near the beginning of the 1982 growing season the center paddock was subdivided into three, 10-ha paddocks to establish the RG-42 treatment. Stocking densities in the 14- and 42-paddock treatments were 4.2 and 12.5 AU/ha, respectively, from March 1982 to June 1984 and 3.0 and 9.1 AU/ha from June to November 1984. During 1981, estimated ANPP in the two RG-14 paddocks averaged 4,088 kg/ha as compared to 5,762 in the single RG-42 paddock. Following subdivision, ANPP in the RG-14 paddocks averaged 2,533 kg/ha as compared to 2,670 kg/ha in the RG-42 paddocks. Although ANPP varied significantly among the 4 years of the study it was not affected by density treatment. Likewise, harvest efficiency varied among years but was unaffected by density treatment. Average harvest efficiency over the 4 years was about 42%. Aboveground biomass dynamics were also generally unaffected by density treatments.
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792. Alfalfa survival and vigor in rangeland grazed by sheep.

Berdahl, J. D.; Wilton, A. C.; Lorenz, R. J.; and Frank, A. B.
Journal of Range Management 39(1): 59-62. (1986)
NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1986/391/15berd.pdf>
Descriptors: Medicago/ cultivars/ germplasm/ grazing/ regrowth/ sheep/ rangelands/ North Dakota
This citation is from AGRICOLA.

793. An assessment of restoration of biodiversity in degraded high mountain grazing lands in northern Ethiopia.

Asefa, D. T.; Oba, G.; Weladji, R. B.; and Colman, J. E.
Land Degradation and Development 14(1): 25-38. (2003)
NAL Call #: S622.L26; ISSN: 1085-3278
Descriptors: state and transition model: mathematical and computer techniques/ biodiversity restoration/ land

abandonment/ land degradation/ mountain grazing lands: area enclosures, open management schemes/ soil properties/ species richness/ vegetation composition

Abstract: Loss of biodiversity is the single most important threat to the conservation and sustainable use of drylands in northern Ethiopia due to many centuries of cultivation and heavy livestock grazing pressure. The current study assessed the restoration of biodiversity in highly degraded areas in eastern Tigray, northern Ethiopia using area enclosures (AEs). The study assessed whether the differences in biodiversity between AEs and open management schemes and time of land abandonment influenced diversity of plant life forms (i.e. herbs, shrubs and trees). Changes in biodiversity were compared using the state-and-transition model. Management types and time since abandonment (hereafter called age) had a significant effect on herbaceous plant species abundance but not in shrub species, while site factors had a greater effect on diversity of plant life forms in general. Herbaceous species richness increased with age of restoration, reaching a maximum after three years of rest and declined thereafter, most probably as a result of hay harvesting and replacement of annual species by perennial grass species. Tree species richness increased gradually with age of land abandonment up to the maximum age of eight years. Four vegetation states and seven possible transitions that could guide management were identified. The vegetation states differed in terms of diversity of herbs and tree species but not those of shrubs. Promotion of tree species states will require longer periods of rest, while promotion of herbaceous species richness will need shorter periods. The state-and-transitional model could, therefore, be used to guide future management by promoting vegetation states that are desired by land users.
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794. Bacteria as bioindicators in wetlands:

Bioassessment in the Bonneville Basin of Utah, USA.
Merkley, M.; Rader, R. B.; McArthur, J. V.; and Eggett, D.
Wetlands 24(3): 600-607. (2004)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: marshes/ wetlands/ basins/ biodegradation/ genetic analysis/ indicator species/ grazing/ surface area/ comparative studies/ analytical techniques/ genetics/ bioassays/ degradation/ man-induced effects/ anthropogenic factors/ genetic diversity/ species diversity/ bacterial/ biodiversity/ organic compounds/ substrates/ ecosystems/ bioindicators/ USA, Utah, Bonneville Basin
Abstract: Bacteria should be excellent indicators of the early signs of degradation caused by human intervention because they have the highest surface area to volume ratio of all organisms. We determined the utility of a simple procedure that measures aerobic bacterial metabolic

diversity (BIOLOG EcoPlates) as a reliable tool for assessing the effects of cattle grazing on spring ecosystems of the Bonneville Basin, Utah, USA. Marshes disturbed by cattle could be distinguished from protected marshes using EcoPlate analyses. The diversity of organic compounds used by bacteria was greater in grazed versus ungrazed marshes. A separate genetic analysis (DGGE) provided corroborating evidence. Greater metabolic diversity (EcoPlates) corresponded to greater bacterial assemblage diversity in grazed versus protected marshes. Greater plant diversity at grazed sites might account for the greater diversity of organic substrates used by bacteria in grazed sites. However, the results were not conclusive. In some marshes, a greater diversity of organic substrate use occurred where there was greater plant diversity, whereas in other marshes the diversity of organic substrates used by bacteria was lower where plant diversity was greatest. Regardless of the mechanism, aerobic bacterial metabolic diversity (EcoPlates) is a potentially valuable tool for assessing the early signs of degradation in wetland ecosystems.

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795. Below-ground biomass and productivity of a grazed site and a neighbouring ungrazed enclosure in a grassland in central Argentina.

Pucheta, Eduardo; Bonamici, Ivano; Cabido, Marcelo; and Diaz, Sandra

Austral Ecology 29(2): 201-208. (2004)

NAL Call #: QH540 .A8; ISSN: 1442-9985

Descriptors: long term enclosure: applied and field techniques/ below ground biomass/ below ground net plant productivity [bnpp]/ climates/ grazing impact/ mountain grasslands/ root turnover rates/ seasonal variation

Abstract: We estimated the below-ground net plant productivity (BNPP) of different biomass components in an intensively and continuously 45-ha grazed site and in a neighbouring enclosure ungrazed for 16 years for a natural mountain grassland in central Argentina. We measured approximately twice as much dead below-ground biomass in the grazed site as in the ungrazed site, with a strong concentration of total below-ground biomass towards the upper 10 cm of the soil layer in both sites. The main contribution to total live biomass was accounted for by very fine (<0.5 mm) and fine roots (0.5-1.0 mm) both at the grazed (79%) and at the ungrazed (81%) sites. We measured more dead biomass for almost all root components, more live biomass of rhizomes, tap roots and bulbs, and less live biomass of thicker roots (>1 mm) in the grazed site. The seasonal variation of total live below-ground biomass mainly reflected climate, with the growing season being limited to the warmer and wetter portion of the year, but such variation was higher in the grazed site. Using different methods of estimation of BNPP, we estimated maximum values of 1241 and 723 g m⁻² year⁻¹ for the grazed and ungrazed sites, respectively. We estimated that very fine root productivity was almost twice as high at the grazed site as at the ungrazed one, despite the fact that both sites had similar total live biomass, and root turnover rate was twofold at the grazed site.

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796. Benefits of protective fencing to plant and rodent communities of the Western Mojave Desert, California.

Brooks, Matthew L.

Environmental Management 19(1): 65-74. (1995)

NAL Call #: HC79.E5E5; ISSN: 0364-152X

Descriptors: alien grass/ annual plant biomass/ community diversity/ desert ecosystem/ desert tortoise research natural area/ forb biomass/ human disturbance/ Kern County/ livestock grazing/ Merriami's kangaroo rat/ method/ protective effect

Abstract: Human disturbance in the western Mojave Desert takes many forms. The most pervasive are livestock grazing and off-highway vehicle use. Over the past few decades several areas within this region have been fenced to preclude human disturbance. These areas provide opportunities to study the impact of human activities in a desert ecosystem. This paper documents the response of plant and small mammal populations to fencing constructed between 1978 and 1979 at the Desert Tortoise Research Natural Area, Kern County, California. Aboveground live annual plant biomass was generally greater inside than outside the fenced plots during April 1990, 1991, and 1992. The alien grass *Schismus barbatus* was a notable exception, producing more biomass in the unprotected area. Forb biomass was greater than that of alien annual grasses inside the fence during all three years of the study. Outside the fence, forb biomass was significantly higher than that of alien grasses only during spring 1992. Percent cover of perennial shrubs was higher inside the fence than outside, while no significant trend was detected in density. There was also more seed biomass inside the fence; this may have contributed to the greater diversity and density of Merriam's kangaroo rats (*Dipodomys merriami*), long-tailed pocket mice (*Chaetodipus formosus*), and southern grasshopper mice (*Onychomys torridus*) in the protected area. These results show that protection from human disturbance has many benefits, including greater overall community biomass and diversity. The significance and generality of these results can be further tested by studying other enclosures of varying age and configurations in different desert regions of the southwestern United States.

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797. Beyond the "climate versus grazing" impasse: Using remote sensing to investigate the effects of grazing system choice on vegetation cover in the eastern Karoo.

Archer, E. R. M.

Journal of Arid Environments 57(3): 381-408. (2004)

NAL Call #: QH541.5.D4J6; ISSN: 0140-1963

Descriptors: degradation/ grazing/ resilience/ climate/ ecosystem resilience/ grazing management/ land degradation/ NDVI/ remote sensing/ vegetation cover/ Africa/ Karoo Basin/ South Africa/ southern Africa/ sub-Saharan Africa

Abstract: Much research has been directed at determining the relative roles of climate and grazing in driving vegetation cover change in semi-arid ecosystems. Recent attempts seek to move beyond this debate as it has stagnated, or reached an "impasse". This study follows this pathway in investigating the effect of commercial stock grazing practices on vegetation cover in an eastern Karoo study site in South Africa. The study "corrects" a 14-year NDVI time-series for precipitation effects. Results suggest that some grazing strategies lead to consistently lower

vegetation cover measures than do others, once rainfall is accounted for. Such findings provide a basis for recommendations for more sustainable grazing practices under conditions of variable precipitation. © 2003 Elsevier Ltd. All rights reserved.
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798. Big game-livestock relationships study: Vegetal change in the absence of livestock grazing on deer winter range in Red Butte and Emigration canyons, Utah.

Austin, D. D. and Urness, P. J. Utah State Dept. Natural Resources, 1985. 18 p.
Descriptors: cover/ deer, mule/ grazing/ history/ interspecies relationships/ oak/ vegetation/ wildlife-habitat relationships/ wildlife-livestock relationships/ North America/ United States/ Utah/ Red Butte Canyon/ Emigration Canyon/ Wasatch Mountains
Abstract: Objective was to determine change, if any, in the vegetation of Emigration Canyon resulting from withdrawal of livestock grazing in contrast to Red Butte Canyon that has been ungrazed since 1905.
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799. Big sacaton riparian grassland management: Seasonal grazing effects on plant and animal production.

Cox, J. R.; Gillen, R. L.; and Ruyle, G. B.
Applied Agricultural Research 4(2): 127-134. (1989)
NAL Call #: S539.5.A77; *ISSN:* 0179-0374
Descriptors: Sporobolus/ forage/ steers/ Brahman/ range management/ grazing intensity/ natural regeneration/ weight gain/ climatic factors/ seasonal growth/ riparian buffers/ grazing
Abstract: F1 Brahman steers annually grazed the same big sacaton (*Sporobolus wrightii* Monro) pastures in either spring (May 1-June 12), summer (July 1-August 12), or fall (September 1-October 12) for three years. Green forage accumulated gradually in spring, accumulated rapidly in summer and declined gradually in fall, but mean daily steer gains averaged 1.5, 0.8, and 0.5 lb/animal on spring, summer, and fall grazed pastures, respectively. Spring gains were superior because green forage quality was greatest when plants initiated growth in spring. Summer gains were directly affected by green forage quantity, and green forage quantity was dependent on highly variable summer rainfall amounts. Fall gains were consistently low because forage quality declines rapidly in fall when green forage transfers to dead forage. In the three years, more than 80% of the green forage disappeared during spring grazing but pastures recovered in subsequent summer growing seasons. If the land manager wishes to maximize animal production without damaging the renewable natural resource (plant production), it is recommended to graze big sacaton grasslands in spring, avoid these riparian grasslands in dry summers, and discontinue fall grazing. This citation is from AGRICOLA.

800. Biological efficiency from rangelands through management strategies.

Cook, C. Wayne.
In: Proceedings of a conference on multispecies grazing. (Held 25 Jun 1985-28 Jun 1985 at Morrilton, Ark.) Baker, Frank H. and Jones, R. Katherine (eds.)
Morrilton, Ark.: Winrock International Institute for

Agricultural Development; pp. 54-64; 1985.
NAL Call #: SF85.3.P76
Descriptors: range management/ mixed grazing/ sustained yield management/ evaluation criteria/ common lands/ biological value
This citation is from AGRICOLA.

801. Biological implications of rotational grazing.

Gerrish, J. R.
Proceedings of the Forage and Grassland Conference: 6-9. (1991)
NAL Call #: SB193.F59; *ISSN:* 0886-6899
Descriptors: rotational grazing/ pasture plants/ range management/ grazing
This citation is from AGRICOLA.

802. Biotic soil crusts of Oregon's shrub steppe: Community composition in relation to soil chemistry, climate, and livestock activity.

Ponzetti, J. M. and McCune, B. P.
Bryologist 104(2): 212-225. (2001)
NAL Call #: 450 B84; *ISSN:* 0007-2745
Abstract: We examined biotic soil crust cover and composition at nine shrub-steppe sites in central and eastern Oregon, U.S.A. One pair of livestock-grazed and excluded transects was established at each site. Data were collected on the cover of biotic soil crust and vascular plant species, soil surface pH and electrical conductivity, and other environmental variables. Using gradient analysis, we found that differences in community composition among sites were most strongly related to soil pH, electrical conductivity (EC), and Calcareous Index Value (CIV; a scale representing the relative calcium carbonate content of soils). Other important variables included precipitation, elevation, aspect, and temperature. We found total crust cover to be highest at sites with lower pH, EC, and CIV. Dominant species differed markedly between the more calcareous sites with higher pH, and the less calcareous, lower pH sites. Livestock exclusion was not an important gradient in the ordination of these data, being overshadowed by the strong soil chemistry and climate gradients. However, overall community composition of soil crust species was different between grazed and long-ungrazed sites ($p = 0.02$, Blocked Multi-Response Permutation Procedure). Comparison of grazed and long-ungrazed sites revealed lower cover of biotic crusts, nitrogen-fixing lichens, crust-dominated soil surface roughness, and lower species richness in the grazed transects. There was more bare ground in the grazed transects, on average ($p > 0.02$ for all, two-tailed paired t-tests). Our results suggested that total bunchgrass cover was higher within exclosures, but conclusive evidence was lacking ($p = 0.1$, two-tailed paired t-test). Vascular plant composition, cover, richness, shrub cover, electrical conductivity, and pH were not different between the grazed and livestock-excluded transects. Thus, livestock-related reductions in cover and richness of biotic soil crusts were apparent while significant impacts to vascular plants were not obvious. We conclude that 1) biotic soil crusts are sensitive indicators of disturbance and 2) there are strong compositional differences in shrub steppe crust communities of Oregon, which are correlated with regional soil and climate gradients.
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803. Biotic stress and population distribution of primary producers in grassland ecosystem.

Bisht, N. S. and Gupta, S. K.

Indian Journal of Ecology 11(1): 50-56. (1984)

NAL Call #: QH540.156; ISSN: 0304-5250

Descriptors: deforestation/ ecosystems/ range management/ grasslands/ grazing/ population distribution/ India

This citation is from AGRICOLA.

804. Burning and grazing management in a California grassland: Effect on bunchgrass seed viability.

Dyer, Andrew R.

Restoration Ecology 10(1): 107-111. (2002)

NAL Call #: QH541.15.R45R515; ISSN: 1061-2971

Descriptors: grazing management: management method/ annual grassland/ critically endangered grassland habitats/ grazing/ maternal provisioning/ prescribed fire/ soil seed bank/ vegetation responses

Abstract: Prescribed fire is an important management tool for reducing the dominance of non-native species in annual grasslands; both annual and perennial native species show strong vegetative responses in the subsequent growing season. However, although the post-fire contribution of native species to the seed bank is assumed to be larger than in pretreatment years, the effects on seed quality, particularly viability and longevity, are not well understood. In this study, I germinated *Nassella pulchra* (purple needlegrass) seed that had been stored for 10 years after collection from target plants receiving treatment combinations of summer burning and grazing by sheep. Seeds from burned plants were larger and had higher germinability than seed from unburned plants. Seeds from plants that were both burned and grazed had the highest germination. The strong relationship between long-term viability and seed size suggests greater maternal provisioning and increased seed quality subsequent to burning and grazing. I conclude that managing for seed quality may be a useful approach for conservation of native species in California's critically endangered grassland habitats.

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805. Burning and grazing management in a California grassland: Growth, mortality, and recruitment of *Nassella pulchra*.

Dyer, Andrew R.

Restoration Ecology 11(3): 291-296. (2003)

NAL Call #: QH541.15.R45R515; ISSN: 1061-2971

Descriptors: burning management/ grassland/ grazing management/ growth/ life history/ mortality/ recruitment/ restoration ecology/ topography

Abstract: Annual grasslands in California are often managed with seasonal grazing and prescribed burning on the assumption that such practices have long-term benefits for native species. Mature native perennial bunchgrasses, particularly *Nassella pulchra* (purple needlegrass), are often the focal species, although very little is known about responses at different life history stages. Thus, important questions remain about long-term population dynamics of both mature plants and seedling recruitment. In plots receiving repeated grazing and burning events over 7 years, mortality of mature plants was threefold higher on mounds than on intermounds and likely reflected increased competition intensity associated with increased resource

availability in deeper soil. Burning and grazing treatments had strong positive effects on basal area of mature *N. pulchra*. However, plants in grazed plots that were not burned contained considerable standing dead biomass. Topographic location strongly influenced growth as intermound plants grew relatively more than mound plants, but the effects on growth of burning and grazing did not vary with topographic location. In mapped plots *N. pulchra* recruitment was very low, and overall density dropped an average of 31%. However, a significant time-by-burning effect indicated that survival was significantly higher in burned plots. After 7 years of repeated treatments, effects of burning and grazing management on mature *N. pulchra* were positive but not for all phenological stages. Understanding long-term influence of management on bunchgrass populations may not be easy to determine because short-term results may not reflect long-term responses and some life cycle dynamics may be observed only over very long periods.

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806. Can grazing response of herbaceous plants be predicted from simple vegetative traits?

Diaz, Sandra; Noy Meir, Imanuel; and Cabido, Marcelo

Journal of Applied Ecology 38(3): 497-508. (2001)

NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: functional vegetative traits/ grazing responses/ life history traits/ plant height/ range management/ specific leaf area [SLA]/ taxonomy/ temperate subhumid upland grasslands: habitat

Abstract: 1. Range management is based on the response of plant species and communities to grazing intensity. The identification of easily measured plant functional traits that consistently predict grazing response in a wide spectrum of rangelands would be a major advance. 2. Sets of species from temperate subhumid upland grasslands of Argentina and Israel, grazed by cattle, were analysed to find out whether: (i) plants with contrasting grazing responses differed in terms of easily measured vegetative and life-history traits; (ii) their grazing response could be predicted from those traits; (iii) these patterns differed between the two countries. Leaf mass, area, specific area (SLA) and toughness were measured on 83 Argentine and 19 Israeli species. Species were classified by grazing response (grazing-susceptible or grazing-resistant) and plant height (< or > 40 cm) as well as by life history (annual or perennial) and taxonomy (monocotyledon or dicotyledon). 3. Similar plant traits were associated with a specific response to grazing in both Argentina and Israel. Grazing-resistant species were shorter in height, and had smaller, more tender, leaves, with higher SLA than grazing-susceptible species. Grazing resistance was associated with both avoidance traits (small height and leaf size) and tolerance traits (high SLA). Leaf toughness did not contribute to grazing resistance and may be related to selection for canopy dominance. 4. Plant height was the best single predictor of grazing response, followed by leaf mass. The best prediction of species grazing response was achieved by combining plant height, life history and leaf mass. SLA was a comparatively poor predictor of grazing response. 5. The ranges of plant traits, and some correlation patterns between them, differed markedly between species sets from Argentina and Israel. However, the significant relationships between plant traits and grazing response were maintained. 6. The results of this

exploratory study suggest that prediction of grazing responses on the basis of easily measured plant traits is feasible and consistent between similar grazing systems in different regions. The results challenge the precept that intense cattle grazing necessarily favours species with tough, unpalatable, leaves.

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807. Canadian bluejoint response to heavy grazing.

Collins, W. B.; Becker, E. F.; and Collins, A. B.
Journal of Range Management 54(3): 279-283. (2001)
NAL Call #: 60.18 J82; ISSN: 0022-409X
http://jrm.library.arizona.edu/data/2001/543/279-283_collins.pdf

Descriptors: Calamagrostis canadensis/ grazing/ cattle/ horses/ plant competition/ wildlife/ woody plants/ phenology/ plant development/ Epilobium angustifolium/ rhizomes/ weight/ biomass/ digestibility/ carbohydrates/ shoots/ nitrogen content/ viability/ chemical constituents of plants/ seed productivity/ Alaska

Abstract: A disclimax stand of Canadian bluejoint (*Calamagrostis canadensis* (Michx.) Beauv.) was heavily grazed by cattle and horses for 4 years to weaken the grass's competition with hardwoods important as browse and cover to wildlife. Stocking at 0.084 ha AUM(-1) resulted in uniform utilization of bluejoint and maintenance of early phenology through the growing season. Etiolated bluejoint declined about 90%, but grass production increased 10 to 15%, as fireweed (*Epilobium angustifolium* L.), a principal herbaceous component of the stand, decreased in response to trampling. Rhizomes of heavily grazed bluejoint had lower total nonstructural carbohydrates (TNC) ($p = 0.0127$), lower weight (g cm(-1) length) ($p = 0.05$), and reduced biomass (g cm(-3) of soil) ($p = 0.05$). Shoots of grazed bluejoint maintained higher nitrogen ($p = 0.0001$) and higher digestibility (IVDMD) ($p = 0.0017$) than bluejoint that was never grazed. This enabled heavily grazed bluejoint to retain good forage quality through the entire growing season, as opposed to ungrazed bluejoint, which became poor forage at the time of flowering during early July. Following one season of rest, rhizome TNC, shoot nitrogen, and IVDMD returned to levels of never grazed bluejoint. Seedhead production, seed production, seed weights, and seed viability of rested bluejoint were about the same as in ungrazed stands. On wet sites, heavy grazing does not adequately reduce the vigor of this grass. This citation is from AGRICOLA.

808. Carbon exchange and species composition of grazed pastures and exclosures in the shortgrass steppe of Colorado.

LeCain, D. R.; Morgan, J. A.; Schuman, G. E.; Reeder, J. D.; and Hart, R. H.
Agriculture, Ecosystems & Environment 93(1/3): 421-435. (2002)

NAL Call #: S601 .A34; ISSN: 0167-8809

Descriptors: pastures/ steppes/ botanical composition/ carbon/ carbon dioxide/ gas exchange/ biogeochemical cycles/ grazing/ range management/ leaf area index/ seasonal variation/ photosynthesis/ Colorado

Abstract: Grasslands comprise approximately 40% of the world's terrestrial surface. Consequently, grassland ecosystems are a significant component of the global carbon cycle. In order to better understand how grazing affects the carbon cycle of grasslands, this study measured

CO₂ exchange rate (CER) and soil respiration rate (SRR) on 130 ha pastures with a 56-year history of heavy (60% removal) and light (20% removal) grazing, and their accompanying 0.8 ha exclosures, on the shortgrass steppe of northeastern Colorado, USA. A CER chamber that covered 1 m² of native grassland was used on five plots in each of the four areas. Mid-day CER and SRR were measured during the growing seasons of 1995-1997, along with green vegetation index (GVI, similar to leaf area index) and plant species composition. When averaged over each growing season, there was no significant difference in CER of grazed pastures versus exclosures. However, there were seasonal differences in CER, which varied over the 3 years. Differences in CER between grazed pastures and exclosures were not related to GVI, which rarely differed between treatments. Grazing treatment differences in CER were driven by climate variability and species composition differences resulting from long-term grazing and exclusion from grazing. Exclosures had more cool-season (C3) grasses and forbs than grazed plots, which contained more warm-season (C4) grasses (primarily *Bouteloua gracilis* (H.B.K.) Lag. Ex Steud.). The somewhat unique, cool spring of 1995 was favorable to cool-season plant metabolism and resulted in higher CER in exclosures compared with grazed pastures. Warm, dry conditions in spring of 1996 favored warm-season species, resulting in higher CER in the heavily-grazed pasture. In 1997, there was little difference in CER between grazed pastures and exclosures. There were very few sampling dates when SRR was different in grazed pastures and exclosures. This study suggests that these intensities of cattle grazing do not alter the photosynthetic and soil respiration components of the carbon cycle of the US shortgrass prairie. It appears that cattle grazing can be a sustainable component of managing this ecosystem for maximum global carbon sequestration. This citation is from AGRICOLA.

809. Catastrophic vegetation shifts and soil degradation in terrestrial grazing systems.

Koppel, J.; Rietkerk, M.; and Weissing, F. J.
Trends in Ecology and Evolution 12(9): 352-356. (1997)
NAL Call #: QH540.T742; ISSN: 0169-5347

Descriptors: soil degradation/ grazing systems/ vegetation/ overgrazing/ reviews/ natural grasslands/ grasslands/ semiarid grasslands/ salt marshes/ environmental degradation

Abstract: The presence of alternative vegetation states in terrestrial grazing systems is discussed. Early theoretical studies emphasized saturation of herbivore feeding to explain multiple stable states and catastrophic behaviour, but recent studies on semiarid grasslands and arctic salt marshes have related catastrophic events in these systems to plant-soil interactions. A herbivore-induced decrease in vegetation has led to soil degradation and reduced plant growth, and positive feedback between reduced plant standing crop and deteriorated soil conditions has thereby contributed to irreversible vegetation destruction.

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810. Cattle grazing and oak trees as factors affecting soil emissions of nitric oxide from an annual grassland.

Davidson, Eric A.; Herman, Donald J.; and Firestone, Ayelet Schuster.

In: Agricultural ecosystem effects on trace gases and global climate change. (Held 28 Oct 1991 at Denver, Colorado, USA.) Rolston, Dennis Eugene (eds.)

Madison, Wisconsin: Soil Science Society of America; pp. 109-119; 1993.

Notes: ISSN 0066-0566; ISBN 089118113X

NAL Call #: 64.9 Am3 no.55

Descriptors: diurnal variation/ mineralization/ nitrification/ range management/ seasonality/ soil temperature

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811. Cattle grazing impacts on annual forbs and vegetation composition of mesic grasslands in California.

Hayes, Grey F. and Holl, Karen D.

Conservation Biology 17(6): 1694-1702. (2003)

NAL Call #: QH75.A1C5; ISSN: 0888-8892

Descriptors: grazing management: applied and field techniques/ coastal prairie community/ disturbance regime/ grazing impacts/ life history guild/ litter depth/ mesic grasslands/ soil chemistry/ species richness/ vegetation composition/ vegetation cover/ vegetation height/ vegetation structure

Abstract: Livestock grazing represents a major human alteration of natural disturbance regimes in grasslands throughout the world, and its impacts on plant communities have been highly debated. We investigated the impact of cattle grazing on the California coastal prairie plant community with a focus on native annual forbs, a number of which are of conservation concern. In spring 2000 and 2001, we surveyed the vegetation community composition, vegetation structure, and soil chemical parameters at 25 paired grazed and ungrazed sites over a 670-km range of the ecosystem. Native annual forb species richness and cover were higher in grazed sites, and this effect was concomitant with decreased vegetation height and litter depth. Soil properties explained less of the variation. Exotic annual grass and forb cover were higher in grazed sites. Native grass cover and species richness did not differ in grazed and ungrazed sites, but cover and species richness of native perennial forbs were higher in ungrazed sites. Our results suggest that cattle grazing may be a valuable management tool with which to conserve native annual forbs in the ecosystem we studied but that grazing differentially affects the various life-history guilds.

Therefore, land managers must focus on creating a matrix of disturbance regimes to maintain the suite of species native to these mesic grasslands. The results of this and other studies highlight the importance of considering the adaptation of vegetation communities to disturbance in making recommendations for grazing management.

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812. Cattle grazing in a hummock grassland regenerating after fire: The short-term effects of cattle exclusion on vegetation in south-western Queensland.

Letnic, M.

Rangeland Journal 26(1): 34-48. (2004)

NAL Call #: SF85.4.A8A97; ISSN: 1036-9872

Descriptors: prescribed burning/ animal preferences/ grazing intensity/ grazing management/ Eragrostis/ vegetation cover

This citation is from AGRICOLA.

813. Cattle grazing in wetlands on Alamosa/Monte Vista NWR.

Dieboll, R. A. Univ. of Missouri-Columbia, 1999.

Descriptors: birds/ cattle/ cover/ grazing/ history/ mapping/ population density/ refuges, wildlife/ sampling/ size/ soils/ vegetation/ water level/ wetlands/ Aves/ North America/ United States/ Colorado/ San Luis Valley

Abstract: Objectives were to evaluate in classified wetland (drier and wetter) and treatment (grazed and ungrazed) types: (1) successive changes in vegetation structure (vertical density or height at 100 percent coverage) of existing short emergent vegetation; (2) successive changes in tall whitetop (number of rosettes, stems, and seed heads and average height of rosettes and stems); and (3) successive changes in the percent of residual and new baltic rush and new tall whitetop.

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814. Cattle grazing mediates climate change impacts on ephemeral wetlands.

Pyke, Christopher R. and Marty, Jaymee

Conservation Biology 19(5): 1619-1625. (2005)

NAL Call #: QH75.A1C5; ISSN: 0888-8892

Descriptors: climatic changes/ grazing/ feeding behaviour/ amphibiotic species/ environmental impact/ wetlands/ resource management/ vulnerability/ rare species/ hydrology/ environmental effects/ precipitation/ reproduction/ conservation/ temperature effects/ *Ambystoma californiense*/ Caudata/ USA, California/ California tiger salamander/ salamanders

Abstract: Climate change impacts depend in large part on land-management decisions; interactions between global changes and local resource management, however, rarely have been quantified. We used a combination of experimental manipulations and simulation modeling to investigate the effects of interactions between cattle grazing and regional climate change on vernal pool communities. Data from a grazing exclosure study indicated that 3 years after the removal of grazing, ungrazed vernal pools dried an average of 50 days per year earlier than grazed control pools. Modeling showed that regional climate change could also alter vernal pool hydrology. Increased temperatures and winter precipitation were predicted to increase periods of inundation. We evaluated the ecological implications of interactions between grazing and climate change for branchiopods and the California tiger salamander (*Ambystoma californiense*) at four sites spanning a latitudinal climate gradient. Grazing played an important role in maintaining the suitability of vernal pool hydrological conditions for fairy shrimp and salamander reproduction. The ecological importance of the interaction varied nonlinearly across the region. Our results show that grazing can confound hydrologic changes driven by climate change and play a critical role in maintaining the hydrologic suitability of vernal pools for endangered aquatic invertebrates and amphibians. These observations suggest an important limitation of impact assessments of climate change based on experiments in unmanaged ecosystems.

The biophysical impacts of land management may be critical for understanding the vulnerability of ecological systems to climate change.

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815. Cattle trampling of crested wheatgrass *Agropyron-cristatum* under short-duration grazing.

Ralph, D. F. and Malecheck, J. C.

Journal of Range Management 38(3): 226-227. (1985)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1985/383/7balp.pdf>

Descriptors: hoof action/ hoof print/ frequency

Abstract: This paper tests 3 predictions that stem from the hypothesis that Angus heifers avoid stepping on crested wheatgrass (*Agropyron cristatum*) tussocks because the tussocks present an uneven surface upon which to walk: (1) hoofprints are located disproportionately more often in the open spaces between tussocks than on tussocks; (2) the disproportionality persists despite the frequency of hoof prints per unit area; and (3) the more tussocks are elevated above the surrounding substrate, the less they are trampled. The methods relate the observed and expected frequency of hoofprints on tussocks along 2 transects in a crested wheatgrass paddock. The results significantly support all 3 predictions. We conclude that under the conditions that existed, the hoof action hypothesized by some to be of benefit to short-duration grazing pastures was minimal, and so was the hoped-for destruction of standing dead vegetation that deters grazing.

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816. Cattle use affects forage quality in a montane riparian ecosystem.

Phillips, R. L.; Trlica, M. J.; Leininger, W. C.; and Clary, W. P.

Journal of Range Management 52(3): 283-289. (1999)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/1999/523/283-289_phillips.pdf

Descriptors: cattle/ *Carex aquatilis*/ *Salix*/ in vitro digestibility/ nitrogen content/ phosphorus/ grazing intensity/ seasonal variation/ riparian buffers

Abstract: Forage nitrogen (N) and phosphorous (P) concentrations and in-vitro dry-matter digestibility (IVDMD) were measured in 2 important riparian species the year following short-term, high-intensity cattle grazing treatments in a montane riparian ecosystem in northcentral Colorado. Current year's growth of water sedge (*Carex aquatilis* Wahlenb.) and planeleaf willow (*Salix planifolia* Pursh.) was collected monthly from May to September 1996. The effects of grazing and season of grazing in 1995 on forage quality the following growing season was determined. Season of grazing (i.e., late-spring, early-summer, late-summer, and fall) the previous year did not differentially affect forage quality in either species. However, grazing by cattle the previous year did increase forage quality of water sedge as compared with plants that were not previously grazed. Grazed water sedge plants had higher concentrations of N and P and greater IVDMD than ungrazed controls. Nitrogen and P concentrations of browsed planeleaf willow were not different from controls, but current year's growth collected in the fall from previously browsed plants was 11% more digestible than current year's growth from non-browsed willow. The 2 species responded uniquely to cattle use, which suggested that these 2 life forms differ in response to

herbivory. This study supported the hypothesis that grazing by cattle would improve forage quality in a riparian ecosystem, although results varied with life form.

This citation is from AGRICOLA.

817. Change in plant spatial patterns and diversity along the successional gradient of Mediterranean grazing ecosystems.

Alados, C. L.; El Aich, A.; Papanastasis, V. P.; Ozbek, H.; Navarro, T.; Freitas, H.; Vrahnakis, M.; Larrosi, D.; and Cabezudo, B.

Ecological Modelling 180(4): 523-535. (2004)

NAL Call #: QH541.15.M3E25; ISSN: 0304-3800

Descriptors: defoliation/ deposition/ diversity/ faeces/ frequency/ grazing/ matorral/ mineralization/ soil compaction/ spatial distribution/ trampling/ urine/ woodlands

Abstract: In this study, we analyze the complexity of plant spatial patterns and diversity along a successional gradient resulting from grazing disturbance in four characteristic ecosystems of the Mediterranean region. Grazing disturbance include not only defoliation by animals, but also associated disturbances as animal trampling, soil compaction, and mineralization by deposition of urine and faeces. The results show that woodland and dense matorral are more resistant to species loss than middle dense and scattered matorral, or grassland. Information fractal dimension declined as we moved from a dense to a discontinuous matorral, increasing as we moved to a more scattered matorral and a grassland. In all studied cases, the characteristic species of the natural vegetation declined in frequency and organization with grazing disturbance.

Heliophyllous species and others with prostrate or rosette twigs increased with grazing pressure, particularly in dense matorral. In the more degraded ecosystem, only species with well-adapted traits, e.g., buried buds or unpalatable qualities showed a clear increase with grazing. Indeed, the homogeneity of species distribution within the plant community declined monotonically with grazing impact. Conversely, the spatial organization of the characteristic plants of each community increased in the better-preserved areas, being also related to the sensitivity of the species to grazing impact. The degree of autocorrelation of plant spatial distribution at the species level and the information fractal dimension at the community level allow us to quantify the degree of degradation of natural communities and to determine the sensitivity of key species to disturbance.

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818. Changes in plant functional groups, litter quality, and soil carbon and nitrogen mineralization with sheep grazing in an Inner Mongolian grassland.

Barger, N. N.; Ojima, D. S.; Belnap, J.; Wang, S.; Wang, Y.; and Chen, Z.

Journal of Range Management 57(6): 613-619. (Nov. 2004)

NAL Call #: 60.18 J82; ISSN: 0022-409X

Descriptors: botanical composition/ steppes/ plant litter/ vegetation cover/ overgrazing/ indicator species/ soil nutrient dynamics/ China

Abstract: This study reports on changes in plant functional group composition, litter quality, and soil C and N mineralization dynamics from a 9-year sheep grazing study in Inner Mongolia. Addressed are these questions: 1) How does increasing grazing intensity affect plant community composition? 2) How does increasing grazing intensity alter

soil C and N mineralization dynamics? 3) Do changes in soil C and N mineralization dynamics relate to changes in plant community composition via inputs of the quality or quantity of litter? Grazing plots were set up near the Inner Mongolia Grassland Ecosystem Research Station (IMGERS) with 5 grazing intensities: 1.3, 2.7, 4.0, 5.3, and 6.7 sheep ha(-1).yr(-1). Plant cover was lower with increasing grazing intensity, which was primarily due to a dramatic decline in grasses, *Carex duriuscula*, and *Artemisia frigida*. Changes in litter mass and percentage organic C resulted in lower total C in the litter layer at 4.0 and 5.3 sheep ha(-1).yr(-1) compared with 2.7 sheep ha(-1).yr(-1). Total litter N was lower at 5.3 sheep ha(-1).yr(-1) compared with 2.7 sheep ha(-1).yr(-1). Litter C:N ratios, an index of litter quality, were significantly lower at 4.0 sheep ha(-1).yr(-1) relative to 1.3 and 5.3 sheep ha(-1).yr(-1). Cumulative C mineralized after 16 days decreased with increasing grazing intensity. In contrast, net N mineralization (NH₄(+) + NO₃(-)) after a 12-day incubation increased with increasing grazing intensity. Changes in C and N mineralization resulted in a narrowing of CO₂-C:net N(min) ratios with increasing grazing intensity. Grazing explained 31% of the variability in the ratio of CO₂-C:net N(min). The ratio of CO₂-C:net N(min) was positively correlated with litter mass. Furthermore, there was a positive correlation between litter mass and *A. frigida* cover. Results suggest that as grazing intensity increases, microbes become more C limited resulting in decreased microbial growth and demand for N. This citation is from AGRICOLA.

819. Changes in plant functional types in response to goat and sheep grazing in two semi-arid shrublands of SE Spain.

Navarro, T.; Alados, C. L.; and Cabezudo, B. *Journal of Arid Environments* 64(2): 298-322. (2006) NAL Call #: QH541.5.D4J6; ISSN: 0140-1963
Descriptors: land management/ applied and field techniques/ drought/ grazing/ regeneration/ clonality/ drought resistance/ ecosystem stability/ canopy structure/ semi arid shrubland/ sclerophilly/ leaf presence/ plant coverage/ phenological deciduousness/ plant functional type
Abstract: In Mediterranean plant communities, grazing induces severe floristic changes affecting the life histories of grazed and non-grazed species. Alteration of the grazing regimen causes important changes in the structure and dynamics of the plant community and ecosystem stability. To determine the susceptibility of different plant functional types to landscape management, we measured changes in Plant Functional Types (PFTs) in response to grazing by goat and sheep in an inland dwarf-palm matorral and a marine-exposed thorny-shrub matorral in Cabo de Gata Natural Park (SE Spain). We classified the major life forms into PFTs, and identified six PFT shrubs (dwarf-palms, sclerophyllous small trees, xeric thorny-shrubs, spiny legumes, glaucous dwarf-shrubs, and xeric half-shrubs), four PFT forbs (leafy stem herbs, xeric prostrate herbs, rosette herbs, and clonal spiny herbs), and two PFT grasses (steppe and short grasses). Morphological traits measured include sclerophilly, leaf presence, leaf size, shape of leaf margins, hairiness, position of dormant buds (growth form), clonality, plant coverage, canopy structure, phenological deciduousness (drought resistance), and regeneration (reproduction type, pollination type,

inflorescence position, and seed size). There was a higher correlation within and between morphological growth forms, leaf and phenological traits, than within regenerative traits (only seed size was correlated with main dispersal type). We analysed the importance of these PFTs at several sites of the two communities, which were subjected to different livestock rates. In inland and marine-exposed communities, the same PFTs decreased in response to medium-high grazing: sclerophyllous small trees (*Quercus coccifera*, *Olea europaea* var. *sylvestris*), glaucous dwarf-shrubs (*Phlomis* and *Cistus* spp.) and short grasses (*Brachypodium*, *retussum*). In both communities, the decrease of these grazing-susceptible PFTs was widely associated with an increase in steppe grasses (*Stipa tenacissima*, "alfa-grass") and xeric prostrate herbs (*Fagonia cretica*, *Paronichia sufruticosa*), the latter of which is a reliable indicator of degradation in semi-arid systems. Instead, different PFTs behave as either grazing-averse and/or grazing-tolerant in each community: Dwarf-palms (*Chamaerops humilis*) and xeric thorny shrubs (*Periploca laevigata*) in the marine-exposed community, and xeric half-shrubs (*Thymus hiemalys*, *Sideritis osteoxylla*, *Teucrium* spp., *Artemisia herba-alba*) in the inland community. The latter functional group resists disturbances, such as medium-moderate grazing and drought, in semi-arid zones and is an indicator of long-term degradation. (c) 2005 Elsevier Ltd. All rights reserved. © The Thomson Corporation

820. Changes in population biology of two succulent shrubs along a grazing gradient.

Riginos, Corinna and Hoffman, M. Timm *Journal of Applied Ecology* 40(4): 615-625. (2003) NAL Call #: 410 J828; ISSN: 0021-8901
Descriptors: succulent karoo: biome/ fruit production/ grazing gradients/ management implications/ microsite availability/ mortality/ population biology/ recruitment/ reproductive output/ seed production/ seed set/ seedling establishment/ stockposts/ survival/ vegetation composition
Abstract: 1. Heavy livestock grazing in Namaqualand, South Africa, is threatening the region's unique diversity of succulent shrubs. This is especially true in the communally managed lands, where grazing is centred around fixed enclosures (stockposts) in which animals stay overnight. In this study we set out to determine the effects of a semi-permanent stockpost on the composition of the surrounding vegetation and the mechanisms by which grazing limits the persistence of leaf-succulent shrub populations. 2. We used the grazing gradient created by a stockpost to examine the impacts of grazing on vegetation composition and changes in mortality, reproductive output and seedling establishment for the leaf-succulent species *Ruschia robusta* and *Cheiridopsis denticulata*. 3. Vegetation composition was found to change from a community dominated by the unpalatable shrub *Galenia africana* at high grazing intensities to a community dominated by the palatable leaf-succulent shrub *R. robusta* at lower grazing intensities. 4. Mortality of the leaf-succulents *R. robusta* and *C. denticulata* was high at the sites closest to the stockpost, while fruit production and seedling germination were substantially reduced over distances of 800 m and 2 km for the two species, respectively. Seedling establishment was not limited by either grazing or microsite availability. Thus reduction in reproductive output is the greatest impact of heavy grazing on these two species. 5. Synthesis and

applications. This study demonstrates that marked zonation in vegetation composition and population biology can develop around a fixed stockpost and that the greatest impact of grazing on the two leaf-succulent species studied is the suppression of flower and fruit production. Consistent suppression of reproductive output could have long-term consequences for the persistence of succulent shrub populations in the heavily grazed communal lands of Namaqualand. We recommend that (i) herders should be encouraged to relocate their stockposts regularly to prevent the development of centres of degradation, and (ii) areas should be relieved periodically of all grazing pressure to allow for successful seed set of native shrubs.

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821. Changes in the composition of *Carex bigelowii*-*Racomitrium lanuginosum* moss heath on Glas Maol, Scotland, in response to sheep grazing and snow fencing.

Welch, David; Scott, David; and Thompson, Des B. A. *Biological Conservation* 122(4): 621-631. (2005)
 NAL Call #: S900.B5; ISSN: 0006-3207

Descriptors: botanical composition/ grazing intensity/ moss heath/ nitrogen deposition/ sheep grazing/ snow fencing
Abstract: *Carex bigelowii*-*Racomitrium lanuginosum* moss heath has high conservation value in Britain, being one of the most extensive near-natural habitats and also the preferred habitat of dotterel (*Eudromias morinellus*). This rare and attractive bird has declined in Britain in the past century, and loss of *Racomitrium* heath due to heavy sheep grazing and/or nitrogen deposition is probably responsible. Erection of snow fencing for a ski corridor across *Carex-Racomitrium* heath on Glas Maol, a mountain rising to 1068 m in the eastern Highlands, affected sheep (*Ovis aries*) usage, and so gave an opportunity to compare trends in botanical composition under different grazing intensities. We began monitoring in 1990, four years after the fence's erection, and report trends up to 2002/03. Adjacent to the fencing (0-10 m away) sheep usage was much increased due to improved shelter, and *C. bigelowii* and *R. lanuginosum* declined, the latter sharply. *Racomitrium* cover was already reduced by a third in 1990, and fell by a further third over the next 12 years. Grass cover increased to nearly equal *Carex* cover 16 years after the fence erection. *Dicranum Juscenscens* also spread but lichens declined. There was longer snow-lie near the fence, this being correlated with sheep usage despite somewhat different incidence, and logistic regression showed that for the 1990-1996/97 period *Racomitrium* loss was rather more closely related to snow-lie than to sheep pellet-group density, whereas *Agrostis* increase was highly significantly related to pellet-group density. Distant to the fence the composition of the *Carex-Racomitrium* heath changed little over 12 years of monitoring. *Agrostis* increased and *C. bigelowii* declined, both changes being significant but much smaller than adjacent to the fence. Also *Polytrichum alpinum* increased significantly and some lichens declined. For *Racomitrium* there was a fall of only 2.5% from its initial cover of 40% in 1990. Since the dung counts showed only a negligible reduction in sheep usage between plots at 13-15 and 43-45 m from the fence, the trends in composition recorded at positions 19-20 and 39-40 m from the fence apply to the extensive moss heath used by the dotterel on Glas Maol. These birds still nest in the distant zone, and we judge that the condition of the *Carex-Racomitrium* heath will

remain satisfactory for them unless sheep usage increases by 25% or more. However, the ongoing loss of lichens and the sparsity of *Vaccinium myrtillus* imply that the current level of sheep grazing has appreciably modified this community from its former pristine condition. Copyright 2004 Elsevier Ltd. All rights reserved.

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822. Changes in vegetation structure after long-term grazing in pinyon-juniper ecosystems: Integrating imaging spectroscopy and field studies.

Harris, A. Thomas; Asner, Gregory P.; and Miller, Mark E. *Ecosystems* 6(4): 368-383. (2003)
 NAL Call #: QH540 .E3645; ISSN: 1432-9840

Descriptors: airborne hyperspectral remote sensing: applied and field techniques/ geostatistical analysis: mathematical and computer techniques/ imaging spectroscopy: laboratory techniques, spectrum analysis techniques/ spectral mixture analysis: laboratory techniques, spectrum analysis techniques/ biogeophysical properties/ community composition/ ecosystem changes/ field studies/ land use/ landscape management/ long term grazing [overgrazing]/ mesa rangelands/ pinyon juniper rangelands/ relict areas/ spatial autocorrelation/ vegetation cover/ vegetation structure/ woody encroachment
Abstract: We used field studies and imaging spectroscopy to investigate the effect of grazing on vegetation cover in historically grazed and ungrazed high-mesa rangelands of the Grand Staircase-Escalante National Monument, Utah, USA. Airborne hyperspectral remote sensing data coupled with spectral mixture analysis uncovered subtle variations in the key biogeophysical properties of these rangelands: the fractional surface cover of photosynthetic vegetation (PV), nonphotosynthetic vegetation (NPV), and bare soil. The results show that a high-mesa area with long-term grazing management had significantly higher PV (26.3%), lower NPV (54.5%), and lower bare soil (17.2%) cover fractions in comparison to historically ungrazed high-mesa pinyon-juniper rangelands. Geostatistical analyses of remotely sensed PV, NPV, and bare soil were used to analyze differences in ecosystem structure between grazed and ungrazed regions. They showed that PV was spatially autocorrelated over longer distances on grazed areas, whereas NPV and bare soil were spatially autocorrelated over longer distances on ungrazed areas. Field data on the fractional cover of PV, NPV, and bare soil confirmed these remote sensing results locally. Field studies also showed a significantly higher percentage composition of shrubs (27.3%) and forbs (30.2%) and a significantly lower composition of grasses (34.4%) and cacti (1.1%) in grazed areas. No significant difference between grazed and ungrazed mesas was found in percentage composition of trees or in the number of canopies per hectare. Our combined remote sensing and field-based results suggest that grazing has contributed to woody thickening in these pinyon-juniper ecosystems through an increase in shrubs in the understory and intercanopy spaces. These results improve our understanding of broad-scale changes in pinyon-juniper ecosystem structural composition and variability due to long-term grazing.

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823. Comparative effects of stock and wild vertebrate herbivore grazing on treeless subalpine vegetation, Eastern Central Plateau, Tasmania.

Bridle, K. L. and Kirkpatrick, J. B.

Australian Journal of Botany 47(6): 817-834. (1999)

NAL Call #: 450 Au72; ISSN: 0067-1924

Abstract: The existence of two 25-year-old grazing exclosures on Liawenee Moor, Eastern Central Plateau, Tasmania, created an opportunity to investigate the impacts of vertebrate herbivores on treeless subalpine vegetation. There were three treatments: sheep-, native herbivore- and rabbit-grazed; native herbivore and rabbit-grazed; no grazing. The amount of bare ground was highest in the sheep-grazed plots, while vegetation cover was greatest in the ungrazed exclosure. The cover of all lifeform groups, except small herbs, was greater in the exclosures than in the sheep-grazed plots. The percentage frequency of tall herbs was significantly less in the sheep-grazed plots than either of the grazing exclosures. Tall herbs were more likely to be found under the canopy of other vegetation in the sheep-grazed plots while the same species were found to be growing in locations with no other vegetation cover in the ungrazed exclosure. Revegetation of bare ground averaged 1% per year over a 20-year period in the ungrazed exclosure. While percentage bare ground has also decreased in the native- and rabbit-grazed exclosure, it has increased in the sheep-grazed plots. Domestic stock grazing appears to have a much greater impact on vegetation cover, species composition and community structure than grazing by native herbivores and rabbits. No grazing allows for the fastest rehabilitation of the area. Our results are consistent with those from alpine and treeless subalpine areas of the Australian mainland.

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824. A comparison of sheep grazing with herbicides for weed control in seedling alfalfa in the irrigated Sonoran Desert.

Bell, Carl E.; Guerrero, Juan N.; and Granados, Elda Y.

Journal of Production Agriculture 9(1): 123-129. (1996)

NAL Call #: S539.5.J68; ISSN: 0890-8524

Descriptors: crop industry/ agriculture/ agronomy/ biobusiness/ herbicide/ Imperial Valley/ pest assessment control and management/ seedling/ selective grazing/ sethoxydim/ Sonoran Desert/ 2,4 db amine

Abstract: A three year study was conducted in the irrigated Sonoran Desert to compare the effect of different weed management methods in seedling alfalfa (*Medicago sativa* L.) on crop stand and yield. Treatments included; grazing with sheep (*Ovis aries* L.) when the crop was ready for the first harvest, a combination of preemergence and postemergence herbicides, postemergence herbicides only, and an untreated control where weeds were harvested with the hay. Weed management practice did not affect alfalfa yield in the first season, although the herbicide treatments reduced total forage (alfalfa plus weeds) yield compared with the grazed treatments and the untreated control. Crop density was not different between treatments. Herbicide treatments lowered forage yields at the first harvest by eliminating of weeds and because of crop injury in 2 of the 3 yr. At the third and subsequent harvests, there were no differences in forage yield for treatments. Plots were weed free after the second harvest. Lamb grazing selectivity in weedy seedling alfalfa was also quantified by analyzing esophageal extrusa. The lambs were selecting the weeds

over the alfalfa as grazing progressed. This preference was consistent between lambs and plots, although there were year differences. Forage quality of the winter annual broadleaf weeds present in this study was comparable with the alfalfa. We concluded that grazing lambs are a good weed control method in seedling alfalfa during the winter grazing season in the irrigated Sonoran Desert.

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825. Comparison of species composition between different grassland management treatments after 25 years.

Moog, D.; Poschlod, P.; Kahmen, S.; and Schreiber, K. F.

Applied Vegetation Science 5(1): 99-106. (2002)

NAL Call #: QK900 .A66; ISSN: 1402-2001

Descriptors: botanical composition/ controlled burning/ grassland management/ grasslands/ grazing/ mowing/ mulching/ nature conservation/ plant succession

Abstract: To identify management treatments suitable for the conservation of extensively managed grasslands, the 'Fallow experiments in Baden-Wurttemberg' were set up in 1975. In this investigation, species composition of the grazing, mowing, mulching, controlled burning and unmanaged (succession) treatments were analysed after 25 yr of continuous management in *Arrhenatherum elatius* and *Bromus erectus* grasslands. Through ordination analyses it was found that species composition is strongly dependent on the management treatment. The first axis, identified by ordination analysis, essentially corresponded to a gradient of decreasing disturbance frequency. Controlled burning resulted in a unique species composition. Grazing, mowing and mulching twice a year were found to be most suitable for the conservation of unimproved, species-rich grasslands.

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826. A comparison of the effects of different rangeland management systems on plant species composition, diversity and vegetation structure in a semi-arid savanna.

Smet, M. and Ward, D.

African Journal of Range and Forage Science 22(1): 59-71. (2005)

NAL Call #: SB197.J68; ISSN: 1022-0119

Descriptors: commercial livestock ranching: applied and field techniques/ communal livestock ranching: applied and field techniques/ game ranching: applied and field techniques/ grazing intensity/ plant species diversity/ vegetation structure/ plant species composition/ semi arid savanna/ bare soil frequency

Abstract: Most of South Africa's land surface is and or semi-arid rangeland. Three management systems exploit these areas: commercial livestock ranching, communal livestock ranching and game ranching. The ways in which these management systems affect rangeland ecology is contentious due to inherent differences in management characteristics and the controversy surrounding driving forces in rangeland vegetation dynamics. We used 500m-long grazing gradients around water-points in order to evaluate the effects of grazing intensity on plant species composition and diversity, and to compare levels of degradation among management systems. We compared species composition, bare soil frequency, shrub and tree density among management systems. We conclude that

grazing has significant negative effects in these rangelands, although differences in degree of degradation could have been confounded by factors other than grazing.

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827. Compatibility of livestock grazing strategies with riparian-stream systems.

Platts, W. S.

In: Range watersheds, riparian zones and economics: Interrelationships in management and use: Proceedings, 1984 Pacific Northwest Range Management Short Course, Corvallis, Or.: Oregon State University, 1984; pp. 67-74
NAL Call #: QH541.5.R3P3 1984

Descriptors: livestock/ range management/ grazing/ riparian buffers/ rangelands/ streams

This citation is from AGRICOLA.

828. Complementary grazing of reclaimed mined land and native rangeland pastures in Montana.

DePuit, E. J. and Coenenberg, J. G.

In: Proceedings of the conference: Reclamation, A Global Perspective. (Held 27 Aug 1989-31 Aug 1989 at Calgary, Alberta, Canada.); pp. 185-195; 1989.

Descriptors: liveweight gain/ grazing/ mined land
Abstract: A 3-year grazing study was conducted on Montana coal-mined lands revegetated with introduced cool-season grasses and legumes. Objectives were to determine the responses of mined land vegetation and soils to cattle grazing, and to evaluate the capability of mined land-vegetation to support livestock under 2 rotational grazing systems: exclusive grazing of mined land pastures season-long, and complementary mined land/native rangeland grazing. Spring and late summer grazing improved productivity of mined land vegetation, induced certain changes in plant species composition and diversity, and positively influenced certain soil attributes. Forage quality and animal liveweight gain data demonstrated highest utility of the introduced plant species for spring grazing, and lower value during the summer when animal performance on native range pastures was superior to that on mined land pastures. Total spring/summer cattle gains were higher with the complementary mined land-native rangeland grazing system than with the exclusive mined land system, although exclusive grazing of mined land vegetation produced acceptable season-long cattle gains.

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829. Complex effects of grazing treatment on an annual in a species-poor grassland community.

Silvertown, J.; Watt, T. A.; Smith, B.; and Treweek, J. R.

Journal of Vegetation Science 3(1): 35-40. (1992)

NAL Call #: QK900.J67; ISSN: 1100-9233

Descriptors: Geranium/ range management/ community ecology/ mortality/ reproduction/ seeds/ sowing/ sheep/ grazing/ England

This citation is from AGRICOLA.

830. Composition and production of California oak savanna seasonally grazed by sheep.

Bartolome, J. W. and McClaran, M. P.

Journal of Range Management 45(1): 103-107. (1992)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1992/451/21bart.pdf>

Descriptors: sheep/ *Quercus douglasii*/ annual grasslands/

savannas/ botanical composition/ seasonal variation/ grazing/ California

Abstract: Seasonal grazing trials, conducted over 3 years at the Hopland Field Station in Mendocino County, Calif., tested the effects of 2 seasonal grazing strategies on within- and between-year production and composition in blue oak (*Quercus douglasii* H.A.) savanna understory and adjacent open annual grassland. Moderate intensity summer-fall-winter and spring-summer sheep use had few within-year effects. In contrast, production and composition varied considerably between years in both treatments. Forbs (especially legumes) decreased in open grassland and oak understory between years within both seasonal grazing regimes. This change could not have been caused by selective grazing because there were no corresponding within-year patterns. Instead, between-year changes are more likely related to nonselective effects of stocking rate and/or weather. Results from this study suggest that seasonal grazing systems offer little potential for improvement of annual range composition.

This citation is from AGRICOLA.

831. Consequence of grazing pattern and vegetation structure on the spatial variations of net N mineralisation in a wet grassland.

Rosignol, N.; Bonis, A.; and Bouzille, J. B.

Applied Soil Ecology 31(1-2): 62-72. (2006)

NAL Call #: QH541.5.S6 A67; ISSN: 0929-1393

Descriptors: grasslands/ wet environmental conditions/ grazing intensity/ plant communities/ community structure/ nitrogen mineralization/ spatial variation/ habitat fragmentation/ soil nutrients/ nutrient availability

This citation is from AGRICOLA.

832. Consequences of protection from grazing on diversity and abundance of the coastal lowland vegetation in eastern Saudi Arabia.

Shaltout, K. H.; El Halawany, E. F.; and El Kady, H. F.

Biodiversity and Conservation 5(1): 27-36. (1996)

NAL Call #: QH75.A1B562; ISSN: 0960-3115

Descriptors: evenness/ species diversity/ species richness
Abstract: Fourteen years of protection against grazing and human impacts of the coastal lowland vegetation in Eastern Saudi Arabia (an experimental site in the vicinity of Al-Hassa region) has led to an increase of 68% in the total cover, 33% in species richness and 32% in species relative abundance in the protected area are important forage and/or fuel plants. Soil salinity and important soil nutrients (N, K, Mg and Na) are significantly higher in the free grazing area which may be attributable to the fact that the passage of herbage through the grazing animals often enhances nutrient availability.

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833. Conservation implications of grazing practices on the plant and dipteran communities of a turlough in Co. Mayo, Ireland.

Ryder, C.; Moran, J.; Donnell, R.; and Gormally, M.

Biodiversity and Conservation 14(1): 187-204. (2005)

NAL Call #: QH75.A1B562; ISSN: 0960-3115

Descriptors: plant communities/ species richness/ habitat/ stocking/ conservation/ vegetation/ basins/ grazing/ aquatic insects/ species diversity/ plant populations/ stocking density/ biodiversity/ flooding/ community composition/

vegetation cover/ Diptera/ Sciomyzidae/ Eire, Connaught, Mayo/ marsh flies

Abstract: Turloughs, which are classified as priority habitats under the European Habitats Directive, are seasonally flooded depressions found almost exclusively in Ireland. In 2001, three adjacent fields with different stocking densities were selected and plant/dipteran communities within the same vegetation zone of each field (site) were investigated using quadrats and sweep netting, respectively. There was a significant positive relationship between Diptera morphospecies richness/Diptera abundance and mean vegetation height ($P < 0.001$). However, no significant relationship between Diptera morphospecies richness and plant species richness was found. Median Diptera morphospecies richness per sweep was lower at the site with the highest stocking density (17) than at the other two sites (22 and 31, respectively). Total species richness of Sciomyzidae was greater at the least grazed site (7) than at the more heavily grazed sites (2 and 1, respectively). The results suggest that an evaluation of turlough management practices based on plant communities alone is not sufficient and that at least some areas within the turlough basin remain ungrazed on a rotational basis to ensure maximum diversity of Diptera.
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834. Conservation of biodiversity in managed rangelands, with special emphasis on the ecological effects of large grazing ungulates, domestic and wild.

Duncan, Patrick and Jarman, Peter J.
International Grassland Congress: Proceedings 17(3): 2077-2084. (1993); ISSN: 0074-6185

Descriptors: ungulates/ Ungulata/ *Bos taurus*/ conservation/ damage/ grazing/ ecosystems/ mammals/ rangeland/ species diversity/ cattle/ prairie/ diversity
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835. Conservation strategy of a nature reserve in Mediterranean ecosystems: The effects of protection from grazing on biodiversity.

Verdu, Jose R.; Crespo, Manuel B.; and Galante, Eduardo
Biodiversity and Conservation 9(12): 1707-1721. (2000)
NAL Call #: QH75.A1B562; ISSN: 0960-3115

Descriptors: mediterranean ecosystems/ conservation guidelines [conservation regulations]/ conservation strategies/ cultural measures/ ecological measures/ economic measures/ endemism/ environmental management/ environmental protection/ grassland habitat/ grazing/ integrated rural policies/ land use/ landscape ecology/ nature reserves/ species richness

Abstract: Protection of natural areas has caused the elimination of traditional grazing activity on many occasions. As a result, in Mediterranean ecosystems a loss of biodiversity is usually related to a decrease of grassland and grassland-bush mosaic areas. In order to establish relationships between land use and the relative importance of each type of habitat in terms of species richness and endemism, the Font Roja Natural Park in Alicante Province (SE Iberian Peninsula) was studied. Four sites were selected representing the four different existing habitats: a wooded area (holm-oak forest), a dense shrubland, a dense grassland, and a grassland-shrubland mosaic area. In each site, the species composition of vegetation and dung beetle fauna were analysed. The results showed that the highest diversity and endemism, for plants and beetles,

were concentrated in the dense grasslands and the grassland-shrubland mosaic. Thus, controlled grazing activity of sheep and goats which maintained a diverse variegated landscape would favour the historical sustenance of the biodiversity of Mediterranean ecosystems, as that would allow a remarkable diversity of habitats with higher conservation levels of existing species richness and endemism. Therefore, we propose a reintroduction of traditional grazing of sheep and goats throughout ecological, cultural and economical measures, which would include guidelines and regulations, set out to boost an integrated rural policy.

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836. The contribution of managed grasslands to sustainable agriculture in the Great Lakes Basin.

Clark, E. A. and Poincelot, R. P.
Journal of Sustainable Agriculture 8(2/3): 1-172. (1996)
NAL Call #: S494.5.S86S8; ISSN: 1044-0046

Descriptors: farming systems/ range management/ pastures/ soil conservation/ water conservation/ nutrients/ environmental management/ grazing/ crop production/ biogeochemical cycles/ livestock production/ literature reviews/ Ontario

This citation is from AGRICOLA.

837. Cover of perennial grasses in southeastern Arizona in relation to livestock grazing.

Bock, C. E. and Bock, J. H.
Conservation Biology 7(2): 371-377. (1993)
NAL Call #: QH75.A1C5; ISSN: 0888-8892

Abstract: Southwestern grama (*Bouteloua*) grasslands are floristically allied to the North American Central Plains but lie outside the historic range of the plains' principal ungulate grazer, *Bison bison*. The authors compared perennial grassland cover and species composition on eight sites transected by the boundary fence of a 22 yr old livestock enclosure in a grama grassland in SE Arizona. Total grass canopy cover was greatest on the ungrazed portion of each of the eight sites. Two short stoloniferous species (*Hilaria belangeri* and *Bouteloua eriopoda*) were the only taxa substantially more abundant on grazed quadrats overall. Among these and eight taller bunchgrasses, there was a strong positive correlation between potential height and response to release from grazing with the three tallest species showing the greatest increases on ungrazed treatments (*Bouteloua curtipendula*, *Bothriochloa barbinodis*, and *Eragrostis intermedia*). *Bouteloua gracilis*, the most abundant grass in the region, showed an intermediate response to livestock exclusion. Grama grasslands at the Arizona site have changed more and in different ways following livestock exclusion than those on the Central Plains of Colorado. Contributing factors may include: 1) greater annual precipitation at the Arizona site, 2) the much larger size of the Arizona livestock enclosure, and 3) the absence of extensive grazing by native ungulates in the Southwest since the Pleistocene. -from Authors

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838. Crested wheatgrass and shrub response to continuous or rotational grazing.

Angell, R. F.

Journal of Range Management 50(2): 160-164. (1997)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/1997/502/160-164_angell.pdf

Descriptors: Agropyron desertorum/ Artemisia tridentata/ Chrysothamnus viscidiflorus/ rotational grazing/ stocking rate/ tillers/ plant density/ canopy/ rain/ biomass/ steers
Abstract: A four-year study was conducted to investigate effects of continuous and short duration grazing in spring on standing crop and tiller density of crested wheatgrass [Agropyron desertorum (Fisch. ex Link) Schult], along with changes in cover and density of Wyoming big sagebrush (Artemisia tridentata Nutt. subsp. wyomingensis Beetle and Young) and green rabbitbrush [Chrysothamnus viscidiflorus (Hook.) Nutt.]. Eight pastures were each stocked with 10 steers (224 kg) beginning in early May. Four grazing treatments consisted of continuous grazing at 0.6 AUM/ha (CONT) or short duration grazing management at 0.6, 0.9, and 1.2 AUM/ha for LOW, MED, and HIGH treatments, respectively. After 4 years, mean tiller density was greatest on LOW paddocks ($P = 0.10$) (707 tillers/m²). Tiller density on HIGH paddocks did not differ ($P > 0.05$) from CONT. Density of large (> 15-cm tall) Wyoming big sagebrush increased (P less than or equal to 0.05) across years, but did not vary ($P > 0.05$) among treatments, at about 9 plants/100 m². Sagebrush plants < 15-cm tall responded differently ($P = 0.02$) in CONT compared to HIGH. Small sagebrush density increased under short duration grazing at doubled stocking rate (HIGH) compared to CONT, but LOW and MED did not differ from CONT. We concluded that short duration rotation grazing at a conventional stocking rate decreased neither tillering nor yield of crested wheatgrass. Shrub density and cover changes on LOW were similar to CONT. It does appear, however, that short duration grazing at the doubled stocking rate has the potential to limit crested wheatgrass productivity over time because of enhanced sagebrush seedling survival. This citation is from AGRICOLA.

839. Demographic variation in the Australian desert Cassia under grazing pressure.

Silander, J. A.

Oecologia (Berlin) 60(2): 227-233. (1983)

NAL Call #: QL750.O3; ISSN: 0029-8549

Descriptors: Cassia nemophila/ sheep/ rabbit/ model
Abstract: Demographic variation was examined in 3 populations of the Australian desert shrub Cassia nemophila which vary in their grazing histories. Age-specific life tables were constructed from 50 yr of observations on mortality and recruitment at the Koonamore Vegetation Reserve in South Australia. Population projection matrix models were used to examine population responses to grazing pressure. The predicted population growth rates, reproductive values and stable age distributions are evaluated and compared with observed results. Grazing by sheep or rabbits, in high populations, prevents shrub recruitment and causes local population extinction. Where protected from sheep and with low rabbit pressure, Cassia populations have increased. Current sheep grazing practices and rabbit population levels if continued will have

a drastic affect on Cassia populations and other shrub species, and on the structure and composition of the Australian arid shrublands in general.

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840. Desertification processes due to heavy grazing in sandy rangeland, Inner Mongolia.

Zhao, H. L.; Zhao, X. Y.; Zhou, R. L.; Zhang, T. H.; and Drake, S.

Journal of Arid Environments 62(2): 309-319. (2005)

NAL Call #: QH541.5.D4J6; ISSN: 0140-1963

Descriptors: biomass/ desertification/ grazing/ ground cover/ plant height/ rangelands/ roots/ wind damage/ wind effects/ wind erosion/ Nei-Mongol

Abstract: We conducted a grazing experiment from 1992 to 1996 in Inner Mongolia to explore desertification processes of sandy rangeland. The results show that continuous heavy grazing results in a considerable decrease in vegetation cover, height, standing biomass and root biomass, and a significant increase in animal hoof impacts. As a result, small bare spots appeared on the ground and later merged into larger bare areas in the rangeland. Total bare area reached up to 52% and the average depth of wind erosion was 25 cm in the fifth year of the study. We conclude that sandy rangeland with wind-erodible soil is susceptible to desertification. Heavy grazing of such rangeland should be avoided.

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841. Differences in plant composition in cattle and wild ungulate exclosures in north-central Montana.

Hurlburt, Kris and Bedunah, Don.

In: Sharing Common Ground on Western Rangelands: Proceedings of a Livestock/Big Game Symposium. (Held February 26-28 (1996) at Sparks, Nevada.) Evans, Keith E. (eds.); Vol. INT-GTR-343.

Ogden, Utah: U.S. Department of Agriculture Forest Service, Intermountain Research Station; pp. 19-24; 1996.

Notes: ISSN: 0363-6186

NAL Call #: aSD11.A48

Descriptors: nutrition/ diet/ ecology/ habitat/ terrestrial habitat/ land and freshwater zones/ Nearctic Region/ North America/ USA/ Cervus elaphus/ Odocoileus hemionus (Cervidae): food plants/ impact on habitat/ grassland plant community/ impact of grazing/ grassland/ grazing impact on plant community/ Montana/ dupuyer/ grazing impact on grassland plant community/ Cervidae/ Artiodactyla/ Mammalia/ chordates/ mammals/ vertebrates

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842. Differences in riparian vegetation structure between grazed areas and exclosures.

Tucker Schulz, T. and Leininger, W. C.

Journal of Range Management 43(4): 295-299. (1990)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1990/434/4schu.pdf>

Abstract: Differences in vegetation structure were examined in a montane riparian zone in N-central Colorado after 30 yr of cattle exclusion and continued, but reduced, grazing pressure. Total vascular vegetation, shrub, and graminoid canopy cover was greater in the exclosures as compared to grazed areas, while forb canopy cover was similar between treatments. Exclosures had nearly 2 times the litter cover, while grazed areas had 4 times more bare ground. Willow canopy coverage was 8.5 times greater in

protected areas than in grazed areas. Kentucky bluegrass *Poa pratensis* cover was 4 times greater in grazed areas than exclosures, while the cover of fowl bluegrass *Poa palustris* was 6 times greater in the protected sites. Canopy cover of other important riparian species was similar between treatments. Mean peak standing crop was 2410 kg/ha in exclosures and 1217 kg/ha in caged plots within grazed areas. Cattle utilized c65% of the current year's growth of vegetation during the grazing season. – from Authors

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843. Differences in species richness and life-history traits between grazed and abandoned grasslands in southern Sweden.

Dupre, Cecilia and Diekmann, Martin

Ecography 24(3): 275-286. (2001)

NAL Call #: QH540.H6; ISSN: 0906-7590

Descriptors: abandoned grasslands/ community composition/ grazed grasslands/ grazing/ life history traits/ management type/ spatial scale/ species richness

Abstract: Disturbance has profound effects on plant community composition. This paper deals with the influence of grazing on species richness and proportions of life-history attributes of grassland vegetation at six spatial scales (0.001-1000 m²) in two provinces of southern Sweden. The study comprised 33 dry grassland sites, including 22 grazed and 11 abandoned localities, and 28 sites of coastal brackish meadows, divided into five management types (from "heavily grazed" to "abandoned since long time"). In general grazed sites were species-richer than abandoned sites, especially at small plot sizes. However, there was a steeper increase in species number towards larger plot sizes in the abandoned sites. Heavy grazing in the coastal meadows resulted in a comparatively low number of species, corroborating the intermediate disturbance hypothesis. The analysis of life-history traits indicated the importance of taxonomic group, canopy structure, height, regenerative strategy and, in particular, life form. Leaf anatomy and seed dispersal seemed to be less important. The responses to grazing as regards species traits differed somewhat between grassland types. Grazed sites generally had high proportions of legumes, therophytes, species with basal position of leaves and with regeneration by means of a persistent seed bank. Abandonment of grazing favoured monocots, geophytes, species with vegetative regeneration and (partly) leafy canopy structure. Some differences between grazed and abandoned sites were confined to either the smallest or largest plot sizes, indicating different responses of matrix and interstitial species. Various positive associations (attribute syndromes) or negative associations between individual traits were identified. There was, for example, a positive link between the attributes "geophytes" and "ability of vegetative regeneration". The recognition of such links is important to avoid misinterpreting certain attributes as functional adaptations to grazing while they are only positively correlated to other attributes of larger significance.

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844. Differing effects of cattle grazing on native and alien plants.

Kimball, Sarah and Schiffman, Paula M.

Conservation Biology 17(6): 1681-1693. (2003)

NAL Call #: QH75.A1C5; ISSN: 0888-8892

Descriptors: grazing management: applied and field techniques/ adaptations/ compensation/ competition/ differential grazing effects/ growth/ herbivory/ native grassland community/ population restoration/ reproduction

Abstract: Habitat managers use cattle grazing to reduce alien plant cover and promote native species in California grasslands and elsewhere in the western United States. We tested the effectiveness of grazing as a restoration method by examining the effects of herbivory on native and alien plants. At Carrizo Plain National Monument, California, we surveyed native and alien species cover in adjacent grazed and ungrazed areas. We also established experimental plots in which plants were clipped or mulch (dead biomass) was removed. In addition, we clipped plants grown in pots and plants in the field that grew with and without competitors. Native species were negatively affected by clipping in 1999, 2000, and 2001, whereas alien species were unaffected. In the experimental field plots, the European annual forb *Erodium cicutarium* compensated in growth and reproduction following simulated herbivory. In contrast, growth and reproduction of the native perennial bunchgrass *Poa secunda* were reduced 1 year after clipping. In pots, *E. cicutarium* overcompensated and grasses undercompensated. In the field, European grasses were unaffected by the removal of competitors. It is unclear by what mechanism *E. cicutarium* was able to compensate, but the ability may be related to its basal rosette growth form and indeterminately growing inflorescences. The native California grassland community assembled in the absence of grazing herds, whereas invasive European species have been exposed to grazing for centuries. It may be that these invaders have adaptations that better enable them to recover from grazing. In the grassland we studied, the strategy of livestock grazing for restoration is counterproductive. It harms native species and promotes alien plant growth.

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845. The distribution of grazing pressure in relation to vegetation resources in semi-arid west Africa: The role of herding.

Turner, Matthew D.; Hiernaux, Pierre; and Schlecht, Eva

Ecosystems 8(6): 668-681. (2005)

NAL Call #: QH540 .E3645; ISSN: 1432-9840

Descriptors: multiple regression analysis: mathematical and computer techniques/ spatial distribution/ grazing/ distribution/ management/ semi arid/ vegetation resource/ herding/ agropastoralism/ cropped land/ agropastoral landscape/ cultivation pressure/ land unit/ palatable forage mass/ itinerary/ forage availability time/ grazing period/ labor investment

Abstract: In semi-arid West Africa, livestock are increasingly managed by sedentary producers in close proximity to expanding cropped lands. To evaluate the agricultural and environmental implications of this trend, a study was conducted to investigate the effect of grazing management on the spatial distribution of grazing pressure, the forage provided animals during the grazing period, and local herd-forage ratios across three agropastoral landscapes characterized by varying cultivation pressure.

During the 19-month study period, data on herbaceous vegetation, livestock populations, and grazing itineraries were collected. These data were referenced to land units averaging 70 ha in area. Using this approach, each of 3,819 grazing itineraries was characterized as to: 1. the sum of the products of the palatable forage mass of a particular land unit and the time spent grazing by the herd within that unit (FAT, expressed in kg-hours ha⁻¹); and 2. the average palatable herbaceous forage mass encountered by livestock across the itinerary weighted by the time spent in the land units crossed (FA, expressed in kg ha⁻¹). The spatial dispersion of livestock grazing around human settlements was found to decline with a reduction in herding labor investment (herded > herd-release > free pasture). Multiple regression analyses of itinerary data demonstrate that both FAT and FA also decline with a reduction in herding labor investment. Herded and herd-release managed livestock were offered more palatable forage and grazed areas of higher forage availability than free-pastured animals. This supports arguments that as the investment of time and effort into herding declines, feed supply to livestock will decline and the potential for grazing-induced environmental change will increase.

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846. Does grazing reduce survival of indigenous perennial grasses of the semi-arid woodlands of western New South Wales?

Grice, A. C. and Barchia, I.

Australian Journal of Ecology 17(2): 195-205. (1992)

NAL Call #: QH540.A8; ISSN: 0307-692X

Descriptors: Stipa nitida/ Aristida browniana/ Eragrostis eriopoda/ Monachather paradoxa/ livestock/ rabbit/ kangaroo/ sheep/ interspecific variation/ rangeland management

Abstract: Exclosures were used to examine the impact of grazing upon the mortality patterns of populations of six indigenous grass species. The experiment compared unfenced areas with areas from which either sheep only or sheep, rabbits and kangaroos were excluded. There were large interspecific differences in mortality patterns, with Stipa nitida and Aristida browniana having relatively high mortality rates and Eragrostis eriopoda having relatively low mortality rates. Grazing-induced mortality was observed in treatment areas that were grazed by sheep, rabbits and kangaroos and in areas grazed only by rabbits and kangaroos. The short-lived S. nitida appears less likely to suffer grazing-induced mortality than species of intermediate longevity such as Monachather paradoxa. These observations help explain the decline in endemic perennial grasses that has taken place in the vegetation of western New South Wales since European settlement. Management of these rangelands to encourage these grasses must consider total grazing pressure and not simply the impact of livestock.

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847. Drought and grazing patch dynamics under different grazing management.

Teague, W. R.; Dowhower, S. L.; and Waggoner, J. A.

Journal of Arid Environments 58(1): 97-117. (2004)

NAL Call #: QH541.5.D4J6; ISSN: 0140-1963

Descriptors: continuous grazing: applied and field techniques/ grazing management: applied and field

techniques/ rotation grazing: applied and field techniques/ arid environment/ drought/ grazing patch dynamics/ land deterioration: uneven animal impact

Abstract: Land deterioration does not occur uniformly over time or over a landscape. The differential use of preferred areas in the landscape results in uneven distribution of animal impact, and periods of below average precipitation compound the effects of herbivory, providing periods of accelerated deterioration. This study investigates whether rotational grazing during a drought cycle allows reduction of deterioration caused by patch-selective grazing in large (1800-2100 ha) paddocks by providing adequate rest between grazing events. From 1995 through 2000, herbaceous and bare ground changes were measured on adjacent heavily grazed and lightly grazed patches in rotationally and continuously grazed paddocks. The weather interacted with grazing treatment ($p < 0.0001$), species ($p < 0.0001$) and the combined effects of the other factors ($p < 0.0014$), indicating the dominant effect of weather, particularly precipitation, on changes in herbaceous basal area. When summer growing conditions were favorable, the rotational grazing treatment resulted in greater increases of perennial herbaceous basal areas ($p < 0.05$) and lower proportions of bare ground ($P < 0.10$) than the continuously grazed treatment. Although rotational grazing did not prevent deterioration in basal area and bare ground with the series of four drought years, it did decrease the rate of deterioration. The changes in basal area were primarily due to changes in summer growing perennial C4 midgrasses and C4 shortgrasses. Grazing treatment did not influence species aerial biomass composition ($p > 0.1$). When monitoring to effect sustainable use, the commonly used parameter of species composition appears to be a much less sensitive indicator of change than bare ground and basal area. This study provides evidence that, in large paddocks in this environment, rotational grazing can reduce the deterioration and allow improvement of both shortgrass and midgrass patches. Copyright 2003 Elsevier Ltd. All rights reserved.

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848. Dynamic optimal management of wind-erosive rangelands.

Hu, D.; Ready, R.; and Pagoulatos, A.

American Journal of Agricultural Economics 79(2):

327-340. (1997)

NAL Call #: 280.8 J822; ISSN: 0002-9092

Descriptors: soil conservation/ grazing/ wind erosion/ rootstocks/ livestock/ rangelands/ land management/ dynamic models/ equations/ economic impact/ semiarid zones/ China

Abstract: A bioeconomic model of livestock production from wind-erosive rangelands is developed and optimized. Equations of motion capture the impact of topsoil stock on forage productivity and the protective effect of forage stock on soil loss from wind erosion. For overgrazed wind-erosive rangelands, a lower discount rate provides incentives for lighter grazing, as does consideration of effect of stocking rates on animal performance. In the case where off-site damages are large, internalizing off-site effects would also encourage lighter grazing and hence promote sustainable production. An illustrative application of the model is also included.

This citation is from AGRICOLA.

849. The dynamics of grazed woodlands in southwest Queensland, Australia and their effect on greenhouse gas emissions.

Moore, J. L.; Howden, S. M.; Mckean, G. M.; Carter, J. O.; and Scanlan, J. C.

Environment International 27(2-3): 147-153. (2001)

NAL Call #: TD169.E54; ISSN: 0160-4120

Descriptors: GRASP: dynamic tree growth population inclusion, gas emission component inclusion, modeling method, pasture production model/ stock management: changes, management method/ agricultural productivity greenhouse gas reduction conflict/ burning practices: changes/ climate change/ grazed semiarid rangeland: greenhouse gas source/ grazed woodlands: dynamics, greenhouse gas emissions/ grazing

Abstract: This study outlines the development of an approach to evaluate the sources, sinks, and magnitudes of greenhouse gas emissions from a grazed semiarid rangeland dominated by mulga (*Acacia aneura*) and how these emissions may be altered by changes in management. This paper describes the modification of an existing pasture production model (GRASP) to include a gas emission component and a dynamic tree growth and population model. An exploratory study was completed to investigate the likely impact of changes in burning practices and stock management on emissions. This study indicates that there is a fundamental conflict between maintaining agricultural productivity and reducing greenhouse gas emissions on a given unit of land. Greater agricultural productivity is allied with the system being an emissions source while production declines and the system becomes a net emissions sink as mulga density increases. Effective management for sheep production results in the system acting as a net source (approx 60-200 kg CO₂ equivalents/ha/year). The magnitude of the source depends on the management strategies used to maintain the productivity of the system and is largely determined by starting density and average density of the mulga over the simulation period. Prior to European settlement, it is believed that the mulga lands were burnt almost annually. Simulations indicate that such a management approach result in the system acting as a small net sink with an average net absorption of greenhouse gases of 14 kg CO₂ equivalents/ha/year through minimal growth of mulga stands. In contrast, the suppression of fire and the introduction of grazing results in thickening of mulga stands and the system can act as a significant net sink absorbing an average of 1000 kg CO₂ equivalents/ha/year. Although dense mulga will render the land largely useless for grazing, land in this region is relatively inexpensive and could possibly be developed as a cost-effective carbon offset for greenhouse gas emissions elsewhere. These results also provide support for the hypothesis that changes in land management, and particularly, suppression of fire is chiefly responsible for the observed increases in mulga density over the past century.

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850. Dynamics of vegetation along and adjacent to an ephemeral channel.

Smith, M. A.; Dodd, J. L.; Skinner, Q. D.; and Rodgers, J. D.

Journal of Range Management 46(1): 56-64. (1993)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1993/461/9smit.pdf>

Descriptors: streams/ plant density/ grasses/ perennials/ annuals/ pastures/ woody plants/ deserts/ floodplains/ precipitation/ riparian buffers/ grazing/ highlands/ Wyoming

Abstract: Ephemeral channels may be greater contributors to nonpoint sediment loads than perennial channels because of their abundance and lower vegetative cover. This study examines above- and belowground standing crop responses of selected vegetation classes and density of shrubs to grazing use and yearly weather variation along an ephemeral stream in northcentral Wyoming. Aboveground biomass standing crop was determined yearly in channel, floodplain, and upland habitats in ungrazed and grazed pastures during the 4-year study. Belowground biomass and shrub densities were determined yearly in the channel habitat only. Perennial grass standing crop in channels did not respond to grazing but decreased up to 73% with decreases in frequency and amount of precipitation. In floodplains, perennial grasses were not responsive to grazing; annual grasses were twice as abundant in grazed pastures. Vegetation standing crop in uplands was not influenced by grazing. Over the study period in all pastures, standing crop of blue grama (*Bouteloua gracilis* (H.B.K.) Lag. ex Griffiths) declined 4 fold while cool-season grasses increased 5 fold. Shrub density did not increase as much in grazed as in ungrazed pastures. Root biomass of the channel decreased 23% in years with less precipitation but was greater by 24% on concave than convex bank types. Location on channels influenced root biomass but grazing did not. Lack of general negative grazing influences on vegetation suggest short periods (10 days) of grazing as used in this study represent a sustainable management alternative for grazing in the cold desert.

This citation is from AGRICOLA.

851. Early season utilization of mountain meadow riparian pastures.

Clary, W. P. and Booth, G. D.

Journal of Range Management 46(6): 493-497. (1993)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1993/466/5clar.pdf>

Descriptors: beef cattle/ grazing intensity/ grazing/ Idaho

Abstract: Observations suggest spring grazing of riparian areas is a good management strategy because of a reduced tendency for cattle to concentrate along streams during that season. In this study, June cattle distribution was examined within 4 experimental pastures located along Stanley Creek, Sawtooth National Recreation Area, Sawtooth National Forest, in central Idaho. Two pastures were grazed at a light stocking rate and 2 pastures were grazed at a medium stocking rate. Streamside graminoid utilization averaged about 24% under light stocking, while on the adjacent meadow graminoid utilization was 28%. Under medium stocking the average utilization at streamside was 37%, while that on the adjacent meadow was 50%. Residual herbaceous stubble heights under light stocking were 11 to 12 cm for both grazing locations, whereas streamside and meadow stubble heights were 10 cm and 7 cm, respectively, under moderate stocking. Cattle were not disproportionately attracted to the streamside areas during the June period. As stocking rates increased from light to medium, the cattle concentrated most of their additional use on the adjacent drier meadow. Utilization of riparian plant communities during this early summer period

had no relationship to the amount of plant moisture content, but was negatively associated with surface soil moisture.

This citation is from AGRICOLA.

852. Ecological benefit of strip grazing with a solar mobile fence grazing system.

Puga, D. C. and Galina, M. A.

South African Journal of Animal Science 34(Suppl. 1): 89-91. (2004)

NAL Call #: SF1.S6; ISSN: 0375-1589

Descriptors: solar mobile fence grazing system: applied and field techniques/ strip grazing: applied and field techniques/ rural community/ ecological benefit

Abstract: A study was conducted on 14 ha of *Caducifolia* thorny forest with an average total dry matter yield of 800 kg/ha/year. The area of study was divided into two 7 ha camps. Thirty-five Alpine goats were allocated to one of the camps in a continuous grazing system, called the free grazing (FG) camp treatment. Another 35 goats were placed in the other camp where strip grazing was controlled by means of a solar mobile grazing (SMG) system. A high (163 AU/ha) and a low (40.8 AU/ha) stocking rate, allocating 625 m² and 1.250 m², respectively, were applied in the SMG treatment. The number of goats varied to adjust stocking rate daily. The goats were allowed to graze five hours/day. Herbage utilization was measured, using as initial markers the grass length of 24 to 30 cm and number of leaves (156-17) on selected shrub branches, 40 cm. long. The botanical composition was determined at the beginning and end of the grazing period. Chemical analyses of forage selected by the goats were performed monthly. In the SMG treatment the average grass height changed from 37.1 cm. in June to 65.2 cm in February, while percentage leaves changed from 18.4% to 5.9%, compared to changes of 41.4 cm to 42.3 cm and 16.3% to 0.91% in the FG treatment, respectively. In the SMG treatment the goats spent 80% of their time browsing in July and August and 100% of their time from December until March. It is concluded that the economical and social status of the rural community would be improved using the SMG system.

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853. Ecological heterogeneity in the effects of grazing and fire on grassland diversity.

Harrison, S.; Inouye, B. D.; and Safford, H. D.

Conservation Biology 17(3): 837-845. (2003)

NAL Call #: QH75.A1C5; ISSN: 0888-8892

Descriptors: biomass variation/ ecological heterogeneity/ ecosystem productivity/ fire/ grassland diversity/ grazing/ landscape ecology/ nonserpentine soils/ serpentine soil/ soil disturbance interactions/ species composition/ species diversity: exotic, native/ species invasion/ species richness

Abstract: Grazing and fire are major forces shaping patterns of native and exotic species diversity in many grasslands, yet both of these disturbances have notoriously variable effects. Few studies have examined how landscape-level heterogeneity in grassland characteristics, such as soil-based variation in biomass and species composition, may contribute to variation in the effects of fire or grazing. We studied the effects of livestock grazing and fire in a mosaic of serpentine and nonserpentine soils in California, where most grasslands are dominated by exotic annuals and serpentine soil is the major refuge for native

grassland species. We predicted that the effects of disturbance would be proportional to productivity and therefore would be greater on nonserpentine than serpentine soils. We measured species composition at 80-100 grazed or ungrazed sites for 2 years before (1998-1999) and 2 years after (2000-2001) an autumn wildfire. Both disturbances increased total species richness on both soils. However, fire enhanced total and exotic species richness more on nonserpentine soils and enhanced native species richness more on serpentine soils. Grazing increased native species richness on serpentine soils but not on nonserpentine soils. These soil-disturbance interactions suggest that the use of fire and grazing to manage native species diversity in wildlands must be done with careful attention to background ecological heterogeneity.

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854. Ecological principles for increasing grazing capacity of Tersko-Kumsk sands.

Zalibekov, Z. G.; Gasanova, S. M.; Yarullina, N. A.; and Magomedov, G. G.

Problems of Desert Development 4: 1-8. (1987)

NAL Call #: QK938.D4P73; ISSN: 0278-4750

Descriptors: cattle/ grazing intensity/ rangelands/ arid zones/ sandy loam soils/ range management/ climatic factors/ ecosystems/ water management/ grazing/ ecological balance/ Russia

This citation is from AGRICOLA.

855. Ecosystem changes associated with grazing intensity on the Punta Ninfas rangelands of Patagonia, Argentina.

Beeskow, A. M.; Ellisalde, N. O.; and Rostagno, C. M.

Journal of Range Management 48(6): 517-522. (1995)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/1995/486/517-522_beeskow.pdf

Descriptors: rangelands/ grazing intensity/ botanical composition/ grasses/ woody weeds/ shrubs/ steppes/ sheep/ indicator species/ overgrazing/ forage/ biomass/ canopy/ soil types/ Argentina

Abstract: Changes in the vegetation and soil surface were assessed along a grazing intensity gradient on rangelands of the Punta Ninfas area in southern Argentina. Thirty-two transects were sampled in areas with different grazing intensity. Bray-Curtis polar ordination and simple correlation were used to display changes in community composition and measure association between different community attributes. The first axis expressed the changes in species composition along a gradient of grazing intensity. The extremes of the gradient were represented by shrub and grass steppes. Shrub steppes dominated in heavily grazed areas close to permanent water points, while grass steppes dominated in lightly grazed areas in the extremes of the paddocks. A significant negative relation ($r = -0.81$, $p < 0.05$) between grass and shrub cover suggested that grasses decreased as shrub increased. *Flechilla* (*Stipa tenuis* Phil.) and *flechilla negra* [*Piptochaetium napostaense* (Speg.) Hackel ap Stuckert.] were the main decreaser grasses while *quilembai* (*Chuquiraga avellanadae* Cav.) was the main shrub invading the grass steppes. Uneroded soil surface conditions decreased, and the size and frequency of crusted and desert pavement areas and mounds increased with shrub cover. Three states or stages of range

degradation were identified along the gradient of grazing intensity. Grass steppe represented the most desirable state in term of livestock production and soil stability, while shrub steppe represented the most degraded and least productive state.

This citation is from AGRICOLA.

856. Edge effects in grazed and ungrazed western Australian wheatbelt remnants in relation to ecosystem reconstruction.

Scougall, S. A.; Majer, J. D.; and Hobbs, R. J.
In: Reconstruction of fragmented ecosystems; Series: Nature Conservation Series 3.
Chipping Norton, New South Wales, Australia: Surrey Beatty and Sons, 1993; pp. 163-178.
Notes: Meeting Information: Workshop, Tammin, Western Australia, Australia; October 7-11, 1991; ISBN 0949324507
NAL Call #: QH541.15.R45R42 1993
Descriptors: book chapter/ conservation/ habitat reconstruction/ meeting paper/ vegetation
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857. Effect of 6 years livestock exclusion on palatable range vegetation of Banda Daud Shah, Kohat.

Noor, Mohammad; Khan, Mohammad; and Nabi, Gul
Pakistan Journal of Forestry 41(3): 126-129. (1991)
NAL Call #: 99.8 P17; *ISSN:* 0030-9818
Descriptors: forage yield/ livestock grazing/ pasture succession
Abstract: A one hectare livestock enclosure was established at Banda Daud Shah (Pakistan) in 1972, to study changes in vegetation and secondary succession. In May, 1978 vegetation in the enclosed and adjacent grazed areas was sampled to detect changes in vegetation. Average yield and species composition of grasses, forbs and trees/shrubs were not significantly different in the enclosed and adjacent grazed areas. The higher (P ltoreq 0.05) forage production and composition of *Aristida depressa* in the grazed area showed that this species increased under continued grazing. Frequency of grasses, forbs and trees/shrubs was not affected by the exclusion of livestock. The data indicate that direct manipulations in semi-arid environment are essential for rapid improvement of overgrazed rangelands and secondary succession.
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858. The effect of cattle and sheep grazing on salt-marsh vegetation at Skallingen, Denmark.

Jensen, A.
Vegetatio 60(1): 37-48. (1985)
NAL Call #: 450 V52; *ISSN:* 0042-3106
Descriptors: grazing/ salt marshes/ succession/ plant communities/ environmental impact/ vegetation cover/ ecological succession/ effects on/ vegetation/ cattle and sheep/ vegetation cover/ ecological succession/ Puccinellian maritima/ Denmark, Skallingen/ succession/ plant communities
Abstract: The aggregated effect of cattle and sheep grazing on Puccinellion maritimae and other salt-marsh vegetation has been studied together with changes in species composition, the percentage cover of each species, total cover and the percentage of bare ground, six years after grazing had been prevented by construction of experimental enclosures. The species composition of the Puccinellia maritima community did not change during

these six years. During the same period of time *Salicornia europaea*, *Suaeda maritima*, and *Glaux maritima*, disappeared from the plot in the ungrazed marsh as a result of natural development. During thirty-five years the vegetation originally dominated by *P. maritima* and *S. europaea* has changed into a community dominated by *Halimione portulacoides*, whereas the grazed salt marsh is still dominated by *P. maritima* and *S. europaea*.
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859. Effect of cattle grazing on range perennial grasses in the Mendoza plain, Argentina.

Guevara, J. C.; Stasi, C. R.; and Estevez, O. R.
Journal of Arid Environments 34(2): 205-213. (1996)
NAL Call #: QH541.5.D4J6; *ISSN:* 0140-1963
Descriptors: grazing/ selective grazing/ frequency/ diversity/ grasslands/ savannas/ stocking rate/ grazing systems/ continuous grazing/ rotational grazing
Abstract: An open xerophytic savanna and shrubland in the north-central Mendoza plain was subjected to 6 different cattle grazing treatments in 1990-94; continuous stocking or a 4-pasture, 1-herd system, each at stocking rates to give 80, 50 or 20% removal of perennial grasses. Vegetation was analysed along 30-m fixed line transects. Rotational grazing at the high stocking rate decreased total live basal cover, proportion and frequency of occurrence of preferred grasses. Rotational grazing to give 50% grass removal, and continuous grazing at the lowest stocking rate, were beneficial.
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860. The effect of clearing bushes and shrubs on range condition in Borana, Ethiopia.

Angassa, Ayana
Tropical Grasslands 36(2): 69-76. (2002)
NAL Call #: SB197.A1T7; *ISSN:* 0049-4763
Descriptors: botanical composition/ bush clearing effects/ bush encroachment response/ communal grazing area/ range conditions/ rangeland management/ shrub clearing effects/ soil condition/ tropical grasslands
Abstract: The effect of bush encroachment and the responses of range condition to clearing were assessed at 2 locations in Borana rangeland at the end of the growing season on cleared and uncleared sites. The study was carried out in a communal grazing area (Medhecho) and a Government ranch (Dida-Tuyura) in bush and/or shrub-encroached and cleared areas to assess the effect of bush clearing on range condition. In each area, 3 elevation ranges were distinguished and in each range a single transect, covering both uncleared and cleared rangeland, away from water sources, was selected. The assessment was based on botanical composition of the herbaceous layer, basal cover, litter cover, relative number of seedlings, age distribution of grasses and soil condition. A total of 31 grasses, 4 legumes and 3 sedges were identified. The grasses *Bothriochloa radicans*, *Cenchrus ciliaris*, *Chrysopogon aucheri* and *Panicum coloratum* were common or dominant in both cleared and uncleared sites. *Pennisetum mezianum* was typically found in encroached vegetation. In general, the range condition was fair to good. The uncleared vegetation had a significantly lower score for range condition than the cleared vegetation for most parameters as well as for total score, although the differences were small. Differences based on elevation range were also significant for grass composition, soil

condition and total score. Cleared areas contained more desirable species and more seedlings than the uncleared areas.

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861. Effect of exclosure and topography on rehabilitation of overgrazed shrub-steppe in the loess plateau of northwest China.

Hongo, Akio; Matsumoto, Satoshi; Takahashi, Hidenori; Zou, Houyan; Cheng, Jimin; Jia, Hengyi; and Zhao, Zhiyi
Restoration Ecology 3(1): 18-25. (1995)
NAL Call #: QH541.15.R45R515; ISSN: 1061-2971
Descriptors: calcium/ carbon/ grazing/ nitrogen/ organic matter/ precipitation/ soil sample chemical analysis/ species diversity/ water balance

Abstract: The purpose of this study was to clarify the effect of grazing exclosures on the recovery and rehabilitation of overgrazed steppe vegetation on varying slope aspects in the Loess Plateau of northwest China. The annual precipitation in the area studied was 400-480 mm. Soil samples were taken on nine slopes in the five-year exclosure and on five slopes outside the exclosure after a vegetation survey; they were then analyzed chemically. Mean number of species recorded per 0.25 m² was lower on the south-facing slope than all other slopes. The reverse trend was observed for aerial biomass. Species diversity estimated by information content was higher in the grazing zone than in a 3200-ha protected zone within an exclosure. From species ordination by principal component analysis, species with lower coverage in the grazing zone were *Poa sphondylodes*, *Roegneria purpurascens*, *Hierochloa odorata*, and *Potentilla bifurca*, which are all recognized as indicator species for rehabilitation efforts. In the soil surface layer, calcium contents were low, and the total contents of carbon and nitrogen were high on the north-facing slope in the exclosure. The protection by exclosure of overgrazed steppe was seen to be effective because the accumulation of soil organic matter increased and water balance improved.

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862. Effect of fertilizer applications and grazing exclusion on species composition and biomass in wet meadow restoration in eastern Washington.

Beebe, John; Everett, Richard L.; Scherer, George; and Davis, Carl F.

U S Forest Service Pacific Northwest Research Station Research Paper PNW RP(542): 1-15. (2002)
NAL Call #: A99.9 F7625Uni no. 542
<http://www.fs.fed.us/pnw/pubs/rp542.pdf>

Descriptors: biomass/ fertilizer applications: restoration strategy/ grazing exclusion: restoration strategy/ optimum fertilization rates/ soil bulk density/ soil compaction reduction/ species composition/ split block design/ wet meadow restoration

Abstract: Fertilizer applications and grazing exclusion were used as restoration strategies in degraded wet meadows in eastern Washington to grow biomass in the root systems where it could not be grazed. We used a split-block design to test vegetation responses to six fertilizer rates, eight fertilizer types, and three grazing treatments after three growing seasons. Little change in plant composition was detected, but weed biomass was reduced by 50 percent in cattle plus elk grazing. Although forb shoot biomass did not increase, grass shoot biomass doubled but was influenced

by grazing treatments. Root biomass doubled under fertilizer applications. A 10-percent decline in soil bulk density suggested a reduction in soil compaction. These responses were attributed to the increased root biomass. Optimum fertilization rates of 100 kg/ha were recommended along with carefully administered grazing schedules for meadow community restoration.

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863. Effect of fire and grazing on forbs in the western south Texas plains.

Ruthven, Donald C.; Gallagher, James F.; and Synatzske, David R.

Southwestern Naturalist 45(2): 89-94. (2000)
NAL Call #: 409.6 SO8; ISSN: 0038-4909

Descriptors: fire: prescribed burn/ forb density/ herbaceous canopy cover/ livestock grazing/ plains/ species diversity/ species frequency

Abstract: The effects of fire in plant communities in the western South Texas Plains are not clearly understood. Our objective was to compare forb density, cover, frequency, and diversity on prescribed-burned rangelands and untreated rangelands under controlled conditions, and with the influence of livestock grazing during the first growing season after treatment. Four rangeland sites that were burned during winter 1997, and four sites of untreated rangeland were selected on the Chaparral Wildlife Management Area, Dimmit Co., Texas. Two burned and two untreated sites were subjected to grazing by cattle. Herbaceous canopy cover and forb density were estimated with 20- by 50-cm quadrats during late spring 1997. Forb diversity was similar between treatments. Forb coverage was greater on burned than nonburned sites. Important seed-producing annuals, such as prairie sunflower (*Helianthus petiolaris*) and croton (*Croton*), were more prevalent on burned sites. Day flower (*Commelina erecta*), a beneficial perennial, also increased following burning. Grazing did not appear to influence the presence of forbs on burned sites; however, grazing reduced density and cover values of desirable species such as prairie sunflower.

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864. The effect of grazing abandonment on species composition and functional traits: The case of Dehesa grasslands.

Peco, Begona; De Pablos, Isabel; Traba, Juan; and Levassor, Catherine

Basic and Applied Ecology 6(2): 175-183. (2005)
NAL Call #: QH540 .B37; ISSN: 1439-1791

Descriptors: detrended correspondence analysis: mathematical and computer techniques/ grazing: applied and field techniques/ species composition/ vegetation composition/ functional trait/ clonal reproduction/ grazing abandonment/ dehesa grassland

Abstract: This study attempts to identify the consequences of grazing abandonment for changes in floristic and functional vegetation composition in dehesa systems. Species cover was quantified in plots on grazed and abandoned dehesas in Central Spain. Using literature and field measurements, we analysed plant attributes linked to dispersal, establishment, and persistence for the 85 most abundant species. A Detrended Correspondence Analysis of the species x plots matrix and the traits x plots matrix was used to describe differences in species composition and functional traits in relation to grazing. The latter matrix

was obtained by multiplying the traits x species matrix by the species x plots matrix. Grazed sites had a higher proportion of prostrate species, medium specific Leaf area, early flowering, cryptophytes, unassisted seeds and clonal reproduction. Ungrazed sites had a higher proportion of taller plants, heavy Leaf dry weight, Late flowering species and chamaephytes as well. as species with heavy seeds and fruits with adhesive structures. (c) 2005 Elsevier. All rights reserved.

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865. Effect of grazing and abandoned cultivation on a Stipa-Bouteloua community.

Dormaar, J. F.; Adams, B. W.; and Willms, W. D.

Journal of Range Management 47(1): 28-32. (1994)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1994/471/6dorm.pdf>

Descriptors: Hesperostipa comata/ Bouteloua gracilis/ botanical composition/ rangelands/ range management/ soil properties/ soil organic matter/ abandoned land/ prairies/ Alberta

Abstract: A Stipa-bouteloua community, cultivated in the autumn of 1928 and abandoned in the spring of 1932, reverted to a community dominated by needle-and-thread (*Stipa comata* Trin. and Rupr.). An enclosure to prevent grazing was constructed in 1978 to include equal portions of previously cultivated and adjacent native range, while the remainder of the area continued to be subjected to moderate to heavy grazing pressure. This permitted a study to determine the effects of the brief period of cultivation on forage production, species recovery, and soil physical and chemical characteristics compared to those of native prairie. After 14 years of protection from grazing, needle-and-thread accounted for 79% of foliar cover of the abandoned cultivation and 18% of the untreated range while blue grama [*Bouteloua gracilis* (HBK.) Lag. ex Steud] occupied 1 and 51% on the same treatments, respectively. After 60 years, the soil on the abandoned cultivated area showed reduced carbon, total nitrogen, available phosphorus, and hydraulic conductivity but increased N03-N. Grazing reduced hydraulic conductivity, NH4-N, available mineralizable nitrogen (chemical index), available phosphorus, and total carbohydrates but increased carbon, total nitrogen, and N03-N. Cultivation and grazing resulted in reduced root mass. To facilitate a rapid transition from blue gramb to needle-and-thread stable communities, input of energy, such as cultivation, may well be required. This citation is from AGRICOLA.

866. The effect of grazing management on the botanical composition of annual pastures grazed by cattle.

Greathead, K. D.

Proceedings of the Australian Society of Animal Production 18: 220-223. (1990)

NAL Call #: 49.9 AU72; ISSN: 0728-5965

Descriptors: cattle/ grazing/ range management/ botanical composition

This citation is from AGRICOLA.

867. Effect of grazing on plant attributes and hydrological properties in the sloping lands of the East African Highlands.

Taddese, Girma; Mohamed Saleem, M. A.; Astatke, Abyie; and Wagnew, Ayaleneh

Environmental Management 30(3): 406-417. (2002)

NAL Call #: HC79.E5E5; ISSN: 0364-152X

Descriptors: biomass/ cattle dung/ erosion/ grazing/ hydrology/ infiltration/ sloping land/ species richness

Abstract: Extending livestock grazing to the steep slopes has led to unstable grazing systems in the East African Highlands, and new solutions and approaches are needed to ameliorate the current situation. This work was aimed at studying the effect of livestock grazing on plant attributes and hydrological properties. The study was conducted from 1996 to 2000 at the International Livestock Research Institute at Debre Ziet Research Station. Two sites were selected: one at 0-4% slope, and the other at 4-8% slope. The treatments were: (1) no grazing (control); (2) light grazing, 0.6 animal unit months per hectare (aum/ha); (3) moderate grazing, 1.8 aum/ha; (4) heavy grazing, 3.0 aum/ha; (5) very heavy grazing, 4.2 aum/ha; (6) initially plowed and continuously very heavily grazed, 4.2 aum/ha. The result showed that species richness, infiltration rate, bare ground, and soil loss significantly varied with grazing pressure. Species richness was higher in grazed plots compared to nongrazed plots. Biomass yield improved on heavily grazed plots as cow dung accumulated over years. *Cynodon dactylon* plant species persisted with livestock grazing pressure in both sites. Infiltration rate improved and soil erosion declined in all treatments after the first year.

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868. Effect of grazing on soil and plant covers in North Kazakhstan desert.

Asanov, K. A.; Alimaev, I. I.; and Smailov, K.

Problems of Desert Development(2): 5-10. (1992)

NAL Call #: QK938.D4P73; ISSN: 0278-4750

Descriptors: soil water content/ vegetation types/ grazing/ rangelands/ animal husbandry/ soil physics/ soil chemistry/ soil properties/ grasslands/ arid grasslands/ overgrazing/ grazing systems/ rotational grazing

Abstract: In rangelands of the North Kazakhstan desert, unregulated use of land has had an adverse effect on both plant cover and soil fertility. The hydro-physical properties of the soil have worsened. Humus content in topsoil layers has declined to 40% of its initial level. Rotated controlled pasturing exhibits no negative impact on the soil. Moreover, use of grazing lands at 65% of their full capacity favours grass stand self-regeneration and enrichment with ephemeral and perennial plants.

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869. The effect of grazing on the abundance of wild wheat barley and oat in Israel.

Noy Meir, I.

Biological Conservation 51(4): 299-310. (1990)

NAL Call #: S900.B5; ISSN: 0006-3207

Descriptors: Triticum dicoccoides/ Hordeum spontaneum/ Avena sterilis/ cattle/ grasslands/ perennial grass cover

Abstract: Differences in percentage cover of wild cereal species between the two sides of fences with different intensities of cattle grazing were recorded at 14 sites in mediterranean grasslands in northern Israel where these species are native. The cover of the tall wild cereal grasses (*Triticum dicoccoides*, *Hordeum spontaneum*, *Avena serilis*), individually and combined, was in most sites significantly and substantially higher on the protected or more lightly grazed side of the fence, and showed a strong negative correlation with grazing intensity. It was also negatively correlated with perennial grass cover. The

results support the hypothesis that the distribution of the wild progenitors of cereals in the Middle East has been restricted by millenia of heavy livestock grazing to refuge habitats, and suggests that an important mechanism has been the relative vulnerability of these grasses to close grazing in the growing season. It is suggested that considerable variation in attributes affecting tolerance of grazing or clipping may be found among present wild populations. In any in situ conservation programmes the effects of grazing management on both abundance and genetic diversity of the populations will have to be considered.

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870. The effect of grazing on the structure of a high plateau grassland in central Argentina.

Pucheta, E.; Diaz, S.; and Cabido, M.

Coenoses 7(3): 145-152. (1992); ISSN: 0393-9154

Descriptors: enclosure/ floristics/ morphological change

Abstract: Floristic and morphological changes produced by grazing were studied in a high plateau grassland. Two types of disturbance were compared: an enclosed site without grazing during the last twelve years, and a site grazed by cattle and sheep. The effect of grazing on floristic composition and community architecture was analyzed. Grazing produced changes in species frequency, but not an invasion of exotic species. Five groups of species with differing morphology were identified. These morphological groups were represented in a markedly different way in the two grazing types. Grazing caused the occurrence of morphological groups comprised of grazing tolerants, whereas, within the enclosure, groups of species that evade grazing predominated.

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871. The effect of long-term exclusion of large herbivores on vegetation in Murchison Falls National Park, Uganda.

Smart, N. O. E.; Hatton, J. C.; and Spence, D. H. N.

Biological Conservation 33(3): 229-245. (1985)

NAL Call #: S900.B5; ISSN: 0006-3207

Descriptors: Acacia sieberiana/ herbivores/ national parks/ natural regeneration/ plant ecology/ vegetation/ grazing/ Uganda

This citation is from AGRICOLA.

872. Effect of manure on grazing lands in Ethiopia, East African highlands.

Tadesse, Girma; Peden, Don; Abiye, Astatke; and Wagnew, Ayaleneh

Mountain Research and Development 23(2): 156-160. (2003)

NAL Call #: GB500.M68; ISSN: 0276-4741

Descriptors: international livestock research institute/ afro-montane grasslands: habitat/ biomass productivity/ botanical composition/ grazing lands/ grazing pressure/ highlands/ manure/ soil physical properties/ species richness/ water infiltration rates

Abstract: Biomass productivity, botanical composition, and soil physical properties were studied under conditions with and without application of manure. The study was conducted at the Debre Zeit station of the International Livestock Research Institute, located 5 km from Addis Ababa in the Ethiopian highlands. The aim of the study was to assess the effect of manure on botanical composition,

plant biomass, and water infiltration rates. There were 3 treatments: no grazing, moderate grazing (MDG=1.8 animal unit months (AUM)/hectare), and, heavy grazing (HVG=4.2 AUM/hectare), each replicated 4 times. Removing cow dung from grazed plots decreased biomass production. Species richness was higher on manured plots than on nonmanured plots. The water infiltration rate was low on grazed and nongrazed plots with no manure when compared with the manured plots.

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873. The effect of prairie management practices on mycorrhizal symbiosis.

Bentivenga, S. P. and Hetrick, B. A. D.

Mycologia 84(4): 522-527. (1992)

NAL Call #: 450 M99; ISSN: 0027-5514

Descriptors: Glomus ambisporum/ vesicular arbuscular mycorrhizae/ tallgrass prairie/ burning/ mowing/ grazing/ fertilization/ nitrogen/ phosphorus/ root colonization

Abstract: The effects of tallgrass prairie management practices, burning, mowing (simulated grazing), and fertilization, on mycorrhizal symbiosis were studied in a field experiment established in 1986. In 1987 and 1989, there were no significant effects of these management practices on mycorrhizal fungus species composition. While 14 and 11 species were observed in 1987 and 1989, respectively, the dominant species in both samplings was *Glomus ambisporum*. Spore numbers were generally not affected by these management practices. However, in 1987 there were significant effects on spore number due to nitrogen addition and a burn .times. mow interaction, but these were not apparent in 1989. In 1989 there was a significant burn .times. nitrogen interaction, with nitrogen fertilization of unburned plots significantly increasing the number of mycorrhizal fungal spores. In winter months total % root colonization, active % root colonization and inoculum potential were low whether or not plants were fertilized. In contrast, in late spring and early summer when plants were actively growing, fertilization reduced total % root colonization, active % root colonization, and inoculum potential in soil. However, nitrogen fertilization was not as inhibitory to the symbiosis as phosphorus fertilization or phosphorus + nitrogen fertilization. The negative effects of nitrogen fertilization on mycorrhizae are probably offset by the pronounced benefit of nitrogen fertilization to plant biomass production.

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874. Effect of season and regrazing on diet quality of burned Florida range.

Long, K. R.; Kalmbacher, R. S.; and Martin, F. G.

Journal of Range Management 39(6): 518-521. (1986)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1986/396/10long.pdf>

Descriptors: cattle/ grazing/ forage/ seasonal variation/ nutritive value/ digestibility/ crude protein/ range management/ prescribed burning/ Florida

This citation is from AGRICOLA.

875. The effect of severe drought and management after drought on the mortality and recovery of semi-arid grassveld.

Danckwerts, J. E. and Stuart Hill, G. C.

Journal of the Grassland Society of Southern Africa 5(4): 218-222. (1988)

NAL Call #: SB197.J68; ISSN: 0256-6702

Descriptors: increaser decreaser species/ grazing capacity/ Eastern Cape, South Africa

Abstract: The False Thornveld of the Eastern Cape [South Africa] experienced a particularly intense drought. After the drought, recovery was particularly sensitive to the post-drought management treatment applied. Veld that was grazed immediately after the drought recovered far more slowly than veld that was rested. This effect was still evident three years later, illustrating the considerable importance of resting semi-arid grassveld after a drought. Increaser I grass species present were apparently more capable of surviving drought than the Decreaser species, which in turn were more stable than the Increaser II species. Their ability to recover after the drought followed an opposite trend. On this basis, the desirability of Decreaser dominated veld, in situations that are likely to be poorly managed, is questioned.

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876. Effect of stocking rate and rainfall on rangeland dynamics and cattle performance in a semi-arid savanna, South Africa.

Fynn, R. W. S. and O'Connor, T. G.

Journal of Applied Ecology 37(3): 491-507. (2000)

NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: botanical composition/ cattle performance/ grazing effects/ habitat degradation/ herbaceous production/ live weight gain/ non equilibrium behavior/ plant livestock relations/ primary production/ rainfall/ rangeland dynamics/ rotational grazing system/ semi arid savanna/ state and transition model/ stocking rate/ temporal variations

Abstract: 1. In order to examine the emerging paradigm of non-equilibrium behaviour of plant-livestock relations in semi-arid rangeland, the effect of stocking rate, rainfall and their interaction on changes in botanical composition, primary production and live weight gain per animal and per hectare, was studied in a semi-arid African savanna. The objective was to evaluate the relative influence of rainfall and grazing on animal and vegetation dynamics in a temporally varying environment. 2. Two adjacent trials, with different starting conditions of rangeland (good vs. poor) and each of three stocking rates replicated twice, were established in 1986 and maintained for 10 years. A simple rotational grazing system using Brahman weaners was employed. 3. Although changes in botanical composition were strongly influenced by rainfall variability, with a dramatic compositional shift induced by the 1991-92 drought, stocking rate had an additional effect over time in the paddocks on sloping land, particularly on the site which started in good condition. High rainfall and light grazing promoted tufted perennial grasses (*Themeda triandra*, *Digitaria argyrograpt*, *Cymbopogon excavatus*, *Sporobolus ioclados*); heavy grazing and low rainfall promoted some annuals and weakly tufted perennial grasses (*Urochloa mosambicensis*, *Sporobolus nitens*); while other annuals (*Aristida adscensionis*, *Enneapogon cenchroides*) were favoured by heavy grazing and high

rainfall. Patterns of compositional change supported a state-and-transition model. 4. Rainfall had the most marked effect on variability in herbaceous production. Long-term heavy grazing on sloping land resulted in a decline in herbaceous production in both trials. The depletion of herbaceous biomass in a paddock when grazed heavily was more pronounced if botanical composition had changed as a result of drought and grazing. 5. Long-term heavy grazing did not reduce cattle performance (gain animal⁻¹ and gain ha⁻¹). However, during drought cattle performance was worse at high stocking rates on poor condition rangeland than on good condition rangeland. Rainfall was a better predictor of cattle performance than herbaceous biomass and accounted for far more of the variance in gain per animal than did stocking rate. Cattle performance had a curvilinear relationship with rainfall, indicating that a rainfall year of 680 mm is optimal for cattle production in this region. 6. The notion that semi-arid African savannas are non-equilibrium systems in which rainfall overrides grazing was contradicted. Stocking rate determined the requirement of supplementary feeding and influenced gain ha⁻¹ on poor condition rangeland during drought years. In addition, herbaceous productivity was linked to herbaceous composition, which was linked to stocking rate. 7. Key implications for management are (i) the inequality of different parts of the landscape in supporting livestock and in their sensitivity to grazing, slopes being more easily degraded than bottomland; and (ii) the pronounced changes that grazing can induce in semi-arid savanna during and subsequent to drought years. Opportunistic management is a prerequisite for sustained utilization of semi-arid African savanna.

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877. Effect of vertebrate grazing on plant and insect community structure.

Rambo, J. L. and Faeth, S. H.

Conservation Biology 13(5): 1047-1054. (1999)

NAL Call #: QH75.A1C5; ISSN: 0888-8892

Abstract: We compared species diversity of plants and insects among grazed and ungrazed areas of Ponderosa pine-grassland communities in Arizona. Plant species richness was higher in two of three grassland communities that were grazed by native elk and deer and domestic cattle than in ungrazed areas inside a series of three large (approximately 40-ha) grazing exclosures. Similarly, plant species richness was higher in grazed areas relative to ungrazed areas at one of two series of smaller (approximately 25-m²) and short-term exclosure sites. Evenness of plant distribution, however, was greater inside ungrazed long-term exclosures but was reduced inside ungrazed short-term exclosures relative to grazed areas. Relative abundances of forbs, grasses, trees, and shrubs, and native and introduced plants did not differ between the long- and short-term grazing exclosures and their grazed counterparts. Relative abundances of some plant species changed when grazers were excluded, however. In contrast, insect species richness was not different between grazed and ungrazed habitats, although insect abundance increased 4- to 10-fold in ungrazed vegetation. Our results suggest that vertebrate grazing may increase plant richness, even in nutrient-poor, semi-arid grasslands, but may decrease insect abundances.

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878. Effects of 20 years of grazing exclusion in an area of the Queen Elizabeth National Park, Uganda.

Lenzi Grillini, Carlo R.; Viskanac, Paolo; and Mapesa, Moses

African Journal of Ecology 34(4): 333-341. (1996)

NAL Call #: 409.6 Ea7; ISSN: 0141-6707

Descriptors: biodiversity/ grazing exclusion/ monitoring/ Queen Elizabeth National Park/ terrestrial ecology

Abstract: The floristic and structural changes resulting from the long-term exclusion of large herbivores from an experimental area set up in 1971 have been analysed, comparing it to two plots in the surrounding grazed and trampled area. The vegetation of the area is grassland with thicket clumps, with *Sporobolus pyramidalis* P. Beauv. dominating the grassland and *Capparis tomentosa* Lam. dominating the thicket layer. The survey showed that long-term exclusion of herbivores results in: (i) higher density and cover in the grass and thicket layer, (ii) lower biodiversity in the grass layer and in the isolated shrubs, (iii) higher root biomass, probably due to the absence of trampling. Despite the difference in area, no difference was noted between the biodiversity of the thicket clumps of the ungrazed area and the grazed and trampled plots.

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879. Effects of bison grazing, fire, and topography on floristic diversity in tallgrass prairie.

Hartnett, D. C.; Hickman, K. R.; and Walter, L. E.

Journal of Range Management 49(5): 413-420. (1996)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/1996/495/413-420_hartnett.pdf

Descriptors: prairies/ plant communities/ biodiversity/ botanical composition/ bison/ grazing/ topography/ frequency/ fires/ Kansas

Abstract: Grazed and ungrazed sites subjected to different fire frequencies were sampled on the Konza Prairie Research Natural Area in northeast Kansas after 4 years of bison grazing (1987-1991). The objective was to study effects of bison grazing on plant species composition and diversity components (plant species richness, equitability, and spatial heterogeneity) in sites of contrasting fire frequency. Cover and frequency of cool-season graminoids (e.g. *Poa pratensis* L., *Agropyron smithii* Rydb., *Carex* spp.) and some forbes (e.g. *Aster ericoides* [A. Gray] Howell, and *Oxalis stricta* L.) were consistently higher in sites grazed by bison than in ungrazed exclosures, whereas the dominant warm-season grasses (*Andropogon gerardii* Vitman, *Sorghastrum nutans* [L.] Nash, *Panicum virgatum* L., *Schizachyrium scoparium* [Michx.] Nash) and other forbs (e.g. *Solidago missouriensis* Nutt.) decreased in response to bison. Plant species diversity (H') and spatial heterogeneity in all areas sampled were significantly increased by bison. Increased heterogeneity and mean species richness in grazed prairie (40 species per sample site) compared to ungrazed prairie (29 species per site) were likely a result of greater microsite diversity generated by bison, whereas preferential grazing of the dominant grasses and concomitant increases in subordinate species resulted in an increase in equitability of species abundances. Species/area relationships indicated greater effects of bison on plant species richness with increasing sample area. Increases in plant diversity components associated with bison grazing were generally greater in annually burned than in 4-year burned sites. Effects of

ungulate grazers on floristic diversity have important implications given recent evidence that plant species diversity and the compositional and production stability of grassland plant communities are positively related. This citation is from AGRICOLA.

880. Effects of burning and grazing on a coastal California grassland.

Hatch, Daphne A.; Bartolome, James W.; Fehmi, Jeffrey S.; and Hillyard, Deborah S.

Restoration Ecology 7(4): 376-381. (1999)

NAL Call #: QH541.15.R45R515; ISSN: 1061-2971

Descriptors: coastal grassland/ fall burning/ foliar cover/ grazing exclusion/ management strategies/ rainfall patterns/ slope position/ species composition

Abstract: We tested the effects of fall burning and protection from livestock grazing as management to enhance native grasses on a coastal grassland in central California. Plants from the Mediterranean, introduced beginning in the late 1700s, have invaded and now dominate most of California's grasslands. Coastal grasslands are generally less degraded than those inland and have higher potential for restoration and conservation. Productivity of the experimental plots varied annually and declined over the course of the study because of rainfall patterns. Foliar cover of the native *Danthonia californica* (California oatgrass) increased more under grazing than grazing exclusion and did not respond to burning. Two other natives, *Nassella pulchra* (purple needlegrass) and *Nassella lepida* (foothill needlegrass), responded variably to treatments. The response of *N. pulchra* differed from that reported on more inland sites in California. Restoring these grasslands is complicated by differing responses of target species to protection from grazing and burning. The current practice of managing to enhance single species of native plants (e.g., *N. pulchra*) may be detrimental to other equally important native species.

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881. Effects of cattle grazing on blue oak seedling damage and survival.

Hall, L. M.; George, M. R.; McCreary, D. D.; and Adams, T. E.

Journal of Range Management 45(5): 503-506. (1992)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1992/455/17hall.pdf>

Descriptors: *Quercus douglasii*/ seedlings/ cattle/ stocking rate/ grazing intensity/ seasonal variation/ winter/ spring/ summer/ crop damage/ range management/ woodlands/ grazing/ California

Abstract: Cattle grazing has been suggested as a principal cause for poor oak recruitment in California's hardwood rangelands. This study evaluated the effects of stock density and season of grazing on blue oak (*Quercus douglasii* H. & A.) establishment. In December 1989, seven hundred and twenty blue oak seedlings were planted on 3-m centers in 30 plots in 3 annual grassland pastures at the Sierra Foothill Research and Extension Center east of Marysville, Calif. The treatments consisted of 3 seasons X 3 stock densities plus 1 nongrazed control. During January, April, and July of 1990, steers and heifers (mean = 318 kg) were allowed to graze 1 plot per week at low, medium, and high stock densities (2.5, 7.5, and 15.0 head/ha, respectively). Control plots were used to monitor wildlife browsing. One half of all seedling sites received an

application of glyphosate prior to transplanting to eliminate grass competition. Browsing and trampling damage were estimated at the end of each treatment. Total damage (sum of browsing and trampling damage), browsing damage, trampling damage, and survival to April 1991 were significantly different for the 9 season and stock density treatments ($p < 0.05$). Spring and summer grazing tended to be most damaging and resulted in the lowest survival rates. Within each season total damage increased with stock density but survival did not change significantly. Weed control around oak seedlings had no apparent effect on total damage or survival. There were significant differences in browsing damage between seasons but not between control and grazed plots within seasons ($p < 0.05$). Survival in ungrazed plots was not significantly different ($p < 0.05$) from the spring and summer grazed plots. Consequently, the contribution of wildlife to reduced blue oak seedling survival in grazed oak woodlands should not be underestimated.

This citation is from AGRICOLA.

882. Effects of cattle grazing on diversity in ephemeral wetlands.

Marty, Jaymee T.

Conservation Biology 19(5): 1626-1632. (2005)

NAL Call #: QH75.A1C5; ISSN: 0888-8892

Descriptors: species diversity/ grazing/ feeding behaviour/ introduced species/ ranching/ endemic species/ wetlands/ life cycle/ nature conservation/ biodiversity/ rare species/ environmental impact/ aquatic plants/ species richness/ conservation/ USA, California, Central Valley/ USA, California

Abstract: Cattle are usually thought of as a threat to biodiversity. In regions threatened by exotic species invasion and lacking native wild grazers, however, cattle may produce the type of disturbance that helps maintain diverse communities. Across 72 vernal pools, I examined the effect of different grazing treatments (ungrazed, continuously grazed, wet-season grazed and dry-season grazed) on vernal-pool plant and aquatic faunal diversity in the Central Valley of California. After 3 years of treatment, ungrazed pools had 88% higher cover of exotic annual grasses and 47% lower relative cover of native species than pools grazed at historical levels (continuously grazed). Species richness of native plants declined by 25% and aquatic invertebrate richness was 28% lower in the ungrazed compared with the continuously grazed treatments. Release from grazing reduced pool inundation period by 50 to 80%, making it difficult for some vernal-pool endemic species to complete their life cycle. My results show that one should not assume livestock and ranching operations are necessarily damaging to native communities. In my central California study site, grazing helped maintain native plant and aquatic diversity in vernal pools.

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883. Effects of cattle grazing on early postfire regeneration of matorral in northwest Patagonia, Argentina.

Raffaele, Estela and Veblen, Thomas T.

Natural Areas Journal 21(3): 243-249. (2001)

NAL Call #: QH76.N37; ISSN: 0885-8608

Descriptors: Nahuel Huapi National Park/ cattle grazing/ early postfire regeneration/ facilitative ecosystem

interactions/ matorral [shrubland]/ native plant biodiversity/ species richness

Abstract: In the National Reserve sector of Nahuel Huapi National Park, southwestern Argentina, livestock are potential threats to native plant biodiversity and may prevent postfire recovery of shrublands. Effects of cattle grazing were examined in a recently burned shrubland (matorral) by installing livestock enclosures and permanent plots and remeasuring vegetation over a 3-year period. Percentage cover of all vascular plant species, and maximum heights of all shrub species, were recorded in ten 25-mX25-m plots from late summer of 1995 to 1997. Five of the plots were fenced and five were left accessible to low-intensity browsing and grazing by cattle. A substantial decline in total species richness, especially shrub species, was attributed to grazing. Under this relatively low level of cattle grazing pressure, frequency and cover of common shrubs and trees were significantly reduced. In contrast, height growth of shrubs and trees was not significantly affected. Facilitative interactions (e.g., nurse effects of shrubs on the vegetative reproduction of other plants) are important in these shrublands. Consequently, an initially slight reduction in abundance of key shrub species creates the potential for more severe long-term reductions in biodiversity.

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884. Effects of cattle grazing on mountain meadows in Idaho.

Leege, T. A.; Herman, D. J.; and Zamora, B.

Journal of Range Management 34(4): 324-328. (1981)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1981/344/16leeg.pdf>

Descriptors: Idaho

This citation is from AGRICOLA.

885. Effects of cattle grazing on North American arid ecosystems: A quantitative review.

Jones, Allison

Western North American Naturalist 60(2): 155-164. (2000)

NAL Call #: QH1 .G7; ISSN: 1527-0904

Descriptors: meta analysis: analytical method/ arid ecosystems/ cattle grazing/ ecosystem integrity/ environmental impact/ litter biomass/ rangeland conservation/ soil bulk density/ species diversity/ species richness/ vegetative cover/ xeric environment

Abstract: A quantitative review was conducted of the effects of cattle grazing in and systems on 16 response variables ranging from soil bulk density to total vegetative cover to rodent species diversity. Various studies from North American arid environments that used similar measures for assessing grazing effects on the same response variables were used for the review; each study was assigned to serve as a single data point in paired comparisons of grazed versus ungrazed sites. All analyses tested the 1-tailed null hypothesis that grazing has no effect on the measured variable. Eleven of 16 analyses (69%) revealed significant detrimental effects of cattle grazing, suggesting that cattle can have a negative impact on North American xeric ecosystems. Soil-related variables were most negatively impacted by grazing (3 of 4 categories tested were significantly impacted), followed by litter cover and biomass (2 of 2 categories tested), and rodent diversity and richness (2 of 2 categories tested). Vegetative variables showed more variability in terms of quantifiable

grazing effects, with 4 of 8 categories testing significantly. Overall, these findings could shed light on which suites of variables may be effectively used by land managers to measure ecosystem integrity and rangeland health in grazed systems.

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886. The effects of cattle grazing on tall-herb fen vegetation and molluscs.

Ausden, M.; Hall, M.; Pearson, P.; and Strudwick, T. *Biological Conservation* 122(2): 317-326. (2005)
 NAL Call #: S900.B5; ISSN: 0006-3207
 Descriptors: grazing/ vegetation patterns/ wetlands/ species richness/ marshes/ aquatic plants/ light effects/ abiotic factors/ population density/ environmental impact/ ecosystem disturbance/ interspecific relationships/ seasonal variations/ species diversity/ Phragmites australis/ Glyceria maxima/ Vertigo moulinsiana/ Carex/ Phragmites
 Abstract: The effects of light year-round cattle grazing on tall-herb fen vegetation and wetland molluscs were compared to the effects of non-intervention over a period of four years using grazing exclosures. The distribution of cattle within the area of fen was investigated by plotting the position of the herd at 3-4 day intervals throughout the year. Cattle distributed themselves randomly throughout the fen in spring, autumn and winter, but showed a more aggregated distribution in summer. Grazing reduced the biomass of Phragmites australis and increased stem densities of Glyceria maxima, resulting in a shift of dominance from Phragmites to Glyceria. Plant species-richness was also significantly higher in areas open to grazing. Grazing decreased total densities of molluscs and substantially reduced densities of the rare snail Vertigo moulinsiana. V. moulinsiana was particularly associated with areas of fen that had a high water table and high biomass of ungrazed Carex riparia. However, because of the patchy nature of the grazing, V. moulinsiana survived at reasonably high densities in patches of ungrazed vegetation within the grazing unit.

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887. Effects of cattle grazing systems on willow-dominated plant associations in central Oregon.

Kovalchik, B. L. and Elmore, W.
 In: Proceedings: Symposium on Ecology and Management of Riparian Shrub Communities. (Held 29 May 1991-31 May 1991 at Sun Valley, Idaho.) Clary, Warren P.; McArthur, E. Durant; Bedunah, Don; and Wambolt, Carl L. (eds.); Vol. 289.
 Ogden, Utah: US Department of Agriculture, Forest Service, Intermountain Research Station; pp. 111-119; 1992.
 NAL Call #: aSD11.A48
 Descriptors: plant communities/ Salix/ grazing/ cattle/ environmental impact/ browsing/ range management/ riparian buffers/ Oregon
 This citation is from AGRICOLA.

888. Effects of controlled grazing on a degraded dwarf shrub, annual grass semidesert, vegetation type of northwestern Kenya.

Oba, G.
Land Degradation & Rehabilitation 3(4): 199-213. (1992)
 NAL Call #: S622.L26; ISSN: 0898-5812
 Descriptors: range management/ Indigofera/ shrubs/

rangelands/ semiarid zones/ species diversity/ land management/ degradation/ canopy/ botanical composition/ volume/ plant density/ grazing/ plant litter/ Kenya
 This citation is from AGRICOLA.

889. The effects of controlled grazing on phytomass dynamics of the dwarf shrub Indigofera spinosa in arid Kenya.

Oba, Gufu
Acta Oecologica 16(1): 31-54. (1995)
 NAL Call #: QH540.A27; ISSN: 1146-609X
 Descriptors: herbivory/ management/ pastoralism/ production/ standing crop
 Abstract: Conventional range rehabilitation methods use controlled grazing, followed by assessments of either species composition, cover or phytomass dynamics. We compared effects of controlled and free grazing on the dynamics of live (current year's and preceding years' crops), standing dead and litter fraction of the dwarf shrub Indigofera spinosa (Forsk.) Matthew between 1986 and 1990, on arid range of North-West Kenya. Except for standing dead fraction and litter mass, live phytomass fractions varied significantly between growth and dormancy months in the two treatments. Generally, phytomass fractions exhibited disappearance in grazed plots, while it was accumulated in control plots. The control, however, achieved greater phytomass turnover (50.1 +/- 15.8% Yr-1) than grazed plots (34.4 +/- 6.0% Yr-1). The results showed that browsing when combined with declining rainfall, increased depreciation of forage yield, while above-average rainfall enhanced greater phytomass production. Given the rapid recovery potential by the shrub, declining trends of live fractions in grazed plots were unlikely to be permanent but fluctuate between periods of favourable rainfall and drought. The relationship between total monthly rainfall, cumulative rainfall of the current and the preceding months and the current year's crop, respectively, was explained by correlation coefficient (r) of 0.23-0.30 in control plots and 0.43-0.65 in grazed plots (p lt 0.05). Daily green dry matter productivity and rainfall use efficiency (RUE) of I. spinosa improved when rain storm events were closely sequenced and spread over growth months. On this arid range, dwarf shrub litter production showed constancy, while standing dead fraction increased by about 900% in control plots and declined by 40% in grazed. Accumulation of standing dead phytomass fraction in control plots portrayed a deteriorating forage condition. Given that I. spinosa is highly adapted to herbivory, deferral of over-browsed shrubs should be limited to no more than 1-2 growth seasons. The paper discusses management implications of the findings.
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890. The effects of controlled sheep grazing on the dynamics of upland Agrostis-Festuca grassland.

Hulme, P. D.; Pakeman, R. J.; Torvell, L.; Fisher, J. M.; and Gordon, I. J.
Journal of Applied Ecology 36(6): 886-900. (1999)
 NAL Call #: 410 J828; ISSN: 0021-8901
 Descriptors: agrostis festuca grassland: acid grassland, habitat/ controlled grazing/ initial composition/ plant community/ species composition/ sustainable dynamics/ sward height
 Abstract: 1. Agrostis capillaris-Festuca ovina-dominated communities are widespread in the uplands of Great Britain. They are agriculturally productive but little is known

about how to manage this community for specific goals. Vegetation trajectories were examined in this plant community under different sheep grazing management regimes at two sites in Scotland. One site had a substantial presence of moorland species, the other was characterized by a more productive vegetation. Management consisted of maintaining sward heights of 3, 4.5 or 6 cm during the growing season, or complete exclusion of grazing stock. 2. Changes in species composition were small over the 7 years of the experiment. Few species invaded or were lost during the course of the study. The observed changes were largely as a result of shifts in abundance of the dominant species. 3. Maintenance of sward height at low levels (3 or 4.5 cm.) during the growing season resulted in the spread of *Nardus stricta* where present. Where *N. stricta* was absent, the sward developed a higher content of mosses, specifically *Hypnum jutlandicum* and *Rhytidiadelphus squarrosus*. 4. Removal of grazing resulted in an increase of cover of grazing-intolerant species, such as *Deschampsia flexuosa* and *Molinia caerulea*, and in the cover of dwarf shrub species where present. 5. The two sites differed in the treatment that resulted in the smallest change in species composition. At the more productive site, maintenance of the sward at 4.5 cm resulted in the smallest overall change in species composition. At the less productive site, grazing the sward to 6 cm resulted in the smallest shift in vegetation composition. Grazing at this height appeared to prevent the spread of both *M. caerulea* and *N. stricta*. 6. The study demonstrates that sustainable grazing regimes for upland *Agrostis-Festuca* grasslands need to take into account both the initial composition of the vegetation, specifically the presence of species capable of replacing *A. capillaris* and *F. ovina* and of achieving dominance, and the overall productivity of the site.
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891. Effects of cutting and grazing on Andean treeline vegetation.

Kok, Kasper; Vewelij, Pita A.; and Beukema, Hendrien
In: Biodiversity and conservation of neotropical montane forests/ Churchill, Steven P.
New York: New York Botanical Garden, 1995; pp. 527-539.
Notes: Meeting Information: Symposium, New York, New York, USA; June 21-26, 1993; ISBN 0893274003
NAL Call #: QK241.B56 1995
Descriptors: book chapter/ central colombian cordillera/ conservation/ disappearing species/ meeting paper/ regenerating forest/ treeline lowering
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892. The effects of different rotational grazing intensities on the soil, grassland and sheep productions in the northern Tianshan in China.

Li, Jianlong
Archivos de Zootecnia 46(176): 301-310. (1997)
NAL Call #: 49 AR22; *ISSN:* 0004-0592
Descriptors: botanical composition/ carrying capacity/ grassland herbage yield/ grazing intensity/ rotational grazing/ soil compaction/ spring autumn pasture/ wool production
Abstract: The study on the different grazing intensity experiments was conducted on Ziniqan ranch, Shihezi city in Xinjiang province (China) in spring-autumn seasons from 1986 to 1990. The results showed that the soil compaction (0-30 cm), herbage yields, grazing rates, regrowth herbage

yields and sheep productions were affected significantly by the different grazing intensities ($p < 0.05$). From eight side comparisons in this paper, it was considered that the moderate grazing (herbage utilizing rate=50 percent) was the best and the adaptive grazing intensity in 4 treatments, resulted from increasing grassland herbage yields (60 percent higher than overgrazing) and improving grassland botanical composition (3 grass better yields/gross grass yields) in 26.3 percent, and conducted to raising sheep weights (119.5 g/day sheep) and wool productions (5.4 kg/sheep). In the experimental conditions, the carrying capacity (6 sheep/ha) of rotational grazing in 4 regions and 2 seasons was twice that of grazing uncontrolled on large area pasture or that observed in normal grazing conditions (3 sheep/ha).
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893. Effects of differential livestock use on key plant species and rodent populations within selected *Oryzopsis hymenoides*/*Hilaria jamesii* communities of Glen Canyon National Recreation Area.

Bich, Brian S.; Butler, Jack L.; and Schmidt, Cheryl A.
Southwestern Naturalist 40(3): 281-287. (1995)
NAL Call #: 409.6 SO8; *ISSN:* 0038-4909
Descriptors: grazing
Abstract: Four sites that varied with respect to grazing history were studied during 1990 and 1991 on an isolated 8,000 ha peninsula in Glen Canyon National Recreation Area. Density and basal area of *Oryzopsis hymenoides* decreased with increasing grazing intensity while density and foliar cover of *Gutierrezia sarothrae* increased on grazed sites. *Perognathus longimembris* was the most abundant rodent species trapped on all sampled sites and demonstrated a 50% decrease in abundance at the heavily grazed site compared to the nongrazed site. *Peromyscus maniculatus* was the second most abundant rodent species recorded and increased with increasing grazing intensity.
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894. Effects of elevation, slope position and livestock exclusion on microfungi isolated from soils of Mediterranean grasslands.

Maggi, O.; Persiani, A. M.; Casado, M. A.; and Pineda, F. D.
Mycologia 97(5): 984-995. (2005)
NAL Call #: 450 M99; *ISSN:* 0027-5514
Descriptors: elevation/ fungal communities/ herbivory/ soil fungi/ Spain
Abstract: The fungal communities of grassland soils in Spain from four sites at different elevations were studied. Each site contained grazed and fenced ungrazed plots. These plots were situated in two slope positions (upper and lower zones). The ungrazed plots, fenced off 6 y before the sampling, were part of a study of global change that simulates conditions of rural abandonment, which is widespread in Iberian countries, since Spain joined the European Union. We analyzed the structure of the soil fungi communities and its relationship with herbaceous vegetation. The distribution of 207 taxa of fungi revealed that the elevation was the main factor of fungal variability; the effect of grazing and slope position were associated with less variability. Although a halt in grazing resulted in the accumulation of standing plants and plant litter in these ecosystems, it had relatively little effect on soil microfungi

and appeared to be related mainly to growing conditions affected by that accumulation. © 2005 by The Mycological Society of America.

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895. The effects of elk and cattle foraging on the vegetation, birds, and small mammals of the Bridge Creek Wildlife Area, Oregon.

Moser, B. W. and Witmer, G. W.

International Biodeterioration and Biodegradation 45(3-4): 151-157. (2000)

NAL Call #: QH301.I54; ISSN: 0964-8305

Abstract: High densities of elk (*Cervus elaphus*), especially when combined with cattle (*Bos taurus*), may adversely affect local reforestation efforts and reduce forage availability. Few studies, however, have assessed the potential impacts of high densities of elk, combined with cattle, on biodiversity. We compared vegetation, bird, and small mammal diversity of three elk and cattle exclosures (ungrazed sites) to three grazed sites in the Blue Mountains of eastern Oregon. Shrub species richness was greater on ungrazed than grazed sites ($P = 0.04$). We found no differences in herbaceous vegetative cover, biomass, species richness, or diversity, bird abundance, species richness, or diversity between grazed and ungrazed sites. Small mammal abundance ($P \leq 0.01$), species richness ($P \leq 0.01$), and diversity ($P \leq 0.03$) were greater on ungrazed than grazed sites. In this study, foraging by elk and cattle appears to be reducing shrub and small mammal biodiversity. (C) 2000 Published by Elsevier Science Ltd. © 2006 Elsevier B.V. All rights reserved.

896. Effects of excluding grazing animals from grassland on sugar limestone in Teesdale, England.

Elkington, T. T.

Biological Conservation 20(1): 25-35. (1981)

NAL Call #: S900.B5; ISSN: 0006-3207

Descriptors: *Oryctolagus cuniculus*/ *Ovis aries*/ European rabbit/ domestic sheep/ vegetation/ food/ geobotany/ British Isles

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897. Effects of fire and grazing on an arid grassland ecosystem.

Valone, Thomas J.; Nordell, Shawn E.; and Ernest, S. K. Morgan

Southwestern Naturalist 47(4): 557-565. (2002)

NAL Call #: 409.6 SO8; ISSN: 0038-4909

Descriptors: animals and man/ disturbance by man/ commercial activities/ ecology/ community structure/ population dynamics/ habitat/ terrestrial habitat/ abiotic factors/ physical factors/ land and freshwater zones/ Nearctic Region/ North America/ USA/ Rodentia: farming and agriculture/ livestock grazing/ species diversity/ population size/ fire and livestock grazing effects/ grassland/ fire/ New Mexico/ Hidalgo County/ Animas Valley/ fire and livestock grazing effects on abundance and diversity/ arid grassland/ Rodentia/ Mammalia/ chordates/ mammals/ vertebrates

Abstract: We examined short-term responses of grasses, shrubs, and rodents on experimental plots to determine how manipulations of livestock grazing and prescribed fire affect individual species and community structure in a shrub-invaded arid grassland. Two grasses and *Gutierrezia sarothrae* were found in lower abundance on burned plots

in the growing season after plots burned; all *Prosopis glandulosa* survived the fire. Total rodent captures and the number of *Dipodomys spectabilis* did not differ among treatments. No significant interaction between burning and grazing was observed. Fire seems to have few short-term negative effects on species in this system.

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898. Effects of fire, grazing, and the presence of shrubs on Chihuahuan desert grasslands.

Drewa, Paul B. and Havstad, Kris M.

Journal of Arid Environments 48(4): 429-443. (2001)

NAL Call #: QH541.5.D4J6; ISSN: 0140-1963

Descriptors: Chihuahuan desert grasslands: habitat/ drought conditions/ grazing/ perennial forb cover/ perennial grass cover/ precipitation/ prescribed fires/ species diversity

Abstract: Responses of herbaceous and suffrutescent species to fire, grazing, and presence of *Prosopis glandulosa* were examined in a Chihuahuan desert grassland in south-central New Mexico. Treatments were assigned randomly to eight 12X8 m plots within each of two blocks. Following fires in June 1995, unfenced plots were exposed to livestock grazing over 4 years. Plots were established that either included or excluded *P. glandulosa*. Perennial grass cover, primarily *Bouteloua eriopoda*, decreased by 13% in burned plots but increased 5% in unburned areas. Conversely, perennial forb cover was 4% greater after fire. Perennial grass frequency decreased 30% more and perennial forb frequency increased 10% more following burning. Further, increases in evenness after fire resulted in a 225% increase in species diversity. Grazing also resulted in a decrease in perennial grass cover while frequency decreased 22% more in grazed than ungrazed plots. Only frequency and not cover of perennial forbs and annual grasses increased more following grazing. Presence of *P. glandulosa* had no differential effect on responses of non-shrub species. Fires were conducted during near drought conditions while grazing occurred during years of precipitation equivalent to the long-term average. Precipitation immediately following fire may be critical for recovery of *B. eriopoda*-dominated desert grasslands; relationships between fire and post-fire precipitation patterns require future investigation. © The Thomson Corporation

899. The effects of flooding and livestock on post-dispersal seed predation in river red gum habitats.

Meeson, N.; Robertson, A. I.; and Jansen, A.

Journal of Applied Ecology 39(2): 247-258. (2002)

NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: flood histories/ flooding/ floodplain habitat/ floodplain habitats/ forested floodplain/ grazing/ livestock/ livestock management histories/ livestock management regimes/ post dispersal seed predation/ recruitment/ river regulation/ seasonality/ seed predation/ seed removal/ water extraction/ winter seed predation

Abstract: 1. Rates of seed predation are influenced by conditions that alter seed supply and the activity of seed predators. In southern Australia the potential seed supply for the dominant floodplain tree species, the river red gum *Eucalyptus camaldulensis*, has been reduced through forest clearing to support grazing by introduced livestock. River regulation and water extraction have reduced the frequency of flooding and thus the conditions that promote seed germination on floodplains. To determine if poor

recruitment of river red gums could be caused by low seed supply, as a result of post-dispersal seed predation, we used field experiments and observations to investigate how post-dispersal predation on seeds of *E. camaldulensis* was affected by flooding, livestock management and their interaction. 2. Seed predation was measured before and after different flood treatments (0.5 m depth; short flood of 24 h, long flood of 30 days). Flooding of this kind (return frequency of once per year) did not have any significant effect on rates of seed removal by seed predators. 3. Rates of seed predation in floodplain habitats under widespread livestock management regimes changed seasonally. In all seasons seed predation was lowest at sites grazed by sheep. In winter seed predation was highest at ungrazed sites. In spring and summer seed predation was highest at sites grazed by cattle. Ant communities differed between forested and cleared habitats and seed-eating ant species were most abundant in cleared sites grazed by cattle. 4. Rates of seed predation in forested floodplain sites with different flood histories differed among sites with different livestock management histories. The impact of cattle exclusion on seed predation rates increased as the period since flooding increased. 5. Cattle grazing is widespread on the floodplains of rivers across the southern Murray-Darling Basin, and tree densities and hence seed supplies are low. In this situation small floods may not result in significant recruitment to river red gum populations because seed predation may reduce seed supply before and following flooding. Decreases in the frequency of flooding owing to river regulation and water extraction are likely to have exacerbated the influence of livestock on seed supply and thus reduced potential recruitment even further. 6. Efforts to rehabilitate large floodplain rivers based solely on the return of more natural flow regimes may fail if the effects of factors such as livestock grazing are not managed concurrently. © The Thomson Corporation

900. The effects of grassland management on nitrogen losses from grazed swards through ammonia volatilization; the relationship to excretal N returns from cattle.

Jarvis, S. C.; Hatch, D. J.; and Roberts, D. H.
Journal of Agricultural Science 112(pt.2): 205-216. (1989)
NAL Call #: 10 J822; ISSN: 0021-8596
Descriptors: biogeochemical cycles/ nitrogen fertilizers/ losses from soil/ cattle/ excreta/ range management/ grazing/ ammonia/ England
This citation is from AGRICOLA.

901. The effects of grazing and burning on soil and plant nutrient concentrations in Colombian paramo grasslands.

Hofstede, Robert G. M.
Plant and Soil 173(1): 111-132. (1995)
NAL Call #: 450 P696; ISSN: 0032-079X
Descriptors: crop industry/ andosol/ litter decomposition/ minerals/ phosphorus fixation/ tropical alpine/ tussock grass/ vegetation structure
Abstract: The impact of extensive livestock farming on the physical and chemical characteristics of the volcanic soils and on the nutrient status of green plant tissues of neotropical alpine grasslands (paramo) is studied. Soil and plant samples were taken over a one-year period at five sites with different agricultural (grazing and burning) management. In the undisturbed paramo ecosystem, soil

moisture (50-250%) and organic matter content are high (7-27%) and decomposition (11-35% yr⁻¹) and element concentrations are low. Low temperatures (max 10 degree C) and phosphorus fixation by the soil (5 mg P g⁻¹ soil) determine the low mineralization and turn-over rates. Multivariate analysis of laboratory results indicates that the season of sampling and the agricultural practice are the most important explanatory factors for variation of soil characteristics. After long-term heavy grazing, soils have a higher bulk density and a lower moisture content. The outcome of a litterbag experiment confirms the hypothesis of higher decomposition rates at grazed sites. In the intermediate (wet-dry) season, conditions were somewhat better for plant growth but the system remained nutrient limited. Surprisingly, no relation between soil density, moisture or carbon content and concentrations of available nutrients in the soil is found. This is supported by the rather uniform nutrient concentrations in green plant tissue among the sites. It is concluded therefore that the effect of burning and grazing on paramo soils is principally restricted to physical characteristics, and that differences in chemical characteristics of the soil do not cause differences in vegetation structure between grazed, burned and undisturbed sites.

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902. Effects of grazing and depth on two wetland plant species.

Blanch, S. J. and Brock, M. A.
Australian Journal of Marine and Freshwater Research 45(8): 1387-1394. (1994)
NAL Call #: 442.8 Au73; ISSN: 0067-1940.
Notes: Special issue: Plants and processes in wetlands
Descriptors: grazing/ predation/ herbivores/ water depth/ wetlands/ plant populations/ species diversity/ plant growth/ *Myriophyllum variifolium*/ *Eleocharis acuta*/ Australia, New South Wales, Llangothlin Lagoon
Abstract: Wetland plants in Llangothlin Lagoon, northern New South Wales, are subject to grazing and trampling by cattle, sheep and waterbirds and to fluctuating water levels. *Myriophyllum variifolium* J. Hooker, an aquatic dicotyledon with dispersed meristems, exhibited different morphological changes to the emergent monocotyledon *Eleocharis acuta* R. Br. under simulated and natural grazing at different water depths. Responses were principally determined by position and number of meristems. Growth point production (numbers of shoots and branches) increased under light, frequent clipping (25% every 14 or 7 days) in non-submerged plants only. Node production, total plant or shoot length, and above- and below-ground biomass decreased under similar clipping treatments. *E. acuta* did not increase shoot production or above-ground biomass under any clipping treatment, and only for the lightest clipping treatment (clipped once to 7 cm when non-submerged) was no decrease in total shoot length observed. More intense and frequent clipping treatments and submersion to 15 cm prevented both species from replacing lost tissues. Interaction between clipping and submersion occurred in both species, indicating that growth responses are complex. The distribution and abundance of the two species reflect the greater tolerance of *M. variifolium* than *E. acuta* to grazing and inundation. Low intensities of cattle and sheep grazing may be beneficial by increasing species diversity.

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903. Effects of grazing and drought on population dynamics of salt desert shrub species on the Desert Experimental Range, Utah.

Chambers, J. C. and Norton, B. E.

Journal of Arid Environments 24(3): 261-275. (1993)

NAL Call #: QH541.5.D4J6; ISSN: 0140-1963

Descriptors: grasslands/ deserts/ population dynamics/ drought/ grazing intensity/ salt land/ grazing/ grazing systems/ seasonal-grazing

Abstract: Population dynamics of dominant salt desert shrub species were studied in a drought period (July 1975-Jan. 1978) on pastures which had been grazed by sheep at light or heavy intensity in winter or spring since 1937. Species responses in the drought were more predictable from their life history and physiological traits than from past responses to grazing alone. Heavy or spring grazing increased mortality of *Artemisia spinescens*, a cool-season shrub susceptible to past grazing, and of *Sporobolus cryptandrus* and *Atriplex confertifolia*, a C4 grass and shrub, respectively, that had increased under this grazing regime in the past. Light or winter grazing during this period increased survival and natality of *S. cryptandrus*, and of *Ceratoides* [*Krascheninnikovia*] *lanata*, a shrub that had decreased in density but increased in cover under past grazing. Population turnover rates were generally positive for *A. spinescens*, but were highly negative for *A. confertifolia* in all but the heavy spring grazing treatment. *A. confertifolia* had exhibited high mortality during past droughts. *C. lanata* exhibited little population change reflecting past trends. Generally positive rates of turnover for *S. cryptandrus* and *Oryzopsis hymenoides*, paralleled past trends, except in the spring-heavy treatment which had highly negative turnover rates. In a comparison of grass vs. shrub dominated vegetation types, *C. lanata* had higher mortality in grass dominated plots; *O. hymenoides* had higher mortality in shrub dominated plots. Both *S. cryptandrus* and *O. hymenoides* exhibited low or negative turnover rates for grazed plots within the shrub dominated type. Overall, light to moderate grazing and the removal of livestock before active physiological growth of cool season species had the least negative effects on population dynamics during a 2-year drought period. This grazing regime increased survival or natality of certain species.
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904. Effects of grazing and inundation on pasture quality and seed production in a salt marsh.

Pehrsson, O.

Vegetatio 74(2-3): 113-124. (1988)

NAL Call #: 450 V52; ISSN: 0042-3106

Descriptors: grazing/ species composition/ salt marshes/ population dynamics/ flooding/ aquatic plants/ Sweden/ effects on/ environmental impact/ herbage quality/ seed production/ species composition

Abstract: During a six-year period, changes in the composition of dominant plant species of importance to foraging birds in a salt marsh on the Swedish west coast were followed inside and outside exclosures to document effects of grazing on herbage quality and seed production. Since marshes provide an important habitat for foraging geese and ducks, it was of interest to determine how cattle grazing would affect herbage production in *Agrostis stolonifera* and *Puccinellia maritima* and seed and root-tuber production in *Scirpus maritimus*. Measurements of cover and height in permanent plots revealed that a wetter

weather type favoured *Agrostis*, probably through reduced salinity, at the expense of *Puccinellia*, which was the most favoured food of both cattle and birds. *Agrostis* out-competed *Puccinellia* when grazing pressure was low. Seed production in *Scirpus maritimus* was reduced by cattle grazing, particularly when *Phragmites australis* formed part of the vegetation. In the absence of cattle grazing, both herbage- and seed producing plants were gradually reduced, and *Phragmites* increased.

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905. Effects of grazing Conservation Reserve Program lands in North Dakota on birds, insects, and vegetation.

Kennedy, Carmen L.; Jenks, Jonathan A.; and Higgins, Kenneth F.

Proceedings of the South Dakota Academy of Science 80: 213-226. (2001)

NAL Call #: 500 So82; ISSN: 0096-378X

Descriptors: Aves

Abstract: [unedited] Effects of two grazing systems on nongame birds, insect biomass, and vegetation structure in Conservation Reserve Program (CRP) grasslands were evaluated in North Dakota. Treatments included idle (controls), 3-pasture twice-over deferred rotation grazing, and season-long grazing systems. Twelve species of nongame passerine birds in 1992 and ten species in 1993 used CRP fields. The lark bunting (*Calamospiza melanocorys*), grasshopper sparrow (*Ammodramus savannarum*), red-winged blackbird (*Agelaius phoeniceus*) and brown-headed cowbird (*Molothrus ater*) dominated species composition in 1992 and 1993. CRP pastures under rotational or season-long grazing treatments maintained equal or higher mean male bird densities compared to idle CRP control fields. Mean density of male birds, terrestrial insect biomass and, for the most part, vegetation height, were lower in 1993 than 1992. Results indicated that high insect biomass in pastures with dense cover does not necessarily equate to higher nongame bird use. At moderate stocking rates (~2.1 AUM/ha), our results indicated that grazing of CRP lands could be included in contract terms or in negotiations in any extensions or modifications of future CRP contracts without any significant losses to nongame birds.
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906. Effects of grazing exclusion and reseeding on a former uranium mill site in the Great Basin Desert, Arizona.

Lash, Donald W.; Glenn, Edward P.; Waugh, W. Jody; and Baumgartner, Donald J.

Arid Soil Research and Rehabilitation 13(3): 253-264. (1999)

NAL Call #: S592.17.A73A74; ISSN: 0890-3069

Descriptors: former uranium mill site/ grazing exclusion effect/ remediation program/ reseeding effect/ revegetation

Abstract: Germinable seed in the soil seed bank and vegetation were characterized at a former uranium mill site in the Great Basin desert, Arizona, 10 years after a remediation program was conducted to remove surface contamination and revegetate the site. The objective of the study was to evaluate the effectiveness of reseeding as routinely practiced to revegetate such sites. Three different conditions at the site were evaluated: (1) an area that had been bladed to remove topsoil then reseeded with exotic and native species and fenced to exclude livestock

(ungrazed-bladed-reseeded) (2) a control area inside the fence that had not been bladed or reseeded (ungrazed), and (3) for further comparison, an area outside the fence that was undisturbed by the milling and remediation efforts but has received normal grazing pressure (grazed). Each condition was represented by three plots, from which soil samples and transect data were collected. The diversity of species and total number of viable seeds in the seed bank (top 5 cm of soil) were lowest in the ungrazed-bladed-reseeded plots ($P < 0.05$). These plots also had lower plant cover (15%) than the ungrazed plots (24%) ($P < 0.05$), comparable to the cover on grazed plots (11%), even after 10 years of grazing exclusion. We conclude that at this site the results of topsoil removal and replacement were not effectively remediated by reseeded. Although these methods may be effective in moister climates, more intensive efforts to reintroduce vegetation may be required in desert sites such as this.

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907. Effects of grazing exclusion in alpine grasslands in the Central Alps.

Erschbamer, B.; Moser, C.; and Vorhauser, K.
In: Land use systems in grassland dominated regions. (Held 21 Jun 2004-24 Jun 2004 at Luzern, Switzerland.); pp. 284-286; 2004.

Descriptors: alpine grasslands/ canopy/ ecosystems/ ecotones/ grasslands/ grazing/ plant communities/ seed characteristics/ seed production/ seed weight/ treelines
Abstract: In summer 2000 several grazing exclusion areas were established in Obergurgl and Hochgurgl (Otzal, Tyrol, Austria). The main aim was to establish a long-term project in the alpine zone to monitor changes in alpine grassland ecosystems after grazing cessation. Three exclosures were established on each of three alpine sites (2300 m, 2500 m and 2600 m asl) and one exclosure at the treeline ecotone (1950 m asl), respectively. Within each exclosure, permanent plots of 1 m² were established, and compared with control plots outside each fenced area. Frequency counts were made every growing season from 2000 to 2003. In addition, in 2002 and 2003, flower, fruit and seed production were studied. A higher canopy height and a higher amount of litter was observed in the exclosure plots, compared to the controls. The frequency of the species changed in most of the plots. Some species were positively affected, while others exhibited a lower frequency after four years. The number of seeds and the seed weight of selected species were significantly higher within the exclosures. It can be concluded that the frequency of Poaceae and Cyperaceae increases within the exclosures, whereas mosses and lichens generally decrease. Species-poor alpine grassland communities will result from long-term cessation of grazing.

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908. Effects of grazing exclusion on rangeland vegetation and soils, east central Idaho.

Yeo, Jeffrey J.
Western North American Naturalist 65(1): 91-102. (2005)
NAL Call #: QH1 .G7; ISSN: 1527-0904

Descriptors: brush burning: applied and field techniques/ mechanical brush treatment: applied and field techniques/ ecological stability/ grazing exclusion/ ground cover/ livestock grazing/ plant composition/ sagebrush steppe ecosystem/ screening cover/ semiarid ecosystem/

shadscale rangeland/ soil erosion/ soil flow pattern/ soil movement/ soil pedestal/ species richness/ wildlife restoration

Abstract: Nineteen exclosures on sagebrush steppe and shadscale rangelands, varying in age from 18 to 38 years, were sampled for plant species richness, plant composition, indicators of soil erosion, ground cover, vegetative cover, and herb-low shrub layer screening cover. Features within the exclosures were compared with adjacent sites of the same size that were open to grazing by livestock and wildlife. Species richness typically was slightly greater inside p exclosures than in adjacent grazed sites (median = 2 more species inside exclosures), but the difference was not significant ($P = 0.16$). Similarity of plant community composition between exclosures and adjacent grazed sites ranged from 45% to 82%. Evidences 4 soil movement, soil pedestals, and soil flow patterns were all more pronounced outside exclosures than inside (P ltoreq 0.02), even though many sites were on flat to mild slopes (median slope = 12%). Meta-analysis of the 19 exclosure sites indicated that grazing exclusion resulted in less bare ground cover compared with adjacent grazed sites (P ltoreq 0.05). The effect of grazing exclusion on visible soil surface cryptogams was significant (P ltoreq 0.05), with generally greater cover inside exclosures. Cryptogam cover differences between grazed sites and exclosures tended to increase with the number of years of grazing exclusion ($r = 0.64$, $P = 0.046$). *Pseudoroegneria spicata*, a principal livestock forage, averaged greater basal cover inside exclosures than outside on 4 of 10 sites where it occurred, although no exclosure sites had greater *P. spicata* cover on grazed sites. Meta-analysis of the 10 sites indicated that grazing exclusion resulted in greater *P. spicata* cover compared with adjacent grazed areas (P ltoreq 0.05). *Poa secunda*, a short-growing grass that initiates growth early in the spring and is not important livestock forage, averaged greater basal cover outside exclosures on 5 of 15 sites where it occurred. Meta-analysis of the 15 sites indicated a significant treatment effect (P ltoreq 0.05), with greater *Poa secunda* basal cover outside exclosures. Grazing exclusion resulted in greater screening cover in the herb-low shrub layer (0-0.5 m height; P ltoreq 0.05). These results indicate that despite improved livestock grazing management over the past half century, livestock grazing still can limit the potential of native plant communities in sagebrush steppe ecosystems, and that the health of semiarid ecosystems can improve with livestock exclusion in the absence of other disturbances. A few exclosure sites were similar for the measured parameters, suggesting that these sites were ecologically stable and that exclusion of livestock grazing was not sufficient to move succession toward more pristine conditions, at least within the time periods studied. Managed disturbance such as fire or mechanical brush treatments may be necessary to restore herb productivity on these ecologically stable sites.

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909. Effects of grazing intensity on heathland vegetation and ground beetle assemblages of the uplands of County Antrim, north-east Ireland.

Mcferran, D. M.; Montgomery, W. I.; and Mcadam, J. H. *Biology and Environment* 94B(1): 41-52. (1994); ISSN: 0791-7945

Descriptors: above ground biomass/ botanical composition/ grazing pressure/ individual species cover/ land management/ Scottish blackface sheep/ sward structure/ trapping success

Abstract: Grazing pressures have increased on the uplands of the British Isles. This is particularly evident on the Antrim Plateau of north-east Ireland. The effects of grazing pressure on heathland vegetation and ground beetle assemblages was investigated experimentally. Between June and September in 1988 and 1989, enclosures (0.64 ha) on three types of heathland community - low, medium and high density of *Calluna* - were grazed at one of four intensities equivalent to 0-4.5 Scottish Blackface sheep/ha. The effects of grazing intensity on above-ground biomass, individual species cover, botanical composition, sward structure and associated ground beetle assemblages were assessed using standard methods. At higher grazing intensities, percentage composition of green heather, live Gramineae species, live non-Gramineae species and other dead material declined. Live *Calluna* was reduced by increased grazing intensity once more nutritious species were depleted. Ground beetle assemblages differed with respect to heathland community, grazing intensity and trapping dates. Trapping success of the most abundant species, *Nebria salina*, increased with increasing grazing intensity. The effects of management changes on the ecosystem of the Antrim Plateau are discussed.

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910. Effects of grazing management and environmental factors on native grassland and grassy woodland, Northern Midlands, Tasmania.

Leonard, Steven W. J. and Kirkpatrick, J. B. *Australian Journal of Botany* 52(4): 529-542. (2004) NAL Call #: 450 Au72; ISSN: 0067-1924

Descriptors: grazing management: applied and field techniques/ grassy woodland/ lowland grassland

Abstract: Most remnants of lowland grassland and grassy woodland in Tasmania are grazed by sheep. In some instances, grazed remnants have high conservation value, indicating that grazing and biodiversity conservation are not necessarily conflicting management goals. However, few data exist on the management practices most conducive to maintaining conservation values. The present study examined native grassland and grassy woodland subject to seven different sheep-grazing regimes in the Northern Midlands bioregion of Tasmania and sought to identify the effects of management and environmental factors on vegetation structure and composition. Structural and compositional differences between grassland and woodland, and herbivore scat counts, suggested that grazing disturbance was more intense in grassland than in woodland. Floristic differences within the vegetation appeared to be related to differences in grazing regime. Occurrence of species not commonly observed in grassy vegetation was associated with the resting of pastures in spring, while more intensely grazed sites contained assemblages of species typical of disturbed areas. Exotic

invasion was greatest at sites that were not rested and/or had higher stocking rates, and at more eroded sites. Thus, resting and/or low stocking rates were associated with good condition in the grassland and grassy woodland. The nature of differences in vegetation attributes between woodland and grassland suggests that grazer habitat preference increases the differences between these vegetation types. Relatively minor variation in grazing regime was found to have resulted in distinct floristic outcomes, suggesting that the maintenance of a range of management regimes may be conducive to the maintenance of plant species diversity at a landscape scale.

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911. The effects of grazing management on moorland vegetation: A comparison of farm unit, grazing paddock and plot experiments using a community modelling approach.

Rushton, S. P.; Sanderson, R. A.; Wildig, J.; and Byrne, J. P.

In: *Vegetation management in forestry, amenity and conservation areas: Managing for multiple objectives/ Association of Applied Biologists; Series: Aspects of applied biology* 44.

Warwick: Association of Applied Biologists, 1996; pp. 211-219.

Notes: ISSN: 0265-1491

NAL Call #: QH301.A76 no.44

Descriptors: grazing/ range management

This citation is from AGRICOLA.

912. Effects of grazing management on standing crop dynamics in tallgrass prairie.

Cassels, D. M.; Gillen, R. L.; McCollum, F. T.; Tate, K. W.; and Hodges, M. E.

Journal of Range Management 48(1): 81-84. (1995)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/1995/481/081-084_cassels.pdf

Descriptors: grasses/ prairies/ stocking rate/ grazing intensity/ rotational grazing/ rain/ air temperature/ biomass/ forage/ Oklahoma

Abstract: Grazing system and stocking rate effects on forage standing crop of tallgrass prairies in north-central Oklahoma were evaluated from 1989 to 1993. Twelve experimental units, consisting of pastures dominated by big bluestem [*Andropogon gerardi* Vitman], little bluestem [*Schizachyrium scoparium* (Michx. Nash)], indiangrass [*Sorghastrum nutans* (L.) Nash], and switch grass [*Panicum virgatum* L.], were arranged in a completely randomized design with either a short duration rotation or continuous grazing system and stocking rates ranging from 127 kg animal live-weight/ha to 222 kg live-weight/ha. Yearling steers grazed the units from late April to late September. Herbage standing crop was sampled in July and September. Total, live, and dead standing crops did not differ significantly between the 2 grazing systems in July. Total standing crop was significantly higher in the rotation units in September (3,600 versus 3,020 kg/ha, $P < 0.05$). Dead standing crop was also higher in the rotation units in September (1,950 versus 1,570 kg/ha, $P < 0.05$). Evidence suggests the difference in standing crop between systems is due, in part, to reduced forage intake by the livestock. Grazing system did not interact with either stocking rate or year. Stocking rate had significant effects on total, live and

dead standing crops at both sample dates. The slope of the total standing crop-stocking rate relationship varied over years and ranged from -12 to -36 kg/ha per kg live-weight/ha in July and from -12 to -27 kg/ha per kg live-weight/ha in September. Higher standing crop at the end of the grazing season in the rotation units would mean greater soil protection and higher fuel loading for prescribed burning, and would suggest a lower impact on plant vigor. However, if the higher standing crop is a result of lower forage intake, we would expect livestock weight gains to decline.

This citation is from AGRICOLA.

913. Effects of grazing management on streambanks.

Bohn, C. C. and Buckhouse, J. C.

Transactions of the North American Wildlife and Natural Resources Conference 51: 265-271. (1986)

NAL Call #: 412.9 N814; ISSN: 0078-1355

Descriptors: Cervus/ livestock/ Odocoileus hemionus/ runoff/ stocking rate/ streams/ wildlife management/ Oregon

This citation is from AGRICOLA.

914. Effects of grazing on restoration of southern mixed prairie soils.

Fuhlendorf, Samuel D.; Zhang, Hailin; Tunnell, Tim R.;

Engle, David M.; and Cross, Anne Fernald

Restoration Ecology 10(2): 401-407. (2002)

NAL Call #: QH541.15.R45R515; ISSN: 1061-2971

Descriptors: carbon sequestration/ southern mixed prairie soil restoration: grazing effect

Abstract: A comparative analysis of soils and vegetation from cultivated areas reseeded to native grasses and native prairies that have not been cultivated was conducted to evaluate restoration of southern mixed prairie of the Great Plains over the past 30 to 50 years. Restored sites were within large tracts of native prairie and part of long-term grazing intensity treatments (heavy, moderate, and ungrazed), allowing evaluation of the effects of grazing intensity on prairie restoration. Our objective was to evaluate restored and native sites subjected to heavy and moderate grazing regimes to determine if soil nutrients from reseeded cultivated land recovered after 30 years of management similar to the surrounding prairie and to identify the interactive influence of different levels of grazing and history of cultivation on plant functional group composition and soils in mixed prairies. For this mixed prairie, soil nitrogen and soil carbon on previously cultivated sites was 30 to 40% lower than in uncultivated native prairies, indicating that soils from restored sites have not recovered over the past 30 to 50 years. In addition, it appears that grazing alters the extent of recovery of these grassland soils as indicated by the significant interaction between grazing intensity and cultivation history for soil nitrogen and soil carbon. Management of livestock grazing is likely a critical factor in determining the potential restoration of mixed prairies. Heavy grazing on restored prairies reduces the rate of soil nutrient and organic matter accumulation. These effects are largely due to changes in composition (reduced tallgrasses), reduced litter accumulation, and high cover of bare ground in heavily grazed restored prairies. However, it is evident from this study that regardless of grazing intensity, restoration of

native prairie soils requires many decades and possibly external inputs to adequately restore organic matter, soil carbon, and soil nitrogen.

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915. Effects of grazing on the vegetation of the blackbrush association.

Jeffries, D. L. and Klopatek, J. M.

Journal of Range Management 40(5): 390-392. (1987)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1987/405/2jeff.pdf>

Descriptors: Coleogyne ramosissima/ plant communities/ livestock/ vegetation types/ grazing/ Utah/ Arizona

This citation is from AGRICOLA.

916. Effects of grazing on western snowberry communities in North Dakota.

Kirby, D. R.; Sturn, G. M.; and Ransom Nelson, T. A.

Prairie Naturalist 20(3): 161-169. (1988)

NAL Call #: QH540 .P7; ISSN: 0091-0376

Descriptors: Symphoricarpos occidentalis/ Poa pratensis/ cattle/ shrub cover/ herbaceous production/ management strategy

Abstract: Eleven communities dominated by western snowberry (*Symphoricarpos occidentalis*) were compared in 1982 and again in 1986 at the Central Grasslands Research Station in south central North Dakota to examine the impact of cattle grazing under four grazing treatments. Young stems provided 55% of stem compositions in 1982 and 59% in 1986. Shrub cover decreased ($P < 0.05$) season-long, twice-over rotation, and control treatments. Shrubs production averaged across the grazed treatments increased from 142 g/m² in 1982 to 195 g/m² in 1986. Total herbaceous production on treatments averaged 218 g/m² in 1982 and 222 g/m² in 1986. Graminoid species comprised 76% of the herbaceous production; Kentucky bluegrass (*Poa pratensis*) accounted for 68% of the graminoid production. Five years of grazing by cattle under various management strategies, stocking rates, and densities did not consistently alter the structure or composition of western snowberry communities.

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917. The effects of grazing pressure on soil animals and hydraulic properties of two soils in semi-arid tropical Queensland.

Holt, J. A.; Bristow, K. L.; and McIvor, J. G.

Australian Journal of Soil Research 34(1): 69-79. (1996)

NAL Call #: 56.8 Au7; ISSN: 0004-9573

Descriptors: animals and man/ disturbance by man/ commercial activities/ behaviour/ ecology/ community structure/ population dynamics/ habitat/ terrestrial habitat/ land and freshwater zones/ Australasian Region/ Australia/ Acari: farming and agriculture/ population density/ soil fauna/ cattle grazing effects/ soil habitat/ Queensland/ north/ chert towers/ cattle grazing effects on soil fauna/ Acari/ Arachnida/ arachnids/ arthropods/ chelicerates/ insects/ invertebrates

© The Thomson Corporation

918. Effects of grazing pressure on weediness in mallee communities studies at Mallee Cliffs National Park and Nanya Station, southwestern New South Wales.

Westbrooke, M. E.

In: The Mallee lands: A conservation perspective. (Held 18 Apr 1989-21 Apr 1989 at Adelaide, South Australia, Australia.) Noble, J. C.; Joss, P. J.; and Jones, G. K. (eds.) East Melbourne, Victoria, Australia: CSIRO Publications; pp. 276-279; 322 p.; 1990.

NAL Call #: QH77.A8N35 1989; ISBN: 0643051058

Descriptors: sheep/ pasture/ conservation/ land use

© The Thomson Corporation

919. Effects of herbage removal on productivity of selected high-Sierra meadow community types.

Stohlgren, T. J.; DeBenedetti, S. H.; and Parsons, D. J.

Environmental Management 13(4): 485-491. (1989)

NAL Call #: HC79.E5E5; ISSN: 0364-152X

Descriptors: Carex/ Carex rostrata/ Eleocharis/

Calamagrostis/ Deschampsia cespitosa/ forage/ crop

production/ productivity/ national parks/ grazing intensity/

natural regeneration/ California

This citation is from AGRICOLA.

920. Effects of historic livestock grazing on vegetation at Chaco Culture National Historic Park, New Mexico.

Floyd, M. Lisa; Fleischner, Thomas L.; Hanna, David; and Whitefield, Paul

Conservation Biology 17(6): 1703-1711. (2003)

NAL Call #: QH75.A1C5; ISSN: 0888-8892

Descriptors: current grazing/ ecological potential/ edaphic characteristics/ grazing enclosure/ historic livestock grazing/ long term protection/ short term protection/ soil crust/ species richness/ topography

Abstract: Livestock grazing is the most ubiquitous land use in western North America, yet it rarely has been studied in a controlled manner because of the lack of large areas free of grazing. We compared the ecological effects of three grazing treatments-long-term protection, short-term protection, and currently grazed-at Chaco Culture National Historic Park in northern New Mexico. Chaco has a long history of human habitation and is now one of the largest grazing exclosures in the American West. We studied the effects of livestock grazing on the cover of plants, soil crusts, and plant species richness at six sites with different potential natural vegetation. Species richness was higher under long-term protection than under current grazing at all six sites. Trends in shrub and grass response varied significantly across the six sites. Shrub cover increased with long-term protection at four upland sites, and grass cover increased with protection at four sites. The response of Chaco vegetation to release from grazing varied significantly according to each site's ecological potential, determined in part by edaphic and topographic characteristics. These nuances in vegetation response represent natural ecological variation and contrast with the notions of widespread shrub "invasion" often inferred in the past.

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921. Effects of increased precipitation and grazing management on northeastern Montana rangelands.

Branson, F. A. and Miller, R. F.

Journal of Range Management 34(1): 3-10. (1981)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1981/341/1bran.pdf>

Descriptors: ground cover/ forage production/ vegetation changes/ plant communities/ rest rotation

Abstract: To determine possible vegetation changes, 15 plant communities on public lands in the Willow Creek basin near Glasgow, Montana, that were sampled in 1960 were resampled in 1977. Most of the communities showed remarkable improvement in ground cover and forage production. Factors contributing to the changes included higher precipitation during the period between the 1st and 2nd sampling than for the 10-yr period prior to the 1st sampling, and possibly, improved management practices, such as land treatments and application of rest-rotation grazing systems. These results are in conflict with the generally held view that western rangelands have deteriorated.

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922. Effects of late season cattle grazing on riparian plant communities.

Kauffman, J. B.; Krueger, W. C.; and Vavra, M.

Journal of Range Management 36(6): 685-691. (1983)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1983/366/1kauf.pdf>

Descriptors: Salix spp./ Crataegus douglasii/ meadow/ shrub/ forest

Abstract: Livestock impacts on riparian plant community composition, structure, and productivity were evaluated. After 3 yr of comparison between fall grazed and exclosed (nongrazed) areas, 4 plant communities of 10 sampled, displayed some significant species composition and productivity differences. Two meadow types and the Douglas hawthorne (*Crataegus douglasii*) community type had significant differences in standing phytomass. These also were used more heavily than any other communities sampled. Shrub use was generally light except on willow (*Salix* spp.)-dominated gravel bars. On gravel bars, succession appeared to be retarded by livestock grazing. Few differences were recorded in other plant communities sampled, particularly those communities with a forest canopy.

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923. Effects of livestock and prescribed fire on coppice growth after selective cutting of Sudanian savannah in Burkina Faso.

Sawadogo, Louis; Nygard, Robert; and Pallo, Francois

Annals of Forest Science 59(2): 185-195. (2002)

NAL Call #: SD1.A56; ISSN: 1286-4560

Descriptors: fire regimes/ selective cutting: harvesting method/ Sudanian savannah silviculture/ annual early fire/ coppice growth/ livestock grazing/ reduced sprout/ grass competition/ split plot design

Abstract: Can livestock grazing and/or fire regimes be used to promote coppice growth in Sudanian savannah silviculture? Effects of livestock and prescribed fire regimes on stool sprouting after selective cutting were followed during 6 years. Half the initial basal area (at stump height) of 10.8 m² ha⁻¹ (500 stems ha⁻¹) was cut on 48 plots of 0.25 ha each. In a split-plot design with and without

livestock, the effects of annual "early fire" (as soon as possible after end of the rainy season), no fire and 2 years without fire were tested. With moderate (50% of the potential) grazing of 0.7 TLU ha⁻¹ stump mortality decreased and basal area per stool (stems > 10 cm GBH) increased, which we assume was due to reduced sprout/grass competition. Fire regimes had no major impact and no significant interaction was found. Six years after cutting, coppice basal area was 1.1 m² ha⁻¹, corresponding to a recovery of 20% of the initially removed area.
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924. Effects of livestock grazing on the species diversity and biomass production in the alpine meadows of Garhwal Himalaya, India.

Kala, C. P. and Rawat, G. S.
Tropical Ecology 40(1): 69-74. (1999)
NAL Call #: 451 IN85; ISSN: 0564-3295
Descriptors: biomass/ biomass production/ grazing/ meadows/ species diversity/ biodiversity/ trampling/ alpine grasslands/ grasslands
Abstract: The effects of livestock grazing on the alpine (>3500 m AMSL) vegetation in Khiron Valley, Garhwal Himalaya was studied. The study area was stratified into three landscape units viz., undulating land masses (ULM), camping sites (CS) and steep slopes (SS). Within each stratum two barbed wire enclosures of 10x10x3 m (total six) were erected to exclude livestock grazing. Seasonal aboveground biomass production, both within and outside the enclosures, was estimated by harvest method at 30 days interval. Plant species diversity was calculated for all the sites using Shannon-Wiener diversity index and compared with similar landscape units of ungrazed sites in adjacent valleys. Aboveground biomass values within enclosures were 458±or-27 g m⁻², 419±or-17 g m⁻², and 412±or-18 g m⁻² on the CS, ULM and SS respectively. For grazed areas these values were 352±or-28 g m⁻², 308±or-5 g m⁻² and 318±or-7 g m⁻², respectively. The loss of biomass due to grazing and trampling by livestock was 23%, 26%, and 22% on CS, ULM, and SS respectively. *Danthonia cachemyriana* contributed the most (86.41%) total biomass on SS, whereas *Geranium wallichianum* contributed the most (55.37%) on ULM within the enclosures. Species diversity was highest (H'=2.48) in ULM followed by CS (H'=2.32) and SS (H'=2.00). The differences in species diversity due to grazing in one season were not clear but data from adjacent ungrazed valleys showed that heavy grazing reduces the species diversity, and promotes ruderal and weedy species. The results are discussed in the light of biodiversity conservation.
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925. Effects of livestock management on southwestern riparian ecosystems.

Krueper, D. J.
In: Desired future conditions for Southwestern riparian ecosystems: Bringing interests and concerns together. (Held 18 Sep 1994-22 Sep 1994 at Albuquerque, N. Mex.) Shaw, Douglas W. and Finch, Deborah M. (eds.) Fort Collins, Colo.: Rocky Mountain Forest and Range Experiment Station, U.S. Dept. of Agriculture; pp. 281-301; 1996.
NAL Call #: aSD11.A42 no.272

Descriptors: ecosystems/ livestock/ grazing/ environmental degradation/ habitat destruction/ wildlife/ riparian buffers/ Southwestern United States
This citation is from AGRICOLA.

926. Effects of livestock on riparian zone vegetation in an Australian dryland river.

Robertson, A. I. and Rowling, R. W.
Regulated Rivers Research and Management 16(5): 527-541. (2000)
NAL Call #: TC530.R43; ISSN: 0886-9375
Descriptors: dryland river/ bare soil/ canopy tree density/ coarse particulate organic matter/ livestock grazing/ riparian zone vegetation/ river ecosystem management/ species richness/ terrestrial fine woody debris/ vegetation composition/ vegetation structure
Abstract: Vegetation structure and composition and the mass of components of organic detritus were assessed in paired areas, with and without stock access, at six sites. The study revealed that grazing has altered and continues to alter the structure and function of the riparian landscape in the Murrumbidgee River and its tributaries in southeastern Australia. Seedlings and saplings of the dominant Eucalyptus tree species were up to three orders of magnitude more abundant in areas with no stock access, and the biomass of groundcover plants was an order of magnitude greater in areas with no stock access at all sites. Plant species richness did not differ between areas with and without stock access when the ameliorating effect of canopy tree density was taken into account, but plant community composition differed significantly between areas at all sites. Coarse particulate organic matter and terrestrial fine woody debris were consistently more abundant in areas without stock. In-stream fine and coarse woody debris was more abundant in areas without stock at mainstream sites, but not in tributaries. The percentage of bare soil was greater in areas with stock access at all sites. Differences between areas with and without stock access were generally most pronounced at sites where the riparian zone had been excluded from stock access for more than 50 years. The effects of livestock on vegetation and components of detritus have a significant influence on the function of riparian zones. Efforts to restore river health that focus solely on reducing the impact of regulated flows may be nullified if livestock grazing is not considered as part of river ecosystem management.
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927. Effects of long-term cattle enclosure on vegetation and rodents at a desertified arid grassland site.

Valone, T. J. and Sauter, P.
Journal of Arid Environments 61(1): 161-170. (2005)
NAL Call #: QH541.5.D4J6; ISSN: 0140-1963
Descriptors: animals and man/ disturbance by man/ commercial activities/ ecology/ population dynamics/ habitat/ terrestrial habitat/ land zones/ Nearctic Region/ USA/ North America/ Rodentia: farming and agriculture/ community structure/ population density/ grassland/ arid grassland/ Arizona/ southeast/ arid grassland faunal response to vegetation changes due to cattle grazing/ Rodentia/ Mammalia/ chordates/ mammals/ rodents/ vertebrates
Abstract: Arid grasslands are often presumed to exist in one of two alternate stable states: grassland or desertified shrubland. While the conversion to shrubland can occur

rather rapidly following intense overgrazing, the recovery of perennial grasses is often presumed to be difficult or impossible even with livestock removal. We examined vegetation and rodent communities at a desertified shrubland site from which livestock had been removed for more than four decades. Total shrub cover was similar but differed in composition across the grazing fence. *Larrea tridentata* had significantly higher cover Outside while *Parthenium incanum* had significantly higher cover inside the fence. Basal perennial grass cover was significantly higher inside the fence. Rodent diversity was significantly higher inside the fence due to higher abundance and diversity of pocket mice. These data suggest that recovery of perennial grasses at severely desertified sites is possible but may require several decades and that rodent diversity responds positively to such recovery. [copyright] 2004 Elsevier Ltd. All rights reserved.

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928. Effects of long-term grazing by big game and livestock in the Blue Mountains forest ecosystems.

Irwin, L. L. and Cook, J. G.

Portland, Ore.: U.S. Department of Agriculture, Pacific Northwest Research Station; PNW-GTR-325, 1994. 49 p.

NAL Call #: aSD11 .A46 no. 325

<http://www.fs.fed.us/pnw/pubs/pnw%5Fgtr325.pdf>

Descriptors: Ungulata/ *Bos taurus*/ *Equus caballus*/ *Ovis aries*/ ungulates/ cattle/ horse/ domestic sheep/ vegetation/ food/ agriculture/ forest grazing land/ damage [forest]/ silviculture/ regeneration/ change in vegetation/ fertility/ recruitment/ population dynamics

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929. Effects of management on soil decomposers and decomposition processes in grassland.

Curry, J. P.

In: Microfloral and faunal interactions in natural and agro-ecosystems/ Mitchell, Myron J. and Nakas, James P.; Vol. 3; Series: Developments in Biogeochemistry 3.

Dordrecht: M. Nijhoff/Dr. W. Junk, 1986; pp. 349-398

NAL Call #: QH344.D4 v.3

Descriptors: grasslands/ grassland soils/ degradation/ *Oligochaeta*/ grazing/ soil biology/ soil management

This citation is from AGRICOLA.

930. Effects of protection from grazing on morphological and chemical characteristics of Indian ricegrass *Oryzopsis hymenoides*.

Trlica, M. J. and Orodho, A. B.

Oikos 56(3): 299-308. (1989)

NAL Call #: 410 OI4; ISSN: 0030-1299

Descriptors: vegetative tiller/ plant height/ leaf growth/ aboveground biomass/ adaptive plasticity

Abstract: Protection from previous heavy grazing for 50 yr in a national park in southwestern United States has not resulted in any significant increase in height of Indian ricegrass (*Oryzopsis hymenoides* [Roem. and Schult.] Ricker) compared with in situ plants that were previously heavily grazed, and no difference in height or aboveground biomass was detected among grazed and ungrazed populations when grown in a uniform garden. Tussocks heavily utilized in the past produced greater numbers of vegetative tillers than did plants that were protected within the park. However, these differences were not evident when grazed and ungrazed populations were grown in a

uniform garden. Protection from heavy grazing had no significant effect on fiber, cellulose, or lignin in either leaves or stems. Small differences in morphological and chemical characteristics between heavily-grazed and protected populations of Indian ricegrass could be attributed to plastic adaptations with no underlying genetic selection for defense mechanisms to reduce herbivory. Rapid leaf growth after defoliation appears to be the mechanism employed by this tussock grass to withstand heavy grazing use.

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931. Effects of rainfall and grazing on vegetation yield and cover of two arid rangelands in Kuwait.

Zaman, Sameeha

Environmental Conservation 24(4): 344-350. (1997)

NAL Call #: QH540.E55; ISSN: 0376-8929

Descriptors: arid rangelands/ desertification/ grazing impact/ human impact/ phytomass/ rainfall/ seasonal variation/ steppe/ vegetation yield

Abstract: Increasing human pressure has presumably led to a decrease in the cover and herbage yield of Kuwaiti desert vegetation, but, to date, there has been little detailed study on such human impacts. A study of *Rhanterium epapposum* (local name arfaj) and *Haloxylon salicornicum* (local name remeth) steppe was therefore effected to determine the seasonal variation in above-ground phytomass and percentage cover, and to investigate differences between protected and adjacent grazed areas. An average seasonal precipitation of 90 mm supported a mean of 223 kg ha⁻¹ in arfaj steppe in 1979-1989, whereas an average mean seasonal precipitation of 73 mm during 1983-1989 maintained a mean phytomass of 102 kg ha⁻¹ in the remeth steppe. Annual forbs and perennial shrubs were the greatest producers of dry matter per kg of phytomass in the arfaj and remeth steppes, respectively. The seasonal production of dry matter was related directly to the seasonal precipitation in the arfaj steppe, whereas the remeth steppe did not show an obvious relationship to the precipitation. The plant cover was 83% and 70% less, and herbage production was 76% and 91% less in grazed areas than in protected areas in the arfaj and remeth steppes, respectively.

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932. Effects of reducing sheep grazing in the Scottish Highlands.

Hope, D.; Picozzi, N.; Catt, D. C.; and Moss, R.

Journal of Range Management 49(4): 301-310. (1996)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/1996/494/301-310_hope.pdf

Descriptors: sheep/ grazing/ stocking rate/ botanical composition/ *Cervus elaphus*/ sward/ canopy/ plant communities/ ecological succession/ voles/ rangelands/ prescribed burning/ Scotland

Abstract: The effects of reducing sheep grazing on upland vegetation and wild herbivores was studied at 11 sites in the Scottish Highlands. Areas where sheep had been removed for periods of up to 25 years were compared with areas where stocking rates had remained unchanged. At 5 sites, removal of sheep was associated with taller vegetation and more signs of vole activity. While the removal of sheep appeared to have resulted in relatively few changes in floristic composition at these sites, patches

of dwarf shrub-dominated vegetation tended to be larger and patches of grassland to be smaller where sheep had been removed. One previously open site was being invaded by birch woodland after sheep removal. At the remaining 6 sites removal of sheep appeared to have had little or no effect on vegetation or on wild herbivore activity. This was probably due to an increase in grazing by red deer, along with continued heather burning, at these sites. It is concluded that sheep removal is only likely to cause significant changes in vegetation composition and structure in the Scottish Highlands where red deer numbers are low and heather burning infrequent. When this occurs, vole numbers are likely to increase. This citation is from AGRICOLA.

933. Effects of seasonal flooding and grazing on the vegetation of former ricefields in the Rhone delta (southern France).

Mesleard, F.; Lepart, J.; Grillas, P.; and Mauchamp, A. *Plant Ecology* 145(1): 101-114. (1999)
 NAL Call #: QK900.P63; ISSN: 1385-0237
 Descriptors: abandoned land/ *Oryza sativa*/ wetlands/ seasonal variation/ grazing/ vegetation/ water management/ ecological succession/ salinity/ rain/ cattle/ land management/ horses/ plant communities/ irrigation/ botanical composition/ France
 Abstract: Six management regimes were tested during 5 years in 18 abandoned ricefields in the Rhone delta, France: two artificial floodings for 6 months (winter and summer flooding, 10 cm deep) and a control only flooded by rain, each flooding treatment either with or without grazing by cattle and horses. In the absence of artificial flooding and in presence of grazing by domestic herbivores (i.e., maintaining the initial management since the abandonment) no significant change in plant communities was recorded after 5 years. The vegetation was mainly composed of halophytes (*Salicornia fruticosa* and *Inula crithmoides*). The removal of grazing led to the dominance of a salt tolerant grass: *Aeluropus litoralis*. Flooding favoured the dominance of clonal plants and led to a decrease in the number of species. In the ungrazed fields, changes in plant communities were related to the height of species with *Bolboschoenus maritimus* and *Phragmites australis* becoming dominant. When grazing was combined with summer flooding, *B. Maritimus* dominated the first two years of the experiment, but with a low cover, and was replaced in the 3rd year by *Typha angustifolia*. When grazing was combined with winter and early spring flooding the competitive exclusion of *B. maritimus* by *Juncus gerardii* slowed the establishment of the former. The management of former ricefields led to the establishment and dominance of emergent species common to Mediterranean wetlands. Although it is subordinate to the maintenance of artificial flooding, the project may be considered a restoration (or a rehabilitation) of seasonally flooded marshes as original functions existing before the land was put under cultivation are re-established. This citation is from AGRICOLA.

934. Effects of seasonal grazing on plant species diversity and vegetation structure in a semi-arid ecosystem.

Metzger, K. L.; Coughenour, M. B.; Reich, R. M.; and Boone, R. B.
Journal of Arid Environments 61(1): 147-160. (2005)
 NAL Call #: QH541.5.D4J6; ISSN: 0140-1963
 Descriptors: nutrition/ diet/ feeding behaviour/ ecology/ habitat/ terrestrial habitat/ land zones/ Afrotropical Region/ Africa/ *Connochaetes taurinus* (Bovidae): food plants/ foraging/ impact on habitat/ grassland/ Tanzania/ Serengeti National Park/ seasonal grazing impact on plant species diversity and vegetation structure/ semi arid ecosystem/ Bovidae/ Artiodactyla/ Mammalia/ chordates/ mammals/ ungulates/ vertebrates
 Abstract: In evolutionary time frames, grazing by domesticated livestock on the short grass plains of East Africa is a new occurrence resulting in increased animal densities year around and modification to annual timing of grazing. We addressed the following questions: (1) do plant species diversity and vegetation structural differences exist between an area that is grazed only during the wet season and an adjacent area that is grazed year around; and, (2) does plant species diversity and structure correlate temporally with density of grazers? A spatially explicit ecosystem model was used to determine grazer densities. The two areas were similar with respect to grazer density during the wet season but not in the dry season. Dry season grazer densities were solely due to the presence of domesticated livestock. No significant differences in plant species diversity (H'), evenness, or richness were found between the two areas. However, the relative abundance of forbs, shrubs, percent cover of shrubs and bare ground was positively correlated with grazer densities during the dry season. [copyright] 2004 Elsevier Ltd. All rights reserved. © The Thomson Corporation

935. Effects of sheep exclusion on the soil seed bank and annual vegetation in chenopod shrublands of south Australia.

Meissner, Rachel A. and Facelli, Jose M.
Journal of Arid Environments 42(2): 117-128. (1999)
 NAL Call #: QH541.5.D4J6; ISSN: 0140-1963
 Descriptors: annual vegetation/ chenopod shrublands/ grazing exclusion: plant community structure/ soil seed bank
 Abstract: This study investigated the composition of the soil seed bank and growing annual plant community in sheep-grazing exclosures. The effects of stock exclusion on annual plant community structure was slight, and was different in the seed bank and in the growing community because of little correspondence between the two. Stock exclusion favoured a few species, but never decreased the abundance of invasive species. It had little or no effect on species diversity. We conclude that grazing exclusion of the order of a decade is not enough to reverse changes produced by long-term grazing. © The Thomson Corporation

936. Effects of sheep grazing on a riparian-stream environment.

Platts, W. S. Intermountain Forest and Range Experiment Station, U.S. Department of Agriculture, 1981. 6 p. Research Note.

NAL Call #: A99.9 F764Un

Descriptors: grazing/ habitat alterations/ management/ research--rivers and streams/ riparian habitat
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937. Effects of sheep grazing on a spotted knapweed-infested Idaho fescue community.

Olson, B. E.; Wallander, R. T.; and Lacey, J. R. *Journal of Range Management* 50(4): 386-390. (1997)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/1997/504/386-390_olson.pdf

Descriptors: sheep/ grazing/ seedlings/ plant density/ *Festuca idahoensis*/ plant communities/ range management/ weed control/ Idaho

Abstract: Spotted knapweed (*Centaurea Maculosa* Lam.), a Eurasian perennial forb, is replacing many native perennial grasses, such as Idaho fescue (*Festuca idahoensis* Elmer.), in foothills of the Northern Rocky Mountain region. Our objective was to determine if 3 summers of repeated sheep grazing would reduce spotted knapweed without impacting the dominant, associated native perennial grass. Each summer, small pastures were grazed for 1-7 days in mid-June, mid-July, and early September. Areas repeatedly grazed by sheep had lower densities of seedlings, rosettes, and mature spotted knapweed plants than ungrazed areas. In addition, the proportion of young plants in the population was less in grazed than ungrazed areas. Basal areas of spotted knapweed plants were greater in grazed (8.2 cm²) than ungrazed areas (4.0 cm²). There were fewer spotted knapweed seeds in soil samples from grazed areas (12 seeds m⁻²) than from ungrazed (49 seeds m⁻²). Idaho fescue plant density increased 40% in grazed areas from 1991 to 1994, but leaves and flower stems on these plants were 38% and 17% shorter, respectively, than in ungrazed areas. By 1994, frequency of Kentucky bluegrass (*Poa pratensis* L.) was 35% greater in grazed than ungrazed areas. Grazing did not alter the amount of litter; however the amount of bare soil increased from 2.2 to 5.6% in grazed areas, while it decreased from 4 to 1% in ungrazed areas. Three summers of repeated sheep grazing negatively impacted spotted knapweed, but minimally affected the native grass community. A long term commitment to repeated sheep grazing may slow the rate of increase of spotted knapweed in native plant communities.

This citation is from AGRICOLA.

938. The effects of sheep-grazing on the subterranean termite fauna (Isoptera) of the western Australian wheatbelt.

Abensperg Traun, M.

Australian Journal of Ecology 17(4): 425-432. (1992)

NAL Call #: QH540.A8; ISSN: 0307-692X

Descriptors: abundance/ frequency/ soil/ species diversity/ trampling/ wandoo woodland

Abstract: The majority of existing remnants of wandoo *Eucalyptus capillosa* woodland in the Western Australian wheatbelt have been grazed by sheep for several decades

and are often visibly degraded. A pilot survey was conducted into the effects of sheep on vegetation and soil variables, and the abundance, diversity and species frequency of occurrence of subterranean termite communities. Ten 1/4 ha study plots were used for paired grazed/ungrazed comparisons. Ungrazed plots had more litter mass (dry weight), leaf and woody litter, canopy cover (%) and soil moisture (moisture content 1.2% across study plots); grazed plots had a higher percentage of bare ground. Termites were as abundant, and as diverse, in grazed as in ungrazed plots, and were equally often sampled in the soil and surface wood. Termite species eating sound wood, decayed wood/debris and grass were sampled equally often, and were of equal diversity in sheep-grazed as in ungrazed plots. The mounds of *Drepanotermes tamminensis* were more abundant in grazed plots. These findings indicate that prolonged sheep grazing in remnants of wandoo woodland of the Western Australian wheatbelt has had no detrimental or beneficial effect on its subterranean termites.

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939. Effects of short duration and high-intensity, low-frequency grazing systems on forage production and composition.

Taylor, C. A.; Brooks, T. D.; and Garza, N. E. *Journal of Range Management* 46(2): 118-121. (1993)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1993/462/6tayl.pdf>

Descriptors: ewes/ heifers/ grazing/ pastures/ stocking rate/ grazing intensity/ forage/ dry matter accumulation/ botanical composition/ ecological succession/ Texas

Abstract: Research was conducted at the Sonora Research Station during a 4-year period (1984 to 1988) to measure differences in herbaceous vegetation response between two 7-pasture 1-herd grazing systems. Grazing tactics were short duration (SDG-7 days graze, 42 days rest) and high intensity, low frequency (HILF-14 days graze, 84 days rest). Stocking rate for the 2 treatments was 10.4 ha/auy. Total aboveground net primary production (ANPP) varied significantly among years but not between grazing treatments. Significant, divergent shifts in composition did occur over the 4 years as a function of grazing treatment. Shortgrass production in the SDG pastures increased from 45% of the total ANPP for year 1 to 74% for year 4. Shortgrass ANPP in the HILF pastures comprised 44% of the total herbaceous production for year 1 and 51% for year 4. Midgrass ANPP in SDG pastures comprised 3.8% of the herbaceous production for year 1 and 13.6% for year 4. Midgrass production in the HILF pastures represented 4.7% for year 1 and 33.9% for year 4. Our data indicate the SDG system did not promote secondary succession from shortgrasses to midgrasses as effectively as did the HILF system.

This citation is from AGRICOLA.

940. Effects of short-duration on winter annuals in the Texas Rolling Plains.

Weigel, J. R.; McPherson, G. R.; and Britton, C. M. *Journal of Range Management* 42(5): 372-375. (1989)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1989/425/5weig.pdf>

Descriptors: annuals/ rotational grazing/ grazing intensity/ botanical composition/ Texas

Abstract: A study was conducted in the Texas Rolling Plains to test the hypotheses that short-duration grazing increases plant density and diversity in grasslands. Densities of 9 species of winter annual forbs and 2 species of annual grass were compared in short-duration grazed and ungrazed areas for 2 years. Livestock grazing in spring and early summer affected density of 8 winter annuals the following winter. Densities of 2 grasses [little barley (*Hordeum pusillum* Nutt.) and six-weeks fescue (*Vulpia octoflora* [Walt.] Rydb.)] and 3 forbs [common broomweed (*Xanthocephalum dracunculoides* [DC.]), Gordon's bladderpod (*Lesquerella Gordonii* [Gray] Wats.), and Texas filaree (*Erodium texanum* Gray.)] were higher in grazed areas; 3 forbs [bitterweed (*Hymenoxys odorata* DC.), spurge (*Euphorbia* sp.), and woolly pliantain (*Plantago patagonica* Jacq.)] were more abundant in enclosures. Richness and diversity of winter annuals generally were not affected by grazing. Increased precipitation during germination and establishment greatly increased the density of winter annuals.
This citation is from AGRICOLA.

941. Effects of soil water regime and grazing on vegetation diversity and production in a hyperseasonal savanna in the Apure Llanos, Venezuela.

Sarmiento, G.; Pinillos, M.; Da Silva, M. P.; and Acevedo, D.
Journal of Tropical Ecology 20(2): 209-220. (2004)
NAL Call #: QH541.5.T7J68; ISSN: 0266-4674
Descriptors: savannahs/ grazing/ soil moisture/ biomass/ water content/ droughts/ species richness/ primary production/ *Leersia hexandra*/ *Axonopus purpusii*/ *Panicum laxum*/ *Paspalum chaffanjonii*/ Venezuela
Abstract: Soil water content and above-ground biomass accumulation, above 10 cm high, were measured monthly in a flooded savanna ecosystem under grazing pressure and under cattle exclusion, during two growth cycles. Near-to-the-ground and below-ground biomass were measured three times during this period. Besides, composition, species richness and diversity were obtained through a floristic inventory. Despite a relatively high floristic richness and diversity, *Panicum laxum* is the dominant species throughout the study area, while three other perennial grasses, *Paspalum chaffanjonii*, *Leersia hexandra* and *Axonopus purpusii*, also reach high values of cover and biomass. Each of them reacts specifically to flooding, drought and grazing conditions. This ecosystem shows a strongly seasonal behaviour, with primary production, mortality and decomposition sharply timed by soil relative water content. Both drought and water excess seem to limit plant production, even more during wet years when the savanna might remain flooded for up to 4 mo. Some structural and functional differences between the grazed and the protected systems are demonstrated, but under the actual, relatively low stocking rate, the grazed savanna produces as much forage as the ungrazed one.
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942. Effects of sowing and management on vegetation succession during grassland habitat restoration.

Warren, John; Christal, Anna; and Wilson, Fred
Agriculture, Ecosystems & Environment 93(1-3): 393-402. (2002)
NAL Call #: S601 .A34; ISSN: 0167-8809
Descriptors: cutting treatment: applied and field techniques/ grazing treatment: applied and field techniques/ habitat restoration: applied and field techniques/ sowing: applied and field techniques/ Sorenson's qualitative similarity index/ Sorenson's quantitative similarity measure/ community change/ former agricultural land/ grassland habitat restoration/ semi natural community/ summer grazing/ vegetation succession: management effects, sowing effects
Abstract: The impact of sowing a seed mixture to recreate a semi-natural community in combination with six cutting and/or grazing treatments on the vegetation that developed on former agricultural land was examined over 6 years. Introducing seeds significantly increased the number and cover of sown species persisting. Summer grazing by cattle maintained the number, but not cover, of sown species. Few sown species persisted when grazed by sheep, although those that did maintained high cover. Sorenson's qualitative similarity index (based solely on species presence or absence data) revealed that pairs of sown and non-sown plots within a management treatment did not appear to converge during succession. However, using Sorenson's quantitative similarity measure (based on both species occurrence and abundance) pairs of plots became increasingly similar after the first year. The sown plots became less similar to each other using the qualitative similarity measure, but this was less marked using the quantitative measure. In contrast, the non-sown plots became less similar to each other with the quantitative measure, but no changes were observed with the qualitative measure. The vegetation in the sown plots became more like that in the non-sown plots as sown species failed to persist. In contrast, the non-sown plots became more like the sown plots as the sown grasses *Agrostis capillaris* and *Festuca rubra* increased in abundance. The exception to this was the cattle-grazed sown plots, which retained more sown species, however, succession in this treatment also converged towards the non-sown plots because the non-sown species *Trifolium repens* and *Ranunculus repens* increased in abundance in this treatment. The addition of seeds of a desired grassland community appeared to have less effect in directing the trajectory of succession than did the vegetation management.
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943. Elements of grazing strategies for perennial grass management in rangelands.

Hodgkinson, Ken C.
In: *Desertified grasslands: Their biology and management.* (Held 1 Feb 1927 at London.) Chapman, G. P. (eds.) London: Academic Press; pp. 77-94; 1992.
NAL Call #: QK658.A1L5 no.13; ISBN: 0121685705
Descriptors: grasslands--congresses/ grassland ecology--congresses/ desertification--control--congresses/ grasslands--management--congresses
This citation is from AGRICOLA.

944. Elk and cattle forage use under a specialized grazing system.

Halstead, L. E.; Howery, L. D.; Ruyle, G. B.; Krausman, P. R.; and Steidl, R. J.

Journal of Range Management 55(4): 360-366. (2002)

NAL Call #: 60.18 J82; ISSN: 0022-409X

Descriptors: beef cattle/ grazing/ *Cervus elaphus canadensis*/ stubble/ rotational grazing/ topography/ wildlife management/ *Pascopyrum smithii*/ canopy/ Arizona

Abstract: The Walker Basin Allotment grazing system in central Arizona is designed to allocate resource use under elk (*Cervus elaphus* L.) and cattle (*Bos taurus* L.) grazing. The grazing system was designed to promote biologically acceptable levels of forage use on the half of the allotment scheduled for cattle grazing and to rest the other half by attracting elk to pastures recently grazed by cattle. The objectives of our 2-year study were to determine whether the grazing system facilitated proper forage use as defined by recent forage use and residual stubble height guidelines (i.e., 30 to 40% use and an 8- to 10-cm stubble height) and whether the system rested one half of the allotment from elk and cattle grazing. Mean (+/- SEM) total elk and cattle forage use for western wheatgrass (*Pascopyrum smithii* Rydb.), the key forage species, was 32 and 61% +/- 7 in 1997 and 1998, respectively; corresponding mean (+/- SEM) stubble heights were 11 and 10 cm +/- 0.6. Mean total cattle and elk forage use in 1998 (61%) exceeded the 30 to 40% use guidelines. However, mean end-of-year stubble height was never below 10 cm. The grazing system did not provide half the allotment with complete rest; elk used all study pastures. Elk use was higher in pastures with heavier tree cover and steeper terrain in both years, regardless of where cattle grazing occurred. Elk grazing patterns were apparently more dependent on tree cover and topography than any changes in forage caused by the grazing system.

This citation is from AGRICOLA.

945. Environmental effects of low intensity systems of animal production in the hills and uplands of the UK.

Milne, J. A.

Animal Science 63(3): 363-371. (1996)

NAL Call #: SF1.A56; ISSN: 0003-3561

Descriptors: animal production/ environmental impact/ grazing systems/ nature conservation/ vegetation/ grasslands/ grazing/ grazing intensity/ upland grasslands

Abstract: The extent to which grazing intensities of animal production systems in the uplands of the United Kingdom cause impacts on vegetation, soils, birds, mammals and invertebrates, and influence landscape value and water quality are reviewed. It is argued that these impacts need to be considered in an integrated manner in relation to their responses at the field and landscape scales. Evidence is presented which suggests that a range of grazing intensities is required to obtain significant benefits to the natural heritage. This suggests that new approaches are required to the mechanisms of delivering environmental benefits from grazing systems.

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946. Equilibrium and non-equilibrium models of livestock population dynamics in pastoral Africa: Their relevance to Arctic grazing systems.

Behnke, R. H.

Rangifer 20(2-3): 141-152. (2000)

NAL Call #: QL737.U55R341; ISSN: 0333-256X

Descriptors: carrying capacity/ conservation biology/ drought/ economic conditions/ equilibrium dynamics/ food availability/ nonequilibrium dynamics/ overgrazing/ population dynamics/ production strategies/ rainfall/ semi arid rangelands: habitat/ snow cover/ social conditions/ stock density/ temperature

Abstract: Equilibrium grazing systems are characterised by climatic stability that results in predictable primary production. Non-equilibrium grazing systems receive low and erratic rainfall that produces unpredictable fluctuations in forage supplies. In semi-arid Africa, these two types of environment present livestock owners with very different management problems. Identifying and maintaining optimal stocking rates is useful in equilibrium systems because livestock reproduce and produce at a rate determined by the availability of feed, which is an inverse function of stock density. The only problem is to determine what stocking rate is optimal. The correct stocking rate for a grazing system will vary depending on the production strategy and the social and economic circumstances of the rangeland user - there is no single, biologically predetermined optimum density. Variable rainfall complicates the picture in non-equilibrium systems. Set stocking rates of any kind have little value if fluctuation in rainfall has a stronger effect than animal numbers on the abundance of forage. More useful in such an environment is the ability to adjust stocking rates rapidly to track sudden changes in feed availability. In semi-arid Africa, the distinction between equilibrium and non-equilibrium systems hinges on the reliability of rainfall. In northern latitudes, at least three primary variables important for plant growth and the survival of herbivores must be considered: rainfall, snow cover and temperature. It is probably not useful to consider arctic grazing systems as equilibrium systems; on the other hand, the non-equilibrium models developed in hot semi-arid environments do not capture the range of complexity which may be an inherent feature of plant-herbivore dynamics on the mountain and tundra pastures where reindeer are herded or hunted.

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947. An evaluation of grazing intensity influences on California annual range.

Rosiere, R. E.

Journal of Range Management 40(2): 160-165. (1987)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1987/402/17rosi.pdf>

Descriptors: *Trifolium subterraneum*/ *Bromus mollis*/ *Bromus rigidus*/ *Avena barbata*/ *Avena fatua*/ *Hordeum leporinum*/ *Hordeum hystris*/ *Festuca dertonensis*/ *Festuca megalura*/ *Erodium cicutarium*/ *Erodium botrys*/ growth/ environmental conditions

Abstract: Influences of grazing intensity on species composition and herbage production of grass-woodland and improved grassland subtypes of annual range were evaluated over a 5-year period in coastal northern California using 3 grazing treatments (100, 150, and 200% of moderate stocking). Herbage utilization did not differ significantly between the 2 subtypes but averaged 42, 52,

and 69% for the respective treatments. Plants species and production responses differed significantly between woodland and grassland subtypes. On woodland, rigput brome (*Bromus rigidus* Roth.) and wild oats (*Avena barbata* Brot. and *A. fatua* L.) were most sensitive to grazing intensity while wild barley (*Hordeum leporinum* Link. and *H. hystris* Roth.) and annual fescue (*Festuca dertonensis* (all.) Asch. and Graebn. and *F. megalura* Nutt.) were least sensitive. On improved grassland, subterranean clover (*Trifolium subterraneum* L.) increased and soft chess (*Bromus mollis* L.) decreased with increasing grazing intensity. Soft chess remained most plentiful on woodland range under heaviest grazing and it continued to be a major species under heavy grazing of grassland, demonstrating tolerance to grazing intensity. Filaree (*Erodium cicutarium* (L.) L'Her. and *E. botrys* (Cav.) Bertol.) declined on woodland but increase on grassland as grazing intensified. Peak standing crop was not significantly affected by grazing intensity on woodland range but was greatest at 150% of moderate stocking and lowest at 200% of moderate stocking on grassland range. Decline in grassland herbage yield under heaviest grazing was due to reduction of soft chess which was displaced by subterranean clover. Effects of grazing intensity on range composition and productivity were confounded by innate differences in ranges and yearly weather patterns. Herbage production was impacted more by annual growing conditions than by grazing regimens, but there was no correlation between total annual precipitation and peak standing crop.

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948. Evaluation of rest-rotation grazing in the Missouri River Breaks on the Charles M. Russell National Wildlife Refuge, Montana.

Oldemeyer, J. L.; Reid, V. H.; Nickey, D. A.; and Hedrick, M.

In: Proceedings of the Wildlife-Livestock Relationships Symposium. (Held 20 Apr 1981-22 Apr 1981 at Coeur D'alene, Idaho.) Peek, James M. and Dalke, P. D. (eds.) Moscow, Idaho: Forest, Wildlife & Range Experiment Station, University of Idaho; pp. 32-46; 1982.
NAL Call #: SF84.84.W5 1981

949. An evaluation of the empirical basis for grazing management recommendations for rangeland in southern Africa.

O'Reagain, P. J. and Turner, J. R.

Journal of the Grassland Society of Southern Africa 9(1): 38-49. (1992)
NAL Call #: SB197.J68; ISSN: 0256-6702

Descriptors: sheep/ cattle/ goats/ continuous grazing/ rotational grazing/ stocking rate/ range degradation potential/ veld type/ South Africa

Abstract: Analysis of over 50 grazing experiments conducted in southern Africa does not support certain management recommendations. Furthermore, the conclusions of some experiments are questionable owing to poor experimental design or confirmation bias. Based on available evidence, it was concluded that (i) stocking rate has a major impact on range condition and animal production, (ii) continuous and rotational grazing or pauci- and multi-camp systems differ little in terms of their effects upon range condition or animal production, (iii) sheep have a greater potential for range degradation than either cattle or goats, but this effect may be ameliorated and sheep

production increased by stocking sheep with cattle at narrow ratios, (iv) separation of veld types appears important, and (v) regular seeding or vigour rests, or rests to accumulate fodder, appear essential. Simple grazing systems using adaptive and opportunistic management are recommended.

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950. Factors influencing eastern redcedar seedling survival on rangeland.

Schmidt, T. L. and Stubbendieck, J.

Journal of Range Management 46(5): 448-451. (1993)
NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1993/465/13schm.pdf>

Descriptors: Juniperus virginiana/ plant competition/ grazing/ Nebraska

Abstract: Eastern redcedar (*Juniperus virginiana* L.) is the most rapidly expanding woody species on rangeland in the Great Plains. Reasons for the expansion and management solutions have not been determined. The objective of this study was to determine the effect of year of establishment, grazing impacts, and aspect on the survival of eastern redcedar seedlings. Subplots of 10 transplanted eastern redcedar seedlings were replicated at 2 sites in west-central Nebraska. Plots were established in 1987 and 1988 under 3 different grazing levels: actively grazed, actively grazed until 1987 and then fenced from grazing, and not grazed for greater than or equal to 50 years. Split-plots within the 3 grazing levels were established on 3 different aspects: north-facing, south-facing, and flat. Seedling survival was evaluated 6, 18, and 30 months after establishment period. The year that the seedling was established influenced seedling survival after 18 months. Grazing effects and aspect were significant factors in the survival of eastern redcedar seedlings for all 3 evaluation periods. Highest survival for grazing effects occurred where eastern redcedar seedlings were transplanted into plots that were grazed until 1987 and then fenced (57% +/- 1.5%). Lowest survival rates concerning grazing were for areas that were not grazed for greater than or equal to 50 years (40% +/- 3.0%). North-facing slopes had the highest survival after 30 months (65% +/- 2.4%). South facing slopes had the lowest survival after 30 months (34% +/- 2.9%). Land managers may be able to reduce eastern redcedar seedling establishment on grazed range lands through different grazing practices.

This citation is from AGRICOLA.

951. A fence-line contrast reveals effects of heavy grazing on plant diversity and community composition in Namaqualand, South Africa.

Todd, S. W. and Hoffman, M. T.

Plant Ecology 142(1/2): 169-178. (1999)
NAL Call #: QK900.P63; ISSN: 1385-0237

Descriptors: plant communities/ species diversity/ grazing/ plants/ overgrazing/ grazing intensity/ rangelands/ botanical composition/ palatability/ shrubs/ annuals/ plant morphology/ volume/ seedlings/ population dynamics/ land use/ community ecology/ South Africa

Abstract: Changes in plant species richness and community composition were investigated across a fence separating heavily grazed communal and lightly grazed commercial farming systems in Namaqualand, South Africa. No significant differences in plant species richness between communal and commercial farming systems were

detected either locally within individual plots or overall across all plots. Within-plot, richness of species tolerant of grazing, such as annuals and geophytes, has increased, while the richness of large palatable shrub species has decreased on the communal rangeland. In terms of plant cover, species' responses to grazing were strongly associated with growth form. Annuals and geophytes formed the majority of grazing increasers, while large, presumably palatable, shrubs and leaf succulents were characteristic grazing decreasers. An investigation into population processes of five shrub species revealed that heavy grazing on the communal rangeland has resulted in: reduced size of palatable shrub species; reduced flower production and seedling recruitment of palatable species; increased density and recruitment of the unpalatable shrub, *Galenia africana*. Reductions in shrub volume, reproductive output and seedling recruitment were most marked in the palatable shrub *Osteospermum sinuatum* and were in the order of 90%. The results are further discussed in terms of their relevance to rangeland dynamics and the current land use practices of the region.

This citation is from AGRICOLA.

952. Forage height and mass in relation to grazing management.

Wright, I. A.

In: Emerging technology and management for ruminants: 1985 Livestock Seminars, International Stockmen's School/ Baker, Frank H. and Miller, Mason E.

Morillton, Ark.: Winrock International, 1985; pp. 341-348
NAL Call #: SF191.2.I68

Descriptors: beef cattle/ grazing/ stocking rate/ range management/ forage crops/ height/ mass

This citation is from AGRICOLA.

953. Frequent mowing is better than grazing for the conservation value of lowland tussock grassland at Pontville, Tasmania.

Verrier, Frances J. and Kirkpatrick, J. B.

Austral Ecology 30(1): 74-78. (2005)

NAL Call #: QH540 .A8; ISSN: 1442-9985

Descriptors: mowing: applied and field techniques/ biomass reduction/ conservation value/ lowland tussock grassland/ moderate grazing/ rare species

Abstract: The effects of an unusual high frequency mowing regime, which involved the removal of slash, were compared to moderate grazing through the method of paired quadrats across a fenceline, which was orthogonal to a weak environmental gradient. The mown plots proved superior in their conservation characteristics to the moderately grazed plots. The mowing regime produced greater cover of rare or threatened species, greater native cover and lesser exotic grass cover. It thus presents an opportunity for maintaining or improving the condition of previously grazed remnants in reserves without resorting to the use of stock or fire for biomass reduction.

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954. Grass composition and rangeland condition of the major grazing areas in the Mid Rift Valley, Ethiopia.

Sisay, Amsalu and Baars, R. M. T.

African Journal of Range and Forage Science 19(3): 161-166. (2002)

NAL Call #: SB197.J68; ISSN: 1022-0119

Descriptors: altitude zones/ grass composition/ grazing pressure/ rangeland condition/ soil erosion

Abstract: A range inventory and condition study was conducted in three altitude zones: lowland (1 500-1 700m), medium altitude (1 700-2 000m), and highland (2 000-2 500m). Each altitude zone was stratified into four or five important grazing areas. One area represented lightly grazed government ranches or parks which were used as benchmarks, another area represented the seasonal grazing areas with an intermediate grazing pressure and the remaining were the heavily grazed roadsides, lakeshores and other communal grazing lands. The range condition assessment was based on the composition of the herbaceous layer, basal cover, litter cover, relative number of seedlings, age distribution of grasses, soil erosion and soil compaction. Dry matter was sampled in the mid-wet season to assess the relationship between available dry matter and range condition. A total of 36 grass species, 3 legume species, 2 sedge species, 15 other herbs and 31 species of trees were identified. The palatable *Cenchrus ciliaris* was dominant in the benchmarks and seasonally grazed areas of the lowland while *Hyparrhenia* spp. dominated in the same areas of the medium altitude.

Cynodon dactylon, and the non-palatable *Eleusine floccifolia* and *Pennisetum schimperi* were dominant on heavily grazed areas of the lowland, medium altitude and highland, respectively. The total score for range condition of the benchmarks (34 out of 50 points), was significantly higher than that of the seasonally grazed areas (26), the heavily grazed communal grazing areas (19), roadsides (16) and lakeshores (17) ($P < 0.05$). The highlands showed a higher score for benchmarks and seasonally grazed areas only. There was a significant linear relationship between available dry matter of grasses and range condition (excluding unpalatable pioneer grasses, $r^2 = 0.56$, $P < 0.01$). Seasonally grazed areas were identified as key sites for pasture improvement since these are privately owned and managed. Pasture improvement will reduce the grazing pressure on the heavily grazed roadsides, lakeshores and other communally grazed areas.

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955. Grassland recovery by protection from grazing in a semi-arid sandy region of northern China.

Zhang, Ji Yi; Wang, Ying; Zhao, Xia; Zhang, Ting; and Xie, Gang

New Zealand Journal of Agricultural Research 48(2): 277-284. (2005)

NAL Call #: 23 N4892; ISSN: 0028-8233

Descriptors: desertification/ grazing/ biodiversity loss/ grassland recovery/ semi arid sandy region/ community structure development/ community function restoration

Abstract: Vegetation destruction resulting from overgrazing and conversion of rangelands to agricultural use is one of the biggest causes of land desertification and biodiversity loss. The community cover, biomass, species composition, species richness, and species diversity of each of six sites protected from grazing for times ranging from 3 to 45 years were investigated in a semi-arid sandy region called Horqin Sandy Land, northern China. Community cover was maximal in the site with 45 years protection from grazing, and biomass was maximal in the site with 18 years' protection due to the vigorous growth of *Artemisia halodendron*. Species richness and diversity tended to increase as protected time increased. The results showed

that up to 45 years' protection from grazing produced positive and encouraging changes in the site. As the number of years of protection increased, the development of community structure and restoration of community function increased. The study provided an example of grassland recovery under natural conditions in this semi-arid sandy region, and suggested that protection from grazing may be an effective, financially economical and natural way to restore vegetation. It is suggested that this could be of great significance for land use and management practices.

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956. The grassy vegetation of the Darling Downs south-eastern Queensland, Australia: Floristics and grazing effects.

Fensham, R. J.

Biological Conservation 84(3): 301-310. (1998)

NAL Call #: S900.B5; ISSN: 0006-3207

Descriptors: exotic species spread/ floristics/ grassland: habitat/ grazing/ mechanical disturbance/ species richness/ woodland: habitat

Abstract: An ordination of floristic data from the grassy vegetation of the Darling Downs in southern Queensland describes four broad vegetation types, red gum (*Eucalyptus camaldulensis*/E. *tereticornis*) woodland associated with the flood-plain of the major streams, grassland on alluvial clay, poplar box (*E. populnea*) on clay loam terraces and hill woodland dominated by any of *E. albens*, *E. crebra*, *E. melliodora*, *E. orgadophila*. Ten per cent of species proved sensitive to grazing intensity categories (derived largely from land tenure) in hill woodland compared to 3% of species in grassland or poplar box woodland. There were no clear trends in the relative response of native and exotic species, although overall, species richness was greatest in either the moderate or heavily grazed treatment for all broad vegetation types. It is suggested that the interaction between Themeda dominance and the inter-tussock flora may contribute to the importance of grazing as a determinant of floristic composition in hill woodland broad vegetation type. Mechanical disturbance is implicated as a means of effecting the spread of exotic plants. However, there are relatively few exotic species that appear to have the capacity to displace native species without mechanical disturbance, although a notable exception is *Phyla canescens* in the flood-prone habitat. Moderate domestic stock grazing is compatible with nature conservation on the Darling Downs, although it is demonstrated that a proportion of the flora is sensitive to grazing. Remnants will need to be managed under a range of grazing regimes, including light total grazing pressure that excludes domestic stock to ensure the survival of the full range of species.

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957. Grazing and management of saltland shrubs.

Malcolm, C. V. and Pol, J. E.

Journal of Agriculture, Western Australia 27(2): 59-63. (1986)

NAL Call #: 23 W52J; ISSN: 0021-8618

Descriptors: woody plants/ grazing/ sheep/ range management/ *Atriplex*/ *Maireana*/ halophytes/ salt tolerance/ Western Australia

This citation is from AGRICOLA.

958. Grazing as a control against 'grass-encroachment' in dry dune grasslands in the Netherlands.

Kooijman, A. M. and Van Der Meulen, F.

Landscape and Urban Planning 34(3-4): 323-333. (1996)

NAL Call #: QH75.A1L32; ISSN: 0169-2046

Descriptors: conservation/ dry dune grassland/ field method/ grass encroachment/ grazing/ habitat/ species richness

Abstract: A study in dune grasslands in two Dutch coastal dune areas suggests that 'grass-encroachment', the dominance of a few tall grass species in formerly open, species-rich dune grasslands in the Netherlands, results in a loss of species, notably therophytes, bryophytes and lichens, as well as a strong reduction of the availability of daylight at the ground floor. Grazing with cattle and ponies as a control against 'grass-encroachment' has been studied in two coastal dune areas. Grazing with shetland ponies in 'de Zepeduinen' began in 1983. Aerial photographs of 1978, 1988 and 1993 were compared. After an initial increase in tall grass communities in both the valleys and the elevated dune ridges (8-20%) at the expense of more open vegetation, the photographs of 10 years of grazing revealed a decrease of tall grass cover (7-8%) and an increase of low grassland communities (4-5%). Grazing experiments in 'het Zwanenwater' started in parts of the area in 1984 and 1989. Comparison of vegetation maps of 1986 and 1992 revealed that tall grass cover increased over this period in the grazed areas (from 1-4% to 21-26%), but open communities were still prevalent (38-53%). In the non-grazed area, open communities declined dramatically (from 77% to 17%) and tall grass cover increased accordingly (from 3% to 53%). These preliminary results suggest that the present grazing regimes are perhaps not sufficient to stop grass-encroachment completely, but grazing seems a reasonably effective tool of management in terms of vegetation structure.

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959. Grazing as a tool for rangeland management in semiarid regions: A case study in the north-western coastal zone of Egypt.

Duivenbooden, N. van

Agriculture, Ecosystems & Environment 43(3/4): 309-324. (1993)

NAL Call #: S601 .A34; ISSN: 0167-8809

Descriptors: range management

Abstract: Subshrubs are the dominant plant type of rangeland in the north-western coastal zone of Egypt. As animal husbandry depends to a large extent on this feed source, effects of grazing on plant growth were investigated. Experimental results showed that grazing extends the growing period of subshrubs. The mechanism underlying this phenomenon is lower water use by the plants in the rainy season and the consequent higher availability in the dry season. Owing to the characteristic growth form of the subshrubs, leaves are protected inside their dense structure, ensuring plant growth while grazing takes place. Simulations suggested that water storage in deeper soil layers is a function of grazing intensity and annual precipitation. It is suggested that a considerable grazing pressure is necessary to maintain the rangeland. Regeneration of the rangeland is a problem and physical removal (firewood) is a greater danger to its persistence than is grazing.

This citation is from AGRICOLA.

960. Grazing, ecological condition and biodiversity in riparian river red gum forests in south-eastern Australia.

Jansen, A. and Robertson, A. I.

Proceedings of the Royal Society of Victoria 117(1): 85-95. (2005); ISSN: 0035-9211

Descriptors: birds/ ecological condition/ frogs/ plants/ riparian grazing

Abstract: The ecological condition of riparian habitats and the biodiversity of terrestrial birds, wetland frogs and herbaceous plants were surveyed in river red gum habitats on the Murrumbidgee and Murray Rivers. Sites were classified according to the intensity of grazing by domestic livestock: ungrazed; low grazing (<5 DSE/ha/annum); and high grazing (>5 DSE/ha/annum). Declines in the ecological condition of riparian habitats and loss of biodiversity of birds, frogs and plants were clearly associated with increased grazing intensity in river red gum habitats. Riparian condition differed significantly between all three levels of grazing, while bird, frog and plant communities differed significantly between high and low grazing intensities. Loss of woodland-dependent and threatened species of birds, fewer occurrences of tadpoles and the loss of several functional groups of native plants were also related to increases in grazing intensity. Exotic grasses were more abundant in low grazed sites than in ungrazed sites. While it is clear that grazing has had significant impacts on riparian function and biodiversity, it is not clear whether these impacts can be reversed to fully restore riparian river red gum habitats. To achieve full restoration of riparian function and biodiversity may require not only fencing to exclude stock or significantly reduce stocking rates, but also replanting of trees, shrubs and understorey, as well as on-going control of exotic species and restoration of more natural flooding regimes.
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961. Grazing ecology and the conservation of heather moorland: The development of models as aids to management.

Grant, S. A. and Armstrong, H. M.

Biodiversity and Conservation 2(1): 79-94. (1993)

NAL Call #: QH75.A1B562; ISSN: 0960-3115

Descriptors: Calluna vulgaris/ grazing/ overgrazing/ sheep/ feeding preferences/ environmental degradation/ United Kingdom

This citation is from AGRICOLA.

962. Grazing effect on diversity of annual plant communities in a semi-arid rangeland: Interactions with small-scale spatial and temporal variation in primary productivity.

Osem, Y.; Perevolotsky, A.; and Kigel, J.

Journal of Ecology 90(6): 936-946. (2002)

NAL Call #: 450 J829; ISSN: 0022-0477

Descriptors: competition/ disturbance/ Mediterranean sheep/ species richness

Abstract: 1. The interactive effect of grazing and small-scale variation in primary productivity on the diversity of an annual plant community was studied in a semiarid Mediterranean rangeland in Israel over 4 years. The response of the community to protection from sheep grazing by fenced enclosures was compared in four neighbouring topographic sites (south- and north-facing slopes, hilltop and wadi (dry stream) shoulders), differing in

vegetation, physical characteristics and soil resources. The herbaceous annual vegetation was highly diverse, including 128 species. Average small-scale species richness of annuals ranged between 5 and 16 species within a 20 × 20 cm quadrat, and was strongly affected by year and site. 2. Above-ground potential productivity at peak season (i.e. in fenced subplots) was typical of semiarid ecosystems (10-200 g m⁻²), except on wadi shoulders (up to 700 g m⁻²), where it reached the range of subhumid grassland ecosystems. Grazing increased richness in the high productivity site (i.e. wadi), but did not affect, or reduced, it in the low productivity sites (south- and north-facing slopes, hilltop). Under grazing, species richness was positively and linearly related to potential productivity along the whole range of productivity. Without grazing, this relationship was observed only at low productivity (< 200 g m⁻²). 3. The effect of grazing along the productivity gradient on different components of richness was analysed. At low productivity, number of abundant, common and rare species all tended to increase with productivity, both with and without grazing. Rare species increased three times compared with common and abundant species. At high productivity, only rare species continued to increase with productivity under grazing, while in the absence of grazing species number in the different abundance groups was not related to productivity. 4. In this semiarid Mediterranean rangeland, diversity of the annual plant community is determined by the interaction between grazing and small-scale spatial and temporal variation in primary productivity, operating mainly on the less abundant species in the community.
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963. Grazing effects on germinable seeds on the fescue prairie.

Willms, W. D. and Quinton, D. A.

Journal of Range Management 48(5): 423-430. (1995)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/1995/485/423-430_willms.pdf

Descriptors: prairies/ grazing intensity/ seed germination/ seasonal variation/ botanical composition/ prairie soils/ stocking rate/ grazing/ Festuca campestris/ Alberta

Abstract: The germinable seed bank in a grassland affects the succession of degraded range and the recolonization of disturbed sites, and must be understood to predict potential responses to management. The germinable seed bank on the fescue prairie was characterized and its relationship to grazing, season, and depth of burial determined. The study was conducted in the fescue prairie of southwestern Alberta in livestock enclosures and on paddocks that, since 1949, have been stocked at fixed rates to achieve light, moderate, or heavy grazing pressures. Surface debris was sampled in fall and spring, and soil was sampled to a depth of 6 cm in spring. The samples were spread on vermiculite in trays and the seeds allowed to germinate over a 90-day period. In fall, total surface seed numbers m⁻² increased from 1,785 to 7,783 from the ungrazed to heavily grazed site, and most of the differences were accounted for by whitlowgrass (*Draba* spp.) and Kentucky bluegrass (*Poa pratensis* L.). These species also contributed most to differences between fall and spring on the grazed sites. Total seed numbers were similar (1,790 vs 1,803) in spring and fall on ungrazed sites. The species composition of the seed bank did not change with depth. In the soil, the annual forb pygmyflower (*Androsace septentrionalis* L.) was the most

common seed but was not detected in a vegetation survey. Soil disturbance in the fescue prairie is more likely to lead to a seral community dominated by annual forbs, than a rough fescue (*Festuca campestris* Rydb.) dominated grassland.

This citation is from AGRICOLA.

964. Grazing effects on plant cover, soil and microclimate in fragmented woodlands in south-western Australia: Implications for restoration.

Yates, Colin J.; Norton, David A.; and Hobbs, Richard J. *Austral Ecology* 25(1): 36-47. (2000)

NAL Call #: QH540 .A8; ISSN: 1442-9985

Descriptors: grazing effects: microclimate, plant cover, soil woodlands: fragmentation, restoration

Abstract: This study investigated the impacts of livestock grazing on native plant species cover, litter cover, soil surface condition, surface soil physical and chemical properties, surface soil hydrology, and near ground and soil microclimate in remnant *Eucalyptus salmonophloia* F. Muell woodlands. Vegetation and soil surveys were undertaken in three woodlands with a history of regular grazing and in three woodlands with a history of little or no grazing. Livestock grazing was associated with a decline in native perennial cover and an increase in exotic annual cover, reduced litter cover, reduced soil cryptogam cover, loss of surface soil microtopography, increased erosion, changes in the concentrations of soil nutrients, degradation of surface soil structure, reduced soil water infiltration rates and changes in near ground and soil microclimate. The results suggest that livestock grazing changes woodland conditions and disrupts the resource regulatory processes that maintain the natural biological array in *E. salmonophloia* woodlands. Consequently the conditions and resources in many remnant woodlands may be above or below critical thresholds for many species. The implications of these findings for restoration of plant species diversity and community structure are discussed. Simply removing livestock from degraded woodlands is unlikely to result in the restoration of plant species diversity and community structure. Restoration will require strategies that capture resources, increase their retention and improve microclimate.

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965. Grazing effects on species balance and herbage production in indigenous plant communities.

Grant, S. A. and Hodgson, J.

Nato Advanced Science Institutes Series: Series A: Life Sciences 108: 69-77. (1986)

NAL Call #: QH301.N32

Descriptors: grazing/ forage crops/ cattle/ sheep/ seasonal variation/ Scotland

This citation is from AGRICOLA.

966. Grazing effects on spring ecosystem vegetation of California's hardwood rangelands.

Allen-Diaz, B. and Jackson, R. D.

Journal of Range Management 53(2): 215-220. (2000)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/2000/532/215-220_allen.pdf

Descriptors: cattle/ body weight/ grazing/ species diversity/ botanical composition/ plant communities/ springs (water)/ riparian buffers/ plant litter/ highlands/ California

Abstract: Three watersheds at the University of California's Sierra Foothill Research and Extension Center (SFREC), Marysville, Calif. were selected to study cattle grazing effects on the vegetation surrounding cold-water springs and their downslope creeks. Three spring-creek systems from each of 3 watersheds were randomly assigned to grazing treatments (9 total). Treatments were ungrazed, lightly grazed (1,500 kg(.)ha(-1) residual dry matter), and moderately grazed (1,000 kg(.)ha(-1) residual dry matter) based on degree of use in upland pastures encircling the spring-creek systems. Total herbaceous cover at springs varied significantly among the 6 years only once (greater in 1994 than all others covarying with previous year's rainfall). Grazing intensity did not affect total herbaceous cover at springs. A year X grazing treatment interaction ($P < 0.05$) was detected for total herbaceous cover at spring-fed creeks. Three years after grazing removal, total herbaceous cover on ungrazed creek plots surpassed cover at moderately grazed and lightly grazed plots. Moderately grazed plot herbaceous cover declined steadily throughout the first 3 years, while lightly grazed cover remained relatively stable. Plant community composition and stability by year and grazing treatment were analyzed with TWINSPLAN. With few exceptions, stable plant communities persisted on sites regardless of grazing intensity or cover changes. Total herbaceous cover was sensitive to interannual fluctuations, especially under increased grazing intensities. This attribute renders cover a more useful gauge of ecosystem health than plant composition as the latter may not provide evidence of potentially deleterious grazing X climate interactions until after soil erosion or water table characteristics are seriously, perhaps permanently, altered.

This citation is from AGRICOLA.

967. Grazing effects on sustainable semiarid rangelands in Patagonia: The state and dynamics of the soil seed bank.

Bertiller, Monica B.

Environmental Management 20(1): 123-132. (1996)

NAL Call #: HC79.E5E5; ISSN: 0364-152X

Descriptors: grazing exclusion/ land management

Abstract: The composition of the germinable seed bank was studied in four vegetation states of the *Festuca pallescens* grasslands in semiarid Patagonia during four years. The aim of this study was to test whether aboveground vegetation states resulting from grazing exclusion or different combinations of grazing and topography are reflected in different states of the germinable seed bank. The size of the total and dicot germinable seed bank was positively related to the total cover in each state. Dicots dominated all germinable seed bank states. *Carex patagonica* increased its cover as well as its germinable seed bank under grazing disturbance. Grazing did not reduce the germinable seed bank of perennial grasses in uplands where the grazing pressure is lower as compared with slopes. In slopes the germinable seed bank of perennial grasses was significantly reduced by grazing. A reduction of the length of the grazing period in late spring increases the germinable seed bank of perennial grasses both in upland and slope. These results are interpreted in the frame of a model of management techniques where grazing exclusion during late spring and late summer increases the seed bank of the perennial grasses and promotes their establishment in uplands. The

artificial addition of seeds of perennial grasses and the manipulation of the soil surface in order to increase "safe sites" appear as management alternatives that deserve further evaluation to improve plant reestablishment in slopes.

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968. Grazing, environmental heterogeneity, and alien plant invasions in temperate Pampa grasslands.

Chaneton, Enrique J.; Perelman, Susana B.; Omacini, Marina; and Leon, Rolando J. C.

Biological Invasions 4(1-2): 7-24. (2002)

NAL Call #: QH353 .B563; ISSN: 1387-3547

Descriptors: anthropogenic disturbance/ biological invasions/ environmental fluctuation/ environmental heterogeneity/ enclosure experiments/ flooding/ grazing behavior/ herbivory/ landscape ecology/ salinity stress/ soil fertility gradients/ species composition/ species diversity/ species richness/ temperate humid grasslands: habitat/ vegetation surveys

Abstract: Temperate humid grasslands are known to be particularly vulnerable to invasion by alien plant species when grazed by domestic livestock. The Flooding Pampa grasslands in eastern Argentina represent a well-documented case of a regional flora that has been extensively modified by anthropogenic disturbances and massive invasions over recent centuries. Here, we synthesise evidence from region-wide vegetation surveys and long-term enclosure experiments in the Flooding Pampa to examine the response of exotic and native plant richness to environmental heterogeneity, and to evaluate grazing effects on species composition and diversity at landscape and local community scales. Total plant richness showed a unimodal distribution along a composite stress/fertility gradient ranging several plant community types. On average, more exotic species occurred in intermediate fertility habitats that also contained the highest richness of resident native plants. Exotic plant richness was thus positively correlated with native species richness across a broad range of flood-prone grasslands. The notion that native plant diversity decreases invasibility was supported only for a limited range of species-rich communities in habitats where soil salinity stress and flooding were unimportant. We found that grazing promoted exotic plant invasions and generally enhanced community richness, whereas it reduced the compositional and functional heterogeneity of vegetation at the landscape scale. Hence, grazing effects on plant heterogeneity were scale-dependent. In addition, our results show that environmental fluctuations and physical disturbances such as large floods in the pampas may constrain, rather than encourage, exotic species in grazed grasslands.

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969. Grazing for environmental benefits.

Bullock, D. J. and Armstrong, H. M.

In: *Grazing Management*. (Held 2 Feb 1929-2 Mar 2000 at Harrogate, United Kingdom.) Rook, A. J. and Penning, P. D. (eds.); pp. 191-200; 2000.

NAL Call #: SB197.B7; ISBN: 0905944542

970. Grazing frequency and ecosystem processes in a northern mixed prairie, USA.

Biondini, M. E. and Manske, L.

Ecological Applications 6(1): 239-256. (1996)

NAL Call #: QH540.E23; ISSN: 1051-0761

Descriptors: grazing/ frequency/ nutrient uptake/ grasslands/ prairies/ grazing systems/ grazing intensity/ botanical composition/ stocking rate/ mineral uptake/ nitrogen

Abstract: The effects of a twice-over rotation grazing system (ROT) and a season-long grazing system (SL) with cow/calf pairs were evaluated over a 6-year period at the Ranch Headquarters of the North Dakota State University Dickinson Research Center, to compare these effects with long-term grazing exclosures (NG) in terms of species composition and basal cover, aboveground net primary production (ANPP) and aboveground N uptake (ANPP-N), rates of litter and root decomposition, N release, soil N mineralization and immobilization, aboveground C and N flow, grazing intensity (GI) and animal performance. The study period included the drought of 1988. The prairie community was dominated by grasses such as *Agropyron smithii* [*Elymus smithii*], *Koeleria cristata* and *Stipa* sp. and associated with these species were species such as *Bouteloua gracilis*, *Carex filifolia* and *Carex heliophila*. No major differences were found in ANPP and ANPP-N between treatments, but there were important seasonal variations. An average of 72% of ANPP and >82% of ANPP-N occurred by mid-June. No differences were observed among treatments in terms of decomposition and N release rates from litter and root biomass, or in soil N mineralization. Grazing, however, reduced the amount of C and N immobilized in standing dead and litter and the flow of C and N from standing dead to litter to soil organic matter. The NG and ROT treatment were more similar in this regard when compared to the SL treatment, and their similarities increased after the drought of 1988. No consistent differences in GI between the ROT and SL treatments were observed. Before 1988 GI averaged 21% but in 1988 and 1989 GI increased to an average of 49% as a result of the drought and its after-effects. Cumulative animal performance was similar under both grazing treatments but with significant seasonal variations. Species composition was more responsive to grazing than were C and N flows. Differences were found between the grazed and NG treatments but not between the 2 grazing treatments studied. No broad patterns of change in total plant basal cover were observed as a result of grazing patterns or drought. Changes in species composition were highly dependent on range site, the most consistent pattern involving *B. gracilis* which had higher relative cover in the grazed treatments than in the NG treatment. It is suggested that in the grasslands of western North Dakota the recommended stocking rate may be too conservative, that rotational grazing may allow for higher stocking rates than season-long grazing without a major impact on animal performance, that rainfall is more important than grazing or grazing systems in the control of the ecosystem-level variables measured, and that species composition is affected by drought and grazing (but not by grazing systems) and are highly dependent on range site. It is concluded that drought and grazing tend to increase the relative proportions of warm-season grasses and forbs in the sward.

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971. Grazing impacts on infiltration in mixed prairie and fescue grassland ecosystems of Alberta.

Naeth, M. A.; Rothwell, R. L.; Chanasyk, D. S.; and Bailey, A. W.

Canadian Journal of Soil Science 70(4): 593-606. (1990)
NAL Call #: 56.8 C162; ISSN: 0008-4271

Descriptors: range condition/ compaction/ soil structure/ vegetation/ litter removal

Abstract: Infiltration capacity is generally reduced with increased grazing intensity and reduced range condition, mainly through vegetation and litter removal, solid structure deterioration, and compaction. Only one study has documented the effect of grazing on Canadian rangelands, necessitating further investigation. In this study, impact of long-term grazing on infiltration were assessed in mixed prairie and fescue grassland ecosystems of southern and central Alberta, Canada. Grazing regimes were of light to very heavy intensities, grazed early, late, and continuously during the growing season. Ungrazed controls were evaluated at each site. Infiltration was measured with double ring infiltrometers. Heavy intensity and/or early season grazing had greater impact on infiltration than light intensity and/or late season grazing. In mixed prairie, initial and steady state infiltration rates in the control were 1.5 and 1.7 times higher, respectively, than those in the early season grazed treatment. In parkland fescue, initial rates were lowest in June grazed treatments and steady state rates were highest in light autumn grazed and control treatments. Initial infiltration rates in foothills fescue control and light grazed treatments were 1.5-2.3 times those in heavy and very heavy grazed treatments. Steady state rates were 1.5-2 times higher in light grazed and control treatments than in moderate, heavy, and very heavy grazed treatments.

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972. Grazing impacts on litter and roots: Perennial versus annual grasses.

Mapfumo, E.; Naeth, M. A.; Baron, V. S.; Dick, A. C.; and Chanasyk, D. S.

Journal of Range Management 55(1): 16-22. (2002)
NAL Call #: 60.18 J82; ISSN: 0022-409X

Descriptors: Bromus inermis/ Bromus riparius/ triticale/ perennials/ annuals/ grazing intensity/ soil chemistry/ chemical composition/ carbon/ nitrogen/ root systems/ roots/ weight/ autumn/ spring/ seasonal variation/ plant litter/ Alberta

Abstract: Soil carbon (C) and nitrogen (N) storage in grasslands is a function of litter and root mass production. Research on how annual grasses compare with perennials for above ground and below ground mass production, and contributions to the soil C pool under pasture management is scarce. The objective of this research was to evaluate grazing intensity effects on litter and root mass, C and N pools of perennial grasses, smooth brome grass (*Bromus inermis* L.) and meadow brome grass (*Bromus riparius* Rhem.), and the annual grass, winter triticale (*X Triticosecale* Wittmack). Litter mass and C pool for the perennial grasses were greater than those for triticale. Litter C and N pools generally decreased with increased grazing intensity. Root mass was greater for the perennial grasses than for triticale at all grazing intensities. Meadow brome grass generally produced more root mass than smooth brome grass. Root C and N pools for triticale were 31 and 27%, respectively, of that for the perennial grasses.

Estimated total C contribution (roots and litter) to the resistant soil organic C pool was 1.5 times greater for light compared to heavy grazing. Total C (litter + root) contribution for perennial grasses was 2.7 times greater than that for triticale. Perennial grasses provided a larger litter base and root system that promote greater storage of C in the soil compared with triticale. This citation is from AGRICOLA.

973. Grazing impacts on litter and soil organic matter in mixed prairie and fescue grassland ecosystems of Alberta.

Naeth, M. A.; Bailey, A. W.; Pluth, D. J.; Chanasyk, D. S.; and Hardin, R. T.

Journal of Range Management 44(1): 7-12. (1991)
NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1991/441/2naet.pdf>

Descriptors: cattle/ grazing intensity/ prairies/ Festuca/ soil organic matter/ grazing/ plant litter/ Alberta

This citation is from AGRICOLA.

974. Grazing induced biodiversity in the highland ecozone of East Africa.

Woldu, Zerihun and Mohammed Saleem, M. A.
Agriculture, Ecosystems & Environment 79(1):

43-52. (2000)

NAL Call #: S601 .A34; ISSN: 0167-8809

Descriptors: biodiversity induction/ grassland/ grazing intensity/ life forms/ manure management practices/ rainfall pattern/ seed bank/ seed germination/ soil fertility/ species composition/ vegetation composition

Abstract: The species composition of grazing lands can be influenced by livestock and grazing pressure. A study on manure seed bank was conducted in Ghinchi highland Research Site in Ethiopia between 1995 and 1997. The data on species composition and life-form of the plants germinating in pots receiving air dried manure were compared with species composition of experimental plots in natural grassland subjected to varying grazing intensity. There was significant difference among the species composition of grazed and non-grazed grasslands and the manure seed bank ($p = 0.01$). The life-forms of the species also showed variation. There were more families and species in the natural grassland vegetation than indicated in the manure seed bank. The manure seed bank had more annuals than the natural grassland vegetation. The species composition and life-forms in the manure seed bank showed variation with time and this corresponded with the seasonal variation in the grassland, which had a direct relationship with the rainfall pattern. The study showed that livestock play a major role in maintaining the biodiversity of grassland vegetation by spatial and temporal dispersion of readily germinating seeds in their manure. The use of manure to improve soil fertility should be weighed cautiously against the introduction of weeds into crop fields, although weeds are important feed resource for livestock in land-constrained areas. There is therefore the need for developing manure management practices so that the benefits can be optimised and the undesirable effects can be minimised.

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975. Grazing influences on watering point vegetation in the Chihuahuan desert.

Fusco, M.; Holechek, J.; Tembo, A.; Daniel, A.; and Cardenas, M.

Journal of Range Management 48(1): 32-38. (1995)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/1995/481/032-038_fusco.pdf

Descriptors: cattle/ drinking water/ range management/ stocking rate/ botanical composition/ poisonous plants/ arid zones/ New Mexico

Abstract: Long-term influences of livestock grazing on vegetation around watering points was studied on 2 upland Chihuahuan desert ranges in southcentral New Mexico using regression analysis. One range had been conservatively stocked since the 1950's while the other was more heavily stocked. About 45% of the climax vegetation occurred on the heavily stocked range compared to 70% on the conservatively stocked range. During 3 years of study, both ranges were stocked conservatively so annual utilization of the key forage grasses was 30-35%.

Regression analyses showed black grama (*Bouteloua eriopoda* Torr.), mesa dropseed (*Sporobolus flexuosus* Thurb, Rybd.), threeawn (*Aristida* sp.), and total perennial grass standing crop increased as distance from water increased on the good condition range ($P < 0.05$).

However, black grama and threeawn standing crop showed no association with distance from water on the fair condition range. Broom snakeweed (*Xanthocephalum sarothrae* Pursh.), the primary poisonous plant found on both ranges, was associated ($r^2 = 0.35$) with distance from water only on the good condition range in April. Poisonous plants other than broom snakeweed decreased as distance from water increased with the exception of the fair condition range in October. No livestock losses from poisonous plants were noted on either range over the 3 years. We attribute this to the present conservative stocking rates. Our study supports the recommendation that downward stocking rate adjustments be made for the zone more than 1,600 m from water.

This citation is from AGRICOLA.

976. Grazing intensity, aspect, and slope effects on limestone grassland structure.

Amezaga, I.; Mendarte, S.; Albizu, I.; Besga, G.; Garbisu, C.; and Onaindia, M.

Journal of Range Management 57(6): 606-612. (Nov. 2004)

NAL Call #: 60.18 J82; ISSN: 0022-409X

Descriptors: botanical composition/ forage quality/ Spain

Abstract: Three treatments were used to evaluate the effect of grazing intensity (ca 30% and 50% herbage removal), aspect (north and south), and slope (< 10% and 10%-30%) on plant community structure of mountain grasslands in the Basque Country (Spain). Plant species richness was not significantly affected by grazing intensity, aspect, or slope. Although plant species composition was similar (Sorensen's similarity index = 0.87) between both grazing intensities, species frequency and cover were affected by grazing intensity. *Festuca rubra* L. and *Agrostis capillaris* L. were the most common species under both grazing pressures. Moderate grazing intensity (50% herbage removal) plots contained a greater number of plant species with a frequency of more than 50%. The lowest cover for *F. rubra* corresponded to low grazing intensity, north aspects, and steeper slopes. The lowest cover for *A.*

capillaris was found under low grazing intensity (30% herbage removal) and steeper slopes. *Danthonia decumbens* (L.) P. C., *Potentilla erecta* (L.) Rauschal, and *Trifolium repens* L. were significantly affected by aspect and grazing intensity. Low grazing intensity on sites with northern aspects and steep slopes favored *Agrostis curtisii* Kerguelen, a species with a low nutritional value. *A. capillaris*, *A. curtisii*, *P. erecta*, and *T. repens* were sensitive to soil properties and aspect. Nitrogen and K soil concentrations were significantly higher in areas with low grazing intensity, most likely due to greater dead herbage accumulation. Significant ($P < 0.05$) correlations between plant species and soil pH or P concentration were found in areas with low grazing intensity. Reduction in grazing intensity together with the effect of slope and northern aspect has resulted in changes in plant community structure, leading to increases in forages with lower nutritional value.

This citation is from AGRICOLA.

977. Grazing intensity effects on litter decomposition and soil nitrogen mineralization.

Shariff, A. R.; Biondini, M. E.; and Grygiel, C. E.

Journal of Range Management 47(6): 444-449. (1994)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1994/476/5shar.pdf>

Descriptors: grasses/ grazing intensity/ rangelands/ biogeochemical cycles/ degradation/ rangeland soils/ plant litter/ North Dakota

Abstract: A 2 year study in south central North Dakota determined the responses of (1) litter and root decomposition and nitrogen (N) release, and (2) soil N mineralization to grazing intensity. The treatments were: long term not grazed, moderate grazing, and heavy grazing. The moderate grazing and the heavy grazing treatments removed 45% and 77% of annual above-ground growth respectively. The moderate grazing treatment resulted in higher decomposition and soil N mineralization rates, and lower N releases via decomposition than the long term not grazed and heavy grazing treatments. No consistent differences were found between the long term not grazed and heavy grazing treatments. Annual litter and root decomposition rates in the moderate grazing treatment averaged 55% for 1989-1990 and 63% for 1990-1991 while the long term not grazed and heavy grazing treatments had rates for the same periods of 13% and 19%. The moderate grazing treatment had a net soil N mineralization of 60 micrograms.g⁻¹ and 269 micrograms.g⁻¹ during the 1989 and 1990 growing seasons whereas the long term not grazed and heavy grazing treatments had net soil immobilization for the same periods of -59 micrograms.g⁻¹ and -115 micrograms.g⁻¹. Annual N release from litter and root decomposition in the heavy grazing and long term not grazed treatments averaged 70% and 38% respectively during the 1989-1990 incubation period, and 51 % and 23% during 1990-1991. The equivalent values for the moderate grazing treatment were 47% and -6% (net N immobilization) for 1989-1990 and 41% and 23% for 1990-1991. Results from this study seem to indicate that the standard grazing rule of "take half leave half" may have a significant impact in N conservation and the supply of mineral N for plant growth.

This citation is from AGRICOLA.

978. Grazing intensity on the plant diversity of alpine meadow in the eastern Tibetan plateau.

Wu Ning; Liu Jian; and Yan ZhaoLi

Rangifer (Special Issue 15): 9-15. (2004)

NAL Call #: QL737.U55R341; ISSN: 0801-6399

Descriptors: alpine grasslands/ biodiversity/ environmental degradation/ grasslands/ grazing/ grazing systems/ high altitude/ rangelands/ seasonal variation/ seasons/ species diversity/ Kobresia pygmaea

Abstract: Because of the remoteness and harsh conditions of the high-altitude rangelands on the eastern Tibetan Plateau, the relationship between yak grazing and plant diversity has not been so clear although livestock increase was thought as the main issue leading to the degradation of rangeland. In the debate of rangeland degradation, biodiversity loss has been assumed as one of the indicators in the last two decades. In this paper authors measured the effects of different grazing intensities on the plant diversity and the structure of Kobresia pygmaea community in the case-study area, northwestern Sichuan. The results indicated that plant diversity of alpine meadow has different changing trends respectively with the change of grazing intensity and seasons. In June the highest plant diversity occurred in the intensively grazed (HG) plots, but in July and September species biodiversity index of slightly grazed (LG) plots is higher than other experimental treatments. In August the intermediate grazed (IG) plots has the highest biodiversity index. Moreover, it was found that intensively grazing always leads to the increase of plant density but meanwhile the decrease of community height, coverage and biomass. Over-grazing can change the community structure and lead to the succession from Kobresia pygmaea dominated community to Poa pratensis dominated. Analysing results comprehensively, it can be suggested that the relationship between grazing intensity and plant diversity is not linear, i.e. diversity index is not as good as other characteristics of community structure to evaluate rangeland degradation on the high altitude situation. The change of biodiversity is so complicated that it can not be explained with the simple corresponding causality.

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979. Grazing management effects on plant species diversity in tallgrass prairie.

Hickman, K. R.; Hartnett, D. C.; Cochran, R. C.; and Owensby, C. E.

Journal of Range Management 57(1): 58-65. (Jan. 2004)

NAL Call #: 60.18 J82; ISSN: 0022-409X

Descriptors: cattle/ stocking rate/ grazing intensity/ rotational grazing/ botanical composition/ plant communities/ prairies/ C4 plants/ plant architecture/ spatial distribution/ endemic species/ perennials/ forbs/ annuals/ prescribed burning/ range management/ Kansas

Abstract: A 6-year study was conducted in tallgrass prairie to assess the effects of grazing management (cattle stocking densities and grazing systems) on plant community composition and diversity. Treatments included sites grazed season-long (May to October) at 3 stocking densities (3.8, 2.8, and 1.8 hectares per animal unit), ungrazed control sites, and sites under a late-season rest rotation grazing system at this same range of stocking densities. Plant communities were sampled twice each season using a nearest-point procedure. Native plant species diversity, species richness, and growth form

diversity were significantly higher in grazed compared to ungrazed prairie, and diversity was greatest at the highest stocking density. This enhancement of plant species diversity under grazing was not a result of increased frequency of weedy/exotic species. There were no significant effects of grazing system on plant diversity, nor any significant stocking density x grazing system interactions, indicating that animal density is a key management variable influencing plant species diversity and composition in tallgrass prairie and that effects of animal density override effects of grazing systems. Increasing cattle stocking densities decreased the abundance of the dominant perennial tall grasses, and increased abundance of the C4 perennial mid-grasses. The frequency of perennial forbs was relatively stable across grazing treatments. Abundance of annual forbs varied among years and grazing treatments. In half of the years sampled, annual forbs showed the highest frequency under intermediate stocking density. Patterns of responses among plant groups suggest that some species may respond principally to direct effects of grazers and others may respond to indirect effects of grazers on competitive relationships or on the spatial patterns of fuel loads and fires. Thus, this study suggests that large grazer densities, fire, and annual climatic variability interact to influence patterns of plant community composition and diversity in tallgrass prairie. Effects of varying management such as stocking densities and grazing systems on plant species diversity and the relative abundances of different plant growth forms or functional groups may have important consequences for grassland community stability and ecosystem function.

This citation is from AGRICOLA.

980. Grazing management for riparian-wetland areas.

Leonard, S. G.; National Applied Resource Sciences Center (U. S.); and United States. Forest Service. Denver, Colo.: U.S. Dept. of the Interior, Bureau of Land Management, National Applied Resource Sciences Center, 1997. 63 p. Riparian area management.

Notes: "U.S. Department of Agriculture, Forest Service"--Cover. Shipping list no.: 98-0126-P. "BLM/RS/ST-97/002+1737"--P. [2] of cover. Includes bibliographical references (p. 57-63). SUDOCs: I 53.35:1737-14.

NAL Call #: SF85.3.G75--1997

Descriptors: range management--United States/ grazing--environmental aspects--United States/ riparian ecology--United States/ wetland conservation--United States
This citation is from AGRICOLA.

981. Grazing management, resilience, and the dynamics of a fire-driven rangeland system.

Anderies, John M.; Janssen, Marco A.; and Walker, Brian H.

Ecosystems 5(1): 23-44. (2002)

NAL Call #: QH540 .E3645; ISSN: 1432-9840

Descriptors: fire dominated rangeland system/ fire driven rangeland system/ grazing/ grazing management/ grazing resilience/ grazing dominated rangeland system/ mathematical model/ shrub dominated rangeland system
Abstract: We developed a stylized mathematical model to explore the effects of physical, ecological, and economic factors on the resilience of a managed fire-driven rangeland system. Depending on grazing pressure, the model exhibits one of three distinct configurations: a fire-dominated,

grazing-dominated, or shrub-dominated rangeland system. Transaction costs and costs due to shrub invasion, via their effect on grazing decisions, strongly influence which stable configuration is occupied. This, in turn, determines the resilience of the rangeland system. These results are used to establish conditions under which management for profit is consistent with the maintenance of resilience.

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982. Grazing management strategies as a factor influencing ecological stability of Mongolian grasslands.

Sheehy, D. P.

Nomadic Peoples 33: 17-30. (1993)

NAL Call #: GN387.N594; ISSN: 0822-7942

Descriptors: grazing systems/ sustainability/ grassland management/ livestock/ grasslands/ steppes/ environmental degradation/ grazing

Abstract: Mongolian pastoral ecosystems have been grazed by domestic livestock for centuries. During this long history, livestock grazing had minimal impact on the long-term ecological stability of steppe ecosystems. However, the relatively recent imposition of sedentary agricultural production systems and changes in livestock grazing management strategies have seriously affected ecological stability of grazed ecosystems, especially in Inner Mongolia. Although ecosystem stability has been damaged in Mongolia, opportunities remain to implement grazing management strategies that support ecologically sustainable use by livestock. In Inner Mongolia, widespread ecological instability presents agricultural policy-makers and the livestock producer with little opportunity to use grazing management strategies in the livestock production system.

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983. Grazing management strategies for reseeded rangelands in the east Kimberley region of Western Australia.

Hacker, R. B. and Tunbridge, S. B.

Rangeland Journal 13(1): 14-35. (1991)

NAL Call #: SF85.4.A8A97; ISSN: 0313-4555

Descriptors: cattle/ range management/ *Cenchrus*/ introduced species/ *Enneapogon*/ environmental degradation/ botanical composition/ stocking rate/ regeneration/ liveweight gain/ grazing intensity/ dry season/ semiarid zones/ Western Australia

This citation is from AGRICOLA.

984. Grazing management: Technology for sustaining rangeland ecosystems?

Heitschmidt, R. K. and Walker, J. W.

Rangeland Journal 18(2): 194-215. (1996)

NAL Call #: SF85.4.A8A97; ISSN: 1036-9872

Descriptors: stocking rate/ rain

This citation is from AGRICOLA.

985. Grazing strategies, stocking rates, and frequency and intensity of grazing on western wheatgrass and blue grama.

Hart, R. H.; Clapp, S.; and Test, P. S.

Journal of Range Management 46(2): 122-126. (1993)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1993/462/7hart.pdf>

Descriptors: *Bouteloua gracilis*/ *Pascopyrum smithii*/ botanical composition/ stocking rate/ steers/ grazing intensity/ rotational grazing/ defoliation/ forage/ tillers/ grazing

Abstract: Stocking rates and grazing strategies may alter botanical composition of rangeland vegetation by altering frequency and intensity of defoliation of individual plant species. We used long-interval time-lapse photography to study frequency and intensity of defoliation of western wheatgrass (*Pascopyrum smithii*[Rydb.] A. Love) and blue grama (*Bouteloua gracilis* [H.B.K.] Lag. ex Steud.) tillers under continuous season-long and time-controlled short-duration rotation grazing by steers at 2 stocking rates. Frequency, intensity, and variability of defoliation of both grasses were similar under both grazing systems. Western wheatgrass tillers were grazed more frequently under heavy than under moderate stocking, and in 1990 more herbage was removed the second time a tiller was grazed under heavy stocking. Blue grama tillers were grazed more frequently under heavy than under moderate stocking in both years under rotation grazing, but only in 1990 under continuous grazing; more herbage was removed under heavy stocking the second time a tiller was grazed. Under heavy and moderate stocking, respectively, 19% and 36% of western wheatgrass tillers and 42% and 54% of blue grama tillers were ungrazed throughout the grazing season. Few western wheatgrass tillers were grazed more than twice, and few blue grama tillers were grazed more than once. Stocking rates have much greater potential than grazing systems for altering frequency and intensity of defoliation and subsequent changes in botanical composition of range plant communities. Results of grazing studies support this conclusion.

This citation is from AGRICOLA.

986. Grazing systems on the Edwards Plateau of Texas: Are they worth the trouble? Soil and vegetation response.

Taylor, C. A.; Garza, N. E.; and Brooks, T. D.

Rangelands 15(2): 53-57. (1993)

NAL Call #: SF85.A1R32; ISSN: 0190-0528

Descriptors: grasslands/ rangelands/ grazing systems/ grazing/ deferred rotation grazing

Abstract: The effects of the 2 grazing systems in the Edwards Plateau, Texas, deferred-rotation and intensive grazing, on soils and vegetation are reviewed. Deferred-rotation grazing systems were better for soil hydrologic stability than intensive grazing and favoured growth of the short grasses. Short duration grazing at greater stocking rates reduced the midgrass (e.g. side-oats grama [*Bouteloua curtipendula*], cane bluestem [*Bothriochloa barbinodis*]) component of the vegetation. Midgrasses also helped to reduce soil erosion compared with the short grasses (eg common curlymesquite [*Hilaria belangeri*], red grama [*B. gracilis*]).

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987. Grazing systems, stocking rates, and cattle behavior in southeastern Wyoming.

Hepworth, K. W.; Test, P. S.; Hart, R. H.; Waggoner, J. W.; and Smith, M. A.

Journal of Range Management 44(3): 259-262. (1991)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1991/443/16hepw.pdf>

Descriptors: steers/ beef cattle/ grazing/ rotational grazing/ stocking rate/ grazing intensity/ liveweight gain/ Wyoming

Abstract: Grazing systems and stocking rates are used to influence livestock grazing behavior with the intent of improving livestock and vegetation performance. In 1982, a study was initiated to determine effects of continuous, rotationally deferred, and short-duration rotation grazing and moderate and heavy stocking rates on steer gains, range vegetation, and distance traveled by and activity patterns of steers. Steers were observed from dawn to dark on 12 dates during 1983, 1984, and 1985, and activity recorded every 15 minutes. Eight steers per treatment (system X stocking rate combination) per date were observed in 1983 and 1984, and 10 per treatment in 1985. In 1984 and 1985, map locations of all steers were recorded at the same times as activity, and distance traveled summed from distances between successive map locations. In 1984, activity of 3 steers per treatment was electronically monitored during darkness. Steers grazed approximately 8.6 hr per day during daylight and 1.6 hr during darkness. Steers grazed an average of 8.9 hr/day during daylight under moderate vs 8.1 hr under heavy stocking, but stocking rate interacted with date in 1984 and grazing system in 1985. Steers traveled farther under continuous than under short-duration rotation grazing at both stocking rates in 1984, but only at the high stocking rate in 1985. Steers had to travel farther to water in the continuous pastures, and may have had to cover a greater area in an effort to select a more desirable diet, particularly under heavy stocking. These differences were not reflected in differences in gain among stocking rates or grazing systems.

This citation is from AGRICOLA.

988. Growth and reproduction of grasses heavily grazed under rest-rotation management.

Eckert, R. E. and Spencer, J. S.

Journal of Range Management 40(2): 156-159. (1987)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1987/402/16eckepdf>

Descriptors: Festuca idahoensis/ Sitanion hystrix/ Artemisia tridentata wyomingensis/ Stipa thurberiana/ Agropyron spicatum

Abstract: This study evaluated the effects of heavy forage use in a rest-rotation grazing system on the basal-area growth and frequency of occurrence of native bunchgrasses from 1975 to 1984. None of these grasses increased in basal-area cover with brush competition or in basal-area cover or frequency without brush competition when subjected to periodic heavy grazing (65% utilization in June and 75% in July) during the growing season. When plants were protected from grazing, average basal-area cover increased for Idaho fescue [*Festuca idahoensis* Elmer] and squirreltail [*Sitanion hystrix* (Nutt.) J.G. Sm.] in a Wyoming big sagebrush [*Artemisia tridentata* wyomingensis Beetle]-Idaho fescue community type and for Thurber needlegrass [*Stipa thurberiana* Piper] in a Wyoming big sagebrush-bluebunch wheatgrass [*Agropyron spicatum*

(Pursh) Scribn. and Smith] community type. Average basal-area cover was unchanged for protected Thurber needlegrass plants in a Wyoming big sagebrush-Thurber needlegrass community type. Average basal-area cover of Thurber needlegrass plants in the same community type decreased when heavily grazed during the growing season in 1 year during the first 3 years of the study and with no grazing during the growing season in the last 4 years of the study. Bluebunch wheatgrass showed no differential response to grazing or protection. Results of this study strongly implicate periodic heavy grazing during the growing season as a primary cause of restricted basal-area growth and lack of reproduction. These results support the contention that such grazing pressure can prevent range improvement in an otherwise appropriate rotation grazing system.

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989. Growth and water and nitrate uptake patterns of grazed and ungrazed desert shrubs growing over a nitrate contamination plume.

Mckee, C.; Glenn, E. P.; Waugh, W. J.; Eastoe, C.;

Jordan, F.; and Nelson, S. G.

Journal of Arid Environments 64(1): 1-21. (2006)

NAL Call #: QH541.5.D4J6; ISSN: 0140-1963

Descriptors: growth

Abstract: Two native desert shrubs were evaluated for their growth potential and water and nitrogen uptake patterns over a nitrate-contaminated aquifer at a former uranium ore-processing facility in northeastern Arizona. *Sarcobatus vermiculatus* and *Atriplex canescens* are obligate and facultative phreatophytes, respectively, that dominate the local desert plant community. The main questions we addressed were: (1) Are these shrubs able to use water or nitrogen from the alluvial aquifer? (2) If so, does grazing interfere with that ability of shrubs? (3) What would be the ideal strategy to take up N from the plume and prevent its expansion and recharge using shrubs? $\delta^{15}\text{N}$ and $\delta^{18}\text{O}$ isotope signatures from water in plant stem samples suggest that both species utilize mainly deep, stored soil water derived from winter rains for transpiration, rather than summer rains or plume water. $\delta^{15}\text{N}$ enrichment values were similar for leaves of plants growing on and off the plume and for soil and aquifer water samples, but nitrate-N levels in leaf tissues were five times higher in plants growing on the plume compared to off the plume, suggesting they may have derived at least part of their nitrogen from the contamination plume. Total leaf N was also higher for plants growing on the plume. Under present conditions, only about 5% of the area over the plume is vegetated. Plants protected from grazing inside enclosures increased in volume by 2-4-fold over three growing seasons. Transplants of *A. canescens*, protected from grazing and irrigated over the first summer, established readily and grew into large shrubs after 3 years. On the basis of this study, the shrub community could be increased to as high as 25% cover and could make a significant contribution to controlling recharge if the contaminated site was protected from grazing. The results suggest that deeply rooted desert shrubs can impact the subsurface water and nitrogen balance, and that this balance can be disrupted by land use practices such as overgrazing that degrade the vegetation cover. (c) 2005 Elsevier Ltd. All rights reserved.

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990. Has intensive grazing by domestic livestock degraded Mediterranean Basin rangeland?

Seligman, N. G. and Perevolotsky, A.
 In: Plant-animal interactions in Mediterranean-type rangelands/ Arianoutsou, Margarita and Groves, R. H.; Series: Tasks for Vegetation Science 31.
 Dordrecht: Kluwer Academic Publishers, 1994; pp. 93-103.
 Notes: ISSN: 0167-9406
 NAL Call #: QK1.T37
 Descriptors: plant communities/ vegetation/ rangelands/ habitats/ range management/ grazing/ literature reviews/ Mediterranean region
 This citation is from AGRICOLA.

991. Heavy stocking and early-season deferment of grazing on Mediterranean-type grassland.

Gutman, M.; Holzer, Z.; Baram, H.; Noy-Meir, I.; and Seligman, N. G.
Journal of Range Management 52(6): 590-599. (1999)
 NAL Call #: 60.18 J82; ISSN: 0022-409X
http://jrm.library.arizona.edu/data/1999/526/590-599_gutman.pdf
 Descriptors: beef cows/ grazing/ Mediterranean climate/ stocking rate/ feed supplements/ poultry manure/ range management/ duration/ biomass/ feed intake/ energy intake/ calving rate/ replacement rate/ production costs/ weaning weight/ Israel
 Abstract: An experiment with beef cows grazing Mediterranean-type grassland was conducted to study the effect of grazing deferment at the beginning of the growing season on pasture productivity and animal performance under intensive herd management conditions. The grazing trial was composed of 4 treatments (deferred grazing at stocking rates of 0.83 and 0.67 cows per ha and continuous grazing at 0.67 and 0.5 cows per ha) replicated in 2 blocks and continued for 5 consecutive years. The herds were given low-energy supplemental feed during deferment and during the dry summer. At the intermediate stocking rate, at which both deferred and continuous grazing were compared, herbage production was significantly reduced by grazing during the 'deferment period' and calf weaning weights without deferment were significantly lower than in the deferred grazing treatments. Weaned live weight per cow was significantly lowest in the continuous intermediate treatment. Weaned weight per hectare was greatest at the highest stocking rate (with deferment). Utilization of supplementary feed per unit weaned live weight was significantly greater in the deferred treatments. Only about a third of the herbage production was grazed, even at the heavy stocking rates. Herbage production varied more between years than between treatments. It is concluded that in the system studied, deferment with supplementary feeding becomes important for both animal and vegetation production as stocking rate approaches and exceeds 0.67 cows ha⁻¹. With deferment, herbage production during the main growing season can be maintained even under heavy grazing pressure. This result can be explained with a simple dynamic growth and grazing model.
 This citation is from AGRICOLA.

992. Herbage production of Mediterranean grassland under seasonal and yearlong grazing systems.

Gutman, M.; Seligman, N. G.; and Noy-Meir, I.
Journal of Range Management 43(1): 64-68. (1990)
 NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1990/431/16gutman.pdf>
 Descriptors: cows/ forage/ rotational grazing/ grazing/ dietary supplements/ liveweight gain/ Israel/ Mediterranean region
 This citation is from AGRICOLA.

993. How grazing and soil quality affect native and exotic plant diversity in Rocky Mountain grasslands.

Stohlgren, Thomas J.; Schell, Lisa D.; and Vanden Heuvel, Brian
Ecological Applications 9(1): 45-64. (1999)
 NAL Call #: QH540.E23; ISSN: 1051-0761
 Descriptors: multiscale vegetation sampling: sampling method/ competitive exclusion/ exotic species richness/ grazing enclosures/ intermediate disturbance/ mountain grasslands: habitat/ plant diversity/ soil quality/ species specific responses/ weed invasion
 Abstract: We used multiscale plots to sample vascular plant diversity and soil characteristics in and adjacent to 26 long-term grazing enclosure sites in Colorado, Wyoming, Montana, and South Dakota, USA. The enclosures were 7-60 yr old (31.2 ± 2.5 yr, mean ± 1 SE). Plots were also randomly placed in the broader landscape in open rangeland in the same vegetation type at each site to assess spatial variation in grazed landscapes. Consistent sampling in the nine National Parks, Wildlife Refuges, and other management units yielded data from 78 1000-m² plots and 780 1-m² subplots. We hypothesized that native species richness would be lower in the enclosures than in grazed sites, due to competitive exclusion in the absence of grazing. We also hypothesized that grazed sites would have higher native and exotic species richness compared to ungrazed areas, due to disturbance (i.e., the intermediate-disturbance hypothesis) and the conventional wisdom that grazing may accelerate weed invasion. Both hypotheses were soundly rejected. Although native species richness in 1-m² subplots was significantly higher ($P < 0.05$) in grazed sites, we found nearly identical native or exotic species richness in 1000-m² plots in enclosures (31.5 ± 2.5 native and 3.1 ± 0.5 exotic species), adjacent grazed plots (32.6 ± 2.8 native and 3.2 ± 0.6 exotic species), and randomly selected grazed plots (31.6 ± 2.9 native and 3.2 ± 0.6 exotic species). We found no significant differences in species diversity (Hill's diversity indices, N1 and N2), evenness (Hill's ratio of evenness, E5), cover of various life-forms (grasses, forbs, and shrubs), soil texture, or soil percentage of N and C between grazed and ungrazed sites at the 1000-m² plot scale. The species lists of the long-ungrazed and adjacent grazed plots overlapped just 57.9 ± 2.8%. This difference in species composition is commonly attributed solely to the difference in grazing regimes. However, the species lists between pairs of grazed plots (adjacent and distant 1000-m² plots) in the same vegetation type overlapped just 48.6 ± 3.6%, and the ungrazed plots and distant grazed plots overlapped 49.4 ± 3.6%. Differences in vegetation and soils between grazed and ungrazed sites were minimal in most cases, but soil characteristics and elevation were strongly correlated with native and exotic plant diversity in the study region. For the 78 1000-m² plots, 59.4% of the

variance in total species richness was explained by percentage of silt (coefficient = 0.647, $t = 5.107$, $P < 0.001$), elevation (coefficient = 0.012, $t = 5.084$, $P < 0.001$), and total foliar cover (coefficient = 0.110, $t = 2.104$, $P < 0.039$). Only 12.8% of the variance in exotic species cover ($\log_{10}(\text{cover})$) was explained by percentage of clay (coefficient = -0.011, $t = -2.878$, $P < 0.005$), native species richness (coefficient = -0.011, $t = -2.156$, $P < 0.034$), and $\log_{10}N$ (coefficient = 2.827, $t = 1.860$, $P < 0.067$). Native species cover and exotic species richness and frequency were also significantly positively correlated with percentage of soil N at the 1000-m² plot scale. Our research led to five broad generalizations about current levels of grazing in these Rocky Mountain grasslands: (1) grazing probably has little effect on native species richness at landscape scales; (2) grazing probably has little effect on the accelerated spread of most exotic plant species at landscape scales; (3) grazing affects local plant species and life-form composition and cover, but spatial variation is considerable; (4) soil characteristics, climate, and disturbances may have a greater effect on plant species diversity than do current levels of grazing; and (5) few plant species show consistent, directional responses to grazing or cessation of grazing.

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994. How livestock grazing affects vegetation structures and small mammal distribution in the semi-arid Karoo.

Eccard, J. A.; Walther, R. B.; and Milton, S. J. *Journal of Arid Environments* 46(2): 103-106. (2000)
 NAL Call #: QH541.5.D4J6; ISSN: 0140-1963
Descriptors: rodents/ mammals/ wildlife/ livestock relationships/ distribution/ grazing/ food supply/ species diversity

Abstract: In this study the authors investigated vegetation changes superimposed by grazing and their effect on small mammals in the Karoo (South Africa) on grazed farmland and an adjacent, ten-year livestock enclosure. Plains and drainage line habitats were compared by monitoring vegetation height and cover, and small mammal species composition and abundance along transects. Animals were captured by live trapping. Vegetation cover was low on the grazed compared to the ungrazed study site, but vegetation height did not differ. The number of small mammal individuals and the number of species captured was higher at the ungrazed study site. Two species of climbing rodents captured in the ungrazed drainage line were absent from the grazed drainage line. Numbers of small mammals captured on the plains were similar for grazed and ungrazed land, but grazed plains were dominated by a single species of gerbil.

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995. The impact of burning and grazing on heathland plants and invertebrates in County Antrim.

Mcferran, D. M.; Mcadam, J. H.; and Montgomery, W. I. *Biology and Environment* 95B(1): 1-17. (1995);
 ISSN: 0791-7945

Descriptors: biodiversity/ heathland management
Abstract: The impact of burning and grazing on plant, ground beetle and spider species was investigated experimentally in stands of varying ages (burnt in 1982 and 1988 and unburnt plots) on an area of heather moorland in County Antrim, north-east Ireland. Burning initiated complex

succession pathways which appear to have characteristic plant and invertebrate species associations. Removal of *Calluna* dominance initiated a period of high plant species diversity. Investigation of initial post-fire regeneration suggested that the frequency of occurrence of plant species changed over time and was affected by grazing. Grouping of species by the position of their renewal bud, i.e. their life-form, did not account for all observed interspecific variation. The dominant species after burning were *Eriophorum vaginatum*, *E. angustifolium* and *Vaccinium myrtillus*. Studies of vegetation canopy structure showed that, even with the exclusion of the main grazing herbivores, *Calluna* will not re-establish itself as the dominant species until several years after burning. The ground beetle *Nebria salina* was trapped more often on plots burnt in 1988 than on unburnt plots or those burnt in 1982. In comparison, *Pterostichus niger* and *Carabus granulatus* were trapped in greater numbers on plots burnt in 1982 than on unburnt plots and plots burnt in 1988. The large species *Carabus problematicus* and *Carabus glabratus* were trapped in greater numbers on unburnt plots. Similarly, more of the spiders *Ceratinella brevipes* and *Centromerita concinna* were trapped on the plots burnt in 1982. In comparison, *Lepthyphantes zimmermanni* and *Robertus lividus* were trapped more often on unburnt plots than on plots burnt in 1982 and 1988. Results are discussed with respect to the importance of the continuation of traditional heathland management practices.

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996. Impact of cattle on conservation land licensed for grazing in South Westland, New Zealand.

Timmins, Susan M. *New Zealand Journal of Ecology* 26(2): 107-120. (2002)
 NAL Call #: QH540.N43; ISSN: 0110-6465

Descriptors: cattle stock intensity/ conservation land licensed/ grazing/ regeneration/ species structure/ vegetation species composition
Abstract: Making use of existing fences as ready-made enclosures, this study aimed to assess the long-term effects of cattle grazing on forest margins. Results indicated: 1) that cattle browsing and trampling has an impact on vegetation species composition, structure and regeneration; 2) that the effects of a particular grazing regime may take many decades to dissipate; and 3) that the impacts of cattle change with stock intensity. Some plant species appeared to be highly palatable to cattle and only occurred on sites without cattle. Such species included pate (*Schefflera digitata*), broadleaf (*Griselinia littoralis*), pigeonwood (*Hedycarya arborea*), supplejack (*Ripogonum scandens*), mahoe (*Melicactus ramiflorus*), milk tree (*Streblus heterophyllus*), lancewood (*Pseudopanax crassifolius*) and hen and chickens fern (*Asplenium bulbiferum*). A small group of plants appeared to regenerate better under cattle than in their absence, particularly mountain horopito (*Pseudowintera colorata*) and prickly shield fern (*Polystichum vestitum*). A few species were encouraged by cattle at one site but suppressed by them at another: kahikatea (*Dacrydium dacrydioides*), wheki (*Dicksonia squarrosa*), *Coprosma rhamnoides* and *Blechnum fluviatile*. The impact of cattle on most other plant species was not discernible. The results of this study, while somewhat equivocal, indicate that future grazing licences in South

Westland should restrict stock to low numbers and be confined to already modified sites where damage to conservation values would be minimal.

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997. Impact of different sheep grazing intensities on salt marsh vegetation in northern Germany.

Kiehl, K.; Eischeid, I.; Gettner, S.; and Walter, J. *Journal of Vegetation Science* 7(1): 99-106. (1996)

NAL Call #: QK900.J67; ISSN: 1100-9233

Descriptors: plant ecology/ ecological succession/ halophytes/ vegetation/ species diversity/ salt marshes/ sheep/ grazing intensity/ natural resource management/ guidelines/ range management/ Germany

This citation is from AGRICOLA.

998. Impact of grazing management on biodiversity of grasslands.

Tallowin, J. R. B.; Rook, A. J.; and Rutter, S. M.

Animal Science 81(2): 193-198. (2005)

NAL Call #: SF1.A56; ISSN: 1357-7298

Descriptors: biodiversity/ biological indicators/ botanical composition/ fauna/ grassland management/ grasslands/ grazing/ lowland areas/ nature conservation/ plant succession/ species diversity/ species richness/ stand structure/ weeds

Abstract: This paper reviews recent work carried out by the Institute of Grassland and Environmental Research and collaborating organizations that addresses some of the impacts of grazing management on both species-rich and species-poor lowland neutral grassland. Results indicate that for species-rich grassland, lenient grazing pressure maintained botanical diversity and the abundance of positive indicator species of nature conservation value over a 5-year period and also enhanced faunal diversity and abundance reflecting improvements in spatial, architectural and temporal structure. However, there was no enhancement in positive indicator species and there was also an increase in pernicious weeds suggesting that grazing alone may not suffice to deliver all the biodiversity goals for these grasslands and that additional management interventions may be required. For species-poor grassland, results indicate that distinctive differences in structure can lead to differences in faunal diversity. There is also some tentative evidence that livestock breed may affect invertebrate species assemblages.

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999. Impact of grazing management on the carbon and nitrogen balance of a mixed-grass rangeland.

Schuman, G. E.; Reeder, J. D.; Manley, J. T.; Hart, R. H.; and Manley, W. A.

Ecological Applications 9(1): 65-71. (1999)

NAL Call #: QH540.E23; ISSN: 1051-0761

Descriptors: aboveground phytomass/ forage resources/ grazing management/ livestock stocking rate/ mixed grass rangeland: habitat/ nutrient availability

Abstract: Rangeland grazing management strategies have been developed in an effort to sustain efficient use of forage resources by livestock. However, the effects of grazing on the redistribution and cycling of carbon (C) and nitrogen (N) within the plant-soil system are not well understood. We examined the plant-soil C and N balances of a mixed-grass rangeland under three livestock stocking rates using an area that had not been grazed by domestic

livestock for more than 40 years. We established nongrazed exclosures and pastures subjected to continuous season-long grazing at either a light stocking rate (20 steer-days/ha) or a heavy stocking rate (59 steer-days/ha, approx 50% utilization of annual production). Twelve years of grazing under these stocking rates did not change the total masses of C and N in the plant-soil (0-60 cm) system but did change the distribution of C and N among the system components, primarily via a significant increase in the masses of C and N in the root zone (0-30 cm) of the soil profile. The mass of soil C (0-60 cm) under heavy grazing was comparable to that of the light grazing treatment. Grazing at the heavy stocking rate resulted in a decrease in peak standing crop (PSC) of aboveground live phytomass, an increase in blue grama (*Bouteloua gracilis* (H.B.K.) Lag. Ex Steud.), and a decrease in western wheatgrass (*Pascopyrum smithii* (Rydb.) A. Love) compared to the light grazing treatment. The dominant species under light grazing was western wheatgrass, whereas in the nongrazed exclosures, forbs were dominant and appeared to have increased at the expense of western wheatgrass. The observed increase of soil C and N in the surface soil where roots dominate indicates a greater opportunity for nutrient availability and cycling, and hence enhanced grazing quality.

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1000. The impact of grazing on plant communities, plant populations and soil conditions on salt marshes.

Bakker, J. P.

Vegetatio 62(1/3): 391-398. (1985)

NAL Call #: 450 V52; ISSN: 0042-3106

Descriptors: plant density/ grazing/ mowing/ natural resource management/ soil analysis/ salt marshes/ Western European region

This citation is from AGRICOLA.

1001. Impact of grazing on plant species richness, plant biomass, plant attribute, and soil physical and hydrological properties of vertisol in East African highlands.

Taddese, G.; Mohamed Saleem, M. A.; Abyie, A.; and Wagnew, A.

Environmental Management 29(2): 279-289. (2002)

NAL Call #: HC79.E5E5; ISSN: 0364-152X

Descriptors: livestock/ plants/ agriculture/ biomass/ soil/ hydrology/ species diversity/ environmental impact/ land management/ grazing/ environmental effects/ vegetation effects/ soil properties/ soil compaction/ hydraulic properties/ species richness/ grazing effects/ grassland hydrology/ Africa, East/ grazing/ Ethiopia

Abstract: Understanding the problems of grazing land in vertisol areas and seeking long-lasting solutions is the central point where mixed crop livestock is the second stay for the majority of the population. In order to understand this, the current study was conducted at two sites, one with 0-4% slope and the other with 4-8% slope at Ginchi watershed, 80 km west of Addis Ababa, Ethiopia. The specific objectives of the study were to quantify changes in plant species richness, biomass, plant cover, and soil physical and hydrological properties. The grazing regimes were: moderate grazing (regulated), heavy grazing (free grazing), and no grazing (closed to any grazing), which was considered the control treatment. The results showed that the biomass yield in nongrazed plots was higher than in the

grazed plots. However, the biomass yield in grazed plots improved over the years. Species richness and percentage of dominant species attributes were better in medium grazed plots than the other treatments. Soil compaction was higher in very heavily grazed plots than in nongrazed and medium-grazed plots. In contrast to that, the soil water content and infiltration rate were better in nongrazed plots than in grazed plots. Soil loss in grazed plots decreased with the increase of biomass yields and as the soil was more compacted by livestock trampling during the wet season. Finally since the medium stocking rate is better in species richness and plant attributes, and lies between nongrazed and heavily grazed plots in the rest of the measured parameters, it could be the appropriate stocking rate to practice by the smallholder farmer.

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1002. Impact of grazing on the vegetation of South Sinai, Egypt.

Moustafa, Abdel Raouf A.

In: Sustainable land use in deserts/ Breckle, Siegmund-W.; Veste, Maik; and Wucherer, Walter.

Berlin: Springer-Verlag, 2001; pp. 218-228.

Notes: ISBN 3540677623

NAL Call #: GB611 .S87 2001

Descriptors: ecotoxicology/ grazing intensity/ human activity/ overgrazing impact/ protectorates/ species richness/ vegetation/ wadis/ book chapter

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1003. The impact of livestock grazing on landscape biophysical attributes in privately and communally managed rangelands in Namaqualand.

Petersen, A.; Young, E. M.; Hoffman, M. T.; and Musil, C. F.

South African Journal of Botany 70(5): 777-783. (2004)

NAL Call #: QK1.S69; ISSN: 0254-6299

Descriptors: altitude/ cycling/ erosion/ grazing/ ground cover/ infiltration/ landscape ecology/ leaching/ livestock/ nitrogen content/ nutrient content/ rangelands/ runoff/ soil alkalinity/ soil chemical properties/ soil fertility/ soil physical properties/ soil salinity/ species richness

Abstract: This study's objectives were to compare the impact of livestock on vegetation characteristics (species richness and cover), landscape functional attributes (nutrient recycling, water infiltration/runoff, soil stability status) and other soil chemical and physical properties at different altitudes on privately and communally managed rangelands in the vicinities of Kougoedvlakte, Kuile and Paulskraal in Namaqualand in South Africa. The applicability of on temporary methodology for quantifying underlying mechanisms contributing to landscape changes was also evaluated. Statistically significant differences in soil stability status and litter cover only were observed between the differently managed rangelands, these differences independent of altitude and attributed to greater substrate disturbance by livestock. However, on both the privately and communally managed rangelands, soil nutrient and water infiltration status, rock cover, soil alkalinity, salinity and total N content were significantly greater at low than high and/or medium altitudes. These differences reflected increased livestock grazing intensity with reduced rock cover, concomitant increase in soil alkalinity with increased faecal pellet density and reduced soil salinity due to greater erosion and active leaching of

less organically rich soils at lower altitudes. It is concluded that contemporary methodology applied, which was originally developed for grassland ecosystems, was unsuitable for detecting changes in critical landscape functional attributes that drive vegetation change within the succulent karoo biome.

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1004. The impact of livestock grazing on the persistence of a perennial forb in a temperate Australian grassland.

Dorrough, Josh and Ash, Julian

Pacific Conservation Biology 9(4): 302-307. (2003);

ISSN: 1038-2097

Descriptors: grazing management/ herbivory

Abstract: The presence of perennial plant species in grazed habitats may be an imperfect predictor of their long-term ability to persist under grazing by livestock. This is particularly the case in landscapes where grazing by livestock is a relatively recent occurrence or where management practices are leading to intensification of grazing. This paper investigates the impacts of grazing on the native perennial inter-tussock forb *Leptorhynchus elongatus* (Asteraceae) in grasslands on the Monaro Tablelands of New South Wales. Although the species persists in grazed habitats, exclosures indicate that current grazing management can lead to severe depletion of seed, largely due to selective removal of flowers and seed heads by livestock. A population model suggests that under current grazing management, population growth rates may be negative. Removal of livestock during flowering and seed set may assist long-term persistence of this species in grazed habitats. Despite almost 200 years of livestock grazing on the Monaro Tablelands, recent intensification of grazing management could result in the future loss of some plant species in grazed habitats.

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1005. Impact of management practices on the tall grass prairie.

Parton, W. J. and Risser, P. G.

Oecologia (Berlin) 46(2): 223-234. (1980)

NAL Call #: QL750.O3; ISSN: 0029-8549

Descriptors: cow weight gain/ Oklahoma/ USA/ elm/ ecosystem level model/ nutrient uptake/ grazing intensity/ nitrogen/ phosphorus/ heat/ water/ transpiration/ spring burning/ biomass simulation

Abstract: The ELM ecosystem-level grassland model simulates the flow of water, heat, N and P through the ecosystem and the biomass dynamics of plants, consumers and the decomposers. This model was adapted to a tallgrass prairie site in northeastern Oklahoma, USA, the Osage Site of the U.S. International Biological Program Grassland Biome. Several range management manipulations were simulated by the model and the results compared to field data and literature information: altering the grazing intensity, grazing system, and grazing time period; adding N and P to the grassland; adding water during the growing season; and spring burning of the prairie. The model showed that cattle weight gain per head, aboveground and belowground plant production, transpiration water loss, standing dead biomass, and the net N balance decrease with increasing grazing intensity, while soil water content and bare soil water loss increase. A moderately stocked year-round cow-calf grazing system is

more beneficial to the grassland than a more highly stocked seasonal steer grazing system because the former increases the aboveground and belowground primary production and the plant nutrient uptake rates. Range manipulations, such as fire, which stimulate uniform grazing of a pasture, increase primary production, cattle weight gains, and nutrient uptake of plants and animals. Model results indicated that adding fertilizer was the best strategy for increasing cattle weight gains per head, while adding water would produce the greatest increase in primary production. Simulation of yearly and triennial spring burns suggests that these treatments increase primary production, plant nutrient uptake, and cattle weight gain per head. Burning increases the N losses from the systems; however, these losses are greater with annual burns. The model results also suggest the spatial grazing pattern of cattle must be considered to represent correctly the impact of grazing on the prairie. The model is used to describe the behavior of the tallgrass prairie ecosystem, evaluate alternative management strategies, and identify future scientific research and management studies.

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1006. Impact of protection and free grazing on sand dune vegetation in the Rajasthan Desert, India.

Kumar, M. and Bhandari, M. M.

Land Degradation & Rehabilitation 3(4): 215-227. (1992)

NAL Call #: S622.L26; ISSN: 0898-5812

Descriptors: vegetation/ grazing intensity/ overgrazing/ deserts/ plant density/ livestock feeding/ land productivity/ environmental protection/ drought/ soil erosion/ climatic factors/ environmental impact/ soil degradation/ India

This citation is from AGRICOLA.

1007. The impacts of grazing and rainfall variability on the dynamics of a Sahelian rangeland.

Hein, L.

Journal of Arid Environments 64(3): 488-504. (2006)

NAL Call #: QH541.5.D4J6; ISSN: 0140-1963

Descriptors: biological production/ biomass production/ botanical composition/ drought/ environmental impact/ grasslands/ grazing/ grazing systems/ rain/ range management/ rangelands/ semiarid grasslands/ stocking rate/ use efficiency/ grazing effects/ net primary production

Abstract: The impacts of grazing pressure and rainfall variability on rangeland dynamics have been the topic of much debate. Understanding the combined impact of these two factors is crucial for the development of efficient management strategies for rangelands. In this paper, the impacts of grazing and rainfall variability on the dynamics of a Sahelian rangeland in Northern Senegal are examined. Specifically, the paper assesses their combined impact on species composition, above-ground phytomass production and rain-use efficiency (RUE), on the basis of a 10-year (1981-1990) grazing experiment conducted in the Widou-Thiengoly catchment in the Ferlo, Northern Senegal. The experiment included both a high (0.15-0.20 TLU ha⁻¹, corresponding to current grazing) and a medium (0.10 TLU ha⁻¹) grazing pressure. It is shown that species composition, above-ground phytomass production and RUE markedly differ for these two grazing regimes - and that the differences are most pronounced in years with low rainfall. In dry years, both above-ground phytomass production and RUE are significantly reduced in the plots subject to a high grazing pressure. Consequently, the impacts of high

grazing pressures on the productivity of the Ferlo are hardly noticed during years with normal or above normal rainfall, but the rangeland's productivity is strongly affected during a drought. The findings have important implications for the management of rangelands; they indicate that high grazing pressures may increase the vulnerability of rangeland ecosystems and local people to droughts.

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1008. Impacts of grazing intensity and grazing systems on vegetation composition and production.

Bartolome, J. W.

In: Developing strategies for rangeland management: A report/ National Research Council. Committee on Developing Strategies for Rangeland Management.; Series: Westview special studies in agriculture science and policy. Boulder, Colo.: Westview Press, 1984; pp. 917-925

NAL Call #: SF85.3.D48

Descriptors: grazing intensity/ grazing/ pastures/ ecosystems

This citation is from AGRICOLA.

1009. Impacts of grazing intensity and specialized grazing systems on the use and value of rangeland: Summary and recommendations.

Dwyer, D. D.; Buckhouse, J. C.; and Huey, W. S.

In: Developing strategies for rangeland management: A report/ National Research Council. Committee on Developing Strategies for Rangeland Management.; Series: Westview special studies in agriculture science and policy. Boulder, Colo.: Westview Press, 1984; pp. 867-884

NAL Call #: SF85.3.D48

Descriptors: grazing intensity/ grazing/ range management/ pastures/ rangelands

This citation is from AGRICOLA.

1010. Impacts of grazing intensity and specialized grazing systems on watershed characteristics and responses.

Blackburn, W. H.

In: Developing strategies for rangeland management: A report/ National Research Council. Committee on Developing Strategies for Rangeland Management.; Series: Westview special studies in agriculture science and policy. Boulder, Colo.: Westview Press, 1984; pp. p. 927-983. ill.

NAL Call #: SF85.3.D48

Descriptors: ecosystems/ grazing intensity/ grazing/ watershed management/ watersheds/ Idaho/ United States

This citation is from AGRICOLA.

1011. Impacts of grazing on wetlands and riparian habitat.

Platts, W. S. and Raleigh, R. F.

In: Developing strategies for rangeland management: A report/ National Research Council. Committee on Developing Strategies for Rangeland Management.; Series: Westview special studies in agriculture science and policy. Boulder, Colo.: Westview Press, 1984; pp. 1105-1117

NAL Call #: SF85.3.D48

Descriptors: wetlands/ range management/ wildlife management/ grazing/ riparian buffers

This citation is from AGRICOLA.

1012. Impacts of grazing on wetlands and riparian habitat: A review of our knowledge.

Skovlin, J. M.

In: Developing strategies for rangeland management: A report/ National Research Council. Committee on Developing Strategies for Rangeland Management.; Series: Westview special studies in agriculture science and policy. Boulder, Colo.: Westview Press, 1984; pp. 1001-1103
NAL Call #: SF85.3.D48

Descriptors: pastures/ wetlands/ grazing/ riparian buffers
This citation is from AGRICOLA.

1013. Impacts of livestock grazing on lowland heathland.

Lake, S.; Bullock, J. M.; and Hartley, S.

Peterborough, U.K.: English Nature; 422, 2001. 143 p.
English Nature Research Reports.

Notes: ISSN: 0967-876X

<http://www.english-nature.org.uk/pubs/publication/PDF/Enrr422.pdf>

Descriptors: lowlands/ grazing/ conservation practices/ stocking rate

Abstract: Discusses aspects of grazing and heathland management. Covers livestock behavior, species differences, stocking rates, and impacts on native flora and fauna.

1014. Impacts of mule deer and horse grazing on transplanted shrubs for revegetation.

Austin, D. D.; Urness, P. J.; and Durham, S. L.

Journal of Range Management 47(1): 8-11. (1994)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1994/471/2aust.pdf>

Descriptors: Artemisia tridentata/ Chrysothamnus nauseosus/ Odocoileus hemionus/ horses/ grazing/ spring/ winter/ land restoration/ Utah

Abstract: Revegetation success on foothill ranges in northern Utah using big sagebrush (*Artemisia tridentata* Nutt. spp. wyomingensis Beetle and Young) and rubber rabbitbrush (*Chrysothamnus nauseosus* Britt. spp. albicaulis H. and C.) was determined as influenced by winter mule deer browsing and spring horse grazing. Treatment areas of 0.1 ha with 3 replications included a protected control, use by deer only, use by horses only, use by deer and horses, and use by deer with horse grazing delayed for 3 years after seedling transplant. Results from the first 6 growing seasons following transplanting of seedlings showed grazing by horses only tripled the available, per-plant browse production of big sagebrush compared to protected plots, whereas browsing by deer only resulted in a 40% decrease in browse production. Seedling survival of big sagebrush differed between treatments during the first 3 growing seasons but was not affected by grazing after the third growing season. Rubber rabbitbrush was not affected by treatments.
This citation is from AGRICOLA.

1015. Impacts of non-selective grazing on cover, composition, and productivity of Nama-Karoo grassy shrubland.

Beukes, P. C. and Cowling, R. M.

African Journal of Range and Forage Science 17(1-3): 27-35. (2000)

NAL Call #: SB197.J68; ISSN: 1022-0119

Descriptors: Nama Karoo grassy shrubland: composition, cover, productivity/ annual rainfall/ biomass turnover rate/ compensatory growth/ concentrated defoliation/ defoliation regime/ diversity/ dunging/ grassy semi arid shrubland/ grazing strategies/ high intensity grazing/ Karoo veld: moribund, productivity/ large stock unit grazing days/ litter/ non selective rotational grazing system/ paddocks/ perennial species composition/ plant composition temporal changes/ rangeland quality: restoration/ short duration grazing/ short term rainfall/ trampling/ urination/ vegetation change/ vegetation parameters

Abstract: The non-selective rotational grazing system has undergone a long and controversial development. The merits of this grazing system, where relatively large numbers of livestock are herded into numerous small paddocks for short timespans with long rests between grazings, have not been formally evaluated in a long-term monitoring experiment in the Karoo. In this study we used exclosures (controls) on a 7 000 ha farm in the Central Lower Karoo, camped into approximately 50-ha paddocks, to evaluate the impact of this grazing system on certain vegetation parameters. We report on the first four years of monitoring, after each of four replicate paddocks had received four treatments (one treatment=40-60 Large Stock Unit grazing days per hectare over a period of 2-16 days). Concentrated defoliation with concomitant trampling, dunging, and urinating did not influence the perennial species composition, and cover of this grassy, semi-arid shrubland. Changes over time in plant composition, and cover are explained by annual, and short-term (e.g. quarterly) rainfall rather than by grazing impacts. Ephemerals were not favoured by this grazing system, but litter was more abundant in the treatment than the control areas. The dominant grass, *Eragrostis lehmanniana*, and shrub, *Pentzia incana*, are resilient to this defoliation regime, and show signs of compensatory growth. As yet there is no evidence that non-selective grazing increases diversity, but the severe defoliation and trampling may enhance the biomass turnover rate, resulting in more vigorous, and productive plants in the grazed areas. Diversity is unlikely to change rapidly in response to grazing, largely because of the persistence of grazing-tolerant perennials. Concentrating mixed herds of livestock onto small areas with lengthy rests can be a useful tool for 'kick-starting' moribund karoo veld into greater productivity. Several of the impacts hold potential for restoring the rangeland quality of degraded areas, but this needs to be tested.

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1016. Impacts of rotational grazing on mixed prairie soils and vegetation.

Dormaar, J. F.; Adams, B. W.; and Willms, W. D.

Journal of Range Management 50(6): 647-651. (1997)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/1997/506/647-651_dormaar.pdf

Descriptors: range management/ rotational grazing/ grazing intensity/ *Hesperostipa comata*/ *Bouteloua gracilis*/ *Elymus lanceolatus*/ biomass/ rain/ soil chemistry/ chemical composition/ botanical composition/ plant litter/ Alberta
Abstract: In this study the impact of a rotation grazing system on the soil and vegetation of a *Stipa*-*Bouteloua*-*Agropyron* community in the mixed prairie ecoregion was compared with the ungrazed treatment in exclosures. At a

low stocking rate, grazing had no effect on the vegetation but did alter soil quality. Grazing pressure was so light in the rotational grazing treatment that recovery of productivity, as measured by standing crop and litter, was not significantly different from the ungrazed treatment. Conversely, the species distribution was unchanged but was indicative of a lower seral state for this mixed prairie. The effect of grazing on this community was indirect, possibly by altering the microenvironment. The relationships observed among forage production, soil chemistry, and species composition raise questions on the importance of any one variable expressing range condition on the mixed prairie.

This citation is from AGRICOLA.

1017. Implications of grazing vs. no grazing on today's rangelands.

Laycock, W. A.

In: Ecological implications of livestock herbivory in the West/ Vavra, M.; Laycock, W. A.; and Pieper, R. D. Denver, CO: Society for Range Management, 1994; pp. 250-280.

Notes: ISBN: 1-884930-00-X; Proceedings of the 42nd annual meeting of the American Institute of Biological Sciences.

NAL Call #: SF85.35.A17E28

Descriptors: prairies/ scrublands/ steppes/ deserts/ annual grasslands/ vegetation/ overgrazing/ biodiversity/ grasslands/ rangelands/ range condition/ range management/ grazing/ reviews/ species diversity/ nature conservation/ United States/ Ecological implications of livestock herbivory in the west/ North America/ America/ Developed Countries/ OECD Countries

Abstract: Literature on methods used to study the effects of grazing; determination of range condition; comparisons of grazing vs. no grazing (tallgrass prairies, northern mixed grass and palouse prairie, shortgrass steppe, SW desert grasslands, sagebrush-grass vegetation, other shrub-dominated vegetation types in the Great Basin, annual grasslands, riparian and more mesic mountain communities); effects of grazing on biodiversity; new conceptual stable state models; and management implications is reviewed. It showed that many vegetation types on public land are in a stable state condition and would change little if livestock were removed; very heavy grazing on small areas decreased biodiversity but moderate grazing was often beneficial to biodiversity and grazing increased patchiness of vegetation which should increase diversity of both plants and animals at a landscape level.

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1018. Improvement in rangeland condition of the Flooding Pampa of Argentina through controlled grazing.

Deregibus, V. A.; Jacobo, E.; and Rodriguezq, A.

African Journal of Range and Forage Science 12(2): 92-96. (1995)

NAL Call #: SB197.J68; *ISSN:* 1022-0119

Descriptors: grassland/ grazing/ herds/ resource management/ stocking rate/ vegetation

Abstract: The Flooding Pampa grasslands situated in temperate Argentina were ungrazed historically, but now support primarily breeding herds of cattle. These extensive, flat, infertile grasslands experience seasonal floods. Although summer droughts are usual, grasses maintain

productivity during the entire year and produce almost 6 t ha⁻¹ a⁻¹. Continuous grazing has caused deterioration of these grasslands in terms of floristic composition and soil properties (salinisation). Stocking rate has been adversely affected. Controlled grazing systems have been applied with the objective of preventing deterioration. The main characteristics of this system are the concentration of animals in large herds, non-selective grazing of dormant vegetation during autumn and winter, and selective grazing during spring and summer. Rotational grazing ensures adequate rest for grazed plants and promotes tillering and establishment of cool season grasses. A system of controlled grazing has shown an improvement in floristic composition and in animal production, despite no increase in primary production. This system should allow for a sustainable utilization of these grasslands.

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1019. Increasing stock numbers on deteriorating rangeland.

Van Vegten, J. A.

In: Proceedings of the symposium on Botswana's first livestock development project and its future implications/ Hitchcock, Robert K.

Gaborne : Natl. Inst. of Development and Cultural Research, Univ. College of Botswana, 1982; pp. 98-107

NAL Call #: SF55.B54S96 1981

Descriptors: range management/ stocking rate/ pastures/ degradation/ grazing/ deterioration/ landscapes/ rangelands/ Botswana

This citation is from AGRICOLA.

1020. Influence of deferred grazing on vegetation dynamics and livestock productivity in an Andean pastoral system.

Buttolph, L. P. and Coppock, D. L.

Journal of Applied Ecology 41(4): 664-674. (2004)

NAL Call #: 410 J828; *ISSN:* 0021-8901

Descriptors: alpaca/ aymara/ Bolivian Altiplano/ llama/ non-equilibrium/ rural development/ species diversity

Abstract: 1. Management recommendations intended to reduce rangeland degradation and increase livestock productivity often assume equilibrium conditions wherein vegetation and herbivore dynamics are tightly coupled. Recent research in Africa, Asia and North America, however, suggests that the dynamics of some arid systems are driven more by precipitation, a non-equilibrium factor. We examined the applicability of equilibrium and non-equilibrium theory for key grazing resources within an Andean pastoral ecosystem. 2. Residents of Cosapa, Bolivia, recently fenced off portions of critical communal grazing areas called bofedal (wet meadow) and gramadal (dry meadow) as part of a livestock development project. Fenced enclosures were used to implement seasonally deferred grazing practices. We evaluated the effects of deferred grazing on peak standing crop (SC), above-ground net primary production (ANPP) and plant species composition and diversity over a 4-month growing season across 10 locations. Effects of enclosure access on the productivity of alpaca Llama pacos, llama L. glama and sheep Ovis aries were assessed through interviews with 32 herd owners. 3. One to three years of deferred grazing had no effect on SC or ANPP from bofedal or gramadal, but it did reduce plant species diversity for bofedal. Access to enclosures improved survival rates of young alpaca and

birth rates for sheep. Llamas were typically denied access to enclosures, which negatively affected their productivity. 4. Our results suggest that both non-equilibrium and equilibrium forces operate on bofedal. Stable and low rates of ANPP are largely shaped by the cold climate, a non-equilibrium factor. Changes in plant species composition and livestock productivity, however, support equilibrium theory. 5. Synthesis and applications. Ecological models of rangeland dynamics often play a critical role in determining the direction of range management and pastoral development. On bofedal, we found that vegetation and herbivore dynamics are coupled to a large extent, consistent with predictions that equilibrium behaviour can occur for critical, mesic subsystems nested within arid landscapes. Seasonal grazing deferral on bofedal can thus yield benefits to livestock productivity. However, these benefits must be weighed against negative social consequences that can occur when communal resources are privatized.

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1021. The influence of different grazing regimes on Phragmites and shrub vegetation in the well-drained zone of a eutrophic wetland.

Vulink, J. T.; Drost, H. J.; and Jans, L.

Applied Vegetation Science 3(1): 73-80. (2000)

NAL Call #: QK900 .A66; ISSN: 1402-2001

Descriptors: grazing/ vegetation/ range management/ Phragmites australis/ Cirsium arvense/ Urtica dioica/ Poa trivialis/ Sambucus nigra/ cattle/ horses/ conservation areas/ ecological succession/ species diversity/ colonizing ability/ stocking rate/ Netherlands

This citation is from AGRICOLA.

1022. Influence of grazing and soil conditions on secondary savanna vegetation in India.

Pandey, C. B. and Singh, J. S.

Journal of Vegetation Science 2(1): 95-102. (1991)

NAL Call #: QK900.J67; ISSN: 1100-9233

Descriptors: succession/ plant community character/ mathematical model/ climate tropics

Abstract: Savanna vegetation and pertinent soil features were studied on 43 sites in a dry tropical forest region of India. Grazing intensity ranged from 0.68 to 0.98. Soil moisture was positively related to the proportion of fine soil particles (< 0.1 mm), and the latter decreased while the proportion of coarse particles (2.0-0.5 mm) increased with increasing grazing intensity. Canopy biomass ranged from 28 to 104 g/m² in grazed communities and from 230 to 337 g/m² in ungrazed communities and was positively related to vegetation cover which ranged between 30 - 72% in grazed and 68 - 91% in ungrazed communities. Vegetation cover was negatively related to grazing intensity. Species richness and diversity were highest at low grazing intensity. Using community coefficients and Detrended Correspondence Analysis, the grazed stands were clustered into six and the ungrazed ones into three communities. The grazed communities were recognized as degradation stages and the ungrazed ones as recovery stages. Only five grass species, in various combinations were able to dominate in one of the different stages. Evidently the harsh climatic conditions (high temperatures,

high variability in rainfall and a long dry period) in the region permit only a few species already adapted to these conditions to participate in the succession.

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1023. Influence of grazing on the cenopopulation composition of Azerbaijan's desertified steppes and their protection.

Atamov, V. V. and Ponomarenko, L. I.

Problems of Desert Development(3): 70-73. (1996)

NAL Call #: QK938.D4P73; ISSN: 0278-4750

Descriptors: range management/ overgrazing/ grazing intensity/ grassland management/ grasslands/ steppes/ grazing/ environmental degradation/ grazing systems/ rotational grazing/ plant genetic resources/ Diplachne serotina

Abstract: The effect of grazing on desertified steppes at Gobustan, near Bozdag, in the Caucasus was studied in 100-m² plots of Bothriochloa ischaemum, Festuca valesiaca and Stipa lessingiana steppes. All three grasses were viable under grazing but other plants in the steppe communities were more vulnerable and their proportion in the stand was reduced by grazing. Diplachne serotina increased under grazing. As grazing intensity increased from slight to moderate to strong, the number of shoots/m² decreased from 312 to 197 to 102. The proportion of young inedible plants increased and the number of large palatable plants decreased with increasing grazing intensity. Plant cover decreased from 70-90% with no grazing to 30-40% at the end of grazing. Management of grazing by rotation is recommended.

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1024. The influence of grazing pressure on rooting dynamics of Caucasian bluestem.

Svejcar, T. and Christiansen, S.

Journal of Range Management 40(3): 224-227. (1987)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1987/403/7svej.pdf>

Descriptors: Bothriochloa caucasica/ USA/ warm season/ grass reseeding/ farmland/ depleted range/ stocking/ seasonal changes/ leaf area index/ water status/ climatic condition

Abstract: Caucasian bluestem (*Bothriochloa caucasica* (Trin.) C.E. Hubb.) is a warm-season grass introduced from Eurasia that is currently used for reseeding farmland and depleted range in the Southern Great Plains. Although this species is thought to be grazing tolerant, little specific information is available concerning its response to grazing. Variable (put-and-take) stocking was used to maintain heavy (3 to 8 steers/ha) and light (2.5 to 4.5 steers/ha) grazing treatments during mid May to late September from 1983 to 1985. Seasonal changes in root mass and root length to a depth of 60 cm were measured the first 2 years, and end-of-season root length was measured the third year. Leaf areas index (LAI) was measured during the first 2 years. Peak root mass was 27 and 46% less in heavily relative to lightly grazed swards in 1983 and 1984, respectively. Total root length for heavily grazed swards was 33 and 45% less than lengths of lightly grazed swards in 1983 and 1984, respectively. Heavy grazing resulted in a relatively larger reduction in LAI than in either root mass or length, and thus the ratio of absorbing root surface to transpiring leaf surface was greater for heavily grazed than lightly grazed plants. This increased ratio may explain our

previous observation that heavy grazing resulted in an improved water status of leaf tissue. End-of-season total root length over the 3-year period (15 to 18 and 24 to 28 km/m² for heavily and lightly grazed swards, respectively) was remarkably consistent given the variable climatic conditions over the study period.

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1025. Influence of livestock grazing on C sequestration in semi-arid mixed-grass and short-grass rangelands.

Reeder, J. D. and Schuman, G. E.

Environmental Pollution 116(3): 457-463. (2002)

NAL Call #: TD172.E52; ISSN: 0013-9327

Descriptors: C storage/ carbon/ grasslands/ grazing/ Great Plains

Abstract: We evaluated the effects of livestock grazing on C content of the plant-soil system (to 60 cm) of two semi-arid grasslands: a mixed-grass prairie (grazed 12 years), and a short-grass steppe (grazed 56 years). Grazing treatments included season-long grazing at heavy and light stocking rates, and non-grazed exclosures. Significantly higher soil C (0-30cm) was measured in grazed pastures compared to non-grazed exclosures, although for the short-grass steppe higher soil C was observed with the heavy grazing treatment only. Excluding grazing caused an immobilization of C in excessive aboveground plant litter, and an increase in annual forbs and grasses which lack dense fibrous rooting systems conducive to soil organic matter formation and accumulation. Our data indicate that higher soil C with grazing was in part the result of more rapid annual shoot turnover, and redistribution of C within the plant-soil system as a result of changes in plant species composition. Copyright © 2001.

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1026. The influence of livestock grazing on weed establishment and spread.

Lacey, J. R.

Proceedings of the Montana Academy of Sciences 47: 131-146. (1987)

NAL Call #: 500 M762

Descriptors: weeds/ crop-weed competition/ weed control/ livestock/ range management/ seed dispersal/ grazing/ Montana

This citation is from AGRICOLA.

1027. Influence of period of deferment before stocking spring-burnt sourveld on sheep performance and veld productivity.

Barnes, D. L. and Dempsey, C. P.

Journal of the Grassland Society of Southern Africa 9(4): 149-157. (1992)

NAL Call #: SB197.J68; ISSN: 0256-6702

Descriptors: grazing/ lamb growth/ land management/ live mass gain/ livestock production/ pasture productivity
Abstract: Spring-burnt sourveld was stocked with Merino lambs after three different periods of deferment from the time of start of growth in spring. During three seasons, average seasonal livemass gains on veld which was stocked shortly after the start of growth were some 80% higher than on veld stocked two to three weeks later. Using veld from which grazing was excluded by means of exclosure cages as a control, the residual effects of the deferred grazing treatments on yields of grasses classified as palatable, intermediate or unpalatable were estimated in

the next season. Deferring grazing in spring was of negligible value in preventing loss of vigour of the palatable grasses. The respective yields for the three classes were on average for three seasons, 57, 101 and 144% of those for the controls. The findings indicate the need for drastic revision of current recommendations with regard to the management of sourveld for sheep production.

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1028. Influence of rainfall and grazing on herbage dynamics in a seasonally dry tropical savanna.

Pandey, C. B. and Singh, J. S.

Vegetatio 102(2): 107-124. (1992)

NAL Call #: 450 V52; ISSN: 0042-3106

Descriptors: biomass/ diversity

Abstract: Species composition and herbage dynamics in relation to rainfall variability and cattle grazing were studied in permanently protected, grazed, and temporarily fenced treatments on three sites in a seasonally dry tropical savanna. Permanently protected sites, established between 1979 and 1984, were 55-79% similar with each other in species composition, and 14-25% similar with grazed sites during the period 1986-1988. Similarity among grazed sites was only 36-43%. Number of species was greater in the grazed treatment than in the permanently protected treatment. The percentages of annual grasses and non-leguminous forbs were greater in grazed savanna than in permanently protected savanna. Species diversity was higher in grazed savanna than in the corresponding permanently protected savanna. Within the two annual cycles studied, peak live shoot biomass was 614 g m⁻² in permanently protected savanna, 109 g m⁻² in grazed savanna, and 724 g m⁻² in temporarily fenced savanna. Live shoot biomass in temporarily fenced savanna was 18 to 44% greater than in permanently protected savanna. Peak canopy biomass ranged from 342 to 700 g m⁻² in permanently protected savanna. It was related with total rainy season rainfall, and was particularly sensitive to late rainy season rainfall. On the other hand, peak canopy biomass in grazed savanna ranged from 59 to 169 g m⁻² and was related to grazing intensity rather than either total rainy season rainfall or late rainy season rainfall. Coefficient of variation of green biomass in permanently protected savanna was related with rainfall variability indicating it to be a pulsed system which responds quickly to rainfall events. Biomass of woody species ranged from 2466 to 5298 g m⁻² in permanently protected savanna and from 744 to 1433 g m⁻² in the grazed savanna. Green foliage biomass was 3.7 to 6.4% of the woody biomass in permanently protected and 5.6 to 5.9% in grazed savanna, and supplements substantially the fodder resource during the dry periods of the year.

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1029. The influence of stocking rate, range condition and rainfall on residual herbage mass in the semiarid savanna of Kwazulu/Natal.

Hatch, G. P. and Tainton, N. M.

African Journal of Range and Forage Science 12(2): 76-80. (1995)

NAL Call #: SB197.J68; ISSN: 1022-0119

Descriptors: cattle livestock/ forage deficit/ grazing/ regression model

Abstract: Grazing trials at two sites in the semiarid savanna of KwaZulu-Natal were stocked with cattle at light (0.17 LSU ha⁻¹), intermediate (0.23 LSU ha⁻¹) and heavy (0.30 LSU ha⁻¹) stocking. Pasture disc meter data collected over 116 three-week periods were used to develop a step-wise multiple linear model to predict the amount of residual herbage at the end of the summer growing season and the period (days) over which forage supplementation would be required to maintain animal mass during the winter dormant season. Residual herbage mass at the end of summer was significantly related to cumulative summer grazing days, rainfall and range condition (indexed as the sum of the proportions of *Themeda triandra*, *Panicum maximum* and *P. coloratura*). The period of forage deficit during which herbage mass declined below a grazing cut-off of 1695 kg ha⁻¹ was significantly related to residual herbage mass at the end of summer.

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1030. Influences of grazing and exclosure on carbon sequestration in degraded sandy grassland, Inner Mongolia, north China.

Su, Yong Zhong; Zhao, Ha Lin; and Zhang, Tong Hui
New Zealand Journal of Agricultural Research 46(4): 321-328. (2003)

NAL Call #: 23 N4892; ISSN: 0028-8233

Descriptors: degraded sandy grassland/ desertification/ exclosure/ grazing/ protective practices/ soil degradation

Abstract: Livestock grazing is recognised as one of the main causes of vegetation and soil degradation/desertification in the semi-arid Horqin sandy steppe of northern China. In this paper, soil-plant system carbon (C) in a representative degraded sandy grassland in the Horqin sandy steppe (42degree58' N, 120degree42'E altitude c. 360 m a.s.l.) was measured. Three situations: long-term continuous grazing (CG), exclosure for 5 years (5EX), and exclosure for 10 years (10EX), were compared to assess the effect of grazing management on C sequestration. Ground cover increased from the CG (35%) to the 5EX (63%) and to the 10EX (81%), and accordingly soil organic C at 0-15 cm depth and total plant components C increased from the CG (492 and 98 g m⁻²) to the 5EX (524 and 134 g m⁻²) and to the 10EX (584 and 317 g m⁻²). The results suggested that continuous grazing in the erosion-prone sandy grassland is very detrimental to vegetation and soil. Under exclosure conditions, vegetation restoration and litter accumulation significantly increased plant-soil system C storage, and thus sequestration of atmospheric C. It was concluded that the degraded sandy grassland could contribute to significant C sequestration with the implementation of protective practices.

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1031. An integrated approach to studying the role of grazing livestock systems in the conservation of rangelands in a protected natural park (Sierra de Guara, Spain).

Bernues, A.; Riedel, J. L.; Asensio, M. A.; Blanco, M.; Sanz, A.; Revilla, R.; and Casasus, I.

Livestock Production Science 96(1): 75-85. (2005)

NAL Call #: SF1.L5; ISSN: 0301-6226

Descriptors: livestock farming: applied and field techniques/ management strategy/ grazing system/ rangeland conservation

Abstract: The 'Sierra de Guara' Natural Park (81,491 ha, Huesca, Spain) is a protected Mediterranean mountain area dominated by shrub and forest pastures. Traditional agriculture, mainly extensive grazing systems, has decreased in the last decades; concurrently, invasion of shrub vegetation, landscape changes and higher risk of forest fires have been observed. A study, which started in 2000, was carried out with two broad objectives: at the farm level, to analyse the farming systems and evaluate management strategies; at the regional level, to give useful information to conservation authorities for better decision-making. An integrated approach with different spatial scales and methods of analysis was used. First, a survey covering all farms that utilized the Park was carried out and livestock farming systems were characterized in terms of grazing management, technical and socio-economic factors. Second, six representative areas were selected to evaluate, depending on livestock utilization, grass and shrub vegetation dynamics (biomass, green/dead ratio). Third, vegetation and livestock data were analysed using a Geographic Information System to identify constraining factors and areas of intervention. Key imbalances were identified that can threaten the sustainability of the Park: low continuity of farming families; intensification of the management system; degradation of grazing resources; and concentration of grazing areas. A number of management recommendations are raised. (c) 2005 Elsevier B.V. All rights reserved.

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1032. Integrated management systems for improvement of rangeland.

Scifres, C. J. and O'Connor, T. M.

In: *No-tillage and surface-tillage agriculture: The tillage revolution*/ Sprague, Milton A. and Triplett, Glover B. New York: Wiley, 1986; pp. 227-259

NAL Call #: S604.N63

Descriptors: rangelands/ range management/ woody weeds/ brush control/ grazing/ sowing

This citation is from AGRICOLA.

1033. Integrating agricultural land-use and management for conservation of a native grassland flora in a variegated landscape.

Mcintyre, S.

Pacific Conservation Biology 1(3): 236-244. (1994); ISSN: 1038-2097

Descriptors: farm planning/ grazing/ habitat variegation/ herbaceous community/ limited fertilization/ management intensity/ pastoral production/ pasture utilization/ soil disturbance/ vegetation preservation

Abstract: Management of variegated landscapes (in which the native vegetation still forms the matrix but has been modified in a variable way) requires strategies to maintain or enhance existing vegetation within the context of human land-uses such as agriculture. Using rangelands in the New England region of New South Wales as an example, spatial patterns of land-use and modification are described. Management principles for conservation of herbaceous communities in areas of pastoral production are suggested, based on the following assumptions: 1) low intensity pasture utilization and management (i.e., limited fertilization, soil disturbance and grazing) is conducive to the maintenance of species richness at a local and regional scale; 2) stratification of management intensity on farms is

compatible with viable grazing operations; 3) landscape context is important as effects of management may spread beyond the managed area; 4) spatial arrangement of land-uses could be optimized to maintain or increase diversity. Although our understanding of these issues is incomplete, there is general observational and theoretical support for them. Incorporation of principles derived from these assumptions in the farm planning process is a useful strategy for preserving grassland vegetation in landscapes where opportunities for reserve conservation are limited.
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1034. Is the removal of domestic stock sufficient to restore semi-arid conservation areas?

Page, Manda J. and Beeton, R. J. S.
Pacific Conservation Biology 6(3): 245-253. (2000);
ISSN: 1038-2097

Descriptors: conservation area restoration/ domestic stock removal/ grazing regimes/ semi arid conservation areas
Abstract: Increasingly, conservation areas are proclaimed in non-pristine environments that have biodiversity values and the issue of how to change the management regime to restore such landscapes arises. Before gazettal in 1992, Currawinya National Park (28degree52'S, 144degree30'E) in south-west Queensland's mulga lands was grazed by domestic stock for over 130 years. Following gazettal, the area was destocked and a monitoring programme initiated to determine the response by the vegetation. This paper describes the grass dynamics in three vegetation communities on Currawinya National Park with three different grazing regimes. Data are presented for an on-park site (native and feral herbivores present), an off-park site (domestic, native and feral herbivores were present), and an enclosure (no mammalian herbivores present). The results show that removal of domestic livestock alone is not sufficient to promote rapid recovery of grass populations, and suggest that conservation area managers must reduce native herbivore numbers as well if the desired outcome is a return to the supposed "natural" condition.
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1035. A landscape-scale model for optimal management of sheep grazing in the Magellanic steppe.

Cingolani, Ana M.; Anchorena, Juan; Stoffella, Susana L.; and Collantes, Marta B.
Applied Vegetation Science 5(2): 159-166. (2002)
NAL Call #: QK900 .A66; ISSN: 1402-2001
Descriptors: grazing management: applied and field techniques/ landscape scale modeling: mathematical and computer techniques/ magellanic steppe
Abstract: Effective management of rangelands requires the development of landscape-scale models for predicting spatial and temporal variability of forage. In the Magellanic tussock steppes, as in other cold-temperate regions, grazing capacity is dependent on the winter season. To develop a management tool for the region, we analysed links between winter forage availability, weather, stocking rate and vegetation structure. We studied four paddocks over five years with a range of stocking rates from 0 to 1.53 sheep.ha⁻¹. We sampled forb and non-tussock graminoid biomass, vegetation structure and faecal pellet abundance at the end of each summer. Daily temperature and rainfall data were also recorded. A regression model explained the amount of winter forage as a positive function of graminoid

cover, spring minimum temperature, annual precipitation and a negative function of dwarf shrub canopy, bare soil and stocking rate ($R^2 = 0.59$). Interactions of structural variables with precipitation and stocking rate were detected, indicating strong fluctuations of forage availability in lawn communities dominated by short graminoids. The most probable causes of this response would be higher utilisation and lack of canopy structure. Our results illustrate how maps of vegetation structure, obtainable from satellite images, with weather and stocking rate data could be used for predicting optimal stocking rates in large, heterogeneous sheep paddocks.
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1036. Landscape structure and management regime as indicators of calcareous grassland habitat condition and species diversity.

Mitchley, Jonathan. and Xofis, Panteleimon
Journal for Nature Conservation 13(2-3): 171-183. (2005);
ISSN: 1617-1381
Descriptors: management regime/ species diversity/ landscape structure/ grazing management/ calcareous grassland habitat/ spatial landscape
Abstract: This study investigates the importance of spatial landscape characteristics and habitat management on the condition of calcareous grassland in the North Down Natural Area, Kent UK. We used a digitised map of the study area containing shapefiles of all the habitats including 82 patches of calcareous grassland together with management information for each patch and data on the presence and abundance of a range of calcareous grassland indicator plant species. We defined habitat condition by presence of indicator species and used classification trees to generate models with rules for predicting habitat condition from the landscape spatial characteristics and management information. We also applied the same method to investigate the factors affecting presence or diversity of three ecological groups of positive indicator species and dominance of a negative indicator species. All the models except one showed good classification accuracy and high kappa statistic. Favourable habitat condition was predicted by presence of different types of grazing management, presence of woodland around patches of calcareous grassland and shape complexity. These results indicate that calcareous grassland in favourable condition is management-dependent but also located in less intensively managed landscapes. Unfavourable habitat condition was predicted by threat factors such as lack of management and high incidence of arable or improved grassland around patches of calcareous grassland, indicating nutrient enrichment and habitat degradation. Some of these factors also predicted high diversity of the different ecological species groups. The value of this method for predicting habitat condition and species diversity from baseline ecological data for conservation monitoring at the landscape level is emphasised. (c) 2005 Elsevier GmbH. All rights reserved.
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1037. Length and timing of grazing on postburn productivity of two bunchgrasses in an Idaho experimental range.

Bunting, Stephen C.; Robberecht, Ronald; and Defosse, Guillermo E.

International Journal of Wildland Fire 8(1): 15-20. (1998)

NAL Call #: SD420.5.I57; ISSN: 1049-8001

Descriptors: fire/ grazing: timing/ livestock management/ plant mortality/ postburn productivity

Abstract: Plant mortality and productivity in semiarid grasslands may be affected by the length of time grazing is excluded during the postfire regeneration period. The degree of grazing tolerance for the semiarid bunchgrass species, *Festuca idahoensis* and *Agropyron spicatum*, exposed to fire, and how the variation in grazing tolerance was affected by the length of time allowed for undisturbed plant regeneration after fire, were central questions addressed in this study. We examined the degree of plant mortality and productivity that resulted from the interaction of fire and grazing. Plants exposed to fire alone, i.e., without subsequent defoliation, exhibited low plant mortality, although culm production was reduced relative to unburned plants. An early-season-defoliation treatment after fire resulted in the plant mortality as high as 50% for *Festuca* and 70% for *Agropyron* bunchgrasses. Plant height and the number of vegetative and reproductive culms were also most affected by this defoliation treatment. These detrimental effects were lessened when defoliation was delayed by one growing season after the fire. Although our results suggest that one growing season seems to be enough for both species to recover after the fire, more studies will be necessary to confirm these trends, and induce changes in current grazing management policies.
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1038. Livestock exclusion and belowground ecosystem responses in riparian meadows of eastern Oregon.

Kauffman, J. B.; Thorpe, A. S.; and Brookshire, E. N. J.

Ecological Applications 14(6): 1671-1679. (2004)

NAL Call #: QH540.E23; ISSN: 1051-0761

Descriptors: riparian environments/ meadows/ water quality/ livestock/ environmental restoration/ habitat improvement/ aquatic plants/ nitrification/ environmental impact/ grazing/ riparian vegetation/ riparian zone/ river basin management/ restoration/ agriculture/ USA, Oregon
Abstract: Ecological restoration of riparian zones that have been degraded by decades of overgrazing by livestock is of paramount importance for the improvement of water quality and fish and wildlife habitats in the western United States. An increasingly common approach to the restoration of habitats of endangered salmon in the Columbia Basin of the Pacific Northwest (USA) is to exclude livestock from streamside communities. Yet, few studies have examined how ending livestock grazing changes ecosystem properties and belowground processes in herbaceous-dominated riparian plant communities (meadows). Along the Middle Fork John Day River, Oregon, we compared ecosystem properties of dry (grass and forb-dominated) and wet (sedge-dominated) meadow communities at three sites that had been managed for sustainable livestock production with three sites where livestock had been excluded for 9-18 years as a means of riparian and stream restoration. Profound differences in the belowground properties of grazed and exclosed communities were measured. In dry meadows, total belowground biomass

(TBGB consisting of roots and rhizomes) was similar to 50% greater in exclosures (1105 and 1652 g/m super(2) in the grazed and exclosed sites, respectively). In exclosed wet meadows, the TBGB was 62% greater than in the grazed sites (1761 and 2857 g/m super(2), respectively). Soil bulk density was significantly lower, and soil pore space was higher in exclosed sites of both meadow types. The mean infiltration rate in exclosed dry meadows was similar to 13-fold greater than in grazed dry meadows (142 vs. 11 cm/h), and in wet meadows the mean infiltration rate in exclosures was 233% greater than in grazed sites (24 vs. 80 cm/h). In exclosed wet meadows, the rate of net potential nitrification was 149-fold greater (0.747 vs. 0.005 mu g NO sub(3)-N times [g soil] super(-1) times d super(-1)), and the rate of net potential mineralization was 32-fold greater (0.886 vs. 0.027 mu g N times [g soil] super(-1) times d super(-1), respectively) when compared to grazed sites, though changes observed in dry meadows were not significant. Livestock removal was found to be an effective approach to ecological restoration, resulting in significant changes in soil, hydrological, and vegetation properties that, at landscape scales, would likely have great effects on stream channel structure, water quality, and the aquatic biota.

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1039. Livestock exclusion increases the spatial heterogeneity of vegetation in Colorado shortgrass steppe.

Adler, P. B. and Lauenroth, W. K.

Applied Vegetation Science 3(2): 213-222. (2000)

NAL Call #: QK900 .A66; ISSN: 1402-2001

Descriptors: disturbance/ grazing/ Moran's I/ plant competition/ spatial dependence

Abstract: Spatial heterogeneity, an important characteristic in semi-arid grassland vegetation, may be altered through grazing by large herbivores. We used Moran's I, a measure of autocorrelation, to test the effect of livestock grazing on the fine scale spatial heterogeneity of dominant plant species in the shortgrass steppe of northeastern Colorado. Autocorrelation in ungrazed plots was significantly higher than in grazed plots for the cover of the dominant species *Bouteloua gracilis*, litter cover and density of other bunchgrasses. No species had higher autocorrelation in grazed compared to ungrazed sites. *B. gracilis* cover was significantly autocorrelated in seven of eight 60-yr ungrazed exclosures, four of six 8-yr exclosures, and only three of eight grazed sites. Autocorrelograms showed that *B. gracilis* cover in ungrazed sites was frequently and positively spatially correlated at lag distances less than 5 m. *B. gracilis* cover was rarely autocorrelated at any sampled lag distance in grazed sites. The greater spatial heterogeneity in ungrazed sites appeared linked to patches characterized by uniformly low cover of *B. gracilis* and high cover of C3 grasses. This interpretation was supported by simple simulations that modified data from grazed sites by reducing the cover of *B. gracilis* in patches of ca. 8 m diameter and produced patterns quite similar to those observed in ungrazed sites. In the one exclosure where we intensively sampled soil texture, autocorrelation coefficients for sand content and *B. gracilis* cover were similar at lag distances up to 12 m. We suggest that the negative effect of sand content on *B. gracilis* generates spatial heterogeneity, but only in the absence of grazing. An

additional source of heterogeneity in ungrazed sites may be the negative interaction between livestock exclusion and *B. gracilis* recovery following patchy disturbance.

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1040. Livestock grazing and biodiversity conservation in Mediterranean environments: The Israeli experience.

Perevolotsky, A.

Options Mediterraneennes Serie A, Seminaires

Mediterraneens(67): 51-56. (2005)

NAL Call #: S19.O681; ISSN: 1016-121X

Descriptors: biodiversity/ botanical composition/ conversion/ genetic diversity/ grazing/ grazing systems/ landscape/ livestock/ range management/ reviews/ species richness/ grazing-management

Abstract: Livestock grazing has been considered for many years a source of ecological disturbance to natural ecosystems. Consequently, grazing has been excluded from protected areas such as nature reserves. However, livestock grazing is one of the few available tools for the management of dense woody vegetation stands such as those characterising the Mediterranean landscape.

Recently, a more active mode of management has been proposed for biodiversity conservation in Mediterranean environments and livestock grazing should become part of it. This paper reviews research findings from Israel, concerning the relationships between livestock grazing and ecological parameters - genetic diversity, species richness and composition, and landscape structure - relevant for the conservation of biodiversity. The conclusion is that in most cases, livestock grazing can help achieve the conservation goals. However, a clear definition of operative conservation goals is a prerequisite for a successful management that optimises the benefits provided by the grazing livestock.

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1041. Livestock grazing and weed invasions in the arid West.

Belsky, A. Joy and Gelbard, Jonathan L.

Bend, Ore.: Oregon Natural Desert Association, 2000. 31 p.

<http://www.onda.org/library/papers/WeedReport.pdf>

Descriptors: livestock/ weeds/ ecological invasion/ environmental impact

1042. Livestock grazing: Animal and plant biodiversity of shortgrass steppe and the relationship to ecosystem function.

Milchunas, D. G.; Lauenroth, W. K.; and Burke, I. C.

Oikos 83(1): 65-74. (1998)

NAL Call #: 410 OI4; ISSN: 0030-1299

Descriptors: behavior/ birds/ ecosystems/ grasslands species diversity/ habitat use/ mammals/ prairies/ trophic relationships/ wildlife/ habitat relationships/ wildlife/ livestock relationships/ North America/ United States/ Colorado: Northcentral

Abstract: The responses of plants, lagomorphs, rodents, birds, macroarthropods, microarthropods, and nematodes to long-term grazing on North American shortgrass prairies were studied. Diversity, abundance, dominance, and dissimilarity responses to long-term grazing were variable across classes of organisms. lgh.

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1043. Livestock grazing effects on Southwestern streams: A complex research problem.

Rinne, J. N.

In: Riparian ecosystems and their management:

Reconciling conflicting uses. (Held 16 Apr 1985-18 Apr

1985 at Tuscon, Ariz.) Johnson, R. Roy; Ziebell, Charles

D.; Patton, David R.; Ffolliott, Peter F.; and

Hamre, R. H. (eds.)

Fort Collins, Colo.: Rocky Mountain Forest and Range

Experiment Station, United States, Forest Service; pp. 295-299; 1985.

NAL Call #: aSD11.A42

Descriptors: livestock/ habitats/ fish/ grazing/ riparian buffers/ streams/ New Mexico

This citation is from AGRICOLA.

1044. Livestock grazing impacts on rangeland ecosystems.

Holechek, J.

Journal of Soil and Water Conservation 35(4):

162-164. (1980)

NAL Call #: 56.8 J822; ISSN: 0022-4561

Descriptors: grazing systems/ environmental impact/ rangelands/ grazing/ ecology/ reviews/ livestock farming/ range management/ arid regions

Abstract: The impacts of livestock grazing, both controlled and uncontrolled on the rangeland ecosystem of the USA are discussed. Research provides strong evidence that controlled grazing by domestic livestock is compatible with other resources provided by rangelands and may be a valuable tool to enhance these resources. Research needs for the practice of multiple use of public lands are examined.

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1045. Livestock grazing management and biodiversity conservation in Australian temperate grassy landscapes.

Dorrough, J.; Yen, A.; Turner, V.; Clark, S. G.;

Crosthwaite, J.; and Hirth, J. R.

Australian Journal of Agricultural Research 55(3):

279-295. (2004)

NAL Call #: 23 Au783; ISSN: 0004-9409

Descriptors: grazing management: applied and field techniques/ ecosystem function/ grazing strategy/ vegetation heterogeneity

Abstract: There is an increasing interest in the development of livestock grazing management strategies that achieve environmental sustainability and maintain or improve the long-term production capacity of commercial grazing systems. In temperate Australia, these strategies are generally focussed on reducing perennial pasture decline, soil loss, acidity, and salinity. An additional challenge facing land managers and researchers is developing grazing strategies that also maintain and enhance local and regional biodiversity. However, few studies have assessed the compatibility of management practices for maintaining long-term productivity and biodiversity conservation. We still have only a very basic understanding of the effects of different grazing strategies and pasture management on biodiversity and this is a major impediment to the development of appropriate and compatible best management practice. We argue that although there is an increasing desire to find management strategies that protect and enhance biodiversity without

hindering long-term agricultural production, in many cases this may not be possible. Current knowledge suggests that compatibility is most likely to be achieved using low-input systems in low productivity (fragile) landscapes, whereas in highly productive (robust) landscapes there is less opportunity for integration of productive land-use and biodiversity conservation. There is an urgent need for improved communication and collaboration between agronomic and ecological researchers and research agencies to ensure that future programs consider sustainability in terms of biodiversity as well as pasture and livestock productivity and soil and water health.

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1046. Livestock grazing, rest, and restoration in arid landscapes.

Curtin, C. G.

Conservation Biology 16(3): 840-842. (2002)

NAL Call #: QH75.A1C5; ISSN: 0888-8892

Descriptors: grazing management/ range management/ ecological restoration/ arid lands/ Western United States

This citation is from AGRICOLA.

1047. Livestock impacts on riparian ecosystems and streamside management implications: A review.

Kauffman, J. B. and Krueger, W. C.

Journal of Range Management 37(5): 430-438. (1984)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1984/375/11kauf.pdf>

Descriptors: grazing/ streams/ water resources/ livestock production/ riparian buffers

This citation is from AGRICOLA.

1048. Livestock management in the riparian ecosystem.

Bryant, L. D.

In: Riparian ecosystems and their management:

Reconciling conflicting uses. (Held 16 Apr 1985-18 Apr 1985 at Tuscon, Ariz.) Johnson, R. Roy; Ziebell, Charles D.; Patton, David R.; Ffolliott, Peter F.; and Hamre, R. H. (eds.)

Fort Collins, Colo.: Rocky Mountain Forest and Range Experiment Station, United States, Forest Service; pp. 285-289; 1985.

NAL Call #: aSD11.A42

Descriptors: livestock/ grazing

This citation is from AGRICOLA.

1049. Livestock pressure and aspect effect on temperate mountain grassland plant species.

Mendarte, S.; Amezaga, I.; Albizu, I.; Ibarra, A.; and Onaindia, M.

In: Integrating efficient grassland farming and biodiversity: Proceedings of the 13th International Occasional Symposium of the European Grassland Federation. (Held 29 Aug 2005-31 Aug 2005 at Tartu, Estonia.); pp. 255-259; 2005.

NAL Call #: SB202.E85 E87 2005

Descriptors: aspect/ grasslands/ grazing/ mountain areas/ mountain grasslands/ nature conservation/ pastures/ plant communities/ plant pests/ species richness/ temperate grasslands/ vertebrate pests/ *Agrostis nebulosa*

Abstract: The aim of this work was to determine the influence of aspect (North, South and Southwest) and livestock pressure (sheep, cattle and horses) (in relation to animal movement: Hut, Extensive, and Nap zones and

Water points) on the grassland herbaceous communities in the mountain grasslands in the Basque Country (northern Spain). Three grasslands differing in aspect were selected, four zones in relation to livestock grazing pressure within them. At each zone 3 sites were selected and 10 random quadrants (0.5x0.5 m) were used to determine plant composition and cover. Forty plant species were present overall and the most common were *Agrostis capillaris*, *Festuca rubra* and *Trifolium repens* with more than 20% of total cover each. The cover of the observed species changed among grazing pressures showing clearly structural differences. *A. capillaris* and *T. repens* presence was favoured by grazing pressure. The most intense livestock pressure (water points) reduced significantly species richness (13.8±or-1.10), directly related to the dominance of some species tolerant to high grazing pressure, namely gramineae as *A. capillaris* and *F. rubra*. The lowest grazing pressure and the highest spatial heterogeneity zones (with slopes and apparent rocks), i.e. Nap zones, supported the highest species richness (23.2±or-1.30). The intermediate species richness was found at the intermediate grazing pressure site, i.e. extensive zones (17.9±or-1.10). Thus, grazing pressure creates a mosaic of vegetation structures that function in the landscape maintaining a high diverse area.

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1050. Long-term changes of salt marsh communities by cattle grazing.

Andresen, H.; Bakker, J. P.; Brongers, M.; Heydemann, B.; and Irmeler, U.

Vegetatio 89(2): 137-148. (1990)

NAL Call #: 450 V52; ISSN: 0042-3106

Descriptors: invertebrates/ vegetation/ sedimentation/ population density/ species diversity/ immigration/ succession/ food web/ dominance

Abstract: Over a period of 9 years a grazing experiment was carried out in the mainland salt marsh of the Leybucht (Niedersachsen) with three stocking rates, namely, 0.5 ha⁻¹, 1 ha⁻¹, and 2 cattle ha⁻¹. These were also compared with an abandoned area. The results are based on sampling of the invertebrates in 1980, 1981, 1982, and 1988, and of the vegetation in 1980 and 1988. The rate of sedimentation is highest in the *Puccinellia maritima*-zone and decreases with the increase of stocking rates. The *Elymus pycnanthus* vegetation type becomes dominant in the higher salt marsh in the abandoned site. The canopy height decreases with increasing stocking rate, whereas a gradient in the structure of the vegetation develops with the lowest stocking rate. The population densities, the species-richness and the community diversity of invertebrates increases after the cessation of grazing. The high rate of sedimentation in the abandoned site promotes the immigration of species from higher salt marsh levels and adjacent grasslands, and eventually halotophilous species and communities may disappear. On the other hand grazing reduces numerous species living both in or on upper parts of the vegetation or being sensitive to trampling by cattle. The community structure shows that the salt marsh ecosystem changed from a food web dominated by plant feeding animals to a food web dominated by animals foraging on detritus. The salt marsh management has to be

differentiated into both ungrazed and lightly grazed areas (each 50%) of an overall grazing in large areas with less than 0.5 cattle ha⁻¹.

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1051. Long-term effects of livestock grazing in western conifer forests.

Sharrow, S. H.

Proceedings Annual Forest Vegetation Management Conference 20: 7-11. (1999)

NAL Call #: QH541.5.F6F67.

Notes: ISSN: 1057-2147

Descriptors: coniferous forests/ Western United States

This citation is from AGRICOLA.

1052. Long-term grazing influences on Chihuahuan desert rangeland.

Holechek, Jerry L.; Tembo, Ackim; Daniel, Alipayou; Fusco, Michael J.; and Cardenas, Manuel

Southwestern Naturalist 39(4): 342-349. (1994)

NAL Call #: 409.6 SO8; ISSN: 0038-4909

Descriptors: brush control/ forage productivity/ range recovery/ vegetation composition

Abstract: Vegetation composition and forage productivity were studied on two Chihuahuan desert ranges with different management histories. They involved the conservatively grazed New Mexico State University College Ranch, and adjoining intermediately grazed Bureau of Land Management (BLM) ranges north of Las Cruces in southcentral New Mexico. Conservative and intermediate grazing involved about 30 and 50% average use by livestock of the key forage species, respectively. A major focus of this study was the influence of stocking rate on recovery of native perennial grasses on rangeland with moderate amounts of honey mesquite (*Prosopis glandulosa* Torr.) (College Ranch) compared to areas heavily dominated by mesquite (BLM). In fall of 1982 total perennial grass standing crop averaged 182 kg/ha and 36 kg/ha on the long-term conservatively (CG) and intermediately grazed (IG) ranges, respectively. By the fall of 1990 perennial grass standing crop had increased to 349 kg/ha and 159 kg/ha on the CG and IG ranges, respectively. Mesa dropseed (*Sporobolus flexuosus* Thurb. Rybd.) and black grama (*Bouteloua eriopoda* Torr.), two important Chihuahuan Desert forage species, had greater standing crop on the CG than IG range throughout the 1982-1991 study period. Our data indicate that some mesquite-dominated ranges in the Chihuahuan Desert are responsive to both favorable rainfall and conservative stocking if residual perennial grasses remain, and that livestock grazing is sustainable under utilization levels that involve removal of one-third of the current year's growth of key forage species (black grama, dropseeds, threeawns). On course sandy soils with a high canopy cover of honey mesquite, brush control may be necessary to initiate range recovery.

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1053. Long-term grazing study in spring-fed wetlands reveals management tradeoffs.

Allen-Diaz, B.; Jackson, R. D.; Bartolome, J. W.; Tate, K. W.; and Oates, L. G.

California Agriculture 58(3): 144-148.

(July 2004-Sept. 2004)

NAL Call #: 100 C12Cag; ISSN: 0008-0845

Descriptors: grazing/ cattle/ springs (water)/ wetlands/ ecosystems/ California

This citation is from AGRICOLA.

1054. Long-term heavy-grazing effects on soil and vegetation in the Four Corners Region.

Orodho, A. B.; Trlica, M. J.; and Bonham, C. D.

Southwestern Naturalist 35(1): 9-14. (1990)

NAL Call #: 409.6 SO8; ISSN: 0038-4909

Descriptors: *Oryzopsis hymenoides*/ grass cover/ productivity/ microhabitat moisture

Abstract: The effects of previous heavy grazing over an extended period (> 50 years) were assessed by measuring soil and vegetation characteristics in paired plots inside and outside of Chaco Culture National Historical Park in northwestern New Mexico. Soil compaction was greater in the grazed areas. Soil moisture was greatest on the hillside position where greater herbage production for Indian ricegrass (*Oryzopsis hymenoides*) was found. Long-term heavy grazing has resulted in a reduction of desirable shrub vegetation; however, grazing has had little effect on grass over, density, and production. Indian ricegrass, the dominant cool-season grass, was found in greater proportions on the hillsides and hilltops than in swales. It is likely that this grass was influenced by soil characteristics and past grazing preferences.

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1055. Long-term impacts of extensification of grassland management on biodiversity and productivity in upland areas: A review.

Marriott, C. A.; Fothergill, M.; Jeangros, B.; Scotton, M.; and Louault, F.

Agronomie 24(8): 447-462. (2004)

NAL Call #: SB7.A3; ISSN: 0249-5627

Descriptors: literature reviews/ grasslands/ range management/ biodiversity/ fertilizer application/ fertilizer rates/ sustainable agriculture/ extensive farming/ grazing/ mowing/ biomass/ botanical composition/ experimental design/ Europe

This citation is from AGRICOLA.

1056. Long-term impacts of livestock grazing on Chihuahuan Desert rangelands.

Navarro, J. M.; Galt, D.; Holechek, J.; McCormick, J.; and Molinar, F.

Journal of Range Management 55(4): 400-405. (2002)

NAL Call #: 60.18 J82; ISSN: 0022-409X

Descriptors: beef cattle/ grazing intensity/ plant communities/ botanical composition/ drought/ precipitation/ range management/ New Mexico

Abstract: Rangeland ecological condition was monitored over a 48 year period on 41 sites on Bureau of Land Management rangelands scattered across 6 counties in southwestern New Mexico. All sites were grazed by livestock during the study period. Sampling occurred in 1952, 1962, 1982, 1992, 1997, 1998, and 1999. A modified Parker 3 step method in conjunction with Dyksterhuis quantitative climax procedures were used to determine rangeland ecological condition. At the end of the 48 year study period (1952-1999), the average rangeland ecological condition score across study sites was the same ($P > 0.05$) as the beginning of the study (39% versus 41% remaining climax vegetation, respectively). Major changes ($P > 0.05$)

in rangeland condition occurred within the study period due to annual fluctuations in precipitation. Ecological condition scores increased in the 1980s and early 1990s due to above average precipitation. However, drought in the early to mid 1950's and again in the mid to late 1990's caused rangeland condition scores to decline. At the end of the study (1997-1999), 38% of the sites were in late seral ecological condition, compared to an average of 25% in the 1952 to 1982 period. The amount of rangeland in late seral ecological condition increased while the amount of rangeland in mid seral and early seral condition decreased in the 1990s compared to the 1952-1962 period. The average percent cover of black grama (*Bouteloua eriopoda* Torr.) and tobosa (*Hilaria mutica* Buckley), the primary forage grasses in the Chihuahuan Desert, were the same ($P > 0.05$) in 1952 and 1999. Over the 48 year study period, the average cover of shrubs including honey mesquite (*Prosopis glandulosa* Torr.) showed no change ($P > 0.05$). However major increases in honey mesquite basal cover occurred on 1 site and creosote-bush (*Larria tridentata* [Pursh] Nutt.) increased on another. Grazing intensity was evaluated during the last 3 years of study (1997, 1998, 1999). Overall grazing use of forage across sites and years averaged 34% or conservative. Our research shows controlled livestock grazing is sustainable on Chihuahuan Desert rangelands receiving from 26-35 cm annual precipitation.

This citation is from AGRICOLA.

1057. Long-term influences of livestock management and a non-native grass on grass dynamics in the desert grassland.

Angell, Deborah L. and McClaran, Mitchel P.
Journal of Arid Environments 49(3): 507-520. (2001)
 NAL Call #: QH541.5.D4J6; ISSN: 0140-1963
Descriptors: desert grassland/ grass dynamics/ grazing intensity/ livestock management long term influences/ native species decline/ stocking density
Abstract: Density of 23 perennial grass species was measured in 25 permanent plots nine times between 1972-2000. Grass density was not related to the intensity of livestock grazing. Only one species expressed a difference between the summer rest and no summer rest with heavier stocking grazing treatments: bush muhly (*Muhlenbergia porteri* Scribn. ex Beal) density was less under the no summer rest with heavier stocking treatment. Beginning in 1975, the non-native Lehmann lovegrass (*Eragrostis lehmanniana* Nees) spread from distant seedings to one plot, and by 1991, it was the dominant species on most plots. The density of native species was not related to the length of time that the non-native lovegrass was present on a plot. In general, native species declined prior to the arrival and increase of the non-native lovegrass.

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1058. Long-term soil nitrogen and vegetation change on sandhill rangeland.

Berg, W. A.; Bradford, J. A.; and Sims, P. L.
Journal of Range Management 50(5): 482-486. (1997)
 NAL Call #: 60.18 J82; ISSN: 0022-409X
http://jrm.library.arizona.edu/data/1997/505/482-486_berg.pdf
Descriptors: exclosures/ grazing/ litter/ little bluestem/ organic carbon/ sand bluestem/ soil sampling/ Southern Plains/ western ragweed

Abstract: The effect of livestock grazing on organic C and N in rangeland soils is not well defined. In this study on sandy rangeland in western Oklahoma, we sampled 8 pastures moderately grazed by cattle and 8 adjacent exclosures ungrazed by livestock for years. The sagebrush was largely controlled by herbicide in the study areas. The C and N concentrations in the surface 5 cm of soil, total herbage production, and total N uptake by vegetation were similar ($P > 0.05$) in grazed and nongrazed areas. Carbon and N concentrations in soils sampled to a constant mass to a depth of 5 cm or less were not ($P > 0.05$) different from concentrations determined on soil sampled to a constant depth of 5 cm. When calculated on a content basis, grazing increased ($P < 0.001$) the bulk density (1.35 g cm^{-3}) compared to nongrazed pastures (1.19 g cm^{-3}) and had a significant ($P < 0.01$) effect on C and N in the surface 5 cm of soil. Litter and total N in litter were greater ($P < 0.01$) on nongrazed areas. Little bluestem (*Schizachyrium scoparium* (Michx.) Nash) and sand bluestem (*Andropogon hallii* Hack.) produced more herbage and had greater frequency on nongrazed areas, whereas blue grama [*Bouteloua gracilis* (H.B.K.)Lag. ex Griffiths], sand dropseed [*Sporobolus cryptandrus* (Torr.)Gray], and western ragweed [*Ambrosia psilostachya* DC.] in eased in frequency on grazed areas. Thus, 50 years of moderate grazing by rattle had no measurable effect on C and N concentrations in the surface 5 cm of the sandy soil or on total N uptake by plants as compared with nongrazed areas; however, significant differences occurred in species composition which may alter mechanisms of C and N balance.
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1059. Long-term vegetation change in relation to cattle grazing in subalpine grassland and heathland on the Bogong High Plains: An analysis of vegetation records from 1945 to 1994.

Wahren, C. H. A.; Papst, W. A.; and Williams, R. J.
Australian Journal of Botany 42(6): 607-639. (1994)
 NAL Call #: 450 Au72; ISSN: 0067-1924
Descriptors: resource management/ vegetation composition/ vegetative structure
Abstract: Changes in vegetation composition and structure are described for grassland and heathland communities on the Bogong High Plains, in the Victorian Alpine National Park. The data are based on long-term records collected from permanent reference plots over the period 1945 to 1994 from plots established in 1945, 1946 and 1979. In the Pretty Valley grassland plots, established in 1946, cattle grazing has prevented the large-scale regeneration of a number of tall, palatable forbs and short, palatable shrubs, while in the absence of grazing, the cover of these life forms increased substantially. The amount of bare around and loose litter was significantly greater on the grazed compared with the ungrazed plot. Between 1979 and 1994, there was little or no identifiable trend in the cover of vegetation or bare around at either the Pretty Valley grazed site, or two additional grazed grassland sites established nearby in 1979. The current condition of grazed grassland on the Bogong High Plains is interpreted as stable, yet degraded. Improvement in condition will occur in the absence of grazing. In the Rocky Valley open heathland plots, established in 1945, increases in shrub cover over the study period were due to growth of shrubs following the 1939 bushfires that burnt much of the Bogona High Plains. From 1945-1979 shorter-lived shrubs increased in cover;

since 1979, these shrubs have senesced, and are being replaced mainly by grasses. On the grazed plot longer lived, taller shrubs have continued to increase in cover and are not senescing. Between 1979 and 1989, total shrub cover declined on the ungrazed plot, but increased on the grazed plot. There was no evidence that grazing has reduced shrub cover, and therefore potential fire risk, in open heathland. These findings have significant management implications for the Alpine National Park and are consistent with those from other regions in the Australian alps.

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1060. Long-term vegetation changes in experimentally grazed and ungrazed back-barrier marshes in the Wadden Sea.

Bos, Daan; Bakker, Jan P.; De Vries, Yzaak; and Van Lieshout, Suzan

Applied Vegetation Science 5(1): 45-54. (2002)

NAL Call #: QK900 .A66; ISSN: 1402-2001

Descriptors: back barrier salt marshes/ foraging/ grazing/ inundation frequency/ long term vegetation changes/ species richness/ vegetation: changes, development, succession

Abstract: Vegetation succession in three back-barrier salt marshes in the Wadden Sea was studied using a data set comprising 25 years of vegetation development recorded at permanent quadrats. The effect of livestock grazing on succession was assessed by comparing quadrats where grazing was experimentally prevented or imposed. We studied changes at the species level as well as at the level of the plant community. Special attention is given to effects on plant species richness and community characteristics that are relevant for lagomorphs (hares and rabbits) and geese. Inundation frequency and grazing were most important in explaining the variation in species abundance data. The three marshes studied overlap in the occurrence of different plant communities and the observed patterns were consistent between them. Clear differences in frequency and abundance of plant species were observed related to grazing. Most plant species had a greater incidence in grazed treatments. Species richness increased with elevation, and was 1.5 to 2X higher in the grazed salt marsh. Grazing negatively influenced *Atriplex portulacoides* and *Elymus athericus*, whereas *Puccinellia maritima* and *Festuca rubra* showed a positive response. The communities dominated by *Elymus athericus*, *Artemisia maritima* and *Atriplex portulacoides* were restricted to the ungrazed marsh. Communities dominated by *Puccinellia maritima*, *Juncus gerardi* and *Festuca rubra* predominantly occurred at grazed sites. As small vertebrate herbivores prefer these plants and communities for foraging, livestock grazing thus facilitates for them.

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1061. Managed grazing and seedling shelters enhance oak regeneration on rangelands.

McCreary, D. D. and George, M. R.

California Agriculture 59(4): 217-220, 222. (2005)

NAL Call #: 100 C12Cag; ISSN: 0008-0845

Descriptors: Quercus/ grazing/ livestock/ silvopastoral systems/ forest regeneration/ grazing management/ California

This citation is from AGRICOLA.

1062. Management of grazing animals for environmental quality.

Etienne, M.

Options Mediterraneennes Serie A, Seminaires Mediterraneens(67): 225-235. (2005)

NAL Call #: S19.O681; ISSN: 1016-121X

Descriptors: biodiversity/ environmental management/ European Union/ forests/ grasslands/ grazing/ rangelands/ reviews/ stocking rate/ woodlands

Abstract: Since the last decade, increasing importance has been given in the European Union to environmental concerns and sustainable development. This trend has led to consider grazing management not only as a way to transform primary production into meat or milk, but also as a tool to move grassland, rangeland or woodland trajectories towards higher biodiversity and lower environmental hazards. To warrant forest multifunctionality special attention is given to flexible grazing management techniques adapted to the potential multiple uses and the ecological dynamics of the forest. To reduce the threat of fire, grazing management is focused on stimulating dry forage intake and shrub browsing, and is adapted to the structure and spatial organisation of fire prevention management plans. To enhance biodiversity grazing management has shifted towards more diversified stocking rates, by organising grazing calendars adapted to the life cycle of endangered species or to high seasonal grazing pressure on specific ecological targets.

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1063. Management of New Mexico's riparian areas.

Baker, Terrell T.

In: 46th Annual New Mexico Water Conference proceedings: Watershed management: restoration, utilization, and protection. (Held 5 Nov 2001-7 Nov 2001 at: New Mexico Water Resources Research Institute; 2001. <http://wrrri.nmsu.edu/publish/watcon/proc46/baker.pdf>

Descriptors: riparian areas/ environmental impact/ grazing management/ best management practices

Abstract: Discusses the history of riparian areas in New Mexico and provides an overview of grazing practices and systems designed to minimize environmental impacts.

1064. Management strategies for sustainable beef cattle grazing on forested rangelands in the Pacific Northwest.

DelCurto, T.; Porath, M.; Parsons, C. T.; and Morrison, J. A. *Rangeland Ecology and Management* 58(2): 119-127. (2005)

NAL Call #: SF85 .J67; ISSN: 1550-7424

Descriptors: distribution/ mixed-conifer rangelands/ riparian areas

Abstract: Livestock grazing practices on public and private rangelands throughout the western United States are subject to increasing scrutiny. Much criticism arises from the tendency for livestock to concentrate in riparian areas and to disproportionately use the vegetation to the degree that riparian function and vegetation are compromised. The purpose of this synthesis article is to evaluate grazing-management strategies that encourage beef cattle to use forage resources away from riparian areas and areas where topographical features limit grazing use. Specifically, this paper evaluates individual management strategies and attempts to quantify the changes in distribution patterns and vegetation use. An effective strategy uses water

development to encourage uniform distribution. Likewise, timing and duration of grazing have dramatic influences on cattle distribution in riparian and upland range areas. In general, early in the grazing season, when upland forage is green and growing, cattle tend to distribute more uniformly than later in the season, when upland vegetation is dormant and cattle disproportionately use riparian areas. In addition, early in the season, cattle grazing forested rangelands seem to prefer south-facing aspects with more open canopies when compared with late-season distribution patterns when concentration switches to northerly aspects, denser canopies, and more diverse diets. Other factors that appear to influence distribution include cow breed, age, and stage of production. In addition, recent research suggests that as cows age, distribution patterns change: Older cows have been reported to travel further from water than their younger contemporaries as long as adequate forage is available in the uplands. Additional research is needed on beef cattle selection, technological applications, efficient herding practices, supplementation strategies, and whole-range management systems that encourage the sustainable use of rangeland resources.
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1065. Managing for biodiversity conservation in native grasslands on farms.

Dorrough, J.; Turner, V.; Yen, A.; Clark, S.; Crosthwaite, J.; and Hirth, J.

Wool Technology and Sheep Breeding 50(4): 760-765. (2002)

NAL Call #: 304.8 W888; ISSN: 0043-7875

Descriptors: biodiversity/ grassland management/ grasslands/ grazing/ nature conservation/ sustainability/ Australia/ Victoria/ Australasia/ Oceania/ Developed Countries/ Commonwealth of Nations/ OECD Countries/ Australia

Abstract: Native temperate grassland and grassy woodlands have been subject to considerable modification by livestock grazing and clearance for exotic pastures and crops. In Victoria, very little high-quality grassy vegetation persists. Consequently, native grasslands and grassy woodlands are considered endangered ecological communities and therefore are a very high priority for nature conservation. Most of the highest-quality grassland remnants occur in small, isolated areas on public land. The long-term persistence and resilience of these scattered remnants is uncertain. Although typical remnants on private land are of low quality, their large size means that they have the potential to play an important role in the conservation of grassy ecosystems. One of the major challenges of the future is determining how to enhance the quality of these remnants on private land while ensuring productivity for farmers. This paper describes the initial results of a joint project between Agriculture Division and Parks, Flora and Fauna Division within Victoria's Department of Natural Resources and Environment, Australia. This project involves collaborative work between scientists, farmers, extension officers and policy makers to develop best management practices so that native grasslands on farms are grazed in a sustainable manner. A detailed review of grazing management strategies in native grasslands was undertaken. As well, market research was carried out to identify the attitudes of farmers and extension officers towards grazing in native grasslands. This work identified a lack of knowledge about appropriate grazing

management strategies as the major impediment to conserving grasslands within productive grazing enterprises. Four high-priority research areas were identified, as follows: (1) assessment of different grazing management regimes (e.g., timing, set stocking versus cell grazing) for biodiversity enhancement or loss; (2) determination of maximum productivity gains in grasslands (e.g., fertiliser rates, livestock density) beyond which there is biodiversity loss; (3) cost-effective broadscale re-establishment and enhancement of native grassland; and (4) identification of productivity benefits of conserving biodiversity in natural grassland ecosystems.
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1066. Managing grassland for production, the environment and the landscape: Challenges at the farm and the landscape level.

Gibon, A.

Livestock Production Science 96(1): 11-31. (Sept. 2005)
NAL Call #: SF1.L5; ISSN: 0301-6226

Descriptors: range management/ grasslands/ livestock production/ environmental impact/ species diversity/ environmental quality/ pollution control/ public policy/ landscapes/ farm management/ geographical distribution/ sustainable agriculture/ literature reviews/ Europe
This citation is from AGRICOLA.

1067. Managing ungulates to allow recovery of riparian vegetation.

Krueger, W. C.

In: Proceedings of a symposium on sustaining rangeland ecosystems. (Held 29 Aug 1994-31 Aug 1994 at Eastern Oregon State College, La Grande, Oregon.) Edge, W. D. and Olsen-Edge, S. L. (eds.); Vol. Special Report 953. Corvallis, Ore.: Oregon State University Extension Service; pp. 160-164; 1996.

NAL Call #: 100 Or3M no.953

Descriptors: riparian vegetation/ grassland management/ plant communities/ palatability/ regrowth/ hydrology/ livestock/ wild animals/ range management/ grasslands/ riparian grasslands/ grazing/ management/ sustainability
Abstract: The literature evaluating grazing of large ungulates (livestock or big game) and the sustainability of riparian ecosystems is considered to be largely based on case history and observations but clarifies the site specificity of management influences on riparian vegetation. It is suggested that grazing strategies based on a knowledge on animal behaviour, palatability, plant responses to grazing, plant community responses, hydrology and practicality may be integrated into society and ecological requirements for ecosystem management. A land issues forum coordinated resource management planning protocol taking 11 months to implement is presented.

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1068. Manipulative grazing of plant communities.

Vavra, M.

Nato Advanced Science Institutes Series: Series A: Life Sciences 108: 167-178. (1986)

NAL Call #: QH301.N32

Descriptors: cattle/ livestock/ feed intake/ grazing/ liveweight gain/ range management/ plant communities/ United States

This citation is from AGRICOLA.

1069. Measurement of above-ground plant biomass, forage availability and grazing impact by combining satellite image processing and field survey in a dry area of north-eastern Syria.

Hirata, M.; Koga, N.; Shinjo, H.; Fujita, H.; Gintzburger, G.; Ishida, J.; and Miyazaki, A.

Grass and Forage Science 60(1): 25-33. (2005)

NAL Call #: 60.19 B773; ISSN: 0142-5242

Descriptors: field survey; applied and field techniques/ satellite image processing; mathematical and computer techniques/ above ground plant biomass/ dry season/ forage availability/ grazing impact/ growing season/ livestock management/ soil erosion protection

Abstract: Field survey and satellite image processing methods were used to estimate the total available forage over an area of 95 034 ha in north-eastern Syria, and to assess grazing impact on the area. The above-ground plant biomass was measured by a quadrat method at three sites in each of eight vegetation classes. Available forage was measured by excluding woody parts of shrubs from the whole aerial plant parts. The total above-ground plant biomass and available forage were estimated by extrapolating the measured point data to the whole target area using classified vegetation data by satellite image processing. Grazing impact was assessed by calculating the differences between the total available forage at the end of growing season and the end of dry season. The values for the estimated total available forage (s.e. of mean) in the area were 55 628 000 (12 920 000) kg DM and 30 007 000 (2 437 000) kg DM at the end of growing season and dry season respectively. Although the area of the cereal fields covered only 0.315 of the area, about 0.69 and 0.82 of the available forage existed in the harvested cereal fields at the ends of growing season and dry season respectively. The integration of cereal fields and rangeland is a normal land use system for livestock management in the area. The higher cover of herbaceous vegetation types showed higher grazing impacts which reduced the total available forage at the end of the growing season by 0.817 (0.199) at the end of the dry season. Although these dense herbaceous vegetation types could possibly produce more available forage, they would incur more intensive grazing impact. On the contrary, lighter grazing impact would occur with a higher cover of shrub vegetation types. The importance of maintaining plant cover over the rangeland area to protect the land against soil erosion is stressed.

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1070. Measuring plant diversity in the tall threetip sagebrush steppe: Influence of previous grazing management practices.

Seefeldt, Steven S. and McCoy, Scott D.

Environmental Management 32(2): 234-245. (2003)

NAL Call #: HC79.E5E5; ISSN: 0364-152X

Descriptors: vegetation measurement: applied and field techniques/ fall grazed areas/ grazing timing/ long term grazing study/ multiscale modified whittaker plots/ plant diversity/ postfire vegetation composition: previous grazing practice impacts/ previous grazing management practice influences/ psuedoreplication: potential effects/ spring grazed area/ tall threetip sagebrush bunchgrass plant community/ tall threetip sagebrush steppe/ ungrazed areas/ vegetation changes: grazing induced/ wildfire

Abstract: In July 2000, a 490-ha wildfire burned a portion of a long-term grazing study that had been established in

1924 at the US Sheep Experiment Station north of Dubois, Idaho, USA. Earlier vegetation measurements in this tall threetip sagebrush (*Artemisia tripartita* spp. *tripartita*) bunch-grass plant community documented significant changes in vegetation due to grazing and the timing of grazing by sheep. A study was initiated in May 2001 using 12 multiscale modified Whittaker plots to determine the consequences of previous grazing practices on postfire vegetation composition. Because there was only one wildfire and it did not burn all of the original plots, the treatments are not replicated in time or space. We reduce the potential effects of psuedoreplication by confining our discussion to the sample area only. There were a total of 84 species in the sampled areas with 69 in the spring-grazed area and 70 each in the fall- and ungrazed areas. Vegetation within plots was equally rich and even with similar numbers of abundant species. The spring-grazed plots, however, had half as much plant cover as the fall- and ungrazed plots and the spring-grazed plots had the largest proportion of plant cover composed of introduced (27%) and annual (34%) plants. The fall-grazed plots had the highest proportion of native perennial grasses (43%) and the lowest proportion of native annual forbs (1%). The ungrazed plots had the lowest proportion of introduced plants (4%) and the highest proportion of native perennial forbs (66%). The vegetation of spring-grazed plots is in a degraded condition for the environment and further degradation may continue, with or without continued grazing or some other disturbance. If ecosystem condition was based solely on plant diversity and only a count of species numbers was used to determine plant diversity, this research would have falsely concluded that grazing and timing of grazing did not impact the condition of the ecosystem.

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1071. Medium-term changes in grass composition and diversity of Highland Sourveld grassland in the southern Drakensberg in response to fire and grazing management.

Short, A. D.; O'Connor, T. G.; and Hurt, C. R.

African Journal of Range and Forage Science 20(1): 1-10. (2003)

NAL Call #: SB197.J68; ISSN: 1022-0119

Descriptors: conservation status/ fire response/ grass composition/ grassland diversity/ grazing management/ medium term changes

Abstract: This study examined the compositional stability of Highland Sourveld in response to fire and grazing by wildlife (Coleford Nature Reserve) and by cattle on three properties over 20-25 years. A limited amount of compositional change took place except on a property stocked 1.5 times as heavily as the others, but no species were lost. In general, Decreaser species decreased and Increaser 2 species increased, although individual species of a group did not show a consistent pattern of change in abundance. Consistent heavy grazing favoured mtshiki species (*Sporobolus africanus*, *Eragrostis plana*), stoloniferous species (*Paspalum notatum*) and *Alloteropsis semialata*. The extent of compositional change was least at an intermediate (0.4 versus 0.1-0.75AU ha⁻¹) stocking density. Clovelly soils were prone to twice as much change as Hutton or Mispah soils. On lands abandoned for >50 years, the dominant *E. curvula* declined by two thirds and small amounts of characteristic Highland Sourveld species

established. Infrequent burning (every six years) resulted in twice as much compositional change as annual burning. Ordination techniques revealed three main groups of species, in terms of their amount and direction of change, identifiable with the Increaser-Decreaser classification. Important contradictions were, however, evident, such as a similar response for the Decreaser *Themeda triandra* and the Increaser 2 *Diheteropogon filifolius*, indicating revision of this classification is warranted for the Highland Sourveld. Changes in composition reflected changes in grass diversity (evenness, species richness, Shannon-Weaver diversity). Heavy grazing increased evenness, hence Shannon-Weaver diversity, through reducing the mono-dominance of *T. triandra*. Grazing-induced changes in grassland composition may therefore reflect the conservation status of grasslands.

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1072. Microbial carbon nitrogen and phosphorus in dry tropical savanna effects of burning and grazing.

Singh, R. S.; Srivastava, S. C.; Raghubanshi, A. S.; Singh, J. S.; and Singh, S. P.

Journal of Applied Ecology 28(3): 869-878. (1991)
NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: soil/ microorganism/ residue/ decomposition/ plant/ nutrient cycling/ immobilization/ mineralization/ resource management/ microbial population ecology

Abstract: (1) The effects of burning and grazing of dry tropical Indian savanna on the level of available nutrient pools and microbial C, N, and P were assessed. (2) The maximum amounts of available nutrients and microbial biomass occurred in the dry period and minimum in the wet period. (3) Burning and grazing increased inorganic N by 54% and 15-49%, respectively and also increased bicarbonate-extractable inorganic P by 35% and 27-32%, respectively. (4) Mean annual microbial C varied from 361 to 466 $\mu\text{g g}^{-1}$, microbial N from 35 to 44 $\mu\text{g g}^{-1}$ and microbial P from 16 to 23 $\mu\text{g g}^{-1}$ dry soil. The mean annual microbial C, N and P were positively related to other. (5) Burning increased microbial C by 18%, microbial N by 26% and microbial P by 35%, and grazing increased microbial C by 15-18%, microbial N by 14-23% and microbial P by 19-29%.

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1073. Moderate and light cattle grazing effects on Chihuahuan desert rangelands.

Holechek, J.; Galt, D.; Joseph, J.; Navarro, J.; Kumalo, G.; Molinar, F.; and Thomas, M.

Journal of Range Management 56(2): 133-139. (2003)
NAL Call #: 60.18 J82; ISSN: 0022-409X

Descriptors: arid lands/ livestock/ range management/ stocking rate

Abstract: Vegetation changes were evaluated over a 13 year period (1988-2000) on moderately grazed and lightly grazed rangelands in the Chihuahuan Desert of south central New Mexico. During the study period, grazing use of primary forage species averaged 49 and 26% on moderately and lightly grazed rangelands, respectively. Autumn total grass and black grama (*Bouteloua eriopoda* Torr.) standing crop were consistently higher on the lightly than moderately grazed rangeland throughout the study. Total grass standing crop declined on the moderately grazed rangeland when the last 3 years of study were compared to the first 3 years (10 versus 124 kg ha⁻¹), but

showed no change on the lightly grazed rangeland (320 versus 357 kg ha⁻¹). Black grama, the primary perennial grass in the Chihuahuan Desert, increased in autumn standing crop on the lightly grazed rangeland, but decreased on the moderately grazed rangeland. Dropseed (*Sporobolus* spp.) autumn standing crop decreased on both rangelands during the study. However, this decrease was greater on the moderately grazed rangeland (97% decline) than on the lightly grazed rangeland (67% decline). Perennial grass survival following a 3-year period of below average precipitation was higher on the lightly grazed (51%) than the moderately grazed rangeland (11%). Severe grazing intensities on the moderately grazed rangeland during the dry period (1994-1996) appear to explain differences in grass survival between these 2 rangelands. Our study and several others show that light to conservative grazing intensities involving about 25-35% use of key forage species can promote improvement in rangeland ecological condition in the Chihuahuan Desert, even when accompanied by drought.

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1074. Mosses mediate grazer impacts on grass abundance in Arctic ecosystems.

Van Der Wal, R. and Brooker, R. W.

Functional Ecology 18(1): 77-86. (2004)

NAL Call #: QH540.F85; ISSN: 0269-8463

Descriptors: arctic ecosystems/ grazing impacts: indirect/ growth forms/ herbivory/ insulation/ moss layer depth/ nutrient enrichment/ permafrost soils/ plant responses/ positive feedback loops/ soil temperature/ species abundance/ trampling

Abstract: 1. Large herbivores have significant impacts on the structure and function of temperate and tropical ecosystems. Yet herbivore impacts on arctic systems, particularly the mechanisms by which they influence plant communities, are largely unknown. 2. High arctic vegetation, commonly overlying permafrost soils, is often moss-dominated with sparse vascular plant cover. We investigated the potential influence of large herbivores on arctic plant communities via their impact on the depth of the moss layer, leading to warmer soils and potentially benefiting vascular plants. 3. We found that grazer impacts on moss depth, and subsequently soil temperature, may influence vascular plant abundance and community composition because of the observed positive but growth-form-specific response of vascular plants to soil warming, promoting grasses in particular. 4. We propose that the positive association of grasses and large herbivores in arctic moss-dominated systems results from two simultaneously operating positive feedback loops. First, herbivore grazing and trampling reduces moss layer depth, increasing soil temperatures. Second, grasses benefit directly from grazers as a result of additional nutrients from faeces and urine. Additionally, the tolerance of grasses to grazing may enable grasses to expand despite the losses suffered from herbivory.

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1075. Native grassland management: A botanical study of two native grassland management options on a commercial cattle property.

McGufficke, B. R.

Rangeland Journal 25(1): 37-46. (2003)

NAL Call #: SF85.4.A8A97; ISSN: 1036-9872

Descriptors: range improvement/ superphosphate/ botanical composition/ endemic species/ introduced plants/ sown pastures/ grazing management/ range management/ New South Wales

This citation is from AGRICOLA.

1076. 'Nature's Method of Grazing': Non-selective grazing (NSG) as a means of veld reclamation in South Africa.

Hoffman, M. T.

South African Journal of Botany 69(1): 92-98. (2003)

NAL Call #: QK1.S69; ISSN: 0254-6299

Abstract: Acocks was concerned with the past, present and future state of South Africa's vegetation and in the 1960's, together with several farmers in the eastern Karoo, developed a grazing system which he thought would restore the vegetation to its former pristine condition. Acocks felt that the grazing systems advocated by the Department of Agriculture at the time were partly responsible for the degraded vegetation of the region as these systems encouraged livestock to graze selectively, thereby overgrazing the more palatable species in the vegetation. He felt that by forcing animals to graze all species non-selectively, the more palatable elements would be able to out-compete the less palatable species and dominate the vegetation as he believed they once did in pre-colonial times. Acocks found theoretical support for his argument which also relied on relatively long rest periods between grazing events and suggested that this non-selective grazing system simulated the way in which the pre-colonial ungulate herds utilised the vegetation. Although Acocks never conducted the key experiments needed to test his ideas, his approach was supported by several farmers in the eastern Karoo who conducted trials on their farms to test the principles of the method. The approach advocated by Acocks, however, was in direct contrast to that proposed by the Department of Agriculture who were concerned about the comparatively high stocking rates advocated under Acocks' Non-Selective Grazing (NSG) system. Their own experiment on NSG found that it reduced plant cover and increased erosion and they believed that it would lead to further widespread degradation if implemented. Although Acocks was employed by the Department of Agriculture as a Botanical Survey Officer he was not a Pasture Research Officer and it was this latter group of employees who had the responsibility of researching and advocating appropriate grazing systems for South Africa's rangelands. Acocks was, therefore, instructed not to promote NSG in his official capacity. Despite this, Acocks' writing in the last ten years of his life is infused with the ideas of NSG which continue to influence the development of range management systems to the present.

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1077. New perspectives on sustainable grazing management in arid zones of sub-Saharan Africa.

Oba, Gufu; Stenseth, Nils Chr; and Lusigi, Walter J.

Bioscience 50(1): 35-51. (2000)

NAL Call #: 500 Am322A; ISSN: 0006-3568

Descriptors: arid zone/ climate/ equilibrium ecosystem/ grazing/ herbivory/ non equilibrium ecosystem/ stochastic weather/ sustainable grazing management

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1078. Nonequilibrium dynamics of sedge meadows grazed by cattle in southern Wisconsin.

Middleton, Beth

Plant Ecology 161(1): 89-110. (2002)

NAL Call #: QK900.P63; ISSN: 1385-0237

Descriptors: non metric multidimensional scaling: nms/ cattle grazing: exclusion/ equilibrium theory/ mean percentage cover: structural changes/ mean percentage height: structural changes/ sedge meadows: long term structural characteristics, nonequilibrium dynamics, recovery/ shrub carr/ succession

Abstract: Equilibrium theory predicts that after disturbance, ecosystems eventually regain the structural and functional properties characteristic of their predisturbance condition. This study tested this idea by examining the effects of cattle grazing and exclusion on the long-term structural characteristics of sedge meadows in southern Wisconsin. To compare structural changes in mean percentage cover and height, repeated measures analysis was conducted on two sedge meadows over a twenty year period from 1977 to 1997. One sedge meadow was recovering from cattle grazing (cattle excluded in 1973) and the other was a reference area (nearly undisturbed). Both of these study sites changed structurally from 1977 to 1997, supporting non-equilibrium theory. Additional observations were made in a heavily and lightly grazed sedge meadow that were surveyed in 1977. As based on the positions of subunits in an ordination graph produced using Non-Metric Multidimensional Scaling (NMS), the recovery sedge meadow became less structurally similar to the grazed and more similar to the reference site over the 20 year study. However, from the perspective of mean maximum height in another NMS analysis, the recovery sedge meadow became less similar to the reference site over time likely because by 1997, a shrub carr of *Cornus sericea* had developed in the recovery sedge meadow that had been dominated by graminoids and forbs in 1977 (mean maximum height: 1977 vs. 1997; 0 vs. 47 cm). Seedlings of *Cornus sericea* were invading the grazed sedge meadows and in the recovery sedge meadow (cattle excluded 4 years earlier) in 1977. A shrub carr did not develop in the reference sedge meadow. Changes in the reference site were relatively minor over this time interval; certain species either increased or decreased in dominance, e.g., *Carex stricta* increased in cover (1977 vs. 1997, 20 and 28 mean percentage (%) cover, respectively). A few short-term species of the recovery sedge meadow followed the tenets of equilibrium theory. These became less common or disappeared 4-9 years after cattle exclusion including *Aster lanceolatus*, *Calamagrostis canadensis*, *Poa compressa*, *Solidago altissima* and *Verbena hastata*. Some of these species were eaten and likely spread by the cattle. This study suggests that the progression of sedge meadow to shrub carr may not be an inevitable outcome of succession but instead can be a consequence of past cattle grazing

history. Also, because the recovery and the reference sedge both changed structurally over time, the tenets of non-equilibrium theory were supported by this study.

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1079. North Dakota grasslands net primary productivity and plant nitrogen dynamics as a function of grazing intensity.

Shariff, Ahmed R.; Biondini, Mario E.; and Grygiel, Carolyn E.

Prairie Naturalist 26(3): 229-240. (1994)

NAL Call #: QH540 .P7; ISSN: 0091-0376

Descriptors: biomass growth/ grazing animal/ litter biomass/ nitrogen uptake/ root productivity/ seasonal dynamics/ standing dead biomass

Abstract: A study was conducted for two years in south central North Dakota to evaluate the responses of (1) growing season and annual above-ground net primary productivity (ANPP) and growing season root productivity (GSRP), (2) growing season above-ground nitrogen (N) uptake, and (3) seasonal N dynamics in above-ground standing dead biomass and in litter. Three treatments were used: long term not grazed (NG), a moderate (MGT) and a high (HGT) grazing intensity treatments. The MGT and HGT treatments consisted of the removal of 45% and 77% of annual above-ground biomass growth. The MGT treatment resulted in higher ANPP, GSRP, and above-ground N uptake than either the NG or HGT. Standing dead biomass and litter were higher in the NG treatment but the MGT treatment had higher N concentration.

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1080. Nutrient changes in tussock grasslands, South Island, New Zealand.

Mcintosh, Peter

Ambio 26(3): 147-151. (1997)

NAL Call #: QH540.A52; ISSN: 0044-7447

Descriptors: burning/ calcium/ grazing/ magnesium/ nitrogen/ nutrient budget/ nutrient change/ nutrient cycling/ phosphorus/ potassium/ resource management/ soil organic matter/ South Island/ spatial biomass/ terrestrial ecology/ tussock grasslands/ vegetation

Abstract: The New Zealand Resource Management Act (1991) requires that resources should be managed in a way that maintains their potential to meet the reasonably foreseeable needs of future generations, and the 1994 'High Country Review' considered that high country tussock grasslands should be managed in a manner "that will maintain or improve soil organic matter and soil nutrient balance." Nutrient change in grazed, unfertilized tussock grasslands has been measured or estimated from biomass changes, nutrient cycling estimates, temporal soil trends, and spatial biomass and soil comparisons of differently managed areas. There has been a net decline of nutrients in biomass and soils under grazing, or grazing with burning. Maximum measured losses are N 27 kg ha⁻¹ yr⁻¹; P 5.5 kg ha⁻¹ yr⁻¹; K 19 kg ha⁻¹ yr⁻¹; Mg 1.4 kg ha⁻¹ yr⁻¹; and Ca 30 kg ha⁻¹ yr⁻¹. These measured losses are greater than can be accounted for by the direct effects of grazing. Although knowledge gaps mean that a complete nutrient budget cannot be constructed, there is no evidence that such losses are significantly mitigated by addition of nutrients by weathering or other natural processes. It is therefore concluded that continued grazing and burning of tussock grasslands without nutrient inputs is unsustainable,

and that to maintain or improve nutrient balance a new approach to soil and vegetation management will be required.

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1081. Observations on vegetation responses to improved grazing systems in Somalia.

Thurow, T. L. and Hussein, A. J.

Journal of Range Management 42(1): 16-19. (1989)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1989/421/4thur.pdf>

Descriptors: botanical composition/ grazing/ plant communities/ vegetation types/ Somalia

This citation is from AGRICOLA.

1082. On the dynamics of grazing systems in the semi-arid succulent Karoo: The relevance of equilibrium and non-equilibrium concepts to the sustainability of semi-arid pastoral systems.

Richardson, F. D.; Hahn, B. D.; and Hoffman, M. T.

Ecological Modelling 187(4): 491-512. (2005)

NAL Call #: QH541.15.M3E25; ISSN: 0304-3800

Descriptors: agropastoral systems/ farming systems/ grasslands/ grazing/ rain/ range management/ rangelands/ semiarid grasslands/ simulation models/ soil water content/ stocking density/ temperature/ temporal variation

Abstract: Two long-term mechanistic models of grazing systems in the semi-arid succulent Karoo have been used to study factors that influence vegetation changes, livestock productivity and sustainability of the ecosystem. In this region of low and highly variable rainfall, goats and sheep feed on vegetation comprising perennial shrubs and annuals. A previously published model of the Namaqualand system (the "standard" model) explicitly simulates three guilds of perennial shrubs, a guild of annuals, forage consumption, growth of goats and goat reproductive and survival rates. The model also simulates variable rainfall and predicts that, if no steps are taken to control the goat population, stock numbers will vary widely between years and the population of the different plant guilds will fluctuate. Plots of model output indicate that the system is driven by rainfall. Temporal changes in the relative abundance of each guild vary with different sequences of rainfall having similar long-term mean and variability. A single run of the model may display equilibrium, disequilibrium and threshold behaviour. Thus, the system exhibits complex dynamics. If animal numbers are held constant at the long-term average of variable stock or at the recommended stocking rate then the cover of palatable shrubs decreases and that of toxic plants increases substantially. A "simplified" model based on an aggregated forage variable and equilibrium dynamics is inadequate to describe the behaviour of this system.

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1083. Patch dynamics under rotational and continuous grazing management in large, heterogeneous paddocks.

Teague, W. R. and Dowhower, S. L.

Journal of Arid Environments 53(2): 211-229. (2003)

NAL Call #: QH541.5.D4J6; ISSN: 0140-1963

Descriptors: continuous grazing: applied and field techniques/ rotational grazing: applied and field techniques/ patch dynamics: heterogeneous paddocks

Abstract: Overoptimistic stocking rates are the leading cause of rangeland degradation. The phenomenon of

patch-selective grazing means that the stocking rate on heavily used patches is much higher than that intended for the area as a whole. In addition, the differential use of preferred areas in the landscape results in uneven distribution of animal impact. Landscape heterogeneity increases as grazing unit size increases, resulting in heavier impact on preferred areas. Such phenomena compound over time and have a major long-term impact on the environment and primary and secondary production. This study investigates whether rotational grazing allows reduction of, and recovery from, degradation caused by patch-selective grazing in large (1800-2100 ha) paddocks by providing adequate rest between grazing events. From 1995 through 1998, herbaceous basal area and bare ground changes were measured on adjacent heavily and lightly grazed patches in rotationally and continuously grazed paddocks. Although weather was a dominating influence ($p < 0.0001$), the eight-pasture rotation system resulted in greater perennial herbaceous basal area ($p = 0.0987$) and lower proportions of bare ground on bottomland soils ($p = 0.03$) and clay-loam soils ($p = 0.052$) than the continuously grazed control. The increases in basal area with rotational grazing were primarily due to increases in perennial C4 mid- and shortgrasses. Grazing treatment did not influence species aerial biomass composition ($p > 0.1$). This study provides evidence that in large paddocks, rotational grazing allows recovery from and reduces degradation caused by patch overgrazing. Planned rotational grazing addresses the root cause of patch overgrazing and deterioration. It is, therefore, a key tool in managing for sustainable use and restoration of rangeland. © The Thomson Corporation

1084. Perennial grass response to 10-year cattle grazing in the Mendoza Plain, Mid-West Argentina.

Guevara, J. C.; Estevez, O. R.; Stasi, C. R.; and Gonnet, J. M.

Journal of Arid Environments 52(3): 339-348. (2002)
NAL Call #: QH541.5.D4J6; ISSN: 0140-1963

Descriptors: basal area/ cattle selectivity groups/ grazing intensities/ grazing strategies/ perennial grasses/ plant density

Abstract: Basal area (cm^2m^{-2}) and density (plants m^{-2}) for total, undesirable, intermediate and preferred perennial grasses were monitored in 1990 and in 2000 in response to two grazing strategies (yearlong continuous and rotational) and four grazing intensities (ungrazed; light, moderate and heavy grazing). Grazing intensity had a significant effect on basal area of perennial grasses. Basal area and density for all the grass groups tended to be higher in 2000 than in 1990 for all grazing intensities but the grazed treatments did not show significant differences in basal area and density increases from 1990 to 2000 for all the mentioned grass groups. Several hypotheses could be advanced to explain the limited grass response to treatments. The stocking rates applied may have been too light to cause significant effects. Grasses appear to be resistant under the grazing intensities used and the annual drought occurring during 7 of the 9 last years of the study. Given the history of heavy grazing in this environment, it is possible that what has been observed is natural temporal variation in basal area and plant density. © 2002 Published by Elsevier Science Ltd.

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1085. The piosphere revisited: Plant species patterns close to waterpoints in small, fenced paddocks in chenopod shrublands of south Australia.

Heshmatti, G. A.; Facelli, J. M.; and Conran, J. G.

Journal of Arid Environments 51(4): 547-560. (2002)
NAL Call #: QH541.5.D4J6; ISSN: 0140-1963

Descriptors: Waite-Nicolson rangeland management method: management method/ multivariate analysis: mathematical method/ grazing history/ paddock age/ paddock size/ piosphere/ plant species patterns/ semi arid chenopod shrublands/ site features/ small fenced paddocks/ stocking rates/ vegetation cover/ waterpoints
Abstract: The Waite-Nicolson rangeland management method for semi-arid chenopod shrublands predicts that smaller paddocks with medium to moderate stocking rates help to preserve the native vegetation. Vegetation cover around waterpoints in three small paddocks (<2000 ha) from Middleback Station, South Australia was studied using multivariate analysis. Data from quadrats sampled along radiating transects were tested for correlations with a number of site features and grazing history factors. Two significant associations were detected: quadrats with an abundance of *Rhagodia parabolica* and less palatable species such as *Maireana pyramidata*, and *Atriplex stipitata* were correlated positively with proximity to water points, paddock age and stocking rate, and negatively with paddock size. In contrast, quadrats with species such as *Rhagodia ulicina* and the more palatable *M. sedifolia* were correlated with increasing distance from the water points and paddock size, but negatively with age and stocking rates. Transect direction was not correlated with either group. Twelve of the 20 species examined, including the important forage species *A. vesicaria*, also were not correlated with those paddock and grazing features included here. These results suggest that the distribution of some chenopod shrub species in fenced paddocks is still possibly affected by a combination of these factors in the long term by grazing at densities of 6 ha sheep-1 and that the method, although maintaining the fodder species, may not be preserving biodiversity at these grazing levels, although further study is needed.

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1086. Plant and sward response to patch grazing in the Highland Sourveld.

Lutge, B. U.; Hardy, M. B.; and Hatch, G. P.

African Journal of Range and Forage Science 13(3): 94-99. (1996)

NAL Call #: SB197.J68; ISSN: 1022-0119

Descriptors: environmental degradation/ grasslands/ rangelands/ grazing/ overgrazing/ burning/ selective grazing/ grazing systems/ mixed grazing

Abstract: The effects of patch grazing by cattle and sheep on the vigour of *Themeda triandra*, and of the sward, and sward species composition was determined at Kokstad Agricultural Research Station, Natal. The generally held idea that a full season's rest followed by an early spring burn would prevent preferential grazing of patch grazed areas which had developed in the seasons before the rest was also tested. The vigour of *T. triandra* was estimated from etiolated growth of marked tussocks while sward vigour was indexed by aboveground herbage production (AGHP). Etiolated growth of *T. triandra* and AGHP of the sward within patches were negatively affected by three seasons of grazing, but a full season's rest appeared

sufficient to restore both the etiolated growth of *T. triandra* and the AGHP of the sward to a level similar to that in the non-patches. A full season's rest followed by spring burning did not, however, prevent preferential grazing of grazed patches which had developed in the seasons prior to the rest. Species composition within patches differed significantly from the species composition of non-patches. It is concluded that patch grazing may therefore initiate the rangeland degradation process in Highland Sourveld and patch grazing may be the focus from which rangeland degradation proceeds.

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1087. Plant community responses to short duration grazing in tallgrass prairie.

Gillen, R. L.; McCollum, F. T.; Hodges, M. E.; Brummer, J. E.; and Tate, K. W.

Journal of Range Management 44(2): 124-128. (1991)
NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1991/442/6gill.pdf>

Descriptors: cattle/ prairies/ rotational grazing/ grazing intensity/ stocking rate/ plant communities/ botanical composition/ ecological succession/ grazing/ Oklahoma
Abstract: A key to management of short duration grazing systems is maintaining proper rest periods for individual pastures, but information on the necessary length of rest periods for tallgrass prairie is limited. Research hypotheses for this study were that tallgrass prairie plant communities would respond differently to grazing schedules incorporating rest periods of varying lengths and that this response would be dependent on stocking rate. Treatments consisted of 3 grazing schedules (2, 3, or 4 rotation cycles per 152 day grazing season) and 2 stocking rates (1.6 and 2.2 times the moderate continuous rate). Plant frequency, standing crop, species composition, and forage utilization were sampled from 1985 to 1989. Precipitation was above average in 4 of the 5 study years. Grazing schedule did not affect any vegetation parameter over time. Stocking rate did not affect plant frequency or species composition. Standing crop was reduced and forage utilization increased at the higher stocking rate but these effects were consistent over time. Frequency of western ragweed [*Ambrosia psilostachya* DC.] and the relative species composition of the forb component increased in all grazed pastures compared to ungrazed pastures. The overall lack of major treatment effects was attributed to favorable precipitation, spring burning, and the initial high-seral successional stage of the experimental pastures.

This citation is from AGRICOLA.

1088. Plant responses to livestock grazing frequency in an Australian temperate grassland.

Dorrough, J.; Ash, J.; and McIntyre, S.

Ecography 27(6): 798-810. (2004)

NAL Call #: QH540.H6; ISSN: 0906-7590

Abstract: Livestock grazing is often thought to enhance native plant species co-existence in remnant grasslands but may also favour exotic invaders. Recommendations for appropriate grazing strategies are needed, for which an understanding of the response of plant species is necessary. We explored the response of plant species and plant functional groups to grazing in temperate grassland of the Monaro Tablelands of south-east Australia by comparing species abundance in adjacent areas that differed in livestock grazing regime (minimal, infrequent and

frequent). We also examined whether species with similar responses to grazing share certain traits and consider whether these traits might provide a useful method of assessing grazing impact. At the scale measured (0.25 m²), an infrequent grazing regime maximised plant species co-existence in these grasslands due to widespread invasion by exotic plant species at infrequent grazing intensity. Many native species declined in abundance when grazing frequency increased from minimal to infrequent. Annuals invaded under infrequent grazing while perennials declined most strongly under high frequency grazing. Low levels of grazing apparently reduce cover and create sites suitable for seed recruitment whereas more frequent grazing reduces the persistence of perennials. While there was a tendency for native species to be more susceptible to grazing impact than exotics, plant traits, in particular longevity (perennial, annual) provided a better prediction of the response of plants to grazing. Although a few native plant species persisted at high grazing frequency, even infrequent livestock grazing may not be appropriate for the conservation of many native perennial grassland species. Targeted reductions in grazing frequency may be necessary to enable the long-term coexistence of grazing susceptible species.

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1089. Plant species diversity and grazing in the Scandinavian mountains: Patterns and processes at different spatial scales.

Austrheim, Gunnar and Eriksson, Ove

Ecography 24(6): 683-695. (2001)

NAL Call #: QH540.H6; ISSN: 0906-7590

Descriptors: alpine habitat/ colonization/ grazing/ management regime/ persistence/ spatial scale variation/ species diversity/ species richness/ sub alpine habitat
Abstract: There is a long tradition of grazing by semi-domestic reindeer and sheep in alpine and sub-alpine Scandinavian habitats, but present management regimes are questioned from a conservation point of view. In this review we discuss plant diversity patterns in the Scandinavian mountains in a global, regional and local perspective. The main objective was to identify processes that influence diversity at different spatial scales with a particular focus on grazing. In a global perspective the species pool of the Scandinavian mountains is limited, partly reflecting the general latitudinal decline of species but also historical and ecological factors operating after the latest glaciation. At the local scale, both productivity and disturbance are primary factors structuring diversity, but abiotic factors such as soil pH, snow distribution and temperature are also important. Although evidence is scarce, grazing favours local species richness in productive habitats, whereas species richness decreases with grazing when productivity is low. Regional patterns of plant diversity is set by, 1) the species pool, 2) the heterogeneity and fragmentation of communities, and 3) local diversity of each plant community. We suggest that local shifts in community composition depend both on the local grazing frequency and the return-time of the plant community after a grazing session. In addition, an increasing number of grazing-modified local patches homogenises the vegetation and is likely to reduce the regional plant diversity. The time scale of local shifts in community composition depends on plant colonisation and persistence. From a mechanistic point of view, diversity patterns at a regional scale also depend on

the regional dynamics of single species. Colonisation is usually a slow and irregular process in alpine environments, whereas the capacity for extended local persistence is generally high. Although the poor knowledge of plant regional dynamics restricts our understanding of how grazing influences plant diversity, we conclude that grazing is a key process for maintaining biodiversity in the Scandinavian mountains.

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1090. Plant species dynamics in the Southern Tall Grassveld under grazing resting and fire.

Morris, C. D.; Tainton, N. M.; and Hardy, M. B.

Journal of the Grassland Society of Southern Africa 9(2): 90-95. (1992)

NAL Call #: SB197.J68; ISSN: 0256-6702

Descriptors: *Aristida junciformis*/ sward stability/ mowing/ Natal

Abstract: An analysis of temporal changes in botanical composition in a long-term grazing trial indicates that species dynamics in the Southern Tall Grassveld of Natal are determined by the specific combination of grazing, mowing and fire impacts. Species composition of a grazing systems trial was recorded at intervals during 16 years, and in the 14 years following the removal of herbivores, during which time the experimental area was burnt periodically. Site trajectories in ordination space facilitated the assessment of the nature, magnitude and rate of species composition change under various combinations of impacts. Under rotational grazing and mowing, botanical change was minimal, both during the grazing and the subsequent rest and fire phases of the trial. It is suggested that the interruption of continuous grazing at a high stocking rate by a seasonal rest (rotational resting) promoted the invasion of the sward by *Aristida junciformis*. This also occurred in the continuously-grazed treatment at a high stocking rate when stock were removed from the treatment and periodic burning was introduced. It appears that swards dominated by *A. junciformis* remain stable under a rest and burning regime.

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1091. Plant species richness and composition along livestock grazing intensity gradients in a Namaqualand (South Africa) protected area.

Hendricks, H. H.; Bond, W. J.; Midgley, J. J.; and Novellie, P. A.

Plant Ecology 176(1): 19-33. (2005)

NAL Call #: QK900.P63; ISSN: 1385-0237

Descriptors: botanical composition/ conservation areas/ grazing/ habitats/ livestock/ national parks/ palatability/ rangelands/ species diversity/ species richness/ stand structure/ trampling

Abstract: The study described changes in floristic and vegetation structure in relation to livestock grazing intensity in a conservation area in the Succulent Karoo, South Africa. Grazing by goats and sheep is allowed in the Richtersveld National Park (a contractual National Park) which is also an area of high floristic richness and endemism. We used goat faecal pellet density, degree of trampling and percentage bare-ground at distances from the stock posts as surrogates for a gradient in grazing pressure. A stock post is the place where farmers keep, in most cases in an enclosure called a 'kraal', their animals at night and to which they return every evening after the day's herding.

Twenty-seven stock posts were located in the Richtersveld National Park; nine stock posts on flats, foot-slopes and mountain each. We measured plant species richness and diversity, and mean percentage cover of the various plant growth forms (including the number of species falling into each growth form category) in each of the five 10 m x 10 m plots (each 200 m apart) demarcated along a transect of one kilometre length from the centre of each stock post. The results showed that distance from the stock post does reflect grazing intensity use because densities in faecal pellets rapidly declined with increasing distances away from the stock post for all habitats studied. Faecal density was positively correlated with stocking density. Plant species richness and diversity was at a minimum near stock posts. Plants able to endure the effects of heavy grazing occurred near stock posts where declines in palatable plant species, assumingly sensitive to heavy grazing and trampling, were recorded. Grazing increased vegetation patchiness up to 800 m from the stock post for all the habitats. The degree to which this change in species composition occurred did not depend on stocking densities, suggesting that both grazing and landscape variability were responsible for vegetation changes in rangelands of that area of the Succulent Karoo biome.

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1092. A plant trait analysis of responses to grazing in a long-term experiment.

Bullock, James M.; Franklin, Joe; Stevenson, Mark J.; Silvertown, Jonathan; Coulson, Sarah J.; Gregory, Steve J.; and Tofts, Richard

Journal of Applied Ecology 38(2): 253-267. (2001)

NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: community response/ grazing/ grazing season/ life history traits/ long term experiment/ mesotrophic grassland/ species richness/ winter grazing

Abstract: 1. There are few long-term experimental studies of plant community responses to changes in grazing intensity. Here we report species' changes in a mesotrophic grassland after 12 years of a grazing experiment and relate these changes to species' life-history traits. 2. The experiment was set up in 1986 on an extensified species-poor grassland in lowland UK. Treatments comprised sheep grazing vs. no grazing in winter, grazing vs. no grazing in spring, and two grazing intensities in summer, in a 2 X 2 X 2 factorial design with two replicate blocks. 3. Point quadrat surveys in 1998 showed responses to grazing treatments by 17 of the 22 most common species. Species showed different responses, many of which were specific to a grazing season. Community changes were similar under spring and winter grazing, but the heavier summer grazing had different consequences. Species richness was increased by spring grazing, decreased by heavier summer grazing and unaffected by winter grazing. 4. More species responded to treatments in the 1998 survey compared with a survey in 1990. Furthermore, the whole experimental grassland had changed between the surveys, probably as a result of falling soil fertility. The two dominant grasses had declined drastically and most other species had increased in abundance. Five new species were found in 1998. 5. Intensive surveys of dicotyledonous species in 1998 showed five of the 12 most common species had responded to grazing treatments. In most cases dicotyledonous species had increased in abundance under heavier grazing in one or more season, and species

richness was increased by spring and winter grazing. Compared with a 1991 survey, the number of species responding to treatments had increased by 1998 and seven new species were found. 6. We tested whether species' responses to grazing were linked to life-history traits according to three hypotheses: that heavier grazing would disadvantage (i) species grazed preferentially, (ii) species less able to colonize gaps or (iii) more competitive species. Mechanisms differed among seasonal treatments. Responses to heavier summer grazing were linked strongly to gap colonization ability. Responses to spring and winter grazing were positively related to grazer selectivity, a surprising result that might be explained if selectivity was positively related to plant regrowth ability. 7. This study shows the need for long-term experimental analyses of community responses to grazing as vegetation responses may develop over a long time. The traits analysis suggests it may be possible to predict changes in species composition under grazing through an understanding of the mechanisms of plant responses. Grassland managers require such information in order to manipulate grazing regimes to achieve, for example, diversification or weed control.

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1093. The positive and negative conservation impacts of sheep grazing and other disturbances on the vascular plant species and vegetation of lowland subhumid Tasmania.

Kirkpatrick, J. B.; Gilfedder, Louise; Bridle, Kerry; and Zacharek, Andrew

Ecological Management and Restoration 6(1): 51-60. (2005)

NAL Call #: QH75.A1 E362; ISSN: 1442-7001

Descriptors: fertilization: applied and field techniques/ ploughing: applied and field techniques/ conservation/ grazing/ biological diversity/ disturbance tolerance

Abstract: An important conservation question for grazed areas of lowland subhumid Tasmania is 'what effects do different, practical disturbance regimes have on native vegetation?' An experiment designed to determine the single and interactive effects of fire and sheep grazing was established at four sites with distinct vegetation types. There were significant interactive effects of fire and sheep grazing on vegetation attributes at all sites. An analysis of published and new data indicated that there were several vascular plant species that appeared dependent on sheep grazing for their persistence in the present landscape, while there were others that were intolerant of this disturbance but required other types of disturbance, such as mowing. However, most native species appeared to survive in a wide variety of disturbance regimes short of ploughing and fertilization. The implications of these results are that a variety of disturbance regimes is necessary to maintain biological diversity in this environment, and that the naturalness of the regime is not necessarily relevant to its use for conservation.

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1094. Potential herblayer production and grazing effects in anthropogenic savanna-grasslands in the moist tropical forests of the Western Ghats of India.

Lele, Sharachandra and Hegde, Gurupada T.

Tropical Grasslands 31(6): 574-587. (1997)

NAL Call #: SB197.A1T7; ISSN: 0049-4763

Descriptors: anthropogenic savanna grasslands/ herb layer production/ moist tropical forest

Abstract: The moist tropical forests of the Western Ghats of India are pockmarked with savanna-grasslands created and managed by local agricultural communities. A sample of such savanna-grasslands with differing growing conditions was studied in terms of peak above-ground biomass, monthly growth, and cumulative production under different clipping treatments. The herblayer was found to be dominated by perennial C4 grasses, with *Eulalia trispicata*, *Arundinella metzii* and *Themeda triandra* being common to all sites. Peak biomass ranged between 3.3-5.9 t/ha at sites most favourable for grass production. Across these sites, peak biomass was found to be inversely related to the number of rainy days during the growing season, suggesting that growth may be light-limited. This hypothesis is supported by the observation that growth is most rapid immediately after the easing of the monsoon. Single clips early in the growing season had no negative or a slightly positive effect on production, but mid-season single clips or continuous frequent clipping reduced production by as much as 40%. The results suggest that, while indiscriminate grazing may certainly be deleterious, it is possible to obtain sustained high yields from forest lands managed for grass production without totally excluding grazing.

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1095. Potential impacts of fire and grazing in an endangered ecological community: Plant composition and shrub and eucalypt regeneration in Cumberland plain woodland.

Hill, Sarah J. and French, Kristine

Australian Journal of Botany 52(1): 23-29. (2004)

NAL Call #: 450 Au72; ISSN: 0067-1924

Descriptors: enclosure plot method: applied and field techniques/ Cumberland Plain woodland: endangered ecological community, eucalypt regeneration, shrub regeneration/ environmental factors: fire, grazing/ species richness

Abstract: Enclosure plots were used to determine the effect of fire and grazing on the structure of a grassy-woodland community. Eighteen months after fire and fence treatments were applied, the species richness, cover and composition of shrubs, trees, herbs and grasses were assessed and compared to pre-treatment censuses. Unburned plots had fewer shrub species and a lower abundance of shrubs, indicating the importance of fire in promoting regeneration of shrub species. Eucalypt species were more abundant and richer following the wildfire burn in summer, suggesting timing of fires is an important aspect in the establishment of the canopy species. Interactions between fire and grazing were found for the abundance of eucalypts (although weak) and resprouting eucalypts, suggesting a subtle interaction between fire and grazing shortly after fire. There was no effect of grazing and no interaction effect between fire and grazing on shrub species richness and abundance or tree species richness and seedling abundance. All plots showed a change in species composition despite treatment, and 46 species (32% of total richness) were recorded only in the final survey. The high rainfall during the 18-month study is likely to be an important factor in facilitating the establishment of species following all disturbances. This may have ameliorated the impact of grazing as abundant food was available

throughout the woodland. The interaction between fire and grazing may be more important in structuring these grassy communities during periods of lower rainfall.

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1096. The potential importance of grazing to the fluxes of carbon dioxide and methane in an Alpine wetland on the Qinghai-Tibetan Plateau.

Hirota, Mitsuru; Tang, Yanhong; Hu, Qiwu; Kato, Tomomichi; Hirata, Shigeki; Mo, Wenhong; Cao, Guangmin; and Mariko, Shigeru

Atmospheric Environment 39(29): 5255-5259. (2005)

NAL Call #: TD881.A822; ISSN: 1352-2310

Descriptors: alpine wetland/ global warming potential/ livestock grazing impact/ diffusive conductivity

Abstract: To assess the impact of livestock grazing on the emission of greenhouse gases from grazed wetlands, we examined biomass growth of plants, CO₂ and CH₄ fluxes under grazing and non-grazing conditions on the Qinghai-Tibetan Plateau wetland. After the grazing treatment for a period of about 3 months, net ecosystem CO₂ uptake and aboveground biomass were significantly smaller, but ecosystem CH₄ emissions were remarkably greater, under grazing conditions than under non-grazing conditions. Examination of the gas-transport system showed that the increased CH₄ emissions resulted from mainly the increase of conductance in the gas-transport system of the grazed plants. The sum of global warming potential, which was estimated from the measured CO₂ and CH₄ fluxes, was 5.6- to 11.3-fold higher under grazing conditions than under non-grazing conditions. The results suggest that livestock grazing may increase the global warming potential of the alpine wetlands. (c) 2005 Elsevier Ltd. All rights reserved.

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1097. Prescribed fire and cattle grazing influences on the vegetation and elk use of a rough fescue community.

Jourdonnais, C. S. Univ. of Montana, 1985.

Descriptors: *Cervus canadensis*/ habitat management/ livestock/ interspecific relations/ food supply/ Montana/ burning/ carbohydrates/ cattle/ chemical analysis/ communities/ elk/ fall/ fescue/ grasses/ grazing/ nutrients/ production/ soils/ spring/ standing crop/ utilization/ vegetation/ weather/ North America/ United States

Abstract: The influence of seasonal burning and fall cattle grazing were compared to the following: (1) production and composition of a rough fescue community; (2) elk use; (3) nutrient content of rough fescue, Idaho fescue (*F. idahoensis*) and bluebunch wheatgrass (*Agropyron spicatum*); (4) total nonstructural carbohydrate reserves of rough fescue and Idaho fescue; and (5) soil organic carbon content.

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1098. Prescribed grazing as a secondary impact in a western riparian floodplain.

Sedgwick, J. A. and Knopf, F. L.

Journal of Range Management 44(4): 369-373. (1991)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1991/444/13sedg.pdf>

Descriptors: floodplains/ autumn/ cattle/ biomass/ environmental impact/ plant ecology/ botanical composition/ community ecology/ *Salix*/ *Spartina*/ *Populus*/ leaves/ forage/ riparian buffers/ grazing/ *Spartina pectinata*

Populus deltoides subsp. *monilifera*/ Colorado

Abstract: The effect of late-autumn cattle grazing on plant biomass was examined in a western Great Plains cottonwood riparian zone prone to catastrophic flooding every 5-8 years. Following 1 year of pre-treatment data collection in 1982, five 16-ha pastures were grazed from 1982 to 1984 and compared to 5 control pastures within the South Platte River floodplain in northeastern Colorado. At a prescribed grazing level of 0.46 ha/AUM, riparian vegetation proved to be resilient to the impacts of grazing. We detected only a few significant treatment effects for above-ground biomass after succeeding growing seasons. Willows (*Salix* spp.) responded negatively to grazing whereas biomass of prairie cordgrass (*Spartina pectinata* Link) was greater on grazed plots. Yearly changes in above-ground biomass, especially dramatic following a severe flood in 1983, suggest that periodic, catastrophic flooding is a major perturbation to the ecosystem, and in conjunction with our results on grazing impacts, indicate that dormant-season grazing within Soil Conservation Service (SCS) guidelines is a comparatively minor impact within the floodplain. In addition, grazing impacts were probably further mitigated by a major forage supplement of cottonwood leaves which was available at the time of cattle introductions. This local forage supplement ultimately created a lighter grazing treatment than that originally prescribed.

This citation is from AGRICOLA.

1099. Prescribed sheep grazing to suppress cheatgrass: A review.

Mosley, J. C.

Sheep Research Journal 12(2): 74-81. (1996)

NAL Call #: SF371.R47; ISSN: 1057-1809

Descriptors: sheep/ grazing/ *Bromus tectorum*/ weed control/ range management/ fire ecology/ literature reviews

This citation is from AGRICOLA.

1100. The productivity of native grasslands oversown with legumes and grazed at five stocking rates in north-east Thailand.

Gutteridge, R. C.

Journal of Agricultural Science 104(pt. 1): 191-198. (1985)

NAL Call #: 10 J822; ISSN: 0021-8596

Descriptors: *Poaceae*/ *Arundinaria*/ *Stylosanthes*/ *Fabaceae*/ crop production/ range management/ grazing/ steers/ stocking rate/ grasslands/ Thailand

This citation is from AGRICOLA.

1101. Recovery in alpine heath and grassland following burning and grazing, Eastern Central Plateau, Tasmania, Australia.

Bridle, K. L.; Kirkpatrick, J. B.; Cullen, P.; and Shepherd, R. R.

Arctic Antarctic and Alpine Research 33(3): 348-356. (2001)

NAL Call #: GB395.A73; ISSN: 1523-0430

Descriptors: prescribed burning: management method/ alpine grasslands: habitat/ alpine heaths: habitat/ vegetation cover

Abstract: Long-term data from six sites in treeless subalpine and alpine vegetation in central Tasmania are used to document change in vegetation cover and life form dominance over time. All sites have been disturbed by burning and domestic stock grazing in the past. Although

burning ceased at least 8 yr before initial measurements were taken, stock grazing still occurs at one site, and rabbits and native vertebrate herbivores (mainly wallabies) graze throughout the region. Vegetation cover increased across all sites over a 5- to 23-yr period at an average annual increment of approximately 1%. There was no significant relationship between the initial cover of bare ground and change in bare ground over time for most of the sites. Annual increases in vegetation cover were least in locations grazed by rabbits and native vertebrate herbivores and where domestic stock still grazed. Exclosures grazed only by rabbits had an intermediate rate of increase. Vegetation cover was found to increase most in ungrazed exclosures. The rates of increase in vegetation cover suggest that, in the absence of fire, it is a matter of decades before cover will be almost complete in the area.
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1102. Recovery of a high elevation plant community after packhorse grazing.

Olson-Rutz, K. M.; Marlow, C. B.; Hansen, K.; Gagnon, L. C.; and Rossi, R. J.
Journal of Range Management 49(6): 541-545. (1996)
NAL Call #: 60.18 J82; ISSN: 0022-409X
http://jrm.library.arizona.edu/data/1996/496/541-545_olson.pdf
Descriptors: horses/ grazing intensity/ stand density/ plant communities/ environmental impact/ wilderness/ highlands/ Montana
Abstract: We evaluated the impact of packstock grazing on a dry, upper timberline meadow. Horses were picketed on 15 m ropes for different durations, months, and frequencies over 3 summers. Before horse grazing, we estimated vegetal, bare soil, litter, rock, and moss cover, measured grass and forbs plant heights, counted grass and forbs stems per area, and determined the percent of plants grazed. These measurements were repeated 1 growing season later. More bare ground and less litter and vegetal cover were recorded 1 year following single 8- or 18-hour grazing events. Single grazing events of 4-hour duration had no effect on cover. Decreases in vegetal cover were associated with reduced stem numbers. Eighteen hour picket durations reduced subsequent year production of grass and forbs stems. We discuss the difficulties encountered in this study, including estimates of necessary sample sizes, to help in the design of future studies.
This citation is from AGRICOLA.

1103. Recovery of streamside woody vegetation after exclusion of livestock grazing.

Rickard, W. H. and Cushing, C. E.
Journal of Range Management 35(3): 360-361. (1982)
NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1982/353/18rick.pdf>
Descriptors: Washington
This citation is from AGRICOLA.

1104. Recruitment and growth of Pacific willow and sandbar willow seedlings in response to season and intensity of cattle grazing.

Shaw, N. L. (Held 29 May 1991-31 May 1991 at Sun Valley, Idaho.) Clary, Warren P.; McArthur, E. Durant; Bedunah, Don; and Wambolt, Carl L. (eds.)

Ogden, Utah: US Department of Agriculture, Forest Service, Intermountain Research Station; pp. 130-135; 1992.
NAL Call #: aSD11.A48
Descriptors: Salix/ seedling growth/ grazing intensity/ cattle/ wildlife/ browsing/ plant density/ stems/ crown/ diameter/ spring/ autumn/ grazing/ riparian buffers/ Salix exigua/ Oregon
This citation is from AGRICOLA.

1105. Regeneration of degraded woodland remnants after relief from livestock grazing.

Pettit, N. E. and Froend, R. H.
Journal of the Royal Society of Western Australia 83(2): 65-74. (2000)
NAL Call #: 514 P432; ISSN: 0035-922X
Descriptors: degraded woodland: regeneration/ livestock grazing: disturbance factor
Abstract: Clearing for agriculture has left a mosaic of remnants of native vegetation in a matrix of agricultural land. Protection of these remnants is an important issue in minimising the effects of land degradation and for nature conservation in agricultural areas of Western Australia. The first approach to restoration is to remove the disturbing element, and in the case of livestock grazing this requires fencing to exclude stock and allow natural regeneration of the remaining vegetation. The description of this natural regeneration process is an essential first step in developing restoration techniques and management strategies for areas of degraded native vegetation. This article describes the changes in the vegetation for three different vegetation types in degraded woodland remnants in south-west Western Australia after livestock grazing has been excluded for seven years. These include vegetation types characterised by the overstorey species including jarrah (*Eucalyptus marginata*) marri (*Corymbia calophylla*), wandoo (*Eucalyptus wandoo*) and sheoak (*Allocasuarina fraseriana*). Species of the families Poaceae and Asteraceae were dominant in the understorey in grazed remnants for all vegetation types, with the majority of these species being exotics. After seven years, floristic similarity between fenced and grazed plots had decreased while similarity between fenced and ungrazed had increased, in all vegetation types. Native vegetation in jarrah sites have shown the greatest response to cessation of livestock grazing with an increase in species richness and diversity while wandoo and sheoak plots have showed little change. In terms of plant life forms, there was a significant increase in number and cover of native perennial grasses, perennial herbs and shrubs in the fenced jarrah plots. Response of annual species have tended to fluctuate with annual fluctuations in rainfall. There was variation in response to livestock grazing of different vegetation types within these woodland remnants. At a relatively early stage of decline in a remnant, the structure and composition of the native community can be reestablished by excluding stock. However, under severe and prolonged grazing, regeneration will be more difficult. These results indicate that the degree of difficulty of restoration will vary for different community types even within the broad category of jarrah and wandoo woodlands. Therefore, when managing for the restoration of remnants of native vegetation, consideration of vegetation type is an important factor.
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1106. Rehabilitation of degraded *Calluna vulgaris* (L.) hull-dominated wet heath by controlled sheep grazing.
Hulme, P. D.; Merrell, B. G.; Torvell, L.; Fisher, J. M.; Small, J. L.; and Pakeman, R. J.

Biological Conservation 107(3): 351-363. (2002)

NAL Call #: S900.B5; ISSN: 0006-3207

Descriptors: grazing management/ habitat degradation/ habitat rehabilitation/ habitat restoration/ stocking levels/ upland areas/ vegetation composition/ wet heaths: habitat
Abstract: Many upland areas of the British Isles have seen declines in the area and condition of heather (*Calluna vulgaris*)-dominated heathland vegetation. To reverse this decline, management regimes must be designed to rehabilitate areas that have seen this decline. As most of this heathland vegetation is primarily managed by grazing, such management has to determine what stocking levels can maintain the vegetation in a desired state. This paper describes how to reverse this decline through suitable grazing management. A degraded 'wet-heath' system, previously grazed at 2.1 sheep ha⁻¹, was subject to a range of grazing treatments over a 5-year period. Treatments varied in intensity (0-1.4 sheep ha⁻¹) and timing (summer only, winter only, or year round) of grazing. Grazing levels were maintained at 2.1 sheep ha⁻¹ outside the fenced areas. Vegetation composition remained stable outside the fenced treatments. All the fenced treatments showed an increase in the relative frequency of the evergreen *Calluna vulgaris*, with the greatest increase being in the ungrazed treatment, and the least in the year round 1.4 sheep ha⁻¹ treatment. This increase was in line with a reduction in heather utilisation to relatively low and sustainable levels. Other species that benefited from reduced grazing included *Carex nigra*, *Deschampsia flexuosa* and to a lesser extent *Galium saxatile* and *Erica tetralix*, whereas a range of moss species including *Hypnum jutlandicum* and *Rhytidiadelphus loreus* were more frequent at higher grazing levels. Though the recovery of heather was similar in the two seasonally grazed treatments, the vegetation showed different overall trajectories. Winter only grazed allowed a substantial increase in the cover of the deciduous *Molinia caerulea*, whereas this species was kept in check by summer only grazing. A stocking level of between 0.7 and 1.4 sheep ha⁻¹ appears to be appropriate to maintain and even enhance the cover of heather on degraded wet heath. Complete removal is not necessary. Grazing restricted to the winter period is inappropriate in areas where *M. caerulea* occurs. Setting appropriate stocking levels to maintain the condition of the vegetation must take into account site conditions, especially the presence of species that can affect the utilisation of heather.

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1107. Relationship among grazing management growing degree-days and morphological development for native grasses on the northern Great Plains.

Frank, A. B. and Hofmann, L.

Journal of Range Management 42(3): 199-202. (1989)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1989/423/6fran.pdf>

Descriptors: *Pascopyrum smithii*/ *Bouteloua gracilis*/ *Stipa comata*/ *Stipa viridula*/ *Koeleria pyramidata*/ regression analysis/ forage growth models

Abstract: Air temperature or growing degree-days (GDD) are known to influence morphological development of grass, but the effects of grazing history on grass

morphological development has not been established. Morphological development of 5 species located on moderately and heavily grazed mixed prairie sites near Mandan, North Dakota, was determined 3 times per week from beginning of growth in spring to heading. The species were western wheatgrass [*Pascopyrum smithii* Rydb.(Loeve)], blue grama [*Bouteloua gracilis* (H.B.K.) Lag. ex Griffiths], needleandthread (*Stipa comata* Trin. and Rupr.), green needlegrass (*S. viridula* Trin.), and prairie junegrass [*Koeleria pyramidata* (Lam.) Beauv.]. Regression analysis of growth stage with GDD was linear and statistically significant for prairie junegrass ($R^2 = 0.62$), green needlegrass ($R^2 = 0.96$), and needleandthread ($R^2 = 0.95$), and nonlinear for blue grama ($R^2 = 0.95$) and western wheatgrass ($R^2 = 0.97$). Prior grazing management had little effect on this relationship. The number of leaves and accumulated GDD required to produce those leaves varied by each species: prairie junegrass (4 leaves, 520 GDD), needleandthread (4 leaves, 640 GDD), green needlegrass (4 leaves, 800 GDD), blue grama (5 leaves, 1,300 GDD), and western wheatgrass (6 leaves, 1,450 GDD). Based on the species and conditions of this study, plant growth stage can be predicted from accumulated GDD and used for predicting grazing readiness and in development of forage growth models.
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1108. Relationships between biomass and plant species richness in arid-zone grazing lands.

Oba, Gufu; Vetaas, Ole R.; and Stenseth, Nils C.

Journal of Applied Ecology 38(4): 836-845. (2001)

NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: ordination analysis: statistical method/ pair wise test: statistical method/ arid zone grazing lands/ biomass/ floristic gradients/ herbivory/ hump backed models/ seasonal grazing exclosures/ species richness/ temperate vegetation

Abstract: 1. The relationship between biomass and species richness in temperate vegetation has been described as a hump-back response model. The hump-back model predicts that herbaceous species richness is highest at an intermediate level of biomass. However, this has not been investigated in arid-zone grazing lands. 2. We tested the hump-back prediction in an arid tropical grazing region in northern Kenya where a seasonal grazing exclosure system is practised. We compared vegetation structure, species richness and composition on an open range and exclosures at five sites to elucidate the potential mechanisms behind variation in species richness. 3. More biomass was accumulated within seasonal exclosures than in continuously grazed areas. Species richness in exclosure plots varied from 5.3 to 8.3 species m⁻², while that in open plots varied from 5.1 to 7.5 species m⁻². A pair-wise test showed no difference in two of the five sites with respect to both total and herbaceous species richness. 4. The primary floristic gradient illuminated through ordination was related to biomass, while the secondary gradient was related to species richness. The exclosure plots had more abundant species, especially compared with open plots, which had more rare and occasional species. A total of 37 herbaceous species was recorded; 22% were indifferent to grazing, 30% grazing intolerant and 48% promoted by grazing. 5. The relationship between biomass and herbaceous species richness showed (i) no trend within the exclosures (maximum biomass 800 g m⁻²); (ii) a positive trend in the

open grazing land (maximum of 500 g m⁻²); and a hump-back pattern when (i) and (ii) were analysed together. Optimum richness corresponded to a biomass level of 400-500 g m⁻². Species richness declined with increase in age of exclosures. 6. We confirmed that species richness will decline when biomass exceeds 500 g m⁻², as predicted by the hump-back model, even in arid grazing lands. Seasonal grazing exclosures may increase species richness to a certain level, but the decline in species richness with age of exclosures indicates that long-term exclusion of grazing may not necessarily increase species richness in arid-zone grazing lands.

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1109. Relationships between livestock management and the ecological condition of riparian habitats along an Australian floodplain river.

Jansen, Amy and Robertson, Alistar I.

Journal of Applied Ecology 38(1): 63-75. (2001)

NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: ecological conditions/ ecological restoration/ floodplain rivers/ grazing impact/ land use/ livestock management/ off river watering points/ paddocks/ private ownership/ riparian habitats/ stocking rates/ upstream distances

Abstract: 1. Grazing by introduced ungulate livestock is a major form of land use over large parts of Australia. Due to the tendency of stock to concentrate around water, riparian zones and wetlands are heavily impacted by grazing. However, little is known about how effects on riparian habitats vary spatially and with management regimes. We investigated how livestock affected riparian habitats on the Murrumbidgee River in south-eastern Australia. 2. A rapid appraisal index of the ecological condition of floodplain riparian habitats was developed. This measured habitat continuity and extent, vegetation cover, bank stability, soil structure, quantity of fallen debris, dominance of natives vs. exotics, and the presence of indicative species. The method could be readily adapted for use on other floodplain rivers with extensive riparian habitats. 3. Riparian condition was scored at 138 sites along 620 km of the Murrumbidgee River on private properties (n = 77), in State Forests (n = 27) and on Crown Land (n = 34). Riparian condition declined significantly with increasing grazing intensity and also with distance upstream in the upper half of the floodplain. 4. Stocking rate, distance upstream, relative periods of paddock rest and grazing, proportion of bank accessible to stock, and the presence of off-river water in the paddock, accounted for 76% of the variance in riparian condition. 5. Most riparian habitats on the Murrumbidgee River and other rivers in the Murray-Darling Basin are privately owned. Thus exclusion of the grazing industry from the riparian zone is not practical. However, lowered stocking rates, particularly in the upper parts of the catchment, resting of paddocks to allow recovery from grazing, and the provision of off-river watering points could all be used to improve riparian habitats. 6. Exotic plants are ubiquitous, occurring even where grazing has been excluded for many years. Thus restoration of riparian habitats will require weed removal even in areas not used by livestock.

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1110. The relative importance of cattle grazing in subtropical grasslands: Does it reduce or enhance plant biodiversity?

Mcintyre, S.; Heard, K. M.; and Martin, T. G.

Journal of Applied Ecology 40(3): 445-457. (2003)

NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: canonical correspondence analysis: cca, mathematical and computer techniques/ biodiversity conservation/ cattle grazing/ community composition/ eucalypt woodlands: habitat/ floristic variation/ land management/ lithology/ local extinctions/ regional conservation planning/ slope position/ soil disturbance/ species diversity/ species richness/ subtropical grasslands: habitat/ tussock structure/ water enrichment

Abstract: 1. Livestock grazing enterprises have potentially threatening effects on the conservation of plants in grassy subtropical eucalypt woodlands. Commercial levels of grazing could cause local extinctions of sensitive native species and/or reductions in abundance and species richness in native pastures. 2. We studied the nature of grazing impacts on the diversity and composition of herbaceous plants and used a natural experiment to analyse the effects of disturbances (cattle grazing, soil disturbance, water enrichment) and environment (lithology, slope position, presence of trees) on plant community composition in eastern Australia. We sampled pastures and reserves at 191 sites over an area of 3000 ha. 3. Canonical correspondence analysis (CCA) was used to explore the relative importance of disturbance and environment in accounting for floristic variation and to examine individual species responses. From individual responses, we identified seven response groups relating to grazing. The factors analysed explained small but significant amounts of floristic variation, and there were interactions between soil disturbance, water enrichment and grazing. 4. We explored the hypothesis that grazing increased species density at small scales but decreased it at landscape scales, due to the elimination of grazing-sensitive species. Our data did not support the hypothesis, as there were similar numbers of species that increase with grazing (increasers) and species that decline with increasing grazing (decreasers) in the assemblage. However, there were more native decreasers and more exotic increasers in the assemblage. 5. Synthesis and applications. For land managers to retain plant diversity on grazed landscapes, it would be desirable to provide all levels of grazing pressure across the landscape, including areas protected from livestock grazing. This would apply to all plant communities where both grazing increasers and decreasers are present. Extensive areas supporting grassland with a tall tussock structure that is selectively grazed are most important, as all plant response groups have some representation and ecosystem function is retained under moderate grazing. In terms of regional conservation planning, the protection and enlargement of areas protected from livestock grazing is important in the study area, as these occur on only about 4% of the landscape and are threatened by on-going disturbances and land-use intensification.

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1111. Resilience of South African communal grazing lands after the removal of high grazing pressure.

Harrison, Y. A. and Shackleton, C. M.
Land Degradation and Development 10(3): 225-239. (1999)
 NAL Call #: S622.L26; ISSN: 1085-3278

Descriptors: communal grazing lands: grazing pressure, resilience

Abstract: A paired site study was conducted of communally grazed eutrophic and dystrophic grasslands and adjacent ungrazed areas of varying periods of exclusion from communal grazing. This allowed determination of the rate and extent of change of a number of vegetation and soil variables following the removal of high and continuous grazing pressure characteristic of communal lands. Similarity indices for grass species composition between the grazed and adjacent ungrazed areas showed a significant exponential decrease with increasing time since protection from continuous grazing. Most change in grass species composition occurred within four to nine years of protection from communal grazing in eutrophic grasslands, and in six to nine years in dystrophic grasslands. In both grassland types palatability increased with time since protection. In eutrophic sites the abundance of perennials showed a significant increase with time since protection, while the abundance of annuals showed a concomitant decrease. This relationship was not evident in dystrophic grasslands. Grass species diversity, basal cover and density showed no relationship with time since protection in the eutrophic sites, but a general increase with time since protection was found in dystrophic sites. Soil bulk density, field capacity, pH and soil nutrients showed no evidence of a relationship with time since protection for either grassland type, while soil porosity increased significantly with time since protection at eutrophic sites, but not dystrophic sites. These relatively rapid changes following the removal of the high grazing pressure indicate that these systems are characterized by relatively high resilience.

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1112. Response of a semidesert grassland to 16 years of rest from grazing.

Brady, W. W.; Stromberg, M. R.; Aldon, E. F.; Bonham, C. D.; and Henry, S. H.
Journal of Range Management 42(4): 284-288. (1989)
 NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1989/424/4brad.pdf>

Descriptors: pastures/ semiarid zones/ ecosystems/ grazing intensity/ plant communities/ botanical composition/ grazing/ Arizona

This citation is from AGRICOLA.

1113. Response of the alpine gentian *Gentiana nivalis*: To protection from grazing by sheep.

Miller, G. R.; Geddes, C.; and Mardon, D. K.
Biological Conservation 87(3): 311-318. (1999)
 NAL Call #: S900.B5; ISSN: 0006-3207

Descriptors: grazing/ plant density/ seedling establishment/ survival

Abstract: Protection from summer grazing by sheep was imposed experimentally from 1987 to 1996 on colonies of alpine gentian *Gentiana nivalis*, a rare montane annual growing in grassland at Ben Lawers National Nature Reserve. Alpine gentians on ungrazed plots grew taller and survived better than did plants in adjacent grazed plots. The density of plants on ungrazed plots was unaffected for three

years but thereafter declined. By 1996 it was only 20% of the density on grazed plots. Perennial vegetation responded to protection from sheep grazing by growing taller and denser. Ultimately it became 50-60 mm taller in the ungrazed plots than it was in the grazed plots. The spread of perennials also progressively reduced the amount of bare soil in the ungrazed plots-by 1996, it occupied a mere 0.2% there compared to 7% in the grazed plots. The loss of potential gaps for seedling establishment was probably the main cause of the decline in alpine gentian density on the ungrazed plots. The presence of sheep helps to maintain alpine gentian colonies in grassland.

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1114. Response of the mixed prairie to protection from grazing.

Willms, W. D.; Dormaar, J. F.; Adams, B. W.; and Douwes, H. E.
Journal of Range Management 55(3): 210-216. (2002)
 NAL Call #: 60.18 J82; ISSN: 0022-409X

Descriptors: prairies/ grazing intensity/ botanical composition/ soil depth/ soil chemistry/ biomass/ species diversity/ carbon/ nitrogen/ pH/ soil water/ A horizons/ phosphorus/ plant litter/ Alberta

Abstract: The Mixed Prairie plant communities developed with the influences of fire and grazing. Available evidence suggests that removal of these disturbances could cause succession toward a more mesic type with the accumulation or litter or loss in productivity as nutrient turnover is delayed. Exclosures constructed in 1927 in a semiarid Mixed Prairie community provided an opportunity to examine the effects that protection had on vegetation and soils. Fifteen exclosures were selected for detailed examination; of these, 11 were located on Chernozemic soil and 4 on Solonchic soil. We measured plant and soil variables both inside and outside the exclosures in a test of the hypothesis that protection from grazing will lead to a loss of production potential of the semi-arid. Mixed Prairie communities in the Northern Great Plains of southeastern Alberta. We found little evidence that 70 years of protection from large animal disturbance reduced the production potential of the plant communities. Conversely, most evidence suggested a neutral effect or an improvement as reflected in an increased cover of *Pascopyrum smithii* Rydb. (Love) ($P = 0.049$) and increased annual net primary production ($P = 0.047$). The effect of protection appeared largely driven by the accumulation of litter mass that primarily benefits soil and plant indices of quality on the Chernozemic soil type. Although protection tended to reduce species diversity ($P = 0.097$) among native plants on the Chernozemic soil type, evenness and richness were not affected ($P > 0.10$). The potential effect that reduced diversity might have on reducing production stability appears more than compensated for by increased litter mass.

This citation is from AGRICOLA.

1115. Response of vegetation and breeding birds to the removal of cattle on the San Pedro River, Arizona (U.S.A.).

Krueper, D.; Bart, J.; and Rich, T. D.

Conservation Biology 17(2): 607-615. (2003)

NAL Call #: QH75.A1C5; ISSN: 0888-8892

Descriptors: riparian environments/ arid environments/ riparian vegetation/ agriculture/ abundance/ breeding success/ environment management/ nature conservation/ population density/ conservation/ Aves/ USA, Arizona, San Pedro R./ USA, Arizona/ birds/ cattle removal/ passeriformes/ landbirds/ songbirds

Abstract: In late 1987 cattle were removed from the San Pedro Riparian National Conservation Area (NCA) in southeastern Arizona (U.S.A.). We monitored vegetation density and abundance of birds during the breeding season during 1986-1990 in riparian, mesquite grassland, and Chihuahuan desert-scrub communities in the NCA. The density of herbaceous vegetation increased four- to six-fold in riparian and mesquite grassland communities. Little change occurred in herbaceous vegetation in desert scrub, or in the density of shrubs or trees in any of the communities. Of 61 bird species for which sufficient data were collected, mean detections per kilometer increased for 42 species, 26 significantly, and decreased for 19 species, 8 significantly. The number of individuals of all avian species detected on surveys increased each year from 103/kilometer in 1986 to 221/kilometer in 1991, an average annual increase of 23% ($p < 0.001$). The largest increases occurred in riparian species, open-cup nesters, Neotropical migrants, and insectivores. Species of the Chihuahuan desert-scrub, in which vegetation changed the least, showed the smallest increases. Only a few of the species showed increasing regional trends for the same period, as demonstrated by the North American Breeding Bird Survey; thus, increases on the San Pedro Riparian NCA were likely caused by the change in local conditions, not by regional effects. Our results suggest that removing cattle from riparian areas in the southwestern United States can have profound benefits for breeding birds.

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1116. Response of vegetation of the Northern Great Plains to precipitation amount and grazing intensity.

Olson, K. C.; White, R. S.; and Sindelar, B. W.

Journal of Range Management 38(4): 357-361. (1985)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1985/384/18olso.pdf>

Descriptors: plant ecology/ precipitation/ grazing intensity/ plant development/ climatic factors/ United States

This citation is from AGRICOLA.

1117. Response of wild wheat populations to grazing in mediterranean grasslands: The relative influence of defoliation, competition, mulch and genotype.

Noy Meir, I. and Briske, D. D.

Journal of Applied Ecology 39(2): 259-278. (2002)

NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: mediterranean grasslands/ biomass/ competition/ defoliation/ genotype/ grazing/ grazing tolerance/ intensive livestock grazing/ mulch/ mulch applications/ reproductive performance/ seedling emergence/ survival/ vegetative performance

Abstract: 1. Grassland management must be based on an understanding of key species' responses to various grazing

regimes to achieve both production and conservation objectives. An experiment was designed to investigate several population processes that may potentially (i) contribute to the decline of *Triticum dicoccoides* (wild wheat) in intensively grazed grasslands, and (ii) promote the persistence of wild wheat in these grazing regimes. 2. The experiment was conducted in natural Mediterranean grassland on the Korazim Plateau in northern Israel in the 1991-92 growing season. Nursery-grown seed of two morphologically distinct wild wheat genotypes were sown in plots with defined mulch applications and clipping regimes. 3. Mulch application did not affect seedling emergence or establishment, but it did reduce tiller number per plant and ear size compared with plants grown without mulch. The detrimental effects of mulch on plant performance throughout the growing season indicated that both radiation and nitrogen limitations may have contributed to growth suppression. Mulch application reduced wheat biomass to a greater extent than that of interspecific competitors. The negative response indicated that mulch removal by intensive grazing during the dry season was unlikely to contribute to the decline of wild wheat in response to intensive livestock grazing. 4. Both vegetative and reproductive performance of wild wheat increased by 50% in response to a reduction of interspecific competition following defoliation of neighbouring plants. A single severe clipping of vegetative wheat plants in defoliated neighbourhoods did not affect plant survival or tiller number, but did reduce ear and spikelet numbers and vegetative and reproductive biomass, compared with unclipped wheat plants. The positive wheat response to the reduction of interspecific competition almost exactly compensated for the negative effect of direct clipping on wheat fitness, and may thus contribute to the persistence of wheat populations. 5. A second severe clipping of wheat plants in the reproductive growth phase severely reduced plant survival to reproduction, reproductive biomass, and seed quantity and quality in those plants that did become reproductive. One-half of the ears initiated following late-season clipping did not emerge from the flag leaf and produced mostly thin seed with reduced germinability. 6. Genuiculate genotypes exhibited greater grazing tolerance and reproductive performance than the erect genotypes in response to the second severe clipping. An increase in the relative abundance of genuiculate genotypes in intensively grazed communities may provide an important persistence mechanism for wild wheat populations. 7. An integrated estimate of wild wheat fitness, calculated as the mean reproductive output per seed sown, was < 1 in plants clipped during the later phase of reproductive growth. This indicates that wheat populations would experience local extinction if this defoliation regime were continued for several successive years. 8. Management prescriptions to conserve this key annual species must focus on the reduction or deferment of late-season grazing during the reproductive growth phase to ensure population persistence.

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1118. Response to grazing after nine years of cattle exclusion in a Flooding Pampa grassland Argentina.

Facelli, J. M.

Vegetatio 78(1-2): 21-26. (1988)

NAL Call #: 450 V52; ISSN: 0042-3106

Descriptors: Dicotyledon propagule/ basal cover/ floristic composition/ community dynamics

Abstract: This paper reports on changes induced by the introduction of cattle in a grassland that had remained ungrazed for 9 yr, in comparison with two adjacent grasslands: one that remained enclosed and one that has been continuously subject to grazing. Basal cover was measured on 25 interception lines, each 1 m long, three times during one year. The variables studied were: total cover, cover of grasses and dicots, cover of creeping grasses, floristic composition, and dissimilarity among sites. At the first sampling, 2 yr after cattle re-introduction, the newly grazed site was more similar to the ungrazed than to the grazed site. The newly grazed site had very low cover of dicots; the species of dicots present were different from those found in the continuously grazed area. Creeping grasses had higher cover in the newly grazed site than in the other sites, and continued to increase. At the last sampling, one year later, the newly grazed site had become more similar to the continuously grazed site. Only after 5 yr of cattle grazing the exotic dicots that were dominant in the continuously grazed site, were recorded in the re-opened site. The absence of propagules of these species or the absence of safe sites may account for this delayed invasion.

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1119. The response to season, exclosure, and distance from water of three central Australian pasture types grazed by cattle.

Foran, B. D.; Bastin, G.; Remenga, E.; and Hyde, K. W.

Australian Rangeland Journal 4(1): 5-15. (1982)

NAL Call #: SF85.4.A8A97; ISSN: 0313-4555

Descriptors: grazing/ management/ grasslands

Abstract: Three central Australian pasture types (Mulga Annual, Mulga Perennial and Sandy Open Woodland) grazed by beef cattle were closed for 11 yr and detailed plant measurements were made over the last 7 yr. The closed land extended 3.2 km from permanent watering points. Rainfall during this period (1968-1979) varied from well above av. for 3 yr to near drought conditions. The above av. rainfall yr had a greater influence on yield, density and cover of the herbage layer than the experimental treatments of closure and distance from water. DM production varied from 217 kg to 2.38 t/ha. Plant density and cover were generally not affected by treatments although some plant spp. and spp. groups were affected.

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1120. Responses of a remnant California native bunchgrass population to grazing, burning and climatic variation.

Marty, Jaymee T.; Collinge, Sharon K.; and Rice, Kevin J.

Plant Ecology 181(1): 101-112. (2005)

NAL Call #: QK900.P63; ISSN: 1385-0237

Descriptors: climatic variation/ grazing/ burning/ ungrazed/ light rotational grazing/ heavy rotational grazing/ continuously grazed

Abstract: This study examined the interactive effects of grazing intensity and burning on a remnant population of

the California native bunchgrass *Nassella pulchra*. We measured growth, reproduction and mortality of permanently marked bunchgrasses and measured bunchgrass seedling recruitment and density in permanent quadrats. We burned half of the treatment plots in late spring 1998. Grazing treatments were implemented in 1998, 1999 and 2000 at four different intensities: ungrazed, light rotational grazing (31% average biomass removal), heavy rotational grazing (42% average biomass removal), and continuously grazed. Both burning and grazing affected the bunchgrass population. Bunchgrass mortality was 10% higher in burned vs. unburned plots but was not significantly different among grazing treatments. Seedling density was 100% higher in burned vs. unburned plots 2 years after the burn, however seedling densities never attained pre-burn levels. Seedling densities did not differ significantly among grazing treatments, but grazing reduced the height and reproduction of the mature bunchgrasses. Adult bunchgrass density did not differ significantly in any of the treatments but experienced a five-fold decrease over the 4 years of the experiment. Although the continuous grazing treatment reduced the number of culms produced per plant by 75% from the baseline year, the effect on culm production in the continuous grazing treatment was not consistently greater than the rotational grazing treatments. The interaction of grazing and burning had no significant impacts on the *N. pulchra* populations except on the diameter of adult bunchgrasses which was highest in the lightly grazed, unburned treatments 2 years following the burn. All response variables except bunchgrass height followed a similar pattern in time over the 4 years of the experiment regardless of treatment, peaking in 1998 and then declining in 1999 and 2000. We believe the above average rainfall and below average temperatures experienced late in the growing season in 1998 provided conditions that favored the native bunchgrasses. Overall, we found few interactive effects of grazing and burning but the separate treatments did affect bunchgrass growth, reproduction and mortality, and these effects were modulated by the ubiquitous effects of climatic fluctuations.

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1121. Responses of birds, rodents, and vegetation to livestock exclosure in a semi desert grassland site.

Bock, C. E.; Bock, J. H.; Kenney, W. R.; and Hawthorne, V. M.

Journal of Range Management 37(3): 239-242. (1984)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1984/373/12bock.pdf>

Descriptors: *Bouteloua* spp./ *Eragrostis intermedia*/ *Trichachne californicum*/ shrub/ seasonality/ xeric habitat/ feeding/ grazing/ Arizona/ USA

Abstract: Livestock were excluded from a 3160-ha range in southeastern Arizona [USA] since 1968. Compared to an adjacent continuously grazed area, in 1981-1982 a protected upland site supported 45% more grass cover, a comparatively heterogeneous grass community and 4 times as many shrubs. Grama grasses (*Bouteloua* spp.) were equally common in and outside the exclosure, while a variety of other species, especially plains lovegrass (*Eragrostis intermedia*) and Arizona cottontop (*Trichachne californicum*) were much more abundant on the protected site. The grazed area supported significantly higher numbers of birds in summer, while densities did not differ in winter. Rodents were significantly more abundant inside the

protected area. Species of birds and rodents more common in the grazed area included those typical of more xeric lowland habitats and those preferring open ground for feeding. Species more common on the protected site were those which characterize semidesert or plains grasslands, and which prefer substantial grass or shrub cover. Grazing appeared to favor birds as a class over rodents.

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1122. The responses of blanket bog vegetation to controlled grazing by hill sheep.

Grant, S. A.; Bolton, G. R.; and Torvell, L.

Journal of Applied Ecology 22(3): 739-751. (1985)

NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: bogs/ ecosystems/ grazing/ habitat alterations/ Europe/ United Kingdom/ Scotland

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1123. Responses of flower phenology and seed production under cattle grazing impact in sandy grasslands.

Kratochwil, A.; Fock, S.; Remy, D.; and Schwabe-Kratochwil, A.

Phytocoenologia 32(4): 531-552. (2002)

NAL Call #: QK911.P52; ISSN: 0340-269X

Descriptors: Diantho-Armerietum/ generative regeneration/ sand vegetation complexes/ seed bank/ Spergulo-Corynephorum

Abstract: The impact of cattle grazing on selected characteristic and dominant plant species of three sandy grassland communities in northwestern Germany (Spergulo-Corynephorum typicum, S.-C. cladonietosum and Diantho-Armerietum) is investigated with regard to the loss of above-ground diaspores in the course of a vegetation period. Special attention is given to the importance of the seed bank in the soil as compensation potential. The flower and fruit phenology of the plant species was analyzed by counting. A fence was erected so that data samples outside and within an enclosure could be compared. Extracted soil samples and a germination test give information about the diaspore reservoir in the soil at the beginning of the investigation. The comparison of grazed and ungrazed stands yielded the following results. The Spergulo-Corynephorum typicum is poor, the S.-C. cladonietosum richer in palatable inflorescences and infructescences (e.g. *Carex arenaria*). In the former only 12-24% of the inflorescences and infructescences are grazed (*Carex arenaria*, *Corynephorus canescens*), in the latter 45-51% (*Carex arenaria*). The Spergulo-Corynephorum can regenerate itself from the diaspore potential to a slight extent if there are gaps, e.g. caused by cattle trampling. The Diantho-Armerietum is quite intensively grazed, entailing a major reduction of flowers and fruits of certain plant species (*Agrostis capillaris*: inflorescences by 71%, infructescences 72%, *Dianthus deltoides*: flowers by 61%, fruits 22%). In contrast, two species increase flower and fruit numbers (by 36-77%) in the grazed sites (*Agrostis vinealis*, *Ranunculus bulbosus*). Faeces microsites are important elements for patch dynamic systems in the Diantho-Armerietum. At faeces microsites in the Diantho-Armerietum, which constitute about one-third of the plot areas, many flowers and fruits develop. Flower and fruit development at the faeces microsites and the seed bank in the soil ensure a generative regeneration of the Diantho-Armerietum. Gap

dynamics, patch dynamics of faeces microsites and seed bank processes are driving forces for the generative regeneration of the investigated plant communities.

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1124. Responses of herbage and browse production to six range management strategies.

Sanderson H. R.; Quigley T. M.; and Tiedemann A. R. Portland, Or.: U.S. Dept. of Agriculture, Forest Service, Pacific Northwest Research Station; PNW-RP-419, 1990. 15 p.

Notes: ISSN 0882-5165

NAL Call #: A99.9 F7625Uni no.419

http://www.fs.fed.us/pnw/pubs/pnw_rp419.pdf

Descriptors: range management--Oregon/ grazing--Oregon/ browse--Oregon

This citation is from AGRICOLA.

1125. Responses of two semiarid rangeland communities to protection from grazing.

Noy Meir, I.

Israel Journal of Botany Basic and Applied Plant Sciences 39(4-6): 431-442. (1990)

NAL Call #: 450 Is7; ISSN: 0021-213X

Descriptors: Noaea mucronata/ Asphodelus aestivus/ Poa bulbosa/ sheep/ goat/ biomass/ species composition

Abstract: Changes in vegetation following protection from grazing were observed at two sites in semiarid rangelands in Israel with a long history of continuous grazing by sheep and goats. Near Jerusalem, a new enclosure was fenced off; the changes in biomass and species composition within this enclosure, in comparison with an adjacent grazed area, were followed for two growing seasons. The vegetation was initially dominated by *Poa bulbosa* and prostrate annuals. For most of the first growing season, there was surprisingly little difference in biomass and species composition. During the dry season, plant litter and seeds remained largely intact on the surface in the enclosure, but were almost entirely removed by grazers outside it. During the second growing season, biomass in the enclosure was usually double that outside; the increase was mostly due to large-seeded annual grasses. Near Beer Sheva, the effects on the vegetation of 5-6 years of protection from grazing were recorded at two enclosure fences. Annuals were equally sparse on both sides of the fence, though species composition was different. The biomass of perennials was double inside the enclosure, mainly due to an increase in the biomass of *Noaea mucronata* and perennial thistles. Most perennial species, except *Asphodelus aestivus*, were more abundant inside the enclosure than in the grazed area.

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1126. Responses of vegetation and cattle to various systems of grazing on seeded and native mountain rangelands in eastern Utah.

Laycock, W. A. and Conrad, P. W.

Journal of Range Management 34(1): 52-58. (1981)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1981/34/1/15layc.pdf>

Descriptors: Agropyron spp./ Artemisia/ Bromus inermis/ species composition/ cover production/ rest rotation

Abstract: Several grazing systems were compared on the Diamond Mountain Cattle Allotment of the Ashley National Forest in Utah. The area is .apprx. 8000 ft in elevation and

receives 20-25 in. of precipitation annually. On native sagebrush[Artemisia]-grass range, a comparison of summer-long (July-Sept.) grazing every year, summer-long in alternate years, and 3-unit rest-rotation systems revealed no differences between systems in cover, production or species composition of vegetation after 7 yr of grazing. Average daily gains of cattle over the entire period were the same for all systems. During the period of study on this range, which was in fair to good condition and grazed at a moderate intensity, rest-rotation was not a better system than summer-long grazing. The key to this lack of difference was management. Rest-rotation systems require intensive management of water, salt, riding, etc. All units in both systems in the study had good distribution of water and salt and adequate riding to insure uniform cattle distribution. The unit grazed summer-long every year received the same degree of management and thus remained as productive as ranges under rest-rotation management. On seeded units of the allotment, heavy grazing in June in alternate years increased production on areas dominated by crested wheatgrass [Agropyron spp.] and smooth brome [Bromus inermis].
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1127. Restorative grazing as a tool for directed succession with diaspore inoculation: The model of sand ecosystems.

Stroh, Michael; Storm, Christian; Zehm, Andreas; and Schwabe, Angelika
Phytocoenologia 32(4): 595-625. (2002)
NAL Call #: QK911.P52; ISSN: 0340-269X
Descriptors: diaspore inoculation: applied and field techniques/ restorative grazing: applied and field techniques/ Festuco-Brometea/ Koelerio-Coryneporetea/ directed succession/ sand ecosystems
Abstract: In this study we examine the restoration of sand grassland target communities (belonging to Koelerio-Coryneporetea, Festuco-Brometea) on bare ground. A field experiment was established in 1998. Soil seed bank and seed rain were assessed. Directed and spontaneous succession was monitored for 3 years. For diaspore transfer (inoculation) 1. mown material, 2. raked material or 3. sods from intact sand habitats were used. The experimental plots were grazed by sheep from 1999 to 2001; in 2001 also by donkeys. Comparisons with grazed-only plots and controls were made. Additionally, spontaneous succession was determined in two non-managed sand grassland plots. Spontaneous succession leads to ruderal communities (first Stellarietea phase, followed by increasing dominance of Artemisietea and Agropyretea species, e.g. *Poa angustifolia*, *Calamagrostis epigejos*). A few target species were able to establish themselves, but they play a minor role, because they are only present in small numbers in both soil seed bank and seed rain. Grazing-only (without inoculation) is not sufficient to stop the ruderalisation trend. However, after each of the three diaspore inoculation treatments nearly all target species established themselves. Ruderalisation was suppressed by inoculation combined with grazing. Nevertheless, many ruderal species occur and represent a latent ruderalisation potential. Ruderal species are grazed preferentially by sheep. Several ruderal species that are rejected by sheep are grazed by donkeys (e.g. *Cirsium arvense*, *Calamagrostis epigejos*). A compensation for biomass loss after grazing (as supposed by the grazing

optimization hypothesis) was not observed (except for some perennial Fabaceae species). Thus, grazing appears to be a suitable measure to inhibit ruderalisation. Most sand-specific, endangered species are not grazed and thus are able to spread. The analysis of plant tissue has shown that sheep prefer nitrogen-rich plant species (Fabaceae) and plant parts > 2 % N. Plant parts containing < 1 % N are avoided. This may enhance oligotrophication of ruderalised habitats and alter ecosystem functions.
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1128. Results from the use of a system of "rest rotational grazing" for livestock to improve wildlife habitat in Montana.

Mccarthy, J. J.
Ibex Journal of Mountain Studies 7(Supplement): 13-16. (2003); ISSN: 1590-3907
Descriptors: animals and man/ disturbance by man/ commercial activities/ conservation/ conservation measures/ habitat/ land zones/ Nearctic Region/ USA/ North America/ *Cervus canadensis* (Cervidae): farming and agriculture/ rest rotation grazing system/ rangeland management impact on habitat quality/ habitat management/ terrestrial habitat/ rangeland/ Montana/ rangeland grazing management impact on habitat quality/ Cervidae/ Artiodactyla/ Mammalia/ chordates/ mammals/ ungulates/ vertebrates
Abstract: Rest rotation grazing is a forage management system that utilizes livestock grazing to improve forage vigor, reduce erosion and improve range conditions. Cyclic movement of livestock through pastures allow plants to carry out photosynthetic processes and assist in seed dissemination and seedling establishment. Elements of such a grazing system are discussed, as are the benefits to plants and soils. An example of a system that has been in operation since 1980 is also described, as are the benefits to livestock producers and the area's wildlife.
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1129. Riparian grazing management that worked: Introduction and winter grazing.

Masters, L.; Swanson, S.; and Burkhardt, W.
Rangelands 18(5): 192-195. (1996)
NAL Call #: SF85.A1R32; ISSN: 0190-0528.
Notes: Subtitle: [Part] I.
Descriptors: grassland management/ seasonal variation/ grazing/ erosion/ revegetation/ grasslands/ riparian grasslands/ rangelands/ grazing systems/ range management/ management/ cattle/ United States/ Nevada/ Bos/ Bovidae/ ruminants/ Artiodactyla/ mammals/ vertebrates/ Chordata/ animals/ ungulates/ North America/ America/ Developed Countries/ OECD Countries/ Mountain States of USA/ Western States of USA/ United States
Abstract: A review is presented of traditional and alternative grazing strategies for riparian ecosystems. Rotation and rest strategies are highlighted in addition to other herd management techniques such as animal selection, riding, slating and water development. Winter grazing is discussed in relation to the resulting improvement of livestock distribution and plant response, Wickiup Creek and Meadow Valley Wash (both in Nevada), being discussed as examples of the success of this management type. These sites contrast in elevation, vegetation, precipitation patterns and their historical uses,

but winter grazing proved successful in restoring streamside vegetation, maintaining healthy conditions and building new stream channels in both areas.

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1130. Riparian grazing management that worked: Rotation with and without rest and riparian pastures.

Masters, L.; Swanson, S.; and Burkhardt, W.

Rangelands 18(5): 196-200. (1996)

NAL Call #: SF85.A1R32; ISSN: 0190-0528

Descriptors: rotational grazing

This citation is from AGRICOLA.

1131. Riparian livestock enclosure research in the western United States: A critique and some recommendations.

Sarr, Daniel A.

Environmental Management 30(4): 516-526. (2002)

NAL Call #: HC79.E5E5; ISSN: 0364-152X

Descriptors: animal (Animalia): aquatic, terrestrial/ Animals/ Humpty Dumpty model/ agenda laden literature reviews/ broken leg model/ critical reviews/ ecosystem recovery: mechanisms, scales/ geomorphology/ improved enclosure placement/ design/ long term research programs: development/ meta analyses/ post exclusion dynamics/ pre treatment data: collection/ restoration ecology/ riparian ecosystem ecology: livestock impact susceptibility/ riparian livestock enclosure research: critique, recommendations/ rubber band model/ study popularization/ unifying conceptual framework/ vegetation/ weak study designs

Abstract: Over the last three decades, livestock enclosure research has emerged as a preferred method to evaluate the ecology of riparian ecosystems and their susceptibility to livestock impacts. This research has addressed the effects of livestock exclusion on many characteristics of riparian ecosystems, including vegetation, aquatic and terrestrial animals, and geomorphology. This paper reviews, critiques, and provides recommendations for the improvement of riparian livestock enclosure research. Enclosure-based research has left considerable scientific uncertainty due to popularization of relatively few studies, weak study designs, a poor understanding of the scales and mechanisms of ecosystem recovery, and selective, agenda-laden literature reviews advocating for or against public lands livestock grazing. Enclosures are often too small (<50 ha) and improperly placed to accurately measure the responses of aquatic organisms or geomorphic processes to livestock removal. Depending upon the site conditions when and where livestock enclosures are established, postexclusion dynamics may vary considerably. Systems can recover quickly and predictably with livestock removal (the "rubber band" model), fail to recover due to changes in system structure or function (the "Humpty Dumpty" model), or recover slowly and remain more sensitive to livestock impacts than they were before grazing was initiated (the "broken leg" model). Several initial ideas for strengthening the scientific basis for livestock enclosure research are presented: (1) incorporation of meta-analyses and critical reviews; (2) use of restoration ecology as a unifying conceptual framework; (3) development of long-term research programs; (4) improved enclosure placement/design; and (5) a stronger commitment to collection of pre-treatment data.

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1132. Riparian vegetation response to different intensities and seasons of grazing.

Lucas, R. W.; Baker, T. T.; Wood, M. K.; Allison, C. D.; and Vanleeuwen, D. M.

Journal of Range Management 57(5):

466-474. (Sept. 2004)

NAL Call #: 60.18 J82; ISSN: 0022-409X

Descriptors: riparian areas/ grazing intensity/ species diversity/ seasonal variation/ herbaceous plants/ regrowth/ New Mexico

Abstract: Sustainable management of riparian ecosystems depends on our understanding of these complex systems. Thus far, the scientific literature has not adequately addressed the effects of livestock grazing on riparian areas in the American southwest. Most available information is observational, anecdotal, based on unreplicated experiments, or compares heavily grazed areas to areas from which livestock have been completely excluded. This study, in the Black Range of western New Mexico, compared effects of different seasons of use (cool season, warm season, and dormant season) and grazing intensities (light, moderate, and none) of cattle on young narrowleaf cottonwood (*Populus angustifolia* James) populations, and herbaceous vegetation in 2 adjacent southwestern riparian areas. Cottonwoods in lightly grazed and moderately grazed plots received significantly greater use than cottonwoods in ungrazed plots which experienced negligible grazing pressure. Increased grazing pressure did not have significant impacts on cottonwood populations. Effects of season of use were significant on both herbaceous species richness and diversity. We conclude that no single riparian area management approach is best in all situations, but the grazing treatments used in this study appear to have been successful at maintaining riparian communities.

This citation is from AGRICOLA.

1133. The role of grazing in agropastoral systems in the Mediterranean region and their environmental sustainability.

Enne, Giuseppe; Zucca, Claudio; Montoldi, Anna; and Noe, Lorenzo

Advances in Geoecology 37: 29-46. (2004);

ISSN: 0722-0723.

Notes: Meeting Information: Symposium on Sustainability of Dehesas, Montados and other Agrosilvopastoral Systems, Caceres, SPAIN; September 21 -24, 2003

Descriptors: desertification/ grazing/ environmental impact/ environmental sustainability/ land suitability/ agropastoral system/ optimal stocking rate

Abstract: Agro-pastoral systems have significantly contributed in shaping the landscapes of the Mediterranean basin. These systems vary widely according to the differing climatic, cultural and socio-economic conditions under which they developed; from the Parours of the Maghreb steppes to the dehesas in the Iberian peninsula, and from the Mediterranean islands to inland mountain regions. Their present particularities developed both in response to internal needs within the farming systems (need to increase production while reducing costs) and external forces (competition with other activities for the use of land). In many cases recent changes evolved from increased grazing. Overgrazing represents one of the causes for desertification in many areas of the Mediterranean region. To mitigate this problem a better knowledge of agropastoral

systems is first needed. Then, methods must be devised to model and assess environmental impacts, land suitability to grazing, and optimal stocking rate.

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1134. Role of grazing in Mediterranean rangeland ecosystems: Inversion of a paradigm.

Perevolotsky, A. and Seligman, N. G.

BioScience 48(12): 1007-1017. (1998)

NAL Call #: 500 Am322A; ISSN: 0006-3568

Descriptors: grazing/ ecosystems/ grasslands/ Mediterranean grasslands/ rangelands/ nature reserves/ overgrazing/ environmental degradation/ plant communities/ nature conservation/ plant succession/ forest fires/ fire danger/ fire causes/ scrublands/ range management/ plant genetic resources/ wildfires-

Abstract: The popular consensus that characterizes the intensive use of rangelands surrounding the Mediterranean Basin as overgrazing and the altered landscape as degraded is challenged as an oversimplification. It is suggested that heavy grazing in this region may be an efficient and ecologically sound method of land use.

Equating major ecosystem changes with degradation is considered questionable, being based on vegetation structure rather than on species richness and diversity, productivity and utility to society. Where grazing is excluded, impenetrable thickets develop with low species diversity which are increasingly vulnerable to uncontrollable fires. Increasing depopulation of Mediterranean rangelands has resulted in the loss of desirable characteristics from the landscape. Attitudes to change in Mediterranean rangelands are shown to depend on human viewpoint. It is suggested that the main factor responsible for change is human settlement and land clearance from 7000 BC onwards, and that grazed ecosystems are better adapted to this change than other ecosystems which have disappeared. The rangeland vegetation of the Mediterranean basin is described briefly and the effects of grazing on vegetation structure, water and soil, plant species richness, botanical composition, primary and secondary production, plasticity and resilience, and likelihood of wildfire are discussed. Grazing is recommended as a management tool in these rangelands and the reduction in grazing caused by human depopulation considered a greater threat than overgrazing.

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1135. Scale-dependent effects of grazing on rangeland degradation in northern Kenya: A test of equilibrium and non-equilibrium hypotheses.

Oba, G.; Weladji, R. B.; Lusigi, W. J.; and Stenseth, N. C.

Land Degradation and Development 14(1): 83-94. (2003)

NAL Call #: S622.L26; ISSN: 1085-3278

Descriptors: equilibrium grazing model: mathematical and computer techniques/ non equilibrium grazing model: mathematical and computer techniques/ scale dependence analysis: mathematical and computer techniques/ biomass production/ grazing pressure/ rangeland degradation/ seasonality/ species richness

Abstract: This study employs scale-dependence as an analytical approach to understanding effects of livestock grazing on rangeland degradation in northern Kenya. It used extensive datasets previously collected from 13 200 km² rangelands where grazing pressure gradients of livestock (varied from none, light, moderate, heavy and very

heavy grazing) in conjunction with seasonality across different ecological scales influenced plant responses and probably contributed to land degradation. The data representing spatial and temporal scales were used to test the equilibrium and non-equilibrium-grazing models and to verify scales at which the models appropriately described range degradation. The equilibrium-grazing models operated at the coarse scales (e.g. range units, km²) and non-equilibrium-grazing models at multiple scales (e.g. spatial, temporal and fine scales-plots, landscape patches). The study showed that the equilibrium-grazing hypothesis, which stated that responses of plant species richness, cover and biomass varied along grazing pressure gradients at the coarse scale, was rejected, while the non-equilibrium-grazing hypothesis, which stated that the factors responded to temporal and spatial scales combined with grazing pressure gradients at the fine scale, was accepted. This study emphasized that in future discussions on shifts in the thinking of range science from equilibrium- to non-equilibrium-grazing models should clarify scales at which land degradation is assessed. In conclusion, the paper suggests that understanding plant species responses to grazing pressure and seasonality needs to consider multiple scale effects and that the dogmatic notions about degradation of the arid zone rangelands at the coarse scales should be reconsidered. Land degradation assessments in the arid zones should focus at the fine scale.

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1136. Seasonal changes in nutrient content under three defoliation treatments in two coastal grassland communities of Transkei.

Shackleton, C. M. and Mentis, M. T.

Journal of the Grassland Society of Southern Africa 9(1): 30-37. (1992)

NAL Call #: SB197.J68; ISSN: 0256-6702

Descriptors: crude protein/ dry matter digestibility/ phosphorus/ potassium/ calcium/ magnesium/ resource management/ grazing/ burning/ plant growth/ South Africa

Abstract: Changes in nutrient concentrations were monitored over a two-year period in two coastal grassland communities. Dry matter digestibility, crude proteins, phosphorus, potassium, calcium and magnesium were determined from handclipped samples of experimental treatments; namely, burning with and without subsequent grazing and protection from defoliation. Marked seasonal variations were evident in crude protein, dry matter digestibility, phosphorus and potassium. Defoliation treatment effects were superimposed on the seasonal changes. Burning stimulated large increases in crude protein, dry matter digestibility, phosphorus and potassium. Grazing led to higher protein levels, no change in dry matter digestibility and variable responses in mineral concentrations. Crude protein and phosphorus concentrations were frequently below the maintenance requirements for a LSU. In terms of nutrient stocks, optimum grazing conditions for growth existed only 5-6 months following a fire.

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1137. Seasonal wetlands and livestock grazing on the Missouri coteau: Aboveground biomass.

Mings, T. S.; Kirby, D. R.; and Green, D. M.
Proceedings of the North Dakota Academy of Science 43: 63. (Apr. 1989)
 NAL Call #: 500 N813; ISSN: 0096-9214
 Descriptors: livestock/ grazing/ range management/ wetlands/ Missouri
 This citation is from AGRICOLA.

1138. Sheep and cattle grazing strategies on riparian-stream environments.

Platts, W. S.
 In: *Proceedings of the Wildlife-Livestock Relationships Symposium*. (Held 20 Apr 1981-22 Apr 1981 at Coeur D'alene, Idaho.) Peek, James M. and Dalke, P. D. (eds.) Moscow, Idaho: Forest, Wildlife & Range Experiment Station, University of Idaho; pp. 251-270; 1982.
 NAL Call #: SF84.84.W5 1981
 Descriptors: Idaho
 This citation is from AGRICOLA.

1139. Sheep grazing and riparian and watershed management.

Glimp, H. A. and Swanson, S. R.
Sheep Research Journal Special Issue: 65-71. (1994)
 NAL Call #: SF371.R47; ISSN: 1057-1809
 Descriptors: sheep/ watershed management/ range management/ runoff/ water quality/ grazing intensity/ riparian buffers/ literature reviews
 This citation is from AGRICOLA.

1140. Sheep grazing as a brush and fine fire fuel management tool.

Taylor, C. A.
Sheep Research Journal: 92-96. (1994)
 NAL Call #: SF371.R47; ISSN: 1057-1809
 Descriptors: sheep/ grazing/ rangelands/ fire fighting/ woody plants/ botanical composition/ species diversity/ feeding preferences/ brush control/ prescribed burning/ stocking rate
 This citation is from AGRICOLA.

1141. Sheep grazing as a range improvement tool.

Havstad, K. M.
Sheep Research Journal: 72-78. (1994)
 NAL Call #: SF371.R47; ISSN: 1057-1809.
 Notes: Special issue: Role of sheep grazing in natural resource management. Includes references.
 Descriptors: sheep/ range management/ grazing intensity/ grazing effects/ herbivores/ plant succession/ controlled grazing/ literature reviews
 This citation is from AGRICOLA.

1142. Sheep grazing as management tool in western European saltmarshes.

Bouchard, V.; Tessier, M.; Digaire, F.; Digaire, J. P.; Valery, L.; Gloaguen, J. C.; and Lefeuvre, J. C.
Comptes Rendus Biologies 326(Supplement 1): 148-157. (2003)
 NAL Call #: Q2 .C6; ISSN: 1631-0691.
 Notes: Conference: Biodiversity conservation and management, France, 4-7 Jul 2002
 Descriptors: salt marshes/ plant populations/ halophytes/ community composition/ species diversity/ environment

management/ biotic factors/ grazing/ herbivores/ nature conservation/ bays/ Tracheophyta/ France, St-Malo Gulf, Mont-St-Michel Bay/ sheep

Abstract: The effects of sheep grazing on plant community structure and diversity were studied in saltmarshes of the Mont-Saint-Michel bay. This study took place at two scales: (1) at the scale of the entire bay to explore the changes in plant community over a ten year period; and (2) locally with the use of experimental enclosure set up to mimic the abandonment of grazing. Moderate grazing generally enhanced plant richness and diversity, while the absence of grazing and overgrazing lead to a decrease in diversity and richness. The development of management strategies is becoming critical to preserve the diversity of saltmarshes functions.

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1143. Short-term effects of cattle exclusion on riparian vegetation in southeastern Kansas.

Hoover, David E.; Gipson, Philip S.; Pontius, Jeffrey S.; and Hynek, Alan E.

Transactions of the Kansas Academy of Science 104(3-4): 212-222. (2001)

NAL Call #: 500 K13T; ISSN: 0022-8443

Descriptors: Kansas Army Ammunition Plant/ cattle exclusion/ closed canopy riparian woodlands/ grazing/ litter/ riparian vegetation/ short term effects/ understory/ vegetation height

Abstract: Effects of cattle exclusion on the structure and composition of riparian vegetation were observed in a 2-yr study in southeastern Kansas. The study was conducted within riparian habitats on the 5,263-ha Kansas Army Ammunition Plant in north-central Labette County, Kansas. Three grazed and three ungrazed riparian areas were sampled in 1996 and 1997 to monitor vegetation changes in response to livestock exclusion. Total understory, grass, and litter cover were significantly different between the grazed and ungrazed study sites with mean cover estimates being higher (16.3%, 14%, and 12.1% greater respectively) in the ungrazed sites. A significant difference in the percentage of bare ground was observed between the grazed (24.6%) and ungrazed (12.5%) study sites. No difference in herbaceous vegetation height was detected between study sites in 1996. In 1997, mean herbaceous vegetation height differed significantly from 1996 (study sites combined) and was greater (95.6 cm vs. 65.6 cm) in the ungrazed study sites. Excluding cattle from closed canopy riparian woodlands in southeastern Kansas resulted in a positive short-term response of understory herbaceous vegetation. Our results suggest that riparian fencing may be an effective management tool for restoring understory vegetation in riparian communities grazed by cattle in the eastern Great Plains.

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1144. Short-term response of riparian vegetation to 4 grazing treatments.

Popolizio, C. A.; Goetz, H.; and Chapman, P. L.
Journal of Range Management 47(1): 48-53. (1994)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1994/471/10popo.pdf>

Descriptors: grazing/ plant communities/ botanical composition/ leaves/ national forests/ riparian buffers/ Colorado

Abstract: The Sheep Creek watershed of northcentral Colorado provided an ideal site to collect baseline trend data and to estimate foliar cover responses of montane riparian vegetation. Percent relative cover data were compared with Sorensen's similarity index and were analyzed with a 2-stage nested analysis of variance (ANOVA) to assess differences among 4 grazing treatments: long-term grazing (G), protection from livestock grazing since 1956 (P), recent protection following long-term grazing (P88), and recent livestock grazing following protection (G88). This study utilized 3 replications of each treatment. Data were collected in August 1988, June 1989, and August 1989, employing permanent and randomly placed transects and plots. When percent foliar cover means were paired using Sorensen's similarity index, long-term grazing and short-term grazing treatments were least similar in August 1988. Long-term protection and short-term grazing were most similar in June 1989. Average percent cover of bare ground, common dandelion (*Taraxacum officinale* Wiggers), white Dutch clover (*Trifolium repens* L.), and legumes grouped as lifeforms were significantly different among treatments, with long-term grazing being significantly different from long-term protection. Average sedge and forb cover was least affected. However, responses of individual sedge species varied with treatments. Average percent grass cover increased under short-term protection after a history of long-term grazing. Short-term grazing stimulated foliar cover of forbs, grasses, and sedges after more than 30 years of cattle exclusion.

This citation is from AGRICOLA.

1145. Short-term response of vegetation to cattle grazing in an abandoned orchard in southwestern Japan.

Hayashi, K.; Ikeda, K.; Ueda, A.; Fumita, T.; Etoh, T.; and Gotoh, T.

Asian Australasian Journal of Animal Sciences 19(4): 514-520. (2006)

NAL Call #: SF55.A78A7; ISSN: 1011-2367

Descriptors: stocking rate/ grazing response/ abandoned orchard

Abstract: An abandoned mandarin orange orchard in southwestern Japan was set-stocked by Japanese Black cows at two stocking rates (1.0 and 2.0 animals/ha), and vegetation dynamics and diet selection by cattle were monitored for two years, in effort to obtain information on effective use of abandoned agricultural fields for low-cost animal production and environmental consideration. Two dominant species at the commencement of grazing, kudzu (*Pueraria lobata* Ohwi) and tall goldenrod (*Solidago alissima* L.), showed different responses to grazing during the two years, the composition of kudzu decreased, contrasting with that of tall goldenrod which increased at both stocking rates. This was caused by high preference for kudzu and avoidance or low preference for tall goldenrod by cattle. Retrogression of vegetation due to cattle disturbances occurred at both stocking rates, with the high stocking rate leading to a lower degree of succession than the low stocking rate. It was shown that cattle grazing, particularly at a high stocking rate, was effective in the management of vegetation of an abandoned orchard.

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1146. Shrub densities in relation to fire, livestock grazing, and precipitation in an Arizona desert grassland.

Bock, C. E. and Bock, J. H.

Southwestern Naturalist 42(2): 188-193. (1997)

NAL Call #: 409.6 SO8; ISSN: 0038-4909

Descriptors: population density/ grazing/ fires/ rainfall/ precipitation/ shrubs/ livestock/ forest fires/ arid lands/ *Haplopappus tenuisectus*/ USA, Arizona/ woody vegetation/ *Baccharis pteranioides*/ fires

Abstract: Changes in *Baccharis pteranioides* and *Haplopappus tenuisectus* densities in a southeastern Arizona grassland were related to patterns of livestock grazing, fire, and precipitation. Results suggested that both species increased following two periods of relatively wet winters, and declined during an intervening dry period. *Baccharis* completely recovered through vegetative regrowth in one year after a 1987 wildfire, but *Haplopappus* suffered nearly total fire-caused mortality, and had not recovered by 1995 compared to its abundance on a nearby unburned site. In 1995, both species were most abundant in areas protected from grazing. Long-term (1982-1995) densities of *Baccharis* were stable, but *Haplopappus* density increased by more than two orders of magnitude over the same period, except in the burned area.

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1147. Simulated long-term vegetation response to grazing heterogeneity in semi-arid rangelands.

Weber, Gerhard E.; Jeltsch, Florian; Van Rooyen, Noel; and Milton, Suzanne J.

Journal of Applied Ecology 35(5): 687-699. (1998)

NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: grazing heterogeneity: vegetation response/ grid based model: life history, plant biomass production, resource competition/ semi arid rangeland: habitat

Abstract: 1. The long-term effects of small-scale spatial heterogeneity of livestock grazing on vegetation dynamics were studied with a grid-based model of major life forms of savanna vegetation. Based on southern Kalahari ecology, the model includes stochastic life-history variables, resource competition for soil water, and biomass production for annuals, perennial grasses and shrubs. 2. Grazed at individual severities, the model's 25 m² grid cells defined the spatial scale of heterogeneity. Different scenarios of grazing heterogeneity were generated by modifying distributional and behavioural features of the grazing model. Simulations were run over 50 years under moderate to high constant stocking rates. 3. Results confirmed a previously reported threshold response of shrub cover increase: under moderate grazing pressure, little change in shrub cover occurred; when grazing pressure exceeded a threshold, shrub cover increased drastically. 4. Under moderate or high stocking rates, grazing heterogeneity did not modify grazing effects. However, within an intermediate range of stocking rates, small-scale heterogeneity determined the long-term impact of grazing. In particular, utilization intensity at the threshold of shrub cover increase was 60% less under high compared to low local grazing heterogeneity. 5. Sensitivity of vegetation dynamics to local grazing heterogeneity was also exemplified under a landscape-scale grazing gradient as observed at watering points: at a given utilization intensity, a wide zone of increased shrub cover occurred under large local grazing heterogeneity, while under the least heterogeneous grazing

only a narrow zone of slightly increased shrub cover occurred. 6. Because of the slow progress of shrub cover increase, a mismatch of management and ecological time scales was diagnosed and its implications for management are discussed. 7. We conclude that knowledge of local grazing heterogeneity is crucial for correct assessment of livestock impact on vegetation dynamics. Consequently, management aiming at sustainable land use should account for spatial grazing aspects. These poorly understood aspects form a gap to be filled by both empirical and theoretical studies.

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1148. Simulation of rotational grazing to evaluate integrated pest management strategies for *Boophilus microplus* (Acari: Ixodidae) in Venezuela.

Hernandez A. F.; Teel, P. D.; Corson, M. S.; and Grant, W. E.

Veterinary Parasitology 92(2): 139-149. (2000)

NAL Call #: SF810.V4; ISSN: 0304-4017

Descriptors: rotational grazing simulation model: mathematical model/ integrated pest management strategies

Abstract: Ranchers in Venezuela historically have controlled the cattle-fever tick, *Boophilus microplus* (Canestrini), with acaricide treatments of cattle but no technical planning. We developed a simulation model to evaluate cattle-tick population dynamics in systematic pasture rotation systems and Integrated Pest Management (IPM) approaches to managing ticks in the tropical dry-forest ecological zone of Venezuela. Model output showed five generations of cattle-ticks produced each year throughout the dry and rainy seasons that occur in this zone. Sensitivity analyses showed disproportionately large changes in on-host *B. microplus* populations in response to small changes in larval mortality rates, such as those resulting from differences in the innate resistance of cattle to tick parasitism. Simulation results with 1-6 pasture systems suggest that adjusting the graze:rest sequence with systematic rotation among 4-6 pastures could suppress, but not eradicate, tick populations.

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1149. Simulation of vegetation dynamics and management strategies on south Texas, semi-arid rangeland.

Glasscock, Selma N.; Grant, William E.; and Drawe, D. Lynn

Journal of Environmental Management 75(4): 379-397. (2005)

NAL Call #: HC75.E5J6; ISSN: 0301-4797

Descriptors: brush burning: applied and field techniques/ vegetation dynamics/ livestock grazing/ management strategy/ seasonal dynamic/ semi arid rangeland

Abstract: In this paper, we describe a model designed to simulate seasonal dynamics of warm and cool season grasses and forbs, as well as the dynamics of woody plant succession through five seral stages, in each of nine different plant communities on the Rob and Bessie Welder Wildlife Refuge. The Welder Wildlife Refuge (WWR) is located in the Gulf Coastal Prairies and Marshes ecoregion of Texas. The model utilizes and integrates data from a wide array of research projects that have occurred in south Texas and WWR. It is designed to investigate the effects of alternative livestock grazing programs and brush control

practices, with particular emphasis on prescribed burning, the preferred treatment for brush on the WWR. We evaluated the model by simulating changes in the plant communities under historical (1974-2000) temperature, rainfall, livestock grazing rotation, and brush control regimes, and comparing simulation results to field data on herbaceous biomass and brush canopy cover collected on the WWR over the same period. We then used the model to simulate the effects of 13 alternative management schemes, under each of four weather regimes, over the next 25 years. We found that over the simulation period, years 1974-2000, the model does well in simulating the magnitude and seasonality of herbaceous biomass production and changes in percent brush canopy cover on the WWR. It also does well in simulating the effects of variations in cattle stocking rates, grazing rotation programs, and brush control regimes on plant communities, thus providing insight into the combined effects of temperature, precipitation, cattle stocking rates, grazing rotation programs, and brush control on the overall productivity and state of woody plant succession on the WWR. Simulation of alternative management schemes suggests that brush canopy removal differs little between summer and winter prescribed burn treatments when precipitation remains near the long-term average, but during periods of low precipitation canopy removal is greater under winter prescribed burning. The model provides a useful tool to assist refuge personnel with developing long-term brush management and livestock grazing strategies. (c) 2005 Elsevier Ltd. All rights reserved. © The Thomson Corporation

1150. Site productivity and plant size explain the response of annual species to grazing exclusion in a Mediterranean semi-arid rangeland.

Osem, Y.; Perevolotsky, A.; and Kigel, J.

Journal of Ecology 92(2): 297-309. (2004)

NAL Call #: 450 J829; ISSN: 0022-0477

Descriptors: Mediterranean climate/ semiarid zones/ rangelands/ grazing management/ grazing intensity/ plant communities/ community structure/ topography/ Israel

Abstract: 1. The response of an annual plant community to protection from grazing as a function of variation in site productivity was studied in a semi-arid Mediterranean rangeland in Israel over 4 years (1996-99). The abundance of species was compared in grazed vs. ungrazed plots (exclosures) in four neighbouring topographic sites (south- and north-facing slopes, hilltop and Wadi shoulders), representing a gradient of resource availability and productivity. 2. Above-ground potential productivity at peak standing crop in spring (i.e. inside exclosures) varied considerably between years and topographic sites. Productivity was similar among the hilltop, south- and north-facing slopes, and was typical of semi-arid ecosystems (10-200 g(-2)). Productivity in the Wadi was consistently greater (up to 700 g(-2)) and reached the range of subhumid grassland ecosystems. 3. The effect of grazing exclusion on the composition of the annual vegetation was productivity-dependent. Lower similarity (Sorenson's quantitative similarity index) between grazed and ungrazed subplots was observed in the productive Wadi compared with the less productive sites. The small-scale variation in grazing impact on species composition, due to differences in productivity, is consistent with models predicting similar trends in perennial grasslands across larger scale

gradients. 4. The relationship between plant size (above-ground dry-weight), site productivity and response to fencing was analysed for the 36 most abundant annual species. Large species were more abundant in more productive sites, and small species at lower productivity, although few species were restricted to particular productivity levels. The response of individual species to protection from grazing was productivity dependent, with plant size playing a central role. Larger species tended to increase and small ones to decrease in abundance after fencing, with a mixed response in species with intermediate size. 5. A conceptual model is presented relating the response to protection from grazing along gradients of productivity to species plant size. This citation is from AGRICOLA.

1151. Site-specific responses of native and exotic species to disturbances in a mesic grassland community.

Hayes, Grey F. and Holl, Karen D.

Applied Vegetation Science 6(2): 235-244. (2003)

NAL Call #: QK900 .A66; ISSN: 1402-2001

Descriptors: clipping impact/ coastal prairie plant community/ disturbance dependent ecosystem/ grassland restoration/ grazing/ land management/ litter accumulation/ litter removal/ mesic grassland community disturbances/ mowing impact/ site specific responses/ soil disturbance/ vegetation composition

Abstract: Grassland communities are increasingly recognized as disturbance-dependent ecosystems, yet there are few replicated, multi-site studies documenting vegetation responses to varying frequencies and types of grassland disturbance. Even so, land managers frequently manipulate disturbance regimes in an attempt to favour native grassland plants over exotic species. We conducted a factorial experiment testing three frequencies of clipping combined with litter accumulation, litter removal, and soil disturbance within the highly threatened California coastal prairie plant community. We monitored the response of native/exotic, grass/forb plant guilds once a year for four years. More frequent clipping reduced cover of exotic grasses and favoured exotic forbs, whereas native species were largely unaffected by clipping frequency. Litter accumulation, litter removal, and soil disturbance did not affect vegetation composition. Effects of litter accumulation may take longer than our experiment allowed, and soil disturbance due to our treatments was not sufficiently strong to show consistent effects relative to mammalian soil disturbance. Treatment response of some plant guilds differed among sites, highlighting the importance of replicating experiments at several sites before recommending conservation management practices.

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1152. A six-year experimental restoration of biodiversity by shrub-clearing and grazing in calcareous grasslands of the French Prealps.

Barbaro, Luc; Dutoit, Thierry; and Cozic, Philippe

Biodiversity and Conservation 10(1): 119-135. (2001)

NAL Call #: QH75.A1B562; ISSN: 0960-3115

Descriptors: between year correspondence analysis: analytical method/ agri environmental schemes/ agro pastoral management/ calcareous grasslands: conservation, dry/ grazing/ low intensity farming systems/

plant communities: biodiversity/ shrub clearing/ six year permanent plant plot survey

Abstract: The conservation of dry calcareous grasslands in the French Prealps strongly depends on the maintenance of low-intensity farming systems supported by agri-environmental schemes. An experimental assessment of the effect of current agro-pastoral management on the biodiversity of plant communities was conducted during a six-year permanent plot survey in four sites with contrasting habitat conditions (mesic to xeric). Analyses of species changes showed: (i) a strong increase in species richness and open grassland species frequencies four years after shrub-clearing, and (ii) a noticeable recovery of rare annuals and perennial species of conservation interest establishing in gaps created by grazing. At the community level, the restoration effect was evaluated by a between-year Correspondence Analysis, explaining 10.9% of the total floristic variability versus 29.5% for the site effect (between-site CA). Species ordination by between-year CA showed similar trajectories of vegetation changes during restoration despite different habitat conditions and grazing regimes between sites. The successful restoration of prealpine calcareous grasslands was explained by the availability of seed sources during the study in adjacent grazed or mown grasslands. Thus, restoration assessment should focus on dispersal possibilities and functional roles of species rather than species richness only. Finally, the spatial (i.e. the area of patches that need to be restored) and temporal (i.e. the frequency of shrub-clearing) implications for the large-scale conservation of prealpine calcareous grasslands by current agro-pastoral management are discussed.

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1153. Size traits and site conditions determine changes in seed bank structure caused by grazing exclusion in semiarid annual plant communities.

Osem, Yagil; Perevolotsky, Avi; and Kigel, Jaime

Ecography 29(1): 11-20. (2006)

NAL Call #: QH540.H6; ISSN: 0906-7590

Descriptors: structural change/ resource availability/ grazing exclusion/ seed bank density/ site condition/ size trait/ semiarid plant community

Abstract: 1. Contrasting patterns of change in the seed bank of natural grasslands are frequently found in response to grazing by domestic herbivores. Here, we studied the hypotheses that a) patterns of change in seed bank density and composition in response to grazing depend on spatial variation in resource availability and productivity, and b) that variation among species in patterns of seed bank response to grazing is linked to differences in species size traits (i.e. size of plant, dispersal unit and seed). 2. Effects of sheep grazing exclusion on the seed bank were followed during five years in a semiarid Mediterranean annual plant community in Israel. Seed bank density and composition were measured in autumn, before the rainy season, inside and outside fenced exclosures in four neighboring topographic sites differing in vegetation characteristics, soil resources and primary productivity: Wadi (dry stream terraces, high productive site), Hilltop, South- and North-facing slopes (less productive sites). 3. Topographic sites differed in seed density (range ca 2500-18000 seed m⁻²) and in seed bank response to grazing exclusion. Fencing increased seed density by 78, 51 and 18% in the Wadi, South- and North-facing slopes, respectively, but had no

effect in the Hilltop. At the species level, grazing exclusion interacted with site conditions in determining species seed bank density, with larger or opposite changes in the high productive Wadi compared to the other less productive sites.4. Changes in seed bank structure after grazing exclusion were strongly related to species size traits. Grazing exclusion favored species with large size traits in all sites, while seed density of tiny species decreased strongly in the high productive Wadi. Species with medium and small size traits showed lesser or no responses.5. The size of plants, dispersal units and seeds were strongly correlated to each other, thus confounding the evaluation of the relative importance of each trait in the response of species to grazing and site conditions. We propose that the relative importance of plant size vs seed size in the response to grazing changes with productivity level.
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1154. Soil and vegetation responses to simulated trampling.

Abdel-Magid, A. H.; Trlica, M. J.; and Hart, R. H.
Journal of Range Management 40(4): 303-306. (1987)
NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1987/404/4abed.pdf>
Descriptors: livestock/ grazing/ prairie soils/ grasses/ soil water regimes/ soil compaction/ bulk density
This citation is from AGRICOLA.

1155. Soil seed bank and vegetation dynamics in Sahelian fallows; the impact of past cropping and current grazing treatments.

Herault, Bruno and Hiernaux, Pierre
Journal of Tropical Ecology 20(Part 6): 683-691. (2004)
NAL Call #: QH541.5.T7J68; ISSN: 0266-4674
Descriptors: canonical correspondence analysis: mathematical and computer techniques/ past crop management practice/ seasonal grazing regime/ soil seed bank/ vegetation dynamics
Abstract: The soil seed bank in a 5-y-old Sahelian fallow was studied through seed extraction and compared with germinations recorded either in controlled conditions, ex situ in a glasshouse, or in the field. The influence of phosphorus fertilizer and mulch application during the preceding crop period, and that of seasonal grazing regimes applied the last 2 y of fallowing, were assessed on the composition of the seed stock. *Ctenium elegans*, *Fimbristylis hispidula*, *Merremia pinnata* and *Phyllanthus pentandrus* accounted together for 75% of extracted seeds, 72% of ex situ, and 62% of in situ seedlings. Mulch treatment was correlated with the first axis of the canonical correspondence analyses performed on the seedling datasets. Mulch and phosphorus fertilizer treatments held similar responses, as they both favoured the seed bank of erect dicotyledons such as *P. pentandrus* and *Cassia mimosoides*. On the whole, the effects of grazing remained modest compared with the residual effects of past crop management practices. However, seedling densities increased as a result of dry-season grazing, while the soil seed bank decreased with wet-season grazing. Grazing also reduced the spatial heterogeneity of the seed bank rather than the overall number of species.
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1156. Soil seed banks on Argentine seminatural mountain grasslands after cessation of grazing.

Marco, Diane E. and Paez, Sergio A.
Mountain Research and Development 20(3): 254-261. (2000)
NAL Call #: GB500.M68; ISSN: 0276-4741
Descriptors: grazing cessation/ mountain grasslands/ seedling recruitment/ seminatural mountain grassland/ soil seed banks: abundance, composition, richness, species divergence/ vegetation
Abstract: We studied the seed bank and above-ground vegetation in a replicated field experiment with sites ungrazed for 22 years as well as three different grazed sites in seminatural grasslands in central Argentina. We examined the relationship between vegetation and seed bank composition, and tested 3 hypotheses predicting decrease in seed bank richness, decrease in seed bank abundance, and divergence of seed bank species composition from vegetation composition during succession. Grazing changed species abundance and the vertical structure of the vegetation but did not cause loss of species. Most of the taxa in the seed bank occurred in the vegetation. Seed bank richness, diversity, and abundance decreased significantly during grassland succession following cessation of grazing. Although in general the most abundant species in the vegetation at each site were also dominant in the respective seed bank, seed bank and vegetation composition differed greatly after cessation of grazing. The seed bank at sites undisturbed over the long term does not appear to be an important source of seedling recruitment after disturbance in these grasslands.
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1157. Some advantages of long-term grazing trials, with particular reference to changes in botanical composition.

Jones, R. M.; Jones, R. J.; and McDonald, C. K.
Australian Journal of Experimental Agriculture 35(7): 1029-1038. (1995)
NAL Call #: 23 Au792; ISSN: 0816-1089
Descriptors: pastures/ botanical composition/ nitrogen fertilizers/ stocking rate/ cattle/ range management/ grazing/ Queensland
This citation is from AGRICOLA.

1158. Some vegetation responses to selected livestock grazing strategies, Edwards Plateau, Texas.

Thurow, T. L.; Blackburn, W. H.; and Taylor, C. A.
Journal of Range Management 41(2): 108-114. (1988)
NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1988/412/4thur.pdf>
Descriptors: livestock/ rangelands/ grazing intensity/ plant ecology/ biomass/ ecological succession/ grazing/ Texas
This citation is from AGRICOLA.

1159. South Florida flatwoods range vegetation responses to season of deferment from grazing.

Kalmbacher, R. S.; Martin, F. G.; Pitman, W. D.; and Tanner, G. W.
Journal of Range Management 47(1): 43-47. (1994)
NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1994/471/9kalm.pdf>
Descriptors: *Aristida stricta*/ forage/ botanical composition/ seasonal variation/ burning/ grazing/ rangelands/ range management/ Florida

Abstract: Wiregrass (*Aristida stricta* Michx.)-dominated communities characterize extensive areas of South Florida that have been subjected to burning and uncontrolled grazing for decades. We evaluated the effects of deferment from grazing on species composition and herbage mass of these rangelands. Treatments were 1-ha enclosures that were closed to grazing December to March, closed April to July, closed August to November, always closed, or always open. All treatments were burned biennially. Herbage mass of preferred grasses was greater ($P < 0.05$) after 8 years in enclosures that were always closed (avg. 110 kg ha⁻¹) compared with other treatments, which were not different (avg. 65 kg ha⁻¹). Herbage mass of preferred grasses increased by 10 kg ha⁻¹ year⁻¹. Shrub biomass was greater in the treatment that was always closed (2,370 kg ha⁻¹) compared with other treatments (avg. 1,855 kg ha⁻¹), and biomass increased quadratically over years. There were no effects due to treatments or years on biomass of wiregrass, other less desirable grasses, grasslike species, or forbs. Frequency of occurrence of preferred grasses was not affected by treatment and averaged 41%. Although preferred grasses were relatively abundant, neither their biomass nor frequency of occurrence increased on a scale relevant to management for cattle production when protected from grazing. This biennially burned, seasonally flooded, infertile wiregrass range is not highly responsive to grazing or deferment from grazing, hence responses may not justify the inputs required for more intensive grazing management. This citation is from AGRICOLA.

1160. Southern forest range management.

Pearson, H. A. and Cutshall, J. R.
Annual Forestry Symposium 33: 36-52. (1984)
 NAL Call #: 99.9 L935; ISSN: 0076-1095
Descriptors: range management/ grazing/ cattle production/ forests/ Southeastern United States
 This citation is from AGRICOLA.

1161. Spatial components of plant-herbivore interactions in pastoral, ranching, and native ungulate ecosystems.

Coughenour, M. B.
Journal of Range Management 44(6): 530-542. (1991)
 NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1991/446/1coug.pdf>
Descriptors: ungulates/ spatial distribution/ spatial variation/ grazing
Abstract: The spatial component of herbivory remains enigmatic although it is a central aspect of domestic and native ungulate ecosystems. The effects of ungulate movement on plants have not been clearly established in either range or wildlife management. While livestock movement systems have been implemented to cope with increases in livestock density, restrictions on movement, and overgrazing, a large number of studies have disputed the effectiveness of different livestock movement patterns. Traditional pastoralism, particularly nomadism, has been perceived as irrational and even destructive, but many studies have documented features of traditional pastoral land use that would promote sustainability. Disruptions of wild ungulate movements have been blamed for wildlife overgrazing and population declines, but actual patterns and mechanisms of disrupted movement and population responses have been poorly documented. Models that

integrate plant growth, ungulate movement, and foraging are suggested as a way to improve analyses of spatial plant-herbivore systems. Models must give due attention to nonforage constraints on herbivore distribution, such as topography. Models should assess the significance of movement as a means of coping with local climatic variation (patchy rainfall). Models that distribute an aggregate population over a landscape in relation to the distribution of habitat features deemphasize aspects of ungulate movements and population responses that inevitably cause nonideal distributions, particularly in natural ecosystems. Individual based models describe movement and foraging processes more accurately, but these models are difficult to apply over large areas. Both top-down and bottom-up approaches to spatial herbivory are needed. To model plant responses to movement, it is important to account for small scale phenomena such as tiller defoliation patterns, patch grazing, and grazing lawns as well as large scale patterns such as rotation and migration. Herbivory patterns at these different scales are interrelated.

This citation is from AGRICOLA.

1162. Species composition and above ground phytomass in chalk grassland with different management.

Willems, J. H.
Vegetatio 52(3): 171-180. (1983)
 NAL Call #: 450 V52; ISSN: 0042-3106
Descriptors: sheep/ grazing/ mowing/ abandonment/ light/ seedling establishment/ rare species/ species richness
Abstract: During the last decades chalk grasslands lost their agricultural importance in the greater part of their distribution area in Western Europe. Due to their botanical richness a number of chalk grassland sites were established as Nature Reserves. As a consequence of the semi-natural character of these grasslands, an appropriate management is necessary to maintain or recreate this vegetation, including a great number of rare and endangered species. This paper deals with the results of 3 different management practices, i.e., mowing in autumn, sheep grazing and abandoning, of a medium term (8-11 yr) permanent plot experiment. Sheep grazing was considered the best management since it resulted in the highest number of species (phanerogams as well as bryophytes), and the highest number of characteristic chalk grassland species. Abandoning resulted in a decrease in species number and a dominance of a few species only. The changes in species number are related to the above ground biomass. Under the canopy in the abandoned plot, light intensity and the Red/Far-red ratio are very low, which partly explains the decrease in species number as such conditions are not favorable to seedling emergence and survival.

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1163. Spring grazing by sheep effects on seasonal changes during early old field succession.

Gibson, C. W. D.; Dawkins, H. C.; Brown, V. K.; and Jepsen, M.
Vegetatio 70(1): 33-44. (1987)
 NAL Call #: 450 V52; ISSN: 0042-3106
Descriptors: plant composition/ abundance/ secondary succession/ conservation

Abstract: This paper describes early secondary succession on an old field on limestone released from cultivation four years previously. Seasonal changes in plant composition after spring grazing by sheep are compared with those in ungrazed controls. Grazed and ungrazed paddocks were laid out in Latin squares. Plants were sampled before and several times after grazing in April, at several spatial scales. Major changes in plant abundance and sward characters such as height and density persisted throughout the growing season. Annual herbs increased after grazing, but annual grasses declined, as did short-lived perennial herbs. Effects on perennial herbs were weak; perennial grasses usually increased but this depended on the species. This pattern confirms that sheep grazing affects the direction, as well as the rate of succession. Some effects, such as increases in biennial herbs and in species richness, were only evident at large scales of sampling, suggesting that they arose from changes in rare and widely dispersed species. Other species were affected at different spatial scales, and no one sampling method detected the full range of effects. These results indicate the potential power of manipulating grazing early in secondary succession for directing the course of community change, for conservation or other purposes.

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1164. A state-transition approach to understanding nonequilibrium plant community dynamics in Californian grasslands.

Jackson, Randall D. and Bartolome, James W.

Plant Ecology 162(1): 49-65. (2002)

NAL Call #: QK900.P63; ISSN: 1385-0237

Descriptors: classification and regression tree analysis: mathematical and computer techniques/ non equilibrium state transition model: mathematical and computer techniques/ two way indicator species analysis: twinspan, applied and field techniques/ climate/ coast range grassland: California annual grassland subtype/ coastal prairie/ dataset: spatially replicated, temporally replicated/ grasslands/ grazing intensity/ grazing management prescriptions/ nonequilibrium plant community dynamics/ residual dry matter treatment levels/ state transition approach/ system productivity/ valley grassland/ vegetation transitions: twinspan created

Abstract: Using a spatially and temporally replicated dataset, we built a state-transition model for Californian grasslands. We delineated vegetation states by allowing TWINSpan to classify plot-level (approx 10 m²) species cover data collected over 3 to 5 consecutive years on 9 sites in an experimental design that incorporated 5 residual dry matter (RDM) treatment levels representative of the range of grazing management prescriptions for this type (0, 280, 560, 841, 1121 kg RDM/ha). We identified and described a new California annual grassland subtype-Coast Range Grassland - that is distinct from the previously described Coastal Prairie and Valley Grassland. Classification and regression tree (CART) analysis correctly classified 63% of TWINSpan-created vegetation transitions among states with interactions among site and monthly climate averages as the main driving factors. The RDM variable (a surrogate for grazing intensity) was important in model refinement, but only at a few site X year combinations and predictions were rarely attributable to the grazing intensity gradient. The equilibrium-based conclusion that grazing intensity manipulation creates

distinctive community structure was restricted in application to a few sites. The results suggest that equilibrium models may be appropriate for predicting system productivity but not the community composition, details of which require a nonequilibrium approach. The non-equilibrium state-transition model offers considerable potential for improving the development and testing of hypotheses about vegetation change and the limitations of management controls, but will require relatively large spatially and temporally replicated datasets.

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1165. Steer and vegetation response to short duration and continuous grazing.

Pitts, J. S. and Bryant, F. C.

Journal of Range Management 40(5): 386-389. (1987)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1987/405/1pitt.pdf>

Descriptors: steers/ rangelands/ grazing/ stocking rate/ liveweight gain/ feeding preferences/ botanical composition/ forage/ Texas

This citation is from AGRICOLA.

1166. Stocking rate and grazing frequency effects on Nebraska sandhills meadows.

Volesky, J. D.; Schacht, W. H.; and Richardson, D. M.

Journal of Range Management 57(5): 553-560. (Sept. 2004)

NAL Call #: 60.18 J82; ISSN: 0022-409X

Descriptors: rotational grazing/ botanical composition/ forage quality/ *Elymus trachycaulus*/ *Carex*/ defoliation/ biomass/ tillers/ Nebraska

Abstract: Nearly one-half million ha of the Nebraska Sandhills is comprised of highly productive wet meadows. A study was conducted from 1998 to 2001 to evaluate the effects of stocking rate and grazing frequency on herbage dynamics, disappearance, and composition of a wet meadow dominated by cool-season vegetation. Defoliation characteristics were measured on 2 key species. Stocking rates were 148, 296, and 444 AUD ha⁻¹ combined with a grazing frequency of 3 (F3) or 5 (F5) times. Cumulative standing crop disappearance and height reduction increased linearly with increasing stocking rate. Disappearance was 1,920, 2,700, and 3,090 kg ha⁻¹ for the 148, 296, and 444 AUD ha⁻¹ stocking rates, respectively. Greater disappearance at the highest stocking rate was expected based on calculated intake estimates for that stocking rate. Percentage of tillers grazed and percentage height reduction increased with stocking rate for both key species. Percentage of tillers grazed was greater under F3 compared to F5. This likely was caused by higher grazing pressures under the F3 treatment at each grazing period. Frequency of occurrence of the primary plant species or groups was not affected by stocking rate or grazing frequency during any year of the study (P > 0.05); however, frequency of occurrence of legumes and Kentucky bluegrass (*Poa pratensis* L.) was higher in grazed pastures compared to the control. The abundance of soil moisture in these meadows appeared to mitigate the effects of heavier defoliation associated with higher stocking rates. However, defoliation of the taller grasses and sedges resulted in a more open canopy allowing shorter-statured species to increase. Overall, stocking rate affected more response

variables than grazing frequency and the productivity of our wet meadow site would potentially support a stocking rate of 296 AUD ha⁻¹.

This citation is from AGRICOLA.

1167. Stream channel and vegetation responses to late spring cattle grazing.

Clary, W. P.

Journal of Range Management 52(3): 218-227. (1999)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/1999/523/218-227_clary.pdf

Descriptors: cattle/ grazing intensity/ streams/ botanical composition/ grasses/ forbs/ shrubs/ canopy/ Salix/ stream erosion/ riparian buffers/ plant litter/ Idaho

Abstract: A 10-year riparian grazing study was conducted on a cold, mountain meadow riparian system in central Idaho in response to cattle grazing-salmonid fisheries conflicts. Six pastures were established along Stanley Creek to study the effects on riparian habitat of no grazing, light grazing (20-25% utilization), and medium grazing (35-50%) during late June. Stream channels narrowed, stream width-depth ratios were reduced, and channel bottom embeddedness decreased under all 3 grazing treatments as the area responded to changes from heavier historic grazing use. Streambank stability increased and streamside willow communities (*Salix* spp. L.) increased in both height and cover under all 3 treatments. Plant species richness increased on both streamside and dry meadow areas during the years of grazing and moderate drought. The numbers of species receded to near original levels in the ungrazed and light grazed pastures in 1996, a wet post-grazing year, primarily due to a decrease in forb species. Streamside graminoid height growth was similar among treatments after 1 year of rest. Most measurements of streamside variables moved closer to those beneficial for salmonid fisheries when pastures were grazed to 10 cm of graminoid stubble height; virtually all measurements improved when pastures were grazed to 14 cm stubble height, or when pastures were not grazed. Many improvements were similar under all 3 treatments indicating these riparian habitats are compatible with light to medium late spring use by cattle.

This citation is from AGRICOLA.

1168. Streambank and vegetation response to simulated cattle grazing.

Clary, W. P. and Kinney, J. W.

Wetlands 22(1): 139-148. (2002)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: stream banks/ cattle/ grazing/ environmental effects/ vegetation effects/ riparian vegetation/ plant growth/ bank erosion/ channel morphology/ experimental data/ streams/ riparian environments/ plants/ livestock/ vegetation/ simulation/ environmental impact/ wetlands/ feeding behaviour/ river banks/ USA, Idaho/ grazing

Abstract: Simulated grazing techniques were used to investigate livestock impacts on structural and vegetation characteristics of streambanks in central Idaho, USA. The treatments, continued over two years, consisted of no grazing, simulated moderate early summer grazing, simulated moderate mid-summer grazing, and simulated heavy season-long grazing. The moderate treatments depressed the streambank surface about 3 cm, while the heavy season-long treatment resulted in an 11.5-cm

depression. There were no differences between the no-grazing and moderate-grazing treatments for change in stream width, bank angle, bank retreat, or root biomass. The heavy season-long treatment, however, produced significant changes in these variables. The amount of foliage biomass (i.e., kg ha super(-1)) removed by treatment was similar between the two years of study for the moderate treatments. The foliage removed from the heavy season-long treatment plots greatly decreased in the second year as plant growth decreased. Ten months after the last treatment application, the average spring foliage growth was 20-43% lower on the moderate treatment plots and 51-87% lower on the heavy season-long treatment plots than on the untreated control plots.

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1169. Structural resilience of a willow riparian community to changes in grazing practices.

Knopf, F. L. and Cannon, R. W.

In: Proceedings of the Wildlife-Livestock Relationships Symposium. (Held 20 Apr 1981-22 Apr 1981 at Coeur D'alene, Idaho.) Peek, James M. and Dalke, P. D. (eds.) Moscow, Idaho: Forest, Wildlife & Range Experiment Station, University of Idaho; pp. 198-207; 1982.

NAL Call #: SF84.84.W5 1981

1170. Studies in the grazing of a drained lowland fen in Iceland: The responses of the vegetation to livestock grazing.

Magnusson, B. and Magnusson, S. H.

Buvisindi 4: 87-108. (1990)

NAL Call #: S11.184; ISSN: 1012-6910

Descriptors: Carex nigra/ Carex panicea/ Agrostis capillaris/ Eriophorum angustifolium/ Pinguicula vulgaris/ Polytrichum swartzii/ Racomitrium ericoides/ Cladonia chlorophaea/ sheep/ horse/ calf/ moisture/ nutrient regime/ population decline management/ species abundance/ seasonality/ detrended correspondence analysis/ canonical correlation analysis

Abstract: The effects of livestock grazing on vegetation of a drained lowland fen dominated by *Carex nigra* and *Agrostis capillaris* were studied at a site in southern Iceland, which had been used for thirteen years in grazing experiments, initially with sheep and calves, but more recently with horses only. The study was carried out in three sections which were grazed during the summer at low (L), moderate (M) and intense (I) stocking rates. Within twenty plots floristic composition, species abundance and extent of bare ground were recorded, depth to water table determined and samples of soil and water obtained. The vegetation data was analyzed with the procedure detrended correspondence analysis (DCA) and the relationships between the DCA vegetation pattern and environmental and grazing variation were investigated with the aid of canonical correlation analysis (CCA). The DCA revealed strong trends of plant community change which were related to variation in moisture-nutrient regime and grazing intensity. The vegetation responded weakly to difference in grazing intensity between the L and M sections, but markedly between them and the I section. In the I section ground had become bare of vegetation, species richness increased, preferentially grazed species, e.g. *Carex nigra* and *Agrostis capillaris* declined in abundance, while more grazing tolerant and species of disturbed and strongly minerotrophic habitats, e.g. *Carex panicea*, *Eriophorum*

angustifolium, Pinguicula vulgaris, Polytrichum swartzii, Racomitrium ericoides and Cladonia chlorophaea had increased in abundance. The results of the study are discussed in relation to the grazing history at the site and their implications for grazing management.
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1171. The success of a rotational grazing system in conserving the diversity of chalk grassland Auchenorrhyncha.

Morris, M. G.; Clarke, R. T.; and Rispin, W. E.
Journal of Insect Conservation 9(4): 363-374. (2005)
NAL Call #: QL362.J68; ISSN: 1366-638X
Descriptors: rotational grazing system: applied and field techniques/ conservation/ species diversity/ chalk grassland
Abstract: A complex rotational grazing trial on a south-facing slope of chalk grassland at the Old Winchester Hill National Nature Reserve is briefly introduced. The responses of 23 numerous species of Auchenorrhyncha, and of species richness (S) and total abundance (N), from 1981 to 1985 are described. The greatest effects were those of variation between years, between positions on the hillside (top, middle and bottom) and between grazing plots within these positions. 10 (of the total of 23) species favoured the top of the slope, where the vegetation was significantly taller than in the middle or at the bottom. S, N and the numbers of 8 species were significantly lower on plots grazed in the year of sampling compared with ungrazed plots. Early (vs. late) grazing significantly reduced S, N and the abundance of two species, but increased the numbers of *Macrosteles laevis*. S, N and the abundance of 13 species was significantly and positively correlated with vegetation height measured early (May-June) and late (July-October); the numbers of 4 other species were so correlated with the latter height only. The significance of the results is discussed in relation to the management of grassland nature reserves for the maintenance of high invertebrate diversity. It is concluded that rotational management is an important and valuable system, but suggested that such systems should be as simple as possible whilst remaining adequate to achieve conservation objectives.
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1172. Succession and livestock grazing in a northeastern Oregon riparian ecosystem.

Green, D. M. and Kauffman, J. B.
Journal of Range Management 48(4): 307-313. (1995)
NAL Call #: 60.18 J82; ISSN: 0022-409X
http://jrm.library.arizona.edu/data/1995/484/307-313_green.pdf
Descriptors: species diversity/ ecological succession/ introduced species/ riparian buffers/ grazing/ plant litter/ Oregon
Abstract: Comparisons of vegetation dynamics of riparian plant communities under livestock use and exclusions over a 10 year period were quantified in a Northeastern Oregon riparian zone. We measured species frequency, richness, diversity, evenness, and livestock utilization in 8 plant communities. Livestock grazed the study area from late August until mid September at a rate of 1.3 to 1.8 ha/AUM. Utilization varied from > 70% in dry meadows to < 3% in cheatgrass dominated stands. Ungrazed dry and moist meadow communities had significantly lower ($P < 0.1$) species richness and diversity when compared to grazed

counterparts. In the most heavily grazed communities, ruderal and competitive ruderal species were favored by grazing disturbance. In enclosures of the same communities, competitive or competitive stress tolerant species were favored. Both height and density of woody riparian species were significantly greater in ungrazed gravel bar communities. Our results indicate that influences of herbivory on species diversity and evenness varies from 1 community to another and basing management recommendation on 1 component ignores the inherent complexity of riparian ecosystems.
This citation is from AGRICOLA.

1173. Survey of livestock influences on stream and riparian ecosystems in the western United States.

Belsky, A. J.; Matzke, A.; and Uselman, S.
Journal of Soil and Water Conservation 54(1): 419-431. (1999)
NAL Call #: 56.8 J822; ISSN: 0022-4561
<http://www.onda.org/library/papers/BelskyGrazing.pdf>
Descriptors: livestock/ water quality/ riparian land/ streams/ grazing/ environmental effects/ channel morphology/ arid lands/ riparian environments/ arid environments/ agricultural pollution/ agricultural runoff/ pollution effects/ environmental impact/ water pollution/ river banks/ livestock (see also individual animals)/ water quality (natural waters)/ streams (in natural channels)/ ecology/ pollution (environmental)/ arid regions/ USA, west/ livestock grazing/ USA, western
Abstract: This paper summarizes the major effects of livestock grazing on stream and riparian ecosystems in the arid West. The study focused primarily on results from peer-reviewed, experimental studies, and secondarily on comparative studies of grazed versus naturally or historically protected areas. Results were summarized in tabular form. Livestock grazing was found to negatively affect water quality and seasonal quantity, stream channel morphology, hydrology, riparian zone soils, instream and streambank vegetation, and aquatic and riparian wildlife. No positive environmental impacts were found. Livestock also were found to cause negative impacts at the landscape and regional levels. Although it is sometimes difficult to draw generalizations from the many studies, due in part to differences in methodology and environmental variability among study sites, most recent scientific studies document that livestock grazing continues to be detrimental to stream and riparian ecosystems in the West.
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1174. Survival of juvenile basin big sagebrush under different grazing regimes.

Owens, M. K. and Norton, B. E.
Journal of Range Management 43(2): 132-135. (1990)
NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1990/432/10owen.pdf>
Descriptors: *Artemisia tridentata*/ mortality/ pastures/ grazing intensity/ plant density/ grazing/ *Agropyron desertorum*/ population dynamics/ Utah
Abstract: Basin big sagebrush (*Artemisia tridentata* Nutt ssp *tridentata* Beetle) often invades rangelands seeded to introduced grass species. Livestock grazing may enhance the invasion but the effects of grazing intensity on invasion rates are not known. To investigate invasion rates, individual big sagebrush plants were marked and observed for mortality over a 4-year period within a short duration

grazing (SDG) cell and continuous season-long grazed pastures. Over the course of the experiment, the survival of juvenile big sagebrush was higher in the SDG cell.

However, there were no differences in survival between grazing treatments during the first year of the study. In subsequent years, declining tiller numbers and density of individual crested wheatgrass plants may have decreased the competitive pressure on juvenile big sagebrush under SDG. The intensity of grazing did not affect which individual juveniles survived. Plants with more than 50 cm² canopy area had the highest survival rates of all big sagebrush in both grazing treatments. Plant density, which ranged from 1 to 30 plants m⁻², did not affect plant survival in either of the grazing treatments. Big sagebrush survival in the SDG cell was higher in a rhizomatous grass community than in a tussock grass community.

This citation is from AGRICOLA.

1175. Survival of perennial grass seedlings under intensive grazing in semi-arid rangelands.

Salihi, D. O. and Norton, B. E.

Journal of Applied Ecology 24(1): 145-152. (1987)

NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: Agropyron desertorum/ cattle/ germination/ trampling/ agriculture/ Utah/ USA

Abstract: (1) The hypothesis that intensive grazing practices such as short-duration grazing, benefit seedling survival through hoof action of the trampling animals was tested in a one-year study [Utah]. Estimation of survival rates and hypothesis testing followed the numerical optimization approach to maximum likelihood analysis. (2) A total of 1598 crested wheatgrass seedlings (*Agropyron desertorum* (Fisch. ex Link) Schult.), of which 52.5% were protected from livestock grazing, were involved in the study. Seedling survival did not differ significantly between grazed and ungrazed populations prior to the first grazing treatment. (3) Grazing reduced seedling survival significantly in the first as well as in a second three-day grazing period. The treatment effect was not pronounced in the second grazing period. (4) Ten months after cattle were removed from the pastures the two 3-day grazing treatments continued to influence survival of seedlings. Of the 759 seedlings recorded in grazed plots only three survived 1 year after their emergence. In contrast, ninety-seven seedlings survived 1 year in the protected plots where 839 seedlings germinated. (5) Crested wheatgrass seedling survival in relation to the proximity of their well-established parent plants, was also investigated. The majority of seedlings (56%) emerged in bare soil more than 10 cm away from established grasses. Survival was more related to grazing treatment than to seedling location.

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1176. Sustainability and range management in the Patagonian steppes.

Golluscio, Rodolfo A.; Deregibus, V. Alejandro; and Paruelo, Jose M.

Ecologia Austral 8(2): 265-284. (1998); ISSN: 0327-5477

Descriptors: grazing management/ range management/ resource sustainability

Abstract: One hundred years of grazing by domestic herbivores hampered the ecological sustainability of the Patagonian steppes. We propose three management-related factors of such ecosystem degradation: (1) overestimation of carrying capacity of the rangelands, (2)

inadequate distribution of animals in very large, heterogeneous paddocks, and (3) year-long continuous grazing. We suggest that these three management factors interact with the highly selective grazing habit of sheep generating a pattern of grazing heterogeneity at three scales: landscape, community, and population. Grazing differs in intensity among areas of the same paddock, among plant species, and even among individuals of the same species. As a consequence, the most palatable species within a patch are almost continuously subjected to a very high frequency of defoliation in the most preferred areas, which increases the mortality of the most preferred individuals of these forage species. We review the available ecological knowledge and range management technologies that may contribute to revert degradation. A quick assessment of both the availability and spatial heterogeneity of forage resources is now possible with the aid of remote sensing. Range assessment will allow to estimate the carrying capacity of each paddock, and separate different vegetation units. From information on the phenology of the different vegetation units it is possible to decide the timing of grazing and/or resting periods of single paddocks. Rotational grazing methods allow for a recovery of the most preferred species and for a reduction of the heterogeneity of defoliation at the three mentioned levels. Research efforts are needed to develop warning systems, improve the productivity and use efficiency of meadows, and design and evaluate grazing methods for the most arid areas of the region.

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1177. Tallgrass prairie response to grazing system and stocking rate.

Gillen, R. L.; McCollum, F. T.; Tate, K. W.; and Hodges, M. E.

Journal of Range Management 51(2): 139-146. (1998)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/1998/512/139-146_gillen.pdf

Descriptors: continuous grazing/ plant succession/ stocking rate/ grazing/ grazing systems/ rotational grazing/ botanical composition/ grasslands/ prairies

Abstract: Grazing system and stocking rate effects on standing crop of species and relative species composition of tallgrass prairies in north-central Oklahoma were evaluated from 1989 to 1993. Twelve experimental units, consisting of pastures dominated by big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*) and indiangrass (*Sorghastrum nutans*), were managed in a short duration rotation or continuous grazing system with stocking rates ranging from 51.5 animal-unit-days/ha (AUD/ha) to 89.8 AUD/ha. Yearling steers grazed the pastures from late April to late September. Cumulative precipitation was above average during the study period. Continuous and rotational grazing affected the major herbage components similarly over time. Standing crop of all major herbage components declined as stocking rate increased. The standing crop of the major herbage components also declined from the first to the last year of the study. The decrease in standing crop of big bluestem, indiangrass and forbs over years was greatest at lighter stocking rates. Relative composition of switchgrass (*Panicum virgatum*) increased at the lower stocking rates over time in both grazing systems. The relationship between shortgrasses and stocking rate was different

between grazing systems at the start of the study but became similar between grazing systems over time. After 5 years, shortgrasses were positively related to stocking rate under both grazing systems. It is suggested that favourable growing conditions and the high seral state of the vegetation in the experimental pastures may have tempered the response to grazing treatments.

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1178. Technical note: Vegetation response to increasing stocking rate under rotational stocking.

Taylor, C. A.; Ralphs, M. H.; and Kothmann, M. M.
Journal of Range Management 50(4): 439-442. (1997)
NAL Call #: 60.18 J82; ISSN: 0022-409X
http://jrm.library.arizona.edu/data/1997/504/439-443_taylor.pdf

Descriptors: botanical composition/ grazing management/ livestock grazing/ native range/ rotational grazing
Abstract: This 10-year study was designed to evaluate vegetation response to increasing stocking rates under rotational stocking (3 days graze, 51 days rest) and long-term rest. The 4 stocking rate treatments ranged from the recommended rate for moderate continuous grazing to 2.7 times the recommended rate. Common curly-mesquite [*Hilaria belangeri* (Steud.) Nash] increased ($P = 0.05$) in all grazed treatments and decreased in the livestock enclosure. Sideouts grama [*Bouteloua curtipendula* (Michx.) Torr.] along with other midgrasses decreased ($P = 0.07$) in all grazed treatments and increased in the livestock enclosure. Because the midgrasses were palatable species and not abundant, they were defoliated too intensively and too frequently. Rotational stocking was not able to sustain initial species composition at any of the stocking rates tested.

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1179. Temporal responses over 30 years to removal of grazing from a mid-altitude snow tussock grassland reserve, Lammerlaw Ecological Region, New Zealand.

Mark, Alan F. and Dickinson, Katharine J. M.
New Zealand Journal of Botany 41(4): 655-668. (2003)
NAL Call #: 450 N48; ISSN: 0028-825X
Descriptors: conservation management/ fire/ floristics/ grazing removal/ herbivory/ human impact/ mid altitude snow tussock grassland reserve/ native grassland/ pollen record/ succession/ temporal response

Abstract: Monitoring of five representative sites in the 144-ha Black Rock Scientific Reserve of mid-altitude (690-770 m) narrow-leaved snow tussock (*Chionochloa rigida*) grassland over the 30 years since its establishment has revealed, contrary to an early prediction, significant increases in both cover and height of snow tussock. By contrast, co-dominant shrubs have shown only a slight, generally non-significant gain, with *Dracophyllum longifolium* rather than the predicted *Hebe odora* as the only significant increaser. Several sub-dominant shrubs (*Coprosma cheesemaniae*, *Leucopogon colensoi*, *Gaultheria macrostigma*) plus some mosses (*Hypnum cupressiforme*) and lichens (*Cladia retipora*, *Stereocaulon ramulosum*) have increased significantly while some rosette herbs (*Brachyglottis bellidioides*, *Oreomyrrhis colensoi*, *Plantago novae-zelandiae*, and the adventive *Hypochoeris radicata*) have declined. The generally aggressive exotic flatweed *Hieracium pilosella* remains as yet a minor component. These changes in subcanopy cover probably reflect the

obvious increase in shade and dampness of the micro-habitat. The height-frequency sampling indicates an overall decline in vascular species diversity since losses have significantly exceeded gains over the 30-year period of monitoring. Our results confirm that low- to mid-altitude snow tussock grassland ecosystems can be sustained for at least several decades, for their conservation, landscape, and water yield values. We question the interpretation of a general lack of tussock grassland below treeline in immediate pre-human times, and its widespread downslope replacement of forest following Polynesian fires, since it is at variance with the known ecology of the dominant grass species, evidence from relevant pollen records, and results from the present study. Rather, we interpret the available evidence as indicative of succession to a vegetation mosaic of non-woody and woody dominants related to physiography and disturbance, as currently being debated for north-western Europe. We hypothesise that such a mosaic would more closely reflect the pre-human situation below treeline which would have been moulded by periodic fire and avian and invertebrate herbivory, in the absence of land mammals.

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1180. Tiller defoliation in a moderate and heavy grazing regime.

Briske, D. D. and Stuth, J. W.
Journal of Range Management 35(4): 511-514. (1982)
NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1982/354/26bris.pdf>
This citation is from AGRICOLA.

1181. Timescale of perennial grass recovery in desertified arid grasslands following livestock removal.

Valone, Thomas J.; Meyer, Marc; Brown, James H.; and Chew, Robert M.
Conservation Biology 16(4): 995-1002. (2002)
NAL Call #: QH75.A1C5; ISSN: 0888-8892
Descriptors: desertified arid grasslands/ land management/ livestock grazing removal/ recovery timescale/ shrublands/ vegetation stability
Abstract: Over the past two centuries, perennial grass cover has declined and shrub density has increased in many arid grasslands. These changes in vegetation, characteristic of desertification, are thought to have occurred often following prolonged periods of intense grazing by domestic livestock. At many such sites, however, the subsequent removal of livestock grazing for up to 20 years has not resulted in increased grass cover. The apparent stability of vegetation following the cessation of livestock grazing has led to the hypothesis that desertified arid grasslands exist in alternate stable states of either grassland or shrubland over timescales relevant to management. To better understand the timescale of grass recovery in historic arid grasslands dominated by shrubs, we examined the vegetation at two nearby desertified sites that differed in the length of time since livestock removal. There was little difference between the site ungrazed for 20 years and the shrub-dominated vegetation on the other side of the exclusion fence. At a site ungrazed for 39 years there was significantly higher perennial grass cover inside the exclusion fence than outside, and nearly all the increase had occurred over the past 20 years. These data suggest

that there may be time lags of 20 years or more in the response of perennial grasses to removal of livestock in historic grassland ecosystems dominated by shrubs.

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1182. Ungulate herbivory on Utah aspen: Assessment of longterm exclosures.

Kay, C. E. and Bartos, D. L.

Journal of Range Management 53(2): 145-153. (2000)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/2000/532/145-153_kay.pdf

Descriptors: livestock/ grazing/ browsing/ grazing/ population dynamics/ wildlife/ natural regeneration/ understory

Abstract: The role of livestock grazing and big-game browsing in the decline of aspen (*Populus tremuloides*) in the Intermountain West has long been questioned. All known aspen exclosures (n=8) on the Dixie and Fishlake National Forests in south-central Utah were measured during late summer of 1995 and 1996 to determine aspen stem dynamics, successional status, and understory species composition. Five of the exclosures were of a 3-part design with a total-exclusion portion, a livestock-exclusion portion, and a combined-use portion which permitted the effects of deer (*Odocoileus hemionus*) and elk (*Cervus elaphus*) herbivory to be measured separately from those of livestock. Aspen within all total-exclusion plots successfully regenerated and developed multi-aged stems without the influence of fire or other disturbance. Aspen subjected to browsing by wildlife, primarily mule deer, either failed to regenerate successfully or regenerated at stem densities significantly lower (2498 stems ha⁻¹) than that on total-exclusion plots (4474 stems ha⁻¹). On combined wildlife-livestock-use plots, most aspen failed to regenerate successfully, or did so at low stem densities (1012 stems ha⁻¹). Aspen successfully regenerated on ungulate-use plots only when deer numbers were low. Similarly, ungulate herbivory had significant effects on understory species composition. In general, utilization by deer tended to reduce shrubs and tall palatable forbs while favoring the growth of native grasses. The addition of livestock grazing, however, tended to reduce native grasses while promoting introduced species and bare soil. Thus, communities dominated by old-age or single-age trees appear to be a product of ungulate browsing, not a biological attribute of aspen as has been commonly assumed. There was no evidence that climatic variation affected aspen regeneration. Observed differences are attributed to varied histories of ungulate herbivory.

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1183. Use of a model to analyse the effects of continuous grazing managements on seasonal patterns of grass production.

Johnson, I. R. and Parsons, A. J.

Grass and Forage Science 40(4): 449-458. (1985)

NAL Call #: 60.19 B773; ISSN: 0142-5242

Descriptors: range management/ grazing intensity/ crop production/ seasonal variation/ mathematical models

This citation is from AGRICOLA.

1184. Use of sheep grazing in the restoration of semi-natural meadows in northern Finland.

Hellstrom, Kalle; Huhta, Ari Pekka; Rautio, Pasi; Tuomi, Juha; Oksanen, Jari; and Laine, Kari

Applied Vegetation Science 6(1): 45-52. (2003)

NAL Call #: QK900 .A66; ISSN: 1402-2001

Descriptors: grazing management: applied and field techniques/ semi natural meadows: restoration/ soil fertility

Abstract: The biodiversity of species-rich semi-natural meadows is declining across Europe due to ceased management. In this study we aimed to find out how successfully the local species richness of an overgrown semi-natural mesic meadow could be restored by sheep grazing after a long period of abandonment. The cover of vascular plant species in grazed plots and ungrazed exclosures was studied for five years and the responses of different functional plant groups were followed (herbs vs grasses, tall vs short species, species differing in flowering time, species representing different Grime's CSR strategies and species indicative of rich vs poor soil). Grazing increased species number by nearly 30%. On grazed plots the litter cover practically disappeared, favouring small herbs such as *Rhinanthus minor*, *Ranunculus acris*, *Trifolium pratense* and the grass *Agrostis capillaris*. Grazing decreased the cover of the late flowering tall herb *Epilobium angustifolium* but had no effect on the abundance of the early flowering tall herbs *Anthriscus sylvestris* or *Geranium sylvaticum*. We suggest that to succeed in restoration it is useful to determine the responses of different functional plant groups to grazing. Grassland managers need this information to optimize the methods and timing of management used in restoration. Additional management practices, such as mowing, may be needed in mesic meadows to decrease the dominance of tall species. The availability of propagules seemed to restrict further increase of species richness in our study area.

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1185. The use of sheep grazing to recreate species-rich grassland from abandoned arable land.

Gibson, C. W. D.; Watt, T. A.; and Brown, V. K.

Biological Conservation 42(3): 165-184. (1987)

NAL Call #: S900.B5; ISSN: 0006-3207

Descriptors: plant growth/ ecology/ conservation/ vegetation succession/ species diversity/ species abundance/ species composition/ seasonal variation

Abstract: This paper reports the first two years' results of an investigation into the use of sheep grazing to restore species-rich calcicolous grasslands. Five different sheep-grazing treatments were applied to separate parts of a 10 ha arable field last cultivated in 1981. The field has shallow soils over Jurassic corallian limestone. Three treatments were applied in a replicated experimental design. These were ungrazed controls, a short period of grazing in spring and a similar short period in autumn. The other two treatments, more realistic for conservation management, were impractical for a formal design: one area was grazed continuously from April to November with a short break during the summer; the other was grazed continuously from August to early November. Grazing treatments were started in 1985. By the end of 1986, 43 of the 75 vascular plant species restricted to patches of old calcicolous grassland within 2 km of the site had colonised the field. Most of these species could have spread from adjacent patches of old

grassland, but six came from further away. Grazing treatment did not affect the chance of species arriving, but their establishment was better in the grazed areas. Colonisation proceeded downhill, against the prevailing wind. Species richness, diversity, and the abundance of individual plant species in the sward were increased by grazing treatments. In general, the effects of 'realistic' grazing treatments were predictable from the effects of simpler treatments in the formally designed experimental area. By the end of 1986, the area grazed in both spring and autumn had reached a state similar to the ex-arable chalk grasslands described by Cornish (1954). Although the species composition was not yet comparable to a mature calcicolous grassland, many of the component species had already arrived (including one national rarity) and were increasing, in contrast to the control areas.

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1186. Vegetal change in the absence of livestock grazing, mountain brush zone, Utah.

Austin, D. D.; Urness, P. J.; and Riggs, R. A. *Journal of Range Management* 39(6): 514-517. (1986) NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1986/396/9aust.pdf>

Descriptors: gambel oak/ ecology/ conservation
Abstract: Canopy cover of vegetation dominated by Gambel oak was determined in 1983 in adjacent canyons characterized by different grazing histories. Results were compared with data collected in 1935, and the methods replicated those used in the earlier study. Vegetal changes since 1935 in Red Butte Canyon where livestock grazing had been excluded since 1905 were small compared with those of Emigration Canyon where heavy grazing continued into the 1930's, but was gradually phased out and discontinued in 1957. Large differences in vegetal cover between the 2 canyons reported in 1935 were mostly eliminated by 1983.

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1187. Vegetation and arthropod communities at Bou Hedma National Park, southern Tunisia, under different grazing regimes.

Moldrzyk, Uwe

Kaupia Darmstaedter Beitrage zur Naturgeschichte 12: 151-166. (2003); ISSN: 0941-8482

Descriptors: nutrition/ diet/ ecology/ land zones/ Palaearctic Region/ Africa/ Arthropoda: community structure/ national park/ Tunisia/ Bou Hedma National Park/ mammalian grazing regimes comparison/ Mammalia/ arthropods/ chordates/ invertebrates/ mammals/ vertebrates

Abstract: From April 1995 to July 1996, flora and arthropod fauna of three different areas of Bou Hedma National Park in southern Tunisia have been investigated: a) inside the park without any grazing by large herbivores; b) inside the park with grazing by antelopes, gazelles and ostriches; c) outside the park with grazing by sheep and goats. The vegetation was studied by the method of Braun-Blanquet and the determination of phytomass. Arthropods were captured with pitfall traps and diversity and similarity indices were calculated. After sufficient precipitation, the ungrazed area inside the national park differed considerably from the two grazed areas regarding the epigeic arthropod fauna. Due to rainfall during winter months, the vegetation period of most therophytes takes place at this time. By reducing

competition from perennial plants, grazing stimulates growth of annuals, improving conditions for many arthropods. During draught, the comparison of arthropods collected revealed significant differences between the areas within and outside the park. At this time, intensive grazing by numerous domestic animals had negative consequences on the vegetation, which was weakened by the deficient water balance. Caused by the poor soil coverage, Isopoda, Microcoryphia and Isoptera in particular were less frequent outside the park. Remarkably, grazing by wild bovids improved phytomass and the condition of perennial plants.

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1188. Vegetation and litter changes of a Nebraska Sandhills prairie protected from grazing.

Potvin, M. A. and Harrison, A. T.

Journal of Range Management 37(1): 55-58. (1984)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1984/371/13potv.pdf>

Descriptors: Nebraska

This citation is from AGRICOLA.

1189. Vegetation and soil responses to cattle grazing systems in the Texas Rolling Plains.

Wood, M. K. and Blackburn, W. H.

Journal of Range Management 37(4): 303-308. (1984)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1984/374/4wood.pdf>

Descriptors: shortgrass/ midgrass/ shrub/ zonal community/ cattle/ enclosure/ stocking rate/ productivity
Abstract: The influence of cattle grazing on selected vegetation and soil parameters was evaluated on a clay flat range site with shrub zonal, midgrass, and shortgrass communities in the Rolling Plains near Throckmorton, Texas. Measurements were made on 1 pasture of each treatment during 1977 following 4-20 yr of grazing treatments. Heavy, continuous cattle grazing had more area occupied by the shortgrass community than midgrass community. Heavily grazed pastures were generally dominated by the shortgrass community, with midgrasses depending on the degree of utilization, restricted to the shrub zonal community. Cattle enclosures had no shortgrass community, and deferred-rotation and moderately stocked continuously grazed systems had much midgrass community with the shortgrass community occupying only 30% of the area, thus increasing range productivity. Vegetation and soil parameters within the high intensity, low frequency and heavily stocked, continuously grazed pastures tended to be similar for the midgrass and shortgrass communities, but the shrub zonal community was generally different. Vegetation and soil parameters in the midgrass community of the moderately stocked, continuously grazed treatment were generally similar to shrub zonal and different from shortgrass communities. Vegetation and soil variables in the enclosures and deferred-rotation treatments were generally similar among the midgrass and shrub zonal communities; they differed from the shortgrass communities.

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1190. Vegetation change after 13 years of livestock grazing exclusion on sagebrush semi desert in west central Utah.

West, N. E.; Provenza, F. D.; Johnson, P. S.; and Owens, M. K.

Journal of Range Management 37(3): 262-264. (1984)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1984/373/18west.pdf>

Descriptors: Elytrigia intermedia/ Elytrigia smithii/ Elytrigia spicata/ Elymus hystrix/ Oryzopsis hymenoides/ Stipa comata/ Stipa lettermanii/ Poa secunda/ Bromus tectorum/ Artemisia tridentata ssp. tridentata/ forage production/ successional stability/ direction manipulation

Abstract: Range managers often assume that release of vegetation from livestock grazing pressure will automatically result in a trend toward the pristine condition. The pathways and time scales for recovery are also sometimes assumed to be the same as for retrogression. These assumptions were examined via monitoring of plant community composition and forage production in 5 large paddocks of sagebrush [*Artemisia tridentata* ssp. *tridentata*] semi-desert vegetation in west central Utah over a 13-year interval. No significant increases in native perennial grasses [*Elytrigia intermedia*, *E. smithii*, *E. spicata*, *Oryzopsis hymenoides*, *Stipa comata*, *S. lettermanii*, *Poa secunda*, *Bromus tectorum*] were noted over this period despite a trend toward more favorable precipitation in recent years. The present brush-dominated plant community is probably successional stable. A return to vegetation similar to the original sagebrush-native grass mixture is unlikely. The possibility of a successional deflection via fire is enhanced by the increase of annual grass. Improvement of forage production in this vegetation will not necessarily follow after livestock exclusion. Direction manipulations are mandatory if rapid returns to perennial grass dominants are desired in such environments.

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1191. Vegetation change after 65 years of grazing and grazing exclusion.

Courtois, D. R.; Perryman, B. L.; and Hussein, H. S.

Journal of Range Management 57(6): 574-582. (2004)

NAL Call #: 60.18 J82; ISSN: 0022-409X

Descriptors: rangelands/ grazing intensity/ semiarid zones/ plant communities/ botanical composition/ Nevada

Abstract: The Nevada Plots enclosure system was constructed in 1937 following passage of the Taylor Grazing Act to assess long-term effects of livestock grazing on Nevada rangelands. A comparison of vegetation characteristics inside and outside enclosures was conducted during 2001 and 2002 at 16 sites. Data analysis was performed with a paired t test. Out of 238 cover and density comparisons between inside and outside enclosures at each site, 34 (14% of total) were different ($P < 0.05$). Generally, where differences occurred, basal and canopy cover were greater inside enclosures and density was greater outside. Shrubs were taller inside enclosures at 3 sites grazed by sheep (*Ovis aries*). Perennial grasses showed no vertical height difference. Aboveground plant biomass production was different at only 1 site. Plant community diversity inside and outside enclosures were equal at 11 of 16 sites. Species richness was similar at all sites and never varied > 4 species at any site. Few changes in species composition, cover, density, and

production inside and outside enclosures have occurred in 65 years, indicating that recovery rates since pre-Taylor Grazing Act conditions were similar under moderate grazing and grazing exclusion on these enclosure sites. This citation is from AGRICOLA.

1192. Vegetation change following exclusion of grazing animals in depleted grassland, Central Otago, New Zealand.

Allen, R. B.; Wilson, J. Bastow; and Mason, C. R.

Journal of Vegetation Science 6(5): 615-626. (1995)

NAL Call #: QK900.J67; ISSN: 1100-9233

Descriptors: ground cover/ mathematical model/ plant height/ pulse phase dynamic model/ rainfall

Abstract: Models of semi-arid vegetation dynamics were evaluated to explain changes in the grassland of interior South Island, New Zealand. Annual records were taken for six years of plant species height frequency and percentage ground cover in five plots established in 1986. One subplot at each site was fenced to exclude sheep, one to exclude rabbits and sheep, and one remained unfenced as a control. Records from 1986-1992 were analysed by ordination. The overall pattern of vegetation change shows considerable year-to-year variation. At some sites, variation in vegetation composition between years was as great as, or greater than, that between grazed and ungrazed subplots. Such variation is particularly evident in grazed vegetation, perhaps because it is under greater stress than ungrazed vegetation. At one site changes in vegetation total cover and species composition could be statistically related to rainfall during the first half of the growing season. The only general trends following cessation of grazing were for perennials to increase in frequency, and for year-to-year changes to become smaller with time. Total vegetation cover values seldom changed as a result of cessation of grazing, but tended to follow year-to-year changes in species frequency. The results do not in general support switch/state-and-transition models of semi-arid vegetation dynamics. Vegetation change follows changes in grazing and climate with little lag. This most closely conforms with the Pulse-phase dynamic model.

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1193. Vegetation change following removal of keystone herbivores from desert grasslands in New Mexico.

Ryerson, Daniel E. and Parmenter, Robert R.

Journal of Vegetation Science 12(2): 167-180. (2001)

NAL Call #: QK900.J67; ISSN: 1100-9233

Descriptors: climatic conditions/ desert grasslands/ enclosure/ grazing/ keystone herbivore removal/ plant community response/ plant litter/ plant herbivore interaction/ site history/ vegetation change

Abstract: Responses of plant communities to mammalian herbivores vary widely, due to variation in plant species composition, herbivore densities, forage preferences, soils, and climate. In this study, we evaluated vegetation changes on 30 sites within and adjacent to the Sevilleta National Wildlife Refuge (SNWR) in central New Mexico, USA, over a 20-yr period following removal of the major herbivores (livestock and prairie dogs) in 1972-1975. The study sites were established in 1976, and were resampled in 1986 and 1996 using line transect methods. At the landscape scale, repeated measures ANOVA of percentage cover measurements showed no significant overall net changes in total perennial plant basal cover, either with or without

herbivores present; however, there was an overall increase in annual forbs and plant litter from 1976 to 1996. At the site scale, significant changes in species composition and dominance were observed both through time and across the SNWR boundary. Site histories varied widely, with sites dominated by *Bouteloua eriopoda* being the most dynamic and sites dominated by *Scleropogon brevifolius* being the most persistent. Species-specific changes also were observed across multiple sites: *B. eriopoda* cover increased while *Gutierrezia sarothrae* greatly decreased. The non-uniform, multi-directional changes of the sites' vegetation acted to prevent detection of overall changes in perennial vegetation at the landscape level. Some sites displayed significant changes after removal of herbivores, while others appeared to respond primarily to climate dynamics. Certain species that were not preferred by livestock or prairie dogs, showed overall declines during drought periods, while other preferred species exhibited widespread increases during wetter periods regardless of herbivore presence. Therefore, the vegetation dynamics cannot be attributed solely to removal of herbivores, and in some cases can be explained by short- and long-term fluctuations in climate. These results emphasize the variety of responses of sites with differences in vegetation to mammalian herbivores under otherwise similar climatic conditions, and illustrate the value of site- and landscape-scale approaches to understanding the impacts of plant-herbivore interactions.

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1194. Vegetation change in a man-made salt marsh affected by a reduction in both grazing and drainage.

Esselink, Peter; Fresco, Latzi F. M.; and Dijkema, Kees S. *Applied Vegetation Science* 5(1): 17-32. (2002)
NAL Call #: QK900 .A66; ISSN: 1402-2001

Descriptors: framework ordination: analytical method/ vegetation survey: survey method/ artificial drainage system/ drainage/ grazing/ habitats/ man made salt marsh/ permanent plots/ soil aeration/ soil salinity/ soil waterlogging/ species frequency/ species richness/ trampling/ vegetation change/ vegetation succession

Abstract: In order to restore natural salt marsh in a 460-ha nature reserve established in man-made salt marsh in the Dollard estuary, The Netherlands, the artificial drainage system was neglected and cattle grazing reduced. Vegetation changes were traced through two vegetation surveys and monitoring of permanent plots over 15 yr after the management had been changed. Exclosure experiments were started to distinguish grazing effects from effects of increased soil waterlogging caused by the neglect of the drainage system. Both vegetation surveys and permanent plots demonstrated a dichotomy in vegetation succession. The incidence of secondary pioneer vegetation dominated by *Salicornia* spp. and *Suaeda maritima* increased from 0 to 20%, whereas the late-successional (*Phragmites australis*) vegetation from 10 to 15%. Grazing intensity decreased towards the sea. The grazed area contracted landward, which allowed vegetation dominated by tall species to increase seaward. Grazing and increased waterlogging interacted in several ways. The impact of trampling increased, and in the intensively grazed parts soil salinity increased. This can probably be explained by low vegetation cover in spring. Framework Ordination, an indirect-gradient-analysis technique, was used to infer the importance of environmental factors in influencing changes

in species composition. Many changes were positively or negatively correlated with soil aeration and soil salinity, whereas elevation was of minor importance. Grazing accounted for only a few changes in species frequency. Changes in permanent plots were greater during the first than during the second half of the study period. In exclosures that were installed halfway through the study period, there was a relatively rapid recovery of previously dominant species that had decreased during the first half of the study period. Species richness per unit area in the reserve increased. At the seaward side of the marsh, the altered management allowed succession to proceed leading to establishment of stands of *Phragmites australis*, whereas on the landward side, the combination of moderate grazing with neglect of the drainage system appeared an effective measure in maintaining habitats for a wider range of halophytic species.

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1195. Vegetation change in an ombrotrophic mire in northern England after excluding sheep.

Smith, R. S.; Charman, D.; Rushton, S. P.; Sanderson, R. A.; Simkin, J. M.; and Shiel, R. S. *Applied Vegetation Science* 6(2): 261-270. (2003)
NAL Call #: QK900 .A66; ISSN: 1402-2001

Descriptors: grazing cessation/ ombrotrophic mire/ sheep exclusion impact/ site condition/ vegetation change
Abstract: The role of sheep grazing on vegetation change in upland mires removed from livestock farming and surrounded by conifer plantation was investigated with a grazing trial at Butterburn Flow in northern England. Paired grazed and ungrazed plots from central and peripheral locations were compared over 14 yr. Vegetation data from 34 mires in Kielder Forest provided an ordination framework within which vegetation trends were investigated. A gradient from dry moorland/hummock to wet mire/hollow vegetation dominated this framework and may reflect hydrological variability and structural vegetation differences between the mires. Some species were significantly affected by change in grazing intensity and there were differences between the edge and the centre of the mire. Overall vegetation change depended upon the grazing management and the position of the plots such that the removal of sheep grazing decreased the cover of species typical of wet ombrotrophic conditions, but only at the periphery of the mire. The vegetation in one plot became very similar to that of mires elsewhere in Kielder Forest where sheep were removed several decades ago. Cessation of grazing on upland mires is likely to lead to slow structural and species change in vegetation at the mire edge with a long-term loss of ombrotrophic species. The nature conservation significance of these changes will depend upon whether or not management objectives target natural conditions or wish to maximize ombrotrophic vegetation. The context of external factors such as climate and pollution may, however, be more important in determining site condition on the wettest mires.

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1196. Vegetation changes after 10 years of grazing exclusion and intermittent burning in a Themeda triandra (Poaceae) grassland reserve in south-eastern Australia.

Lunt, Ian D. and Morgan, John W.
Australian Journal of Botany 47(4): 537-552. (1999)
 NAL Call #: 450 Au72; ISSN: 0067-1924
Descriptors: adaptive management: management method/ vegetation change: grazing exclusion, intermittent burning
Abstract: Changes in the vegetation composition of a remnant Themeda triandra Forsskal grassland in southeastern Australia were documented following the replacement of stock grazing with intermittent burning at 3-11-year intervals. The vegetation was initially sampled in 1986, 1 year after stock were removed, and then 10 years later in 1996. Most frequently encountered grassland species were abundant in both surveys, although there was little correspondence between species richness at the quadrat scale in 1986 and 1996. Total floristic richness increased slightly over the 10-year period, owing to the proliferation of tall forbs with wind-blown seeds, including exotic thistles and colonising native forbs. Unfortunately, most native 'increasers' were 'weedy' species which are not typical or common components of species-rich temperate grassland remnants in southern Victoria. Thus, replacing grazing with intermittent burning has not resulted in the flora becoming more similar to that of high-quality, species-rich grassland remnants, but instead, has promoted a group of ruderal colonisers. The ability to identify factors contributing to particular botanical changes was hampered by the design of the management regimes implemented over the past decade. Suggestions are provided to overcome these difficulties, incorporating principles from adaptive management.

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1197. Vegetation changes following sheep grazing in abandoned mountain meadows.

Krahulec, Frantisek; Skalova, Hana; Herben, Tomas; Hadincova, Vera; Wildova, Radka; and Pechackova, Sylvie
Applied Vegetation Science 4(1): 97-102. (2001)
 NAL Call #: QK900 .A66; ISSN: 1402-2001
Descriptors: abandoned mountain meadows/ ecosystem restoration/ vegetation succession
Abstract: Sheep grazing was investigated as an alternative to traditional management of meadows in the Krkonose Mts. Until the second World War these meadows were mown in mid-summer and grazed by cattle for the rest of the season. Subsequent abandonment of the meadows has resulted in decreasing species richness. Degradation phases of the former communities have been replacing the original species-rich vegetation. Significant changes were apparent six years after the introduction of sheep grazing. In grazed plots the proportion of dominant herbs (*Polygonum bistorta* and *Hypericum maculatum*) decreased and grasses (*Deschampsia cespitosa*, *Festuca rubra*, *Agrostis capillaris*, *Anthoxanthum alpinum*) increased. The increase in grasses was positively correlated with an increase in several herbs. The proportion of some herbs increased despite being selectively grazed (*Adenostyles alliariae*, *Melandrium rubrum*, *Veratrum lobelianum*). Any losses caused by grazing of mature plants were probably compensated by successful seedling establishment. Cessation of grazing resulted in significant changes in vegetation within three years. The cover of nitrophilous tall

herbs and grasses (e.g. *Rumex alpestris*, *Holcus mollis*, *Deschampsia cespitosa*, *Geranium sylvaticum*) increased in the abandoned plots. In the plots grazed for nine years cover of species-rich mountain meadow species increased (e.g. fine-leaved grasses, *Campanula bohemica*, *Potentilla aurea*, *Viola lutea*, *Silene vulgaris*). The main conservation risk is the expansion of a competitive species with low palatability, *Deschampsia cespitosa*. This species can be suppressed by a combination of grazing and mowing. In order for grazing to be effective, the number of sheep should be proportional to meadow production. This may be difficult to maintain as production is variable and is impossible to predict at the beginning of a growing season. A large part of the biomass may thus remain intact in some years. Negative effects of grazing may be, at least partly, eliminated by a combination of cutting and grazing.
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1198. Vegetation changes in relation to livestock exclusion and rootplowing in southeastern Arizona.

Roundy, B. A. and Jordan, G. L.
Southwestern Naturalist 33(4): 425-436. (1988)
 NAL Call #: 409.6 SO8; ISSN: 0038-4909
Descriptors: grasslands/ livestock/ roots/ plowing/ deserts/ plant density/ ecological succession/ grazing/ Arizona
 This citation is from AGRICOLA.

1199. Vegetation development after the exclusion of grazing cattle in meadow area in the south of Sweden.

Persson, S.
Vegetatio 55(2): 65-92. (1984)
 NAL Call #: 450 V52; ISSN: 0042-3106
Descriptors: succession/ environmental gradients/ moisture/ management history
Abstract: A 24 yr study of secondary succession was based on data from semi-permanent quadrats from investigations in 1952, 1955, 1968 and 1976, involving 2 exclosures, the first in a meadow grazed for hundreds of years but now abandoned, the second in a meadow mowed for hundreds of years and grazed for the last 50 yr. A 1st order classification of quadrats produced units, which formed distinct spatial patterns indicating similar gradients, but also differences in response to the ceased grazing, in the 2 exclosures. A 2nd order classification of units into groups revealed a rather simple structure of spatial and temporal relations. Eleven groups of species with similar behavior could be recognized within a system of spatial and temporal species distributions. The vegetation in both exclosures developed towards an increased differentiation and heterogeneity or patchiness. The border between 2 soil types was clearly reflected in the spatial pattern of units. Rates of change were greatest in the beginning and were shown to closely follow logarithmic functions of time. The average number of species per m² decreased in all plots, in some cases as much as 50%. The diversity decreased as a consequence of decreased species richness, decreased evenness and decreased pattern diversity. Many individual species distributions showed a pattern of nuclei surrounded with marginal belts. Differences in rate of change and persistence of spatial patterns between the plots could be attributed to the differences in management history. These differences disappeared as the succession proceeded. The 2 exclosures instead both conformed to the same floristic gradient, in turn based on a similar pattern of environmental gradients, primarily moisture. In the observed changes the

emphasis was on the shifting importance of competing species populations, as some gained in importance at the expense of others. Competition has so far been a more important process in the vegetation development than immigration/extinction rates.

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1200. Vegetation development influenced by grazing in the coastal dunes near The Hague, The Netherlands.

De Bonte, A. J.; Boosten, A.; Van Der Hagen, Hgjm; and Sykora, K. V.

Journal of Coastal Conservation 5(1): 59-68. (1999)

NAL Call #: GC1080; ISSN: 1400-0350

Descriptors: detrended correspondence analysis: statistical method/ twinspan: classification method/ coastal sand dune system/ grazing/ nature management/ vegetation development

Abstract: In 1990, grazing was introduced in a section of Meijendel, a coastal sand dune system near The Hague, The Netherlands. After five years an evaluation was made of the effects of grazing on vegetation development. Three transects were established, two in grazed areas and one in an ungrazed area. Field survey data were classified by means of TWINSpan, ordinated with Detrended Correspondence Analysis and the resulting vegetation types interpreted according to Westhoff and den Held (1969). All associations were found in both the grazed and the ungrazed areas, but at the subassociation and variant level some communities appeared to be restricted to the grazed area. These variants were five grassland variants characterized by disturbance indicators such as *Senecio sylvaticus* and *Cynoglossum officinale*. The total number of plant species in the 19 permanent plots, which had been observed to have been decreasing since 1960, showed a considerable increase after the introduction of horses and cows in 1990. A marked decrease in the cover of *Calamagrostis epigejos* and *Carex arenaria* since 1990 was evident, while in some plots species such as *Ribes rubrum* and *Viburnum opulus* increased considerably. A series of false-colour aerial photographs were used to compare vegetation structure in the three transects between 1990 and 1995. In the grazed area the tall grass vegetation had almost totally disappeared, whereas the areas of open sand, sand with moss and lichens, and low grass vegetation had increased and the pattern had become more fine-grained. In the ungrazed area the area covered by low grass vegetation had increased at the expense of the area of sand with moss and lichens and the pattern had become more coarse-grained.

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1201. Vegetation development over 25 years without grazing on sagebrush-dominated rangeland in southeastern Idaho.

Anderson, J. E. and Holte, K. E.

Journal of Range Management 34(1): 25-29. (1981)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1981/341/7ande.pdf>

Descriptors: Idaho

This citation is from AGRICOLA.

1202. Vegetation dynamics and plant species interactions under grazed and ungrazed conditions in a western European salt marsh.

Tessier, M.; Vivier, J. P.; Ouin, A.; Gloaguen, J. C.; and Lefeuvre, J. C.

Acta Oecologica 24(2): 103-111. (2003)

NAL Call #: QH540.A27; ISSN: 1146-609X

Descriptors: salt marshes/ vegetation/ grazing/ species diversity/ plant populations/ vegetation cover/ population structure/ biomass/ dominant species/ ecological succession/ fertilizers/ nitrogen/ enclosures/ Suaeda maritima/ Puccinellia maritima/ Salicornia europaea/ Halimione portulacoides/ France/ halophytes

Abstract: Experiments in enclosures were conducted on a salt marsh in a macrotidal system in western France. The aim of this study was threefold: (1) to compare vegetation dynamics over a period of 8 years in grazed and ungrazed conditions (2) to investigate the response of annual species to grazing duration during seedling establishment (3) to test the effect of an increase in soil nitrogen availability after cessation of grazing on interactions between *Suaeda maritima* and *Puccinellia maritima*. In grazed conditions, during all the survey, vegetation was dominated by a short *P. maritima* sward with the annual *Salicornia europaea* in the lower and middle marshes. However, after cessation of grazing in 1994, a homogeneous matrix of the forb *Halimione portulacoides*, quickly replaced *P. maritima* in the well drained lower marsh. At the middle marsh level, fine sediment and poor drainage maintained *P. maritima* while the annual *S. maritima* which tolerates taller and denser vegetation replaced *S. europaea*. *Elymus pungens* cover was limited till 2000 but its rising in 2001 let expect its dominance in the future. While *P. maritima* abundance remained high, spring abundance of annual species such as *S. europaea* and *S. maritima* globally decreased with sheep grazing duration on the salt marsh between February and June. Experiments with monocultures of *P. maritima* and *S. maritima* demonstrated that nitrogen was a limiting factor on the salt marsh. In a mixed community, a moderate application of nitrogen (15 g N m⁻² year⁻¹) as NH₄⁺-NO₃⁻ promoted growth of *P. maritima* and limited the biomass of *S. maritima*, but growth of the latter was enhanced by a high application of nitrogen (30 g N m⁻² year⁻¹). An increase in the abundance of annuals such as *S. maritima* on the salt marsh is discussed.

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1203. Vegetation of exclosures in southwestern North Dakota.

Brand, M. D. and Goetz, H.

Journal of Range Management 39(5): 434-437. (1986)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1986/395/14bran.pdf>

Descriptors: grasslands/ botanical composition/ ecological succession/ range management/ North Dakota

This citation is from AGRICOLA.

1204. Vegetation response on allotments grazed under rest-rotation management.

Eckert, R. H. and Spencer, J. S.

Journal of Range Management 39(2): 166-174. (1986)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1986/392/18ecke.pdf>

Descriptors: range management/ plant communities/ ecological succession/ rotational grazing/ botanical composition/ vegetation/ grazing/ rangelands/ Nevada
This citation is from AGRICOLA.

1205. Vegetation response to cattail management at Cheyenne Bottoms, Kansas.

Kostecke, R. M.; Smith, L. M.; and Hands, H. M.

Journal of Aquatic Plant Management 42(1): 39-45. (2004)

NAL Call #: SB614.H9; ISSN: 0146-6623

Descriptors: plant control/ wetlands/ fire/ grazing/ population density/ aquatic plants/ species diversity/ habitat improvement (biological)/ aquatic birds/ vegetation cover/ plant populations/ ecosystem management/ environment management/ migratory species/ cattails/ incineration/ wildlife/ density/ vegetation/ biomass/ birds/ habitats/ Typha/ Aves/ USA, Kansas/ birds/ Cheyenne Bottoms Wildlife Area

Abstract: Dense, monospecific cattail (*Typha* spp.) stands are a problem in many prairie wetlands because they alter habitat structure and function, resulting in a decrease in use by wildlife species. Cheyenne Bottoms Wildlife Area, a Wetland of International Importance in central Kansas, has experienced a large increase in cattails and a subsequent decrease in migratory wetland bird use. As a consequence, intensive cattail management is practiced. We assessed the effectiveness of prescribed burning, discing following prescribed burning, and cattle grazing following prescribed burning at two stocking rates of 5 and 20 head per 11 ha in suppressing cattail, as well as the effects of these treatments on non-cattail vegetation. The disced and high-intensity (20 head per 11 ha) grazed treatments resulted in the lowest cattail densities and biomass. Implementation of these treatments, however, was at the expense of the non-cattail aquatic plant community. Species richness and diversity, and non-cattail shoot density and biomass, were generally lowest in these treatments. In managed wetlands where cattail reduction is the objective, we recommend discing or high-intensity grazing following prescribed burning to improve wildlife use, at least in the short-term, as they suppressed cattail more effectively than burning alone or low-intensity (5 head per 11 ha) grazing.

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1206. Vegetation response to cattle grazing in the Ethiopian highlands.

Mwendera, E. J.; Saleem, M. A. M.; and Woldu, Z.

Agriculture, Ecosystems & Environment 64(1):

43-51. (1997)

NAL Call #: S601 .A34; ISSN: 0167-8809

Descriptors: biomass yield/ botanical composition/ cattle grazing/ net primary production/ species richness/ vegetation cover

Abstract: The effect of grazing cattle on vegetation was studied on a natural pasture during the rainy and dry seasons of 1995 in the Ethiopian highlands. The study used 0.01 ha plots, established on 0-4% and 4-8% slopes located close to each other at Debre Zeit research station, 50 km South of Addis Ababa. The grazing regimes were:

light grazing stocked at 0.6 animal-unit-month per hectare (AUM ha⁻¹); moderate grazing stocked at 1.8 AUM ha⁻¹; heavy grazing stocked at 3.0 AUM ha⁻¹; very heavy grazing stocked at 4.2 AUM ha⁻¹; very heavy grazing on ploughed pasture stocked at 4.2 AUM ha⁻¹; and a control of 'no grazing'. Heavy grazing significantly reduced vegetative cover and biomass yields, especially on steeper slopes. Light to heavy grazing did not affect the botanical composition of the vegetation at both sites, but very heavy grazing resulted in species normally less preferred by animals dominating the botanical composition. Grazing did not have significant effect on ground vegetative cover on the 0-4% slope except at very heavy grazing pressure, but on the 4-8% slope even moderate grazing significantly reduced vegetative cover. Light to moderate grazing at the beginning of the dry period enhanced plant biomass productivity, while any grazing reduced plant productivity during the periods of reduced growth. Species richness increased with increasing grazing pressure compared with no grazing, but decreased sharply at very heavy grazing pressure. We concluded that there is need for developing 'slope and time specific' grazing management practices, and to assess short and long term effects of grazing and trampling on vegetation.

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1207. Vegetation response to continuous versus short duration grazing on sandy rangeland.

Dahl, B. E.; Cotter, P. F.; Dickerson, R. L.; and

Mosley, J. C.

Texas Journal of Agriculture and Natural Resources 5: 73-81. (1992)

NAL Call #: S1.T49; ISSN: 0891-5466

Descriptors: beef cattle/ steers/ pasture plants/ pastures/ stocking rate/ botanical composition/ forage/ yields/ range management/ climatic factors/ sandy soils/ Texas
This citation is from AGRICOLA.

1208. Vegetation response to grazing management in a Mediterranean herbaceous community: A functional group approach.

Sternberg, Marcelo; Gutman, Mario; Perevolotsky, Avi;

Ungar, Eugene D.; and Kigel, Jaime

Journal of Applied Ecology 37(2): 224-237. (2000)

NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: mediterranean herbaceous community/ climatic conditions/ community composition/ community structure/ functional types/ grazing effects/ grazing management/ grazing regime/ inter seasonal rainfall variation/ plant cover/ species richness/ vegetation response

Abstract: 1. A 4-year study was conducted in a Mediterranean herbaceous community in north-eastern Israel to investigate the effects of cattle grazing management on the structure and composition of the community. Understanding the effects of grazing on the dynamics of Mediterranean herbaceous communities is important in formulating rational management plans for both conservation and sustainable animal production. 2. The relationships among plant functional groups were studied in the context of inter-annual variation in rainfall. Treatments included manipulations of stocking rates (moderate, heavy and very heavy) and grazing regimes (continuous vs. seasonal), in a factorial design. 3. The herbaceous community was rich in species, with 166 species recorded

at the site, of which 74% were annuals. Plant cover was dominated by 10 species that accounted for 75% of the total cover. 4. Inter-seasonal rainfall variation was a dominant factor in the expression of different grazing treatments on the structure of the plant community. Grazing effects were stronger in wet years than in dry years. 5. Paddocks under continuous grazing were higher in number of species compared with paddocks subjected to seasonal grazing, independently of grazing intensity. 6. Functional group analyses showed that reduction in cover of tall grasses was correlated with an increase in cover of prostrate annual legumes and less palatable groups such as annual and perennial thistles, crucifers and forbs. 7. Cover of functional groups composed of hemicryptophytic species was less variable (lower coefficient of variation) in response to grazing treatments and inter-annual variation in climatic conditions compared with functional groups with annual species. 8. The persistence of the dominant species and the relatively small amplitude of change in plant cover of the functional groups suggest that the community was rather stable in spite of wide variation in grazing regimes and climatic conditions. East-Mediterranean grasslands appear to be adapted to grazing due to their long history of human association.

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1209. Vegetation response to increased stocking rates in short-duration grazing.

Ralphs, M. H.; Kothmann, M. M.; and Taylor, C. A. *Journal of Range Management* 43(2): 104-108. (1990)
NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1990/432/5ralp.pdf>

Descriptors: cattle/ stocking rate/ grazing/ plant density/ botanical composition/ pastures/ forage/ Texas
Abstract: Short-duration grazing (SDG) has been purported to increase forage production and utilization compared to other grazing systems, and thus can sustain higher stocking rates. This study was designed to determine if standing crop could be maintained as stocking rates increased. Four stocking rate treatments ranging from the recommended rate for moderate continuous grazing to 2.5 times the recommended rate were applied in a simulated 8-pasture SDG system. There was little change in frequency and composition of short-grasses over the study, but mid-grass frequency and composition both declined. Standing crop of all major forage classes declined as stocking rates increased. However, the rate of decline was less than proportional to the increase in stocking rate during the growing season. By fall, standing crop was inversely proportional to stocking rate, leading us to conclude that standing crop could not be maintained at the higher stocking rates. Low standing crop in the fall indicated a potential shortage of forage at the high stocking rates during the winter.

This citation is from AGRICOLA.

1210. Vegetation response to increasing stocking rate under rotational stocking.

Taylor, C. A.; Ralphs, M. H.; and Kothmann, M. M. *Journal of Range Management* 50(4): 439-442. (1997)
NAL Call #: 60.18 J82; ISSN: 0022-409X
http://jrm.library.arizona.edu/data/1997/504/439-443_taylor.pdf

Descriptors: botanical composition/ rotational grazing/ stocking rate/ vegetation/ grazing/ overgrazing/ grazing systems/ grazing intensity/ grasslands/ rangelands/ palatability/ *Digitaria cognata*/ *Bothriochloa edwardsiana*/ *Panicum obtusum*

Abstract: A 10-year study was designed to evaluate vegetation response to increasing stocking rates under rotational stocking (3 days grazing, 51 days resting) and long-term resting. The 4 stocking rate treatments ranged from the recommended rate for moderate continuous grazing to 2.7-fold the recommended rate. Common curly-mesquite [*Hilaria belangeri*] increased in all grazed treatments and decreased in the livestock enclosure. Sideoats grama (*Bouteloua curtipendula*) along with other midgrasses (*Digitaria cognata*, *Bothriochloa edwardsiana*, *Panicum obtusum* and *Bothriochloa ischaemum*) decreased in all grazed treatments and increased in the livestock enclosure. Because the midgrasses were palatable species and not abundant, they were grazed too intensively and too frequently. Rotational stocking was not able to sustain initial species composition at any of the stocking rates tested.

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1211. Vegetation response to stocking rate in southern mixed-grass prairie.

Gillen, R. L.; Eckroat, J. A.; and McCollum, F. T. *Journal of Range Management* 53(5): 471-478. (2000)
NAL Call #: 60.18 J82; ISSN: 0022-409X
http://jrm.library.arizona.edu/data/2000/535/471-478_gillen.pdf

Descriptors: beef cattle/ stocking rate/ biomass/ botanical composition/ *Bouteloua curtipendula*/ forbs/ *Aristida purpurea* var. *longiseta*/ *Aristida purpurea*/ rain/ *Bothriochloa*/ grasses/ ecological succession/ Oklahoma
Abstract: Stocking rate directly influences the frequency and intensity of defoliation of individual plants which, in turn, impacts energy flow and plant succession in grazed ecosystems. The objective of this study was to determine the effect of stocking rate on standing crop dynamics and plant species composition of a southern mixed-grass prairie over a 7-year period (1990 through 1996). Long-term (30-year) mean precipitation has been 766 mm per year. Growing conditions were generally favorable for the study period. Yearling cattle (initial weight 216 kg, SD = 12 kg) grazed at 6 stocking rates, ranging from 23 to 51 AUD ha⁻¹, from 14 April to 24 September (162 days). The currently suggested year-long stocking rate is 25 AUD ha⁻¹. Herbage standing crop was measured in July and September every year while species composition was determined in July in even years. Total and dead standing crop declined as stocking rate increased but live standing crop was not related to stocking rate. Slopes of regression lines relating standing crop and stocking rate were constant over years, indicating no response for plant productivity. The major vegetation components, sideoats grama [*Bouteloua curtipendula* (Mich.) Torr.], shortgrasses, and forbs were not affected by stocking rate over years. Tallgrasses responded by increasing at the lower stocking rates over the study period. However, these grasses contributed less than 5% of the total standing crop. Red and purple threeawn (*Aristida longiseta* Steud. and *A. purpurea* Nutt.) increased at all stocking rates from 1990 to 1996 but the increase was greater at the lower stocking rates. This mixed-grass vegetation showed little response to stocking rate over the 7-year study period. The vegetation may have

been in equilibrium with previous heavy stocking rates so that little change would be expected at those rates. Increases in grazing sensitive species at lighter stocking rates may occur over longer time intervals. This citation is from AGRICOLA.

1212. Vegetation response to the Santa Rita grazing system.

Martin, S. C. and Severson, K. E.
Journal of Range Management 41(4): 291-295. (1988)
 NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1988/414/5mart.pdf>
Descriptors: semidesert grassland/ grass density/ USA/ rotation grazing/ shrub intercept
Abstract: Changes in vegetation under yearlong grazing were compared with those under the Santa Rita grazing system, a rotation system designed for southwestern US rangelands where 90% of the forage is produced in mid- to late-summer. The study was conducted on the Santa Rita Experimental Range near Tucson, Arizona [USA] from 1972 to 1984. In 1984 there were no differences ($P < 0.05$) in grass densities (16 vs. 17 to 18 plants/m²), forb densities (0.6 vs 0.7 to 1.4 plants/m²), or shrub densities (2.0 vs 1.9 to 2.4 plants/m²), or shrub cover (20 vs 21 to 26%) on pastures grazed yearlong or in the Santa Rita rotation, respectively. Lack of response to grazing schedules is attributed to initial plant densities near the maximum the sites could support and to moderate grazing during the study period. Average herbage yields of pastures were not related significantly to grazing treatments but correlated strongly ($r = 0.909$) with long-time summer rainfall means. Results support the observation that rotation grazing may not improve ranges that are in good condition. It is concluded, however, that the Santa Rita Grazing System may accelerate recovery of ranges in poor condition.
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1213. Vegetation response to time-controlled grazing on mixed and fescue prairie.

Willms, W. D.; Smoliak, S.; and Dormaar, J. F.
Journal of Range Management 43(6): 513-517. (1990)
 NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1990/436/8will.pdf>
Descriptors: cattle/ stocking rate/ prairies/ Festuca/ botanical composition/ regrowth/ crop yield/ forage/ root systems/ grazing/ Alberta
 This citation is from AGRICOLA.

1214. Vegetation responses to long-term sheep grazing on mountain ranges.

Bowns, J. E. and Bagley, C. F.
Journal of Range Management 39(5): 431-434. (1986)
 NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1986/395/13bown.pdf>
Descriptors: sheep/ vegetation/ long term experiments/ grazing/ Utah
 This citation is from AGRICOLA.

1215. Vegetation restoration by seasonal enclosure in the Kerqin Sandy Land, Inner Mongolia.

Katoh, Kazuhiro; Takeuchi, Kazuhiko; Jiang, Deming; Nan, Yin hao; and Kou, Zhenwu
Plant Ecology 139(2): 133-144. (1998)
 NAL Call #: QK900.P63; ISSN: 1385-0237

Descriptors: desertification/ grazing control/ seasonal enclosure/ species composition/ vegetation restoration
Abstract: Grazing control has been reported to be effective for the control of desertification in semi-arid regions. However, economic reasons often make complete inhibition of grazing (complete enclosure) difficult to carry out. Grazing control has been applied to the Kerqin Sandy Lands, Inner Mongolia, China, by means of seasonal enclosure, whereby grazing is allowed from November to April. The harvesting of hay is also allowed once during September - October. The aim of the reported study was to evaluate the effectiveness of this seasonal enclosure on vegetation restoration. Species compositional data were obtained from 356 quadrats and ordinated by Detrended Correspondence Analysis (DCA). Ordination indicated that landform was the most important factor influencing the species composition of the vegetation. Regardless of landform and type of grazing control, however, vegetation coverage, vegetation height and species richness were higher at sites where grazing had been controlled, than at sites lacking any control. Perennial species were dominant at the former while annual species were dominant at the latter. Both shrub and tree species were quite rare at the sites where seasonal enclosure had been carried out. It is concluded that seasonal enclosure is sufficient to restore and maintain grassland vegetation in and around the study area. When shrubby or tree vegetation is needed for reasons such as fixing sands or preventing sand dune remobilization, complete enclosure is recommended.
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1216. Vegetation, soil hydrophysical properties, and grazing relationships in saline-sodic soils of central Argentina.

Cisneros, J. M.; Cantero, J. J.; and Cantero, A.
Canadian Journal of Soil Science 79(3): 399-409. (1999)
 NAL Call #: 56.8 C162; ISSN: 0008-4271
Descriptors: drainage/ enclosure/ grazing relationships/ infiltration/ runoff/ saline sodic soil/ soil hydrophysical properties/ vegetation
Abstract: Land use and grazing regime can influence the dynamic of soil water and salt in humid areas. In Central Argentina, more than 2 X 10⁶ ha are subjected to either permanent or cyclical processes of land salinization, alkalization, flooding and sedimentation. In this region, the natural vegetation is the principal resource on which most systems of animal production are based. The objective of this study was to evaluate the effects of plant cover and grazing over some hydrophysical properties of three saline-sodic soils (two Gleic Solonetz in duripan phase and one Mollic Solonetz in fragipan phase), within a catena sequence. The effects on bulk density, saturated hydraulic conductivity, infiltration runoff, superficial salt accumulation and soil salinity distribution were determined in both bare and covered soil conditions, inside and outside of grazing enclosures. The results showed increased bulk density of topsoil for bare conditions, while saturated hydraulic conductivity did not show significant differences. In soils without any cover, the infiltration decreased significantly. Consequently, the runoff coefficient and salinity were greater, as indicated by significant salt accumulation in the topsoil. The soil profile salinity was reduced as a function of enclosure time, showing a trend toward desalinization resulting from a combined effect of soil cover and changes in intensity of land use. A conceptual model of salt and

water dynamics in the soil profile for the landscape scale is postulated. The role of vegetation in regulating water and salt movement in poorly drained areas is emphasised as a basis for the development of management strategies.

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1217. Vegetation trends within rest-rotation and season-long grazing systems in the Missouri River breaks.

Watts, C. R.; Eichhorn, L. C.; and Mackie, R. J.
Journal of Range Management 40(5): 393-396. (1987)
NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1987/405/3watt.pdf>

Descriptors: cattle/ canopy coverage/ exclosures/ soil cover

Abstract: Trends in canopy-coverage of vegetation and bare ground were measured inside and outside exclosures on recent burns within three-pasture rest-rotation and season-long grazing systems over a 10-year period.

Results suggested that rest-rotation grazing may maintain vegetation and soil cover somewhat comparable to ungrazed cattle exclosures on rough breaks-type range in north-central Montana. Season-long grazing may not maintain satisfactory vegetation and soil cover in the area.

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1218. Vegetational response to short-duration and continuous grazing in southcentral New Mexico.

White, M. R.; Pieper, R. D.; Donart, G. B.; and Trifaro, L. W.
Journal of Range Management 44(4): 399-403. (1991)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1991/444/20whit.pdf>

Descriptors: Bouteloua gracilis/ vegetation/ cattle/ grazing intensity/ biomass/ botanical composition/ stocking rate/ pastures/ range management/ grazing/ vegetation cover/ New Mexico

Abstract: Vegetational response of a nine-paddock, short-duration grazing cell was compared to that of a continuous pasture for a 5-year period in southcentral New Mexico. Differences in vegetational response to short-duration and continuous grazing on blue grama rangeland were small. Basal plant cover was slightly higher for the short-duration pastures, but end-of-season standing crop of all species was similar for both systems. Blue grama aboveground productivity and basal cover were higher for the short-duration pastures than for the continuously-grazed pasture. Possible short-term results from short-duration grazing include slightly higher stocking rates and a positive response of blue grama.

This citation is from AGRICOLA.

1219. Vertical distribution of below-ground biomass in intensively grazed mesic grasslands.

Rodriguez, M. A.; Alvarez, J.; and Gomez Sal, A.
Journal of Vegetation Science 7(1): 137-142. (1996)

NAL Call #: QK900.J67; ISSN: 1100-9233

Descriptors: species diversity/ grassland management/ biomass/ altitude/ grasslands/ mountain grasslands/ Mediterranean grasslands/ grazing/ grazing intensity/ botanical composition/ roots/ distribution

Abstract: Eight grasslands at 4 grassland sites distributed along an altitudinal gradient were investigated in the Cantabrian Mountains, NW Spain during 1988, the upper and lower zones of a slope being sampled at each site. Four of these grasslands were grazed by livestock and the

other 4 were grazed and mown. Biomass was assessed in above-ground, root crown and 3 root layers. Species composition varied according to management and topography. Annuals and perennial forbs had relatively more above-ground biomass at the upper part of the slopes, while perennial grasses dominated the lower parts. The above-ground biomass and root biomass at 4-7 cm depth attained maximum values in the lower, potentially more fertile, parts of the slopes, while crown biomass increased with altitude. Despite their differences in composition and structure, 7 stands showed a remarkable concentration of below-ground biomass near the soil surface which decreased drastically with soil depth. This similarity was more evident in the more mesic-like grasslands, since it increased from the upper (potentially drier) parts of the slopes, to the lower parts, and, when each topographic position was considered separately, from low to high altitudes.

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1220. Wild ungulate influences on the recovery of willows, black cottonwood and thin-leaf alder following cessation of cattle grazing in northeastern Oregon.

Case, Richard L. and Kauffman, J. Boone
Northwest Science 71(2): 115-126. (1997)

NAL Call #: 470 N81; ISSN: 0029-344X

Descriptors: biomass/ black cottonwood/ conservation/ crown volume/ ecosystem restoration/ grazer/ grazing/ habitat degradation/ herbivore/ northeastern region/ salmonid habitat recovery/ seedling establishment/ thin leaf alder/ tree recovery

Abstract: Restoration of degraded riparian ecosystems is of great importance for the recovery of declining and endangered stocks of Columbia River salmonids as well as riparian-obligate wildlife species. Willows (*Salix* spp.), thin-leaf alder (*Alnus incana*), and black cottonwood (*Populus trichocarpa*) are important features of western riparian ecosystems having multiple functional roles that influence biological diversity, water quality/quantity, and aquatic/terrestrial food webs and habitats. Removal of domestic livestock and the construction of big game enclosures have been hypothesized to be effective restoration techniques for riparian ecosystem as well as for salmonid habitat recovery. Following more than a century of livestock grazing, cattle were removed from Meadow Creek in 1991 and the rates of riparian shrub recovery were measured for the two years following. Elk and deerproof enclosures were constructed to quantify the browsing influences of native large ungulates. The initial mean height of 515 deciduous trees and shrubs (14 species) was 47 cm. After two years in the absence of livestock, significant increases in height, crown area, crown volume, stem diameter and biomass were measured both outside and inside of the enclosures. Mean crown volume of willows increased 550% inside of wild ungulate exclosures and 195% outside. Black cottonwood increased 773% inside and 808% outside, while thin-leaf alder increased 1046% inside and 198% outside. Initial shrub densities on gravel bars were low averaging 10.7 woody plants/100m². Shrub numbers significantly increased approx 50% (to 15.8 plants/100m² m or one new shrub for every 9 meters of transect length) outside of elk and deer proof enclosures through both clonal and seedling establishment. At the beginning of the study (1991), catkin production on willows was low (i.e., only 10% produced catkins). Wild herbivores

had a significant influence on the reproductive output of willows; in 1993 catkins were produced by 34% of the tagged willows within enclosures but only 2% outside of enclosures. Wild herbivores were found to have significant influences on the rate of height growth of black cottonwood. For willows, wild herbivores had a significant influence on the rate of growth for the parameters of height, crown area, crown volume, and standing biomass. Nevertheless, due to the inherent resilience and adaptations to natural disturbance processes displayed by the riparian species, there was a rapid and positive response to cessation of those land use activities (i.e., cattle grazing) that caused habitat degradation and/or were preventing recovery.

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1221. Wildfire effects and post-fire responses of an invasive mesquite population: The interactive importance of grazing and non-native herbaceous species invasion.

Kupfer, John A. and Miller, Jay D.

Journal of Biogeography 32(3): 453-466. (2005)

NAL Call #: QH1.J62; ISSN: 0305-0270

Descriptors: Chihuahuan semi desert grassland/ madrean evergreen woodland/ grazing/ savanna/ wildfire

Abstract: Aim To determine how responses of an established velvet mesquite (*Prosopis velutina* Woot.) population to a 2002 wildfire were shaped by grazing and non-native herbaceous species invasions, both of which influenced fire behaviour. Location The study was conducted on contiguous ranches (one actively grazed by cattle, one that had not been grazed since 1968) in the Sonoita Valley of southern Arizona. Plant communities on both ranches were comprised of Chihuahuan semi-desert grassland, savanna, and Madrean evergreen woodland ecosystems, but large areas were dominated by Lehmann and Boer lovegrass, African grass species that were introduced more than 50 years ago. Methods We selected 243 individuals that had been defoliated and bark scorched during the fire using a stratified random design based on pre-fire grazing status and dominant grass cover. After the start of the 2003 growing season, we recorded individual tree characteristics, fire damage, and measures of post-fire response, and tested for relationships among classes of: grazing status, bark damage, dominant grass cover type, abundance of live and dead aboveground branches, flowering status, and sprout number and size. Analyses of fire damage and post-fire response were interpreted with respect to values of fireline intensity, scorch height and energy release that were projected by a fire behaviour model, nexus. Results Nearly all of the trees on grazed areas suffered low levels of fire damage, while a majority on ungrazed areas suffered moderate to severe damage. Trees on grazed areas consequently had significantly more leaf-bearing twigs and branches in 2003 but a very low number of root sprouts, while individuals on ungrazed areas had a greater density of root sprouts but little post-fire dead branching and almost no living branches. Among the ungrazed grassland types, more than 75% of the trees on Boer lovegrass plots suffered moderate to severe damage, while a similar percentage of trees in native grass areas suffered low damage. These differences were: (1) attributed to variations in fire characteristics that were caused by differences in litter production and removal, and (2) ecologically significant because trees in the severe damage class showed almost no aboveground post-fire branching,

either live or dead in 2003, while trees in the low damage class exhibited a greater amount of both. Main conclusions Our results affirm the notion that effective management of western grasslands where mesquite encroachment has or will become a problem requires a better understanding of how interactions among key ecosystem influences (e.g. fire, grazing, non-native species) affect not only mesquite seedlings and saplings but also larger, established individuals and thereby the long-term structure and functioning of semi-desert grassland ecosystems. As managers shift their focus from eradication to management of mesquite in western grasslands and savannas, our results provide insights into how prescribed fires (and their effects on mesquite populations) differ from wildfires and how such effects may be mediated by the altered land uses and ecosystem characteristics that now exist in many western ecosystems.

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1222. Willow planting success as influenced by site factors and cattle grazing in northeastern California.

Conroy, S. D. and Svejcar, T. J.

Journal of Range Management 44(1): 59-63. (1991)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1991/441/13conr.pdf>

Descriptors: cattle/ Salix/ grazing intensity/ mortality/ plant communities/ soil water content/ water table/ riparian buffers/ grazing/ California

This citation is from AGRICOLA.

Other Relevant Studies

Soil and Water Effects

1223. Effect of compaction simulating cattle trampling on soil physical characteristics in woodland.

Ferrero, A. F.

Soil and Tillage Research 19(2-3): 319-329. (1991)

NAL Call #: S590.S48; ISSN: 0167-1987

Descriptors: soil physics/ physical properties/ soil compaction/ trampling/ forest soils/ soil/ soil density/ soil water/ infiltration/ soil chemistry/ soil organic matter/ grazing/ ecology

Abstract: Changes in the physical, chemical and hydrological properties of a silt loam soil under deciduous coppiced woodland as a result of different intensities of compaction were studied. Repeated compaction only affected organic matter content and the bulk density of the topsoil. However compaction did reduce the infiltration capacity and increase the penetration resistance of the soil. Root development, dry root and green matter production were significantly affected by repeated compaction, especially in *Phleum pratense*. Assessment of the effectiveness of the techniques used in the analysis indicated that measurements of infiltration and penetration resistance were the most significant. Growth tests were effective only with species sensitive to compaction and only up to 50 days, after sowing.

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1224. Infiltration and runoff water quality response to silvicultural and grazing treatments on a longleaf pine forest.

Wood, J. C.; Blackburn, W. H.; Pearson, H. A.; and Hunter, T. K.

Journal of Range Management 42(5): 378-381. (1989)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1989/425/7wood.pdf>

Descriptors: coniferous forests/ silviculture/ grazing/ interrill erosion/ water quality/ losses from soil/ runoff/ Louisiana
This citation is from AGRICOLA.

1225. Livestock grazing management impacts on stream water quality: A review.

Agouridis, C. T.; Workman, S. R.; Warner, R. C.; and Jennings, G. D.

Journal of the American Water Resources Association 41(3): 591-606. (2005)

NAL Call #: GB651.W315; ISSN: 1093-474X

Descriptors: streams/ grazing/ water quality/ livestock/ nonpoint pollution sources/ reviews/ best management practices/ hydraulics/ nonpoint pollution/ pollution effects/ agricultural pollution/ USA/ grazing

Abstract: Controlling agricultural nonpoint source pollution from livestock grazing is a necessary step to improving the water quality of the nation's streams. The goal of enhanced stream water quality will most likely result from the implementation of an integrated system of best management practices (BMPs) linked with stream hydraulic and geomorphic characteristics. However, a grazing BMP system is often developed with the concept that BMPs will function independently from interactions among controls, climatic regions, and the multifaceted functions exhibited by streams. This paper examines the peer reviewed literature pertaining to grazing BMPs commonly implemented in the

southern humid region of the United States to ascertain effects of BMPs on stream water quality. Results indicate that the most extensive BMP research efforts occurred in the western and midwestern U.S. While numerous studies documented the negative impacts of grazing on stream health, few actually examined the success of BMPs for mitigating these effects. Even fewer studies provided the necessary information to enable the reader to determine the efficacy of a comprehensive systems approach integrating multiple BMPs with pre-BMP and post-BMP geomorphic conditions. Perhaps grazing BMP research should begin incorporating geomorphic information about the streams with the goal of achieving sustainable stream water quality.

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1226. Nitrogen trace gas emissions from a riparian ecosystem in southern Appalachia.

Walker, J. T.; Geron, C. D.; Vose, J. M.; and Swank, W. T.

Chemosphere 49(10): 1389-1398. (2002)

NAL Call #: TD172.C54; ISSN: 0045-6535

Descriptors: biogeochemistry/ riparian vegetation/ grazing/ rehabilitation/ air-earth interfaces/ nitrogen compounds/ mass transfer/ soil chemistry/ data collections/ nitrogen emissions/ nitrogen in ecosystems/ nitric oxide emissions from soil/ ammonia exchange, air-soil/ nitrous oxide emissions from soil/ livestock biometeorology/ renovation/ soil science/ riparian environments/ gas exchange/ atmospheric chemistry/ ammonia/ atmospheric gases/ soils/ ammonium compounds/ microorganisms/ compaction/ organic wastes/ restoration/ wetlands/ nitrates/ Bos/ USA, Appalachian Mts./ USA, Appalachia/ cattle effects/ nitrous oxide/ nitric oxide/ true cattle

Abstract: In this paper, we present two years of seasonal nitric oxide (NO), ammonia (NH₃), and nitrous oxide (N₂O) trace gas fluxes measured in a recovering riparian zone with cattle excluded and adjacent riparian zone grazed by cattle. In the recovering riparian zone, average NO, NH₃, and N₂O fluxes were 5.8, 2.0, and 76.7 ng N m⁻² s⁻¹ (1.83, 0.63, and 24.19 kg N ha⁻¹ y⁻¹), respectively. Fluxes in the grazed riparian zone were larger, especially for NO and NH₃, measuring 9.1, 4.3, and 77.6 ng N m⁻² s⁻¹ (2.87, 1.35, and 24.50 kg N ha⁻¹ y⁻¹) for NO, NH₃, and N₂O, respectively. On average, N₂O accounted for greater than 85% of total trace gas flux in both the recovering and grazed riparian zones, though N₂O fluxes were highly variable temporally. In the recovering riparian zone, variability in seasonal average fluxes was explained by variability in soil nitrogen (N) concentrations. Nitric oxide flux was positively correlated with soil ammonium (NH₄⁺) concentration, while N₂O flux was positively correlated with soil nitrate (NO₃⁻) concentration. Ammonia flux was positively correlated with the ratio of NH₄⁺ to NO₃⁻. In the grazed riparian zone, average NH₃ and N₂O fluxes were not correlated with soil temperature, N concentrations, or moisture. This was likely due to high variability in soil microsite conditions related to cattle effects such as compaction and N input. Nitric oxide flux in the

grazed riparian zone was positively correlated with soil temperature and NO₃⁻ concentration. Restoration appeared to significantly affect NO flux, which increased approximately 600% during the first year following restoration and decreased during the second year to levels encountered at the onset of restoration. By comparing the ratio of total trace gas flux to soil N concentration, we show that the restored riparian zone is likely more efficient than the grazed riparian zone at diverting upper-soil N from the receiving stream to the atmosphere. This is likely due to the recovery of microbiological communities following changes in soil physical characteristics.

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1227. Recovery of some surface soil properties of ecological interest after sheep grazing in a semi-arid woodland.

Braunack, M. V. and Walker, J.

Australian Journal of Ecology 10(4): 451-460. (1985)

NAL Call #: QH540.A8; ISSN: 0307-692X

Descriptors: Eucalyptus populnea/ population dynamics/ organic matter compaction/ Australia

Abstract: Solodic soils within a semi-arid poplar box (Eucalyptus populnea) woodland at Wycanna, in southern Queensland [Australia] have been subjected to impacts from sheep and cattle grazing for at least 100 years. The micromorphology of the surface of two soils, a gradational texture profile (Gn 3.13, Paleustalf) and a duplex profile (Db 1.23, Paleustalf) showed that compaction had occurred. Recovery of the soil surfaces following removal of animal grazing was measured in terms of porosity, presence of illuvial layers, surface soil strength, some chemical properties and water infiltration rates. The grazing impact was greatest on the Gn 3.13 soil and visual signs of the grazing impact were still evident 16 years following sheep removal. Reduced soil organic matter and increased surface soil hardness as a result of grazing, rather than surface crusting or changes in water infiltration rates are suggested as the mechanisms controlling the observed increases in woody plant populations in these semi-arid woodlands.

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1228. Role of plant cover and stock trampling on runoff and soil erosion from semi-arid wooded rangelands.

Greene, R. S. B.; Kinnell, P. I. A.; and Wood, J. T.

Australian Journal of Soil Research 32(5): 953-973. (1994)

NAL Call #: 56.8 Au7; ISSN: 0004-9573

Descriptors: soil-water-plant relationships/ soil erosion/ semiarid climates/ forest watersheds/ vegetation effects/ rainfall simulators/ erosion rates/ sediment erosion/ runoff/ rainfall/ plant populations/ stormwater runoff/ vegetation cover/ environment management/ Australia/ stormwater runoff/ vegetation cover/ environment management/ soil-water-plant relationships/ semiarid climates/ forest watersheds/ vegetation effects/ rainfall simulators/ erosion rates/ sediment erosion

Abstract: Relationships between plant cover, runoff and erosion of a massive red earth were investigated for a runoff zone of an intergrove area in a semi-arid wooded rangeland in eastern Australia. The measurements were carried out in small experimental paddocks with different stocking rates of sheep and kangaroos. A trailer-mounted rainfall simulator was used to apply rainfall at a time

averaged rate of 30 mm/h to obtain runoff rates and sediment concentrations. There was a significant negative relationship ($r^2 = 0.58$; $P < 0.01$) between final runoff rate and plant cover. It is probable that the plants increase infiltration and decrease runoff by (i) funneling water down their stems and (ii) providing macropores at the base of the plant through which water can rapidly enter the soil. However, there was no significant effect of plant cover on sediment concentration. Probable reasons for this are: (i) even though plant cover will absorb raindrop energy and decrease the erosive stress on the soil, the nature of the plants investigated is such that they may not be 100% effective in protecting the soil beneath them, and (ii) the distribution of contact cover provided by the base of the plants is highly patchy and thus relatively inefficient at reducing sediment concentration. At zero cover final runoff rates from paddocks with a high and low stocking rate were similar, i.e. 23.4 and 22.3 mm/h respectively. However, at zero cover, the sediment concentration from the high stocking rate paddock was significantly ($P < 0.01$) greater than that from the low stocking rate paddock. Greater hoof activity and lower organic matter (and hence lower structural stability) of the 0-20 mm layer in the high stocking rate paddock caused the soil surface to be more susceptible to erosion. These results show that grazing by removing perennial grasses and pulverizing the surface soil can have a major impact on local water balances and erosion rates respectively within the intergrove areas. The implications of these results for the long-term stability of semi-arid mulga woodlands is briefly discussed.

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1229. Run-off and soil movement on mid-slopes in north-east Queensland [Australia] grazed woodlands.

Scanlan, J. C.; Pressland, A. J.; and Myles, D. J.

Rangeland Journal 18(1): 33-46. (1996)

NAL Call #: SF85.4.A8A97; ISSN: 1036-9872

Descriptors: woodlands/ soil movement/ rain/ erosion/ sediment yield/ vegetation/ ground cover/ pastures/ soil water balance/ runoff/ grasslands/ woodland grasslands/ soil

Abstract: Runoff, bed load and sediment concentration data were collected over a five-year period from unbounded catchments in grazed and exclosed pastures in woodlands. Cover varied from <5% during drought conditions to almost 100% in exclosed areas after above-average rainfall. High bed load soil loss, sediment concentration and runoff percentages were associated with low cover (<30%). Runoff as a percentage of rainfall increased linearly with rainfall intensity; decreased linearly with cover; decreased slightly as soil moisture status declined; and reached a maximum at intermediate rainfall events. Interactions between these factors were observed. Runoff was up to 30% of rainfall in moderate rainfall events (30-40 mm) where maximum rainfall intensity over any 15 minute period (I₁₅) exceeded 70 mm/h. When soil moisture status was high, mean run-off exceeded 30% for 40-80 mm rainfall events. For all rainfall event sizes, run-off exceeded 20% where I₁₅ exceeded 60 mm/h. Cover had very little effect on runoff when rainfall intensity was low (I₁₅ < 20 mm/h), soil water deficit was low (<10 mm) or when rainfall events were >75 mm or <10 mm. Bed load plus suspended sediment loads ranged from negligible to 1 t/ha per year, depending principally on cover. Soil movement from areas with >40-50% cover was very low. Pastures dominated by

Bothriochloa pertusa (a stoloniferous, naturalised grass) had lower runoff and lower rates of soil movement than pastures dominated by *Heteropogon contortus* (a native tussocky perennial grass) when compared at the same level of cover. Differences between grazed and exclosed areas could be attributed solely to differences in cover.

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1230. Soil hydrologic response to intensive rotation grazing: A state of knowledge.

Warren, S.

In: Infiltration development and application/ Fok, Yu-Si. Manoa, Hawaii: Water Resources Research Center, 1987; pp. 488-501

NAL Call #: QD543.I5 1987

Descriptors: soil water movement/ infiltration/ grazing/ stocking rate/ animal husbandry

Abstract: An extensive review of the available scientific literature provides no support for a hypothesis suggesting that infiltration rates improve with the implementation of intensive systems of rotational grazing. Intensive rotational grazing systems are generally characterized by significantly lower infiltration rates than are ungrazed exclosures, indicating a negative hydrologic impact. The detrimental impact of intensive rotation grazing is very similar to that incurred under comparably stocked continuous grazing regimes. The decline in infiltration rates is most apparent in recently grazed pastures versus rested pastures, and is related to reductions in protective organic cover and modifications of surface soil properties which accompany intense periodic livestock activity. Stocking rate may be the most important variable governing the hydrologic impact of

intensive rotation grazing systems. As stocking rates increase beyond recommended moderate levels, infiltration rates decline dramatically.

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1231. Soil quality of harvested and grazed forest cutblocks in southern British Columbia.

Krzic, M.; Broersma, K.; Newman, R. F.; Ballard, T. M.; and Bomke, A. A.

Journal of Soil and Water Conservation 56(3): 192-197. (2001)

NAL Call #: 56.8 J822; ISSN: 0022-4561

Descriptors: cattle grazing/ forest soil/ lodgepole pine/ soil compaction/ soil quality

Abstract: This study evaluated soil chemical and physical properties as affected by timber harvesting and cattle grazing on cutblocks planted to lodgepole pine (*Pinus contorta* Dougl. ex Loud. var. *latifolia* Engelm.). Soil conditions on the ungrazed exclosures (representing disturbance by harvest only) and pastures grazed over 10 years to achieve 50% forage utilization (representing disturbance by harvest and grazing) were compared to the nearby forest without harvest and cattle grazing. Soil chemical properties showed no detrimental impacts from harvesting and/or livestock grazing. Inject, greater CEC, Ca, C, and N values on disturbance treatments should improve these soils as rooting media. Soil physical properties, although less favorable for tree growth on the two disturbance treatments than the mature forest, showed that a majority of the soil profile was not compacted above root-restricting threshold conditions. Results obtained from this study support the integrated use of forested rangelands in southern British Columbia.

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Fish and Wildlife Effects

1232. Avian and amphibian use of fenced and unfenced stock ponds in northeastern Oregon forests.

Bull, E. L.; Deal, J. W.; and Hohmann, J. E. USDA Forest Service Rocky Mountain Research Station; PNW-RP-539, 2001. 9 p.

NAL Call #: A99.9 F7625Uni no. 539

<http://www.treesearch.fs.fed.us/pubs/2964>

Descriptors: amphibians/ birds/ livestock grazing/ northeastern Oregon/ stock ponds

Abstract: The abundance of birds and amphibian larvae was compared between fenced and unfenced stock ponds in 1993 to determine if fencing improved the habitat for these species in northeastern Oregon. Stock ponds that were fenced had significantly higher densities of bird species, guilds, and taxonomic groups than stock ponds that were unfenced. No differences in the relative abundance of larvae of Pacific treefrogs (*Pseudacris regilla*) or long-toed salamanders (*Ambystoma macrodactylum*) were found between fenced and unfenced ponds. Fencing at least a portion of stock ponds in forested areas provides habitat for a greater diversity and abundance of birds.

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1233. Breeding bird response to cattle grazing of a cottonwood bottomland.

Sedgwick, J. A. and Knopf, F. L.

Journal of Wildlife Management 51(1): 230-237. (1987)

NAL Call #: 410 J827; ISSN: 0022-541X

Descriptors: *Troglodytes aedon*/ *Toxostoma rufum*/ *Turdus migratorius*/ *Geothlypis trichas*/ *Icteria virens*/ *Pipilo erythrophthalmus*/ *Populus sargentii*/ foraging

Abstract: We studied avian habitat relationships and the impact of grazing on breeding densities of selected migratory birds in a plains cottonwood (*Populus sargentii*) bottomland in northeastern Colorado. Five 16-ha plots served as controls and 5 were fenced and fall-grazed October-November 1982-84 following a season of pre-treatment study in the spring of 1982. We focused our analysis on bird species directly dependent on the grass-herb-shrub layer of vegetation for foraging, nesting, or both. The guild included house wren (*Troglodytes aedon*), brown thrasher (*Toxostoma rufum*), American robin (*Turdus migratorius*), common yellowthroat (*Geothlypis trichas*), yellow-breasted chat (*Icteria virens*), and rufous-sided towhee (*Pipilo erythrophthalmus*). Moderate, late-fall grazing had no detectable impact on calculated densities of any of the 6 species, implying that proper seasonal grazing of a cottonwood floodplain is, at least initially (3 years), compatible with migratory bird use of a site for breeding.

Habitat associations suggested that common yellowthroats and yellow-breasted chats were most unique and most likely to respond negatively to higher levels of grazing. We suggest that these latter 2 species are appropriate ecological indicators of the quality of ground-shrub vegetation as breeding bird habitats in lowland floodplains of the Great Plains.

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1234. Brown-headed cowbird behavior and movements in relation to livestock grazing.

Goguen, Christopher B. and Mathews, Nancy E.
Ecological Applications 11(5): 1533-1544. (2001)
NAL Call #: QH540.E23; ISSN: 1051-0761

Descriptors: animals and man/ disturbance by man/ commercial activities/ conservation/ nutrition/ feeding behaviour/ reproduction/ reproductive behaviour/ associations/ parasites diseases and disorders/ land and freshwater zones/ Nearctic Region/ North America/ USA/ Passeriformes: farming and agriculture/ conservation measures/ nest parasitism/ *Molothrus ater* (Aves)/ brood parasite livestock grazing associations/ conservation implications/ New Mexico/ Colfax County/ livestock grazing control related to brood parasite associations/ Passeriformes/ Aves/ birds/ chordates/ vertebrates
Abstract: The Brown-headed Cowbird (*Molothrus ater*) is a widespread brood parasite which often engages in a commensalistic feeding relationship with domestic livestock. We studied the behavior of female cowbirds breeding in pinyon-juniper woodlands in New Mexico, USA, on two adjacent sites, one an active cattle ranch, and the other a site that was not grazed by domestic livestock throughout the songbird breeding season. In 1994, we conducted morning and afternoon surveys of cowbird abundance in pinyon-juniper and prairie habitats; from 1995 to 1997 we used radio telemetry to monitor daily and seasonal movement and behavioral patterns of female cowbirds. Our objectives were to measure how closely cowbird feeding behavior was linked to livestock grazing, and how the presence or absence of active livestock grazing within a female's breeding range influenced diurnal patterns of behavior. During morning surveys, we detected cowbirds primarily in pinyon-juniper habitat, but in similar numbers in the ungrazed and actively grazed woodlands. In the afternoon, we detected cowbirds feeding almost exclusively in actively grazed prairies but found that they deserted those sites when cattle were removed in early July. Radio telemetry confirmed that individual females were commuting daily between these habitats. Females (n = 30) were generally located in pinyon-juniper habitats from 0500 to [approximately]1200, presumably breeding. Females that bred within actively grazed pinyon-juniper habitat often fed on the ground with livestock on their morning ranges, while those breeding in ungrazed habitat did not. In total, 98% of cowbird feeding observations occurred with livestock. Although most females commuted <3 km between breeding and feeding ranges, some individuals with breeding ranges located toward the center of the ungrazed property averaged 7.7 km. When cattle were rotated out of the main feeding pasture in early July, females immediately extended their commutes by [approximately]1.2 km to access remaining actively grazed pastures. Overall home range sizes were large (160-4344 ha) and tended to increase with distance between the females' breeding range and active livestock grazing. This

increase was reflected mainly by differences in feeding range sizes rather than breeding range sizes. The observed link between cowbird behavior and the distribution of livestock suggests that in regions where livestock grazing is the dominant land use, manipulations of livestock grazing patterns may provide an effective tool to manage cowbird parasitism.

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1235. Cattle grazing in a national forest greatly reduces nesting success in a ground-nesting sparrow.

Walsberg, Glenn E.
Condor 107(3): 714-716. (2005)
NAL Call #: QL671.C6; ISSN: 0010-5422

Descriptors: dark-eyed junco/ *Pinus ponderosa*/ ponderosa pine/ Arizona/ cattle grazing/ Coconino County, Kaibab National Forest/ commercial enterprises/ disturbances/ farming and agriculture/ forest/ grazing/ habitat destruction/ land zones/ nearctic region/ nesting success/ North America/ predation/ productivity/ reproduction/ savanna/ terrestrial ecology/ USA/ vegetation cover/ wildlife/ human relationships/ junco/ *Junco hyemalis*/ nest success/ cattle
Abstract: Grazing of domestic livestock on public lands in the western United States is a major source of habitat destruction. I quantified nest success of ground-nesting Dark-eyed Juncos (*Junco hyemalis*) breeding in ponderosa pine forests and pine savanna in the Kaibab National Forest of northern Arizona. Comparison of results for areas grazed by cattle to results for immediately adjacent areas protected from grazing revealed that cattle grazing was associated with a dramatic (75%) reduction in nest success. Cattle grazing reduced vegetation cover over nests by an average of 41%, exposing the nest to more extreme climatic conditions as well as possibly making them more conspicuous to predators.

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1236. Changing fire regimes and the avifauna of California oak woodlands.

Purcell, Kathryn L. and Stephens, Scorr L.
Studies in Avian Biology(30): 33-45. (2005)
NAL Call #: QL671.S8; ISSN: 0197-9922

Descriptors: violet-green swallow/ western bluebird/ western kingbird/ anthropogenic/ avian diversity/ fire/ fire frequency/ fire intensity/ fire suppression/ livestock grazing/ oak woodlands
Abstract: Natural and anthropogenic fire once played an important role in oak woodlands of California. Although lightning-ignited fires were infrequent, the California Indians used fire to modify oak woodland vegetation for at least 3,000 yr. These high-frequency, low-intensity fires likely resulted in little mortality of mature oaks, low but continuous tree recruitment, an open understory, and a fine-grained mosaic of vegetation patches. Following settlement by Europeans in the mid-1800s, ranchers burned to reduce shrub cover and to increase grassland area and forage production; surface fires were common with average fire-return intervals of 8-15 yr. Fire suppression, begun in the 1940s to 1950s, led to increases in surface and crown fuels, invasion of woody vegetation in the understory, and increased tree density. In the absence of demonstrated fire effects on oak woodland birds, we used changes in vegetation structure expected to result from fire and fire suppression to predict the response of oak woodland birds to fire and fire suppression based on nesting habitat of 17

common oak woodland species breeding at the San Joaquin Experimental Range, Madera County, California. Our results suggest that populations of Western Kingbirds (*Tyrannus verticalis*), Western Bluebirds (*Sialia mexicana*), and Violet-green Swallows (*Thrycineta thalassina*), would increase in abundance following fire, because they consistently nested in habitat similar to that expected to result from frequent, low-intensity fire. The species predicted to respond negatively to changes resulting from fire differed among the variables examined. If fire produces a mosaic of habitat patches rather than a homogeneous landscape, we expect that the differing habitat needs of most species will be provided for. As with fire, the most obvious change resulting from excluding livestock was an increase in shrub cover. The question naturally arises to what extent livestock grazing creates habitat similar to that created by historical fire, but this question remains unstudied. More fire-history research is needed to understand past fire regimes of oak woodlands and the effects of fire, including prescribed fire, on the vegetation and the bird community. The effects of grazing and the extent to which grazing mimics fire clearly require more study. We encourage others to test our hypotheses regarding responses of birds to variables expected to be altered by fire: shrub cover, tree density, and numbers of snags, saplings, and logs. Finally, we need to test our working hypothesis that a mosaic of habitat patches will provide the habitat conditions needed to sustain the high avian diversity characteristic of oak woodlands. (Author)
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1237. Comparison of rodent communities in sites with different degrees of disturbance in deciduous forest of southeastern Morelos, Mexico.

Garcia Estrada, Carlos; Romero Almaraz, Ma De Lourdes; and Sanchez Hernandez, Cornelio
Acta Zoologica Mexicana Nueva Serie(85): 153-168. (2002); ISSN: 0065-1737

Descriptors: age structure/ cattle grazing/ climates/ community composition/ conservation biology/ deciduous forests: habitat/ demographic parameters/ environmental disturbance/ firewood extraction/ intersite differences/ lumber harvesting/ microhabitat preference/ population density/ soils/ species diversity/ species evenness/ topography

Abstract: This study is the first work that compares rodent communities in a deciduous forest in Mexico. It documents differences between sites experiencing different degrees of disturbance caused by firewood and lumber extraction, and cattle grazing; a relatively undisturbed site (Site 1) and another more disturbed site (Site 2) in southeastern Morelos State. In each site we captured six species of rodents. Though habitat disturbance did not modify diversity or evenness of rodent species, the total number of individuals captured in Site 1 (n=319) was greater than in Site 2 (n=90). Effects of habitat fragmentation were expressed in significant differences in population density, age structure and microhabitat preference between two sites for *Baiomys musculus*, *Peromyscus levipes* and *P. melanophrys*. The disturbance of deciduous forest appears to be the principal factor explaining differences in demographic parameters of rodent species between the two study sites, as these two sites have the same climate, similar soils, and topography which differ only slightly.

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1238. Effect of domestic cattle on the condition of female white-tailed deer in southern pine-bluestem forests, USA.

Jenks, Jonathan A.; Leslie, David M.; and Leslie, D. M.
Acta Theriologica 48(1): 131-144. (2003)
NAL Call #: 410 AC88; ISSN: 0001-7051

Descriptors: Arkansas/ carcass weight/ cattle stocking/ commercial enterprises/ disturbances/ ecosystems/ farming and agriculture/ fat/ femur/ food competition/ food supply/ forest management/ forests/ globulin/ glucose/ habitat use/ Howard & Pike Counties/ interspecies relationships/ interspecies relationships or intraspecies relationships/ kidneys/ land zones/ McCurtain County/ Nearctic Region/ North America/ nutrition/ nutritional condition/ Oklahoma/ physical condition/ physiological indices/ physiology/ productivity/ reproduction/ soils/ southern pine bluestem forests/ stocking intensity/ USA/ vegetation/ wildlife management/ wildlife/ human relationships/ white-tailed deer/ cattle/ agriculture/ condition/ weight/ competition/ food/ pregnancy/ blood/ white-tailed deer

Abstract: [unedited] Effect of domestic cattle stocking on the nutritional condition of white-tailed deer *Odocoileus virginianus* (Zimmermann, 1780) was assessed using physiological indices of collected specimens. Three study areas were delineated in McCurtain County, Oklahoma (heavy cattle stocking), and Howard (moderate to light cattle stocking) and Pike (no cattle stocking) counties, Arkansas that were similar with respect to soils and vegetation but differed with respect to cattle stocking rate. Female white-tailed deer were collected from study areas in February and August 1987-1988 to assess nutritional condition. Deer collected from study areas exposed to cattle grazing in February had lower carcass weights, fat attributes (femur marrow and kidney fat), and reproductive rates (fetuses/doe) than deer that were not exposed to cattle grazing. In August, deer collected from the moderate cattle area had heavier eviscerated carcass weights, serum glucose, albumin, and albumin/globulin ratios than deer collected from the heavy cattle area. Results suggest that if cattle are removed from managed forests in winter, nutritional condition of deer would be improved because of reduced competition for food.

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1239. The effect of habitat fragmentation and livestock grazing on animal communities in remnants of gimlet Eucalyptus salubris woodland in the Western Australian wheatbelt: Lizards.

Smith, G. T.; Arnold, G. W.; Sarre, S.; Abensperg Traun, M.; and Steven, D. E.

Journal of Applied Ecology 33(6): 1302-1310. (1996)
NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: biogeography/ forests/ woodlands/ fragmentation/ habitats/ animal ecology/ forest litter/ understory/ shrubs/ stand density/ species diversity/ forest fragmentation/ grazing/ wildlife/ effects/ nature conservation/ animal communities

Abstract: The study examined relationships between habitat and biogeographic variables and the presence of lizard groups and individual lizard species in remnants of gimlet *Eucalyptus salubris* woodland in Western Australia. The lizard species found in various gimlet woodland remnants are sub-sets of those found prior to fragmentation. Regression analysis showed that woody litter, percentage shrub cover and number of trees were the

only habitat variables to influence species richness of the lizard taxa. Area, connectivity and distance to the nearest native vegetation were the only biogeographical variables to influence species richness of geckos, other lizard species and total lizards. Three individual species showed no significant relationships with any variables, whereas three species had significant relationships with variables related to cover/shelter only. Disturbance from sheep grazing and trampling had no influence on the species richness of the different lizard taxa, but may have influenced the persistence of individual species in some remnants. The implications of these findings for management of remnant vegetation are discussed.

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1240. Effects of cattle grazing and haying on wildlife conservation at National Wildlife Refuges in the USA.

Strassman, B. I.

Environmental Management 11(1): 35-44. (1987)

NAL Call #: HC79.E5E5; ISSN: 0364-152X

Descriptors: grass/ bird/ Fish and Wildlife Service/ regulatory agencies/ government agency/ environmental protection/ economics/ cost/ prescribed burning/ environmental law/ cattle industry/ feed industry

Abstract: The National Wildlife Refuge System is perhaps the most important system of federal lands for protecting wildlife in the USA. Only at refuges has wildlife conservation been legislated to have higher priority than either recreational or commercial activities. Presently, private ranchers and farmers graze cattle on 981,954 ha and harvest hay on 12,021 ha at 123 National Wildlife Refuges. USA Fish and Wildlife Service policy is to permit these uses primarily when needed to benefit refuge wildlife. To evaluate the success of this policy, I surveyed grassland management practices at the 123 refuges. The survey results indicate that in fiscal year 1980 there were 374,849 animal unit months (AUMs) of cattle grazing, or 41% more than was reported by the Fish and Wildlife Service.

According to managers' opinions, 86 species of wildlife are positively affected and 82 are negatively affected by refuge cattle grazing or haying. However, quantitative field studies of the effect of cattle grazing and haying on wildlife coupled with the survey data on how refuge programs are implemented suggest that these activities are impeding the goal of wildlife conservation. Particular management problems uncovered by the survey include overgrazing of riparian habitats, wildlife mortality due to collisions with cattle fences, and mowing of migratory bird habitat during the breeding season. Managers reported that they spend \$919,740 administering cattle grazing and haying; thus refuge grazing and haying programs are also expensive. At any single refuge these uses occupy up to 50% of refuge funds and 55% of staff time. In light of these results, prescribed burning may be a better wildlife management option than is either cattle grazing or haying.

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1241. The effects of domestic livestock grazing on breeding nongame birds in northeastern New Mexico.

Goguen, C. B. Texas Tech University, 1994.

Descriptors: animals, non-game/ birds/ birds, passerine/ blackbirds and cowbirds/ gnatcatchers/ grazing/ habitat/ interspecies relationships/ livestock/ mortality/ nests and nesting/ predation/ statistics/ surveys/ vegetation/ North

America/ United States/ New Mexico/ Northeastern Region/ Colfax County

Abstract: Objectives were to compare the following features of ungrazed and grazed pinyon-juniper woodlands: habitat and vegetation characteristics; songbird diversity and abundance; and songbird nesting success and cause-specific nest mortality levels. Study was conducted on the NRA Whittington Center and the adjacent Van Sweden Ranch in Colfax County. Thesis is divided into the following section titles: (1) The Influence of Domestic Livestock Grazing on Breeding Nongame Birds in Pinyon-Juniper Woodlands in Northwestern New Mexico; (2) Brown-headed Cowbird Parasitism of Grazed and Ungrazed Pinyon- Juniper Woodlands in Northeastern New Mexico; and (3) Nest Desertion and Moving by the Blue-Gray Gnatcatcher in Association with Brown- headed Cowbird Parasitism

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1242. The effects of habitat fragmentation and livestock-grazing on animal communities in remnants of gimlet *Eucalyptus salubris* woodland in the Western Australian wheatbelt. I. Arthropods.

Abensperg Traun, M.; Smith, G. T.; Arnold, G. W.; and Steven, D. E.

Journal of Applied Ecology 33(6): 1281-1301. (1996)

NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: biogeography/ forests/ woodlands/ fragmentation/ isolation/ effects/ habitats/ arthropod communities/ forest litter/ understorey/ shrubs/ species diversity/ forest fragmentation/ grazing/ wildlife/ nature conservation/ ecology/ forest trees/ biology/ agricultural entomology

Abstract: The effects of habitat fragmentation and livestock activity on arthropod communities were examined within 26 remnants of gimlet *Eucalyptus salubris* woodland in Western Australia. Significant correlations were found between various remnant biogeographical variables: remnant area and connectivity (positive), and connectivity and distance from the study remnant to the nearest patch of native vegetation (negative). Remnant disturbance indices (sheep faecal pellet density, percentage cover of weeds) were significantly correlated with remnant biogeographic characteristics. Small and poorly connected remnants showed significantly higher intensities of disturbance than larger and better connected remnants. When disturbance indices were used to categorize study remnants into groups with high, moderate or low disturbance, remnants with high intensities of disturbance had significantly less lichen, litter and shrub cover. Highly disturbed remnants were associated with fewer scorpion species, lower termite and ant diversity, a lower abundance of scorpions, termites and mygalomorph spiders, more beetle species and higher beetle diversity, and greater abundance of earwigs and beetles. Cockroach, earwig and ant species richness showed no significant response to disturbance. Species richness of termites, and the abundance of lycosid and idiopid (mygalomorph) spiders, isopods, cockroaches and ants, was highest under moderate disturbance. Significant biogeographical covariates were area (abundance of araneomorph spiders, 'associated subordinate' and 'opportunistic' ants; richness of carabid, scarabaeid and 'other' beetle species, subordinate and opportunistic ants), connectivity (richness of termites, scarabaeid beetles) and distance to the nearest native vegetation (richness of

'dominant' ants). When disturbance and biogeographical effects were combined, total termite richness, and the richness of termite functional groups, declined markedly in highly disturbed, small and poorly connected remnants. Termite communities in relatively undisturbed remnants were more similar in species composition to communities in moderately disturbed quadrats than to communities in highly disturbed quadrats. Community similarity values for ants and beetles were similar across the study quadrats with different degrees of disturbance. Arthropod communities were also examined by canonical variate analyses across remnants with different degrees of disturbance, using total abundance and richness, and abundance and richness of predators (scorpions, spiders, carabid beetles, ants) and detritivores/herbivores (termites, isopods, earwigs, cockroaches, weevil and scarabaeid beetles). Effective site separation into the 3 disturbance categories was found for abundance and richness of all arthropods, and for predators alone. Abundance and richness of detritivores/herbivores separated into 2 groups of sites: high disturbance sites, and sites with low or moderate disturbance with no separation. In stepwise regression analyses, lichen cover, weed cover and sheep faecal pellet density were the most significant indicators of faunal abundance, richness and diversity. Remnant biogeographic variables explained a low percentage of variation in faunal characteristics. Habitat disturbance was the major influence on the arthropod communities, with remnant biogeographical factors consistently explaining low variations in the abundance or diversity of the fauna. Implications for the management of remnant vegetation are discussed.

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1243. Impact of livestock grazing activities on stream insect communities and the riverine environment.

Strand, M. and Merritt, R. W.

American Entomologist 45(1): 13-30. (1999)

NAL Call #: QL461.A52; ISSN: 1046-2821

Descriptors: grazing/ community composition/ riparian environments/ aquatic insects/ environment management/ ecosystem disturbance/ insecta/ insects

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1244. Impacts of domestic livestock grazing on small mammals of forest grazing allotments in southeastern Idaho.

Johnson, S. J.

In: Proceedings of the Wildlife-Livestock Relationships Symposium. (Held 20 Apr 1981-22 Apr 1981 at Coeur D'alene, Idaho.) Peek, James M. and Dalke, P. D. (eds.) Moscow, Idaho: Forest, Wildlife & Range Experiment Station, University of Idaho; pp. 242-250; 1982.

NAL Call #: SF84.84.W5 1981

Descriptors: Idaho

This citation is from AGRICOLA.

1245. Impacts of grazing and burning on spider assemblages in dry eucalypt forests of north-eastern New South Wales, Australia.

Harris, Rebecca; York, Alan; and Beattie, Andrew J.

Austral Ecology 28(5): 526-538. (2003)

NAL Call #: QH540 .A8; ISSN: 1442-9985

Descriptors: litter extraction: applied and field techniques/ pitfall trapping: applied and field techniques/ prescribed

burning: applied and field techniques/ sweep sampling: applied and field techniques/ assemblage structure/ dry eucalypt forests/ grazing behavior/ habitat variability/ management strategies/ spatial relationships/ spatial scales/ stocking rates

Abstract: In the dry eucalypt forests of north-eastern New South Wales, Australia, cattle grazing occurs at low intensities and is accompanied by frequent low-intensity burning. This study investigated the combined effects of this management practice on the ground-dwelling and arboreal (low vegetation) spider assemblages. Spiders were sampled at 49 sites representing a range of grazing intensities, using pitfall trapping, litter extraction and sweep sampling. A total of 237 spider morphospecies from 37 families were collected using this composite sampling strategy. The abundance, richness, composition and structure of spider assemblages in grazed and ungrazed forest sites were compared and related to a range of environmental variables. Spider assemblages responded to a range of environmental factors at the landscape, habitat and microhabitat scales. Forest type, spatial relationships and habitat variability at the site scale were more important in determining spider assemblages than localized low-intensity grazing and burning. However, it is possible that a threshold intensity of grazing may exist, above which spiders respond to grazing and burning. Although low-intensity grazing and burning may not affect spider assemblages below a threshold stocking rate, that stocking rate has yet to be established.

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1246. Impacts of grazing and burning on terrestrial invertebrate assemblages in dry eucalypt forests of north-eastern New South Wales: Implications for biodiversity conservation.

York, Alan and Tarnawski, Jaynia

In: Conservation of Australia's forest fauna/ Lunney, Daniel. Mosman: Royal Zoological Society of New South Wales, 2004; pp. 845-859.

Notes: ISBN: 095860858X

Descriptors: animals and man/ disturbance by man/ commercial activities/ conservation/ conservation measures/ ecology/ habitat/ terrestrial habitat/ abiotic factors/ physical factors/ land zones/ Australasian Region/ Australasia/ Australia/ Invertebrata: farming and agriculture/ cattle grazing/ effects on terrestrial communities and conservation implications/ habitat management/ dry eucalypt forests management/ grazing and burning effects on terrestrial communities implications/ community structure/ ground active taxa/ forest and woodland/ terrestrial communities/ grazing and burning effects and conservation implications/ fire/ burning effects on terrestrial communities and conservation implications/ New South Wales/ north east/ grazing and burning effects on terrestrial taxa and conservation implications/ dry eucalypt forests/ invertebrates

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1247. Impacts of logging, fire and grazing regimes on bird species assemblages of the Pilliga woodlands of New South Wales.

Date, E. M.; Ford, H. A.; and Recher, H. F.

Pacific Conservation Biology 8(3): 177-195. (2002); ISSN: 1038-2097

Descriptors: adaptive management strategies/ assemblage composition/ assemblage distribution/ boxironbark woodlands/ fire/ fire exclusion/ fuel reduction/ grazing regimes/ logging/ species assemblages

Abstract: We investigated the composition and distribution of bird assemblages in the continuous Pilliga woodlands of northwest New South Wales in relation to floristic assemblages and disturbance (logging, fire and grazing) patterns. Box-ironbark woodlands contained high densities of White Cypress Pine *Callitris glaucophylla* and Narrow-leaved Ironbark *Eucalyptus crebra*, had a sparse, depauperate understorey, and were associated with frequent, intense logging and infrequent fires (due to fire exclusion and the use of grazing for fuel reduction). Box-ironbark woodlands were characterized by high frequencies of 12 bird species that occurred throughout the Pilliga and low frequencies of many other species. Blakely's Red Gum *E. blakelyi* woodlands typical of creeks and Broad-leaved Ironbark *E. fibrosa* woodlands typical of poor soils contained lower densities or smaller trees of *C. glaucophylla* and *E. crebra*, had a moderately dense, diverse understorey, and were associated with infrequent low-intensity logging and moderately frequent wildfire. Bird species assemblages of Broad-leaved Ironbark woodlands were similar to those of box-ironbark woodlands. Blakely's Red Gum woodlands were characterized by 36 bird species that were virtually absent from box-ironbark and Broad-leaved Ironbark woodlands, including 10 threatened and declining species. The 10 are among 48 woodland species that are known or thought to be declining and that are dependent on woodlands with mature trees and grassy or patchy grass/shrub understorey. We conclude that these species have declined in the Pilliga and will continue to decline under existing disturbance regimes, particularly in box-ironbark woodlands. We suggest adaptive management strategies for maintaining and rehabilitating their habitats.

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1248. Influence of fire and other anthropogenic practices on grassland and shrubland birds in New England.

Vickery, Peter D.; Zuckerberg, Benjamin; Jones, Andrea L.; Gregory Shryver, W.; and Weik, Andrew P.

Studies in Avian Biology(30): 139-146. (2005)

NAL Call #: QL671.S8; ISSN: 0197-9922

Descriptors: upland sandpiper/ upland sandpipers/ vesper sparrow/ vesper sparrows/ blueberry barrens/ farmland/ grassland birds/ New England/ prescribed fire/ shrubland birds

Abstract: The extent of grassland and shrubland habitat in New England has changed dramatically over the past 400 yr as a result of changing land uses. Presently, grasslands and shrublands in New England have been created and maintained primarily as a result of four types of habitat management: mowing, livestock grazing, clearcutting, and prescribed burning. Hayfields and pastures comprise the largest proportion of open land, approximately 718,500 ha. Clearcutting has created extensive shrubland patches in

northern Maine, where 3.5% (243,000 ha) of the commercial forestland has been harvested in the past 20 yr. creating ephemeral, early successional shrublands used by a wide variety of warblers, sparrows, and other birds. The most widespread use of prescribed fire is agricultural and takes place on commercial lowbush blueberry (*Vaccinium angustifolium*) barrens in Maine, where approximately 3,000 ha are burned annually. These barrens are especially important habitats for Upland Sandpipers (*Bartramia longicauda*) and Vesper Sparrows (*Poocetes gramineus*). The scale of ecological prescribed burns in New England for habitat management of endangered ecosystems has been small; in recent years fewer than 300 ha have been burned annually. The effects of burning differ in grasslands versus shrublands. In native grasslands, burning has a strong effect on vegetation structure, which, in turn, has clear effects on most grassland specialist birds. Shrubland fires have less impact on shrubland birds because most of the woody structure remains intact. (Author)

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1249. Influence of forest and rangeland management on anadromous fish habitat in western North America: Effects of livestock grazing.

Platts, W. S. USDA Forest Service, Pacific Northwest Forest and Range Experiment Station; General Technical Report PNW-124, 1981. 25 p. ill.

Notes: ISSN 0368-6224

NAL Call #: aSD11.A46

Descriptors: North America

This citation is from AGRICOLA.

1250. The influence of livestock grazing and weed invasion on habitat use by birds in grassy woodland remnants.

Maron, Martine and Lill, Alan

Biological Conservation 124(4): 439-450. (2005)

NAL Call #: S900.B5; ISSN: 0006-3207

Descriptors: grazing/ habitat degradation/ conservation strategy/ weed invasion/ ground foraging birds/ grassy woodland remnants/ cryptogamic crust/ prey attack manoeuvre

Abstract: Remnants of native vegetation in regions dominated by agriculture are subject to degradation, especially by livestock grazing and weed invasion. Ground-foraging birds are amongst the most threatened bird groups in Australia, and these agents of degradation might be contributing to their decline by causing a reduction in food availability. We studied the foraging behaviour and microhabitat use of seven species of ground-foraging insectivores in south-eastern Australian buloke woodland remnants with native, grazed and weedy ground-layers. If birds must resort to using more energetically expensive prey-attack manoeuvres, or selectively use substrates and microhabitats that are less available in degraded habitats, then such degradation is likely to be negatively impacting on these species. We found evidence of a negative impact of one or both of these types of degradation on five of the seven bird species. Three species that employ a range of foraging manoeuvres to attack prey used potentially more energetically expensive aerial manoeuvres significantly more frequently in weedy remnants than in remnants with a native or grazed ground layer. Red-capped robins *Petroica goodenovii* and brown treecreepers *Climacteris picumnus*

both selectively foraged near trees in grazed sites, and hooded robins *Melanodyras cucullata*, red-capped robins and willie wagtails *Rhipidura leucophrys* avoided foraging in microhabitats with a high percentage cover of exotic grasses in weedy sites. Brown treecreepers were also less likely to be present in weedy sites that had been protected from grazing than in either grazed or native sites. These results suggest that although grazing appears to have a detrimental impact on foraging habitat of ground-foraging birds, the exclusion of livestock grazing from previously disturbed buloke remnants alone is not adequate to restore habitat values for ground-foraging birds. A conservation strategy for this habitat type should consider the exclusion of heavy grazing from sites with an intact cryptogamic crust and the management of weeds in disturbed remnants, potentially through the use of carefully controlled light grazing. (c) 2005 Elsevier Ltd. All rights reserved.

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1251. Livestock grazing effects in western North America.

Saab, Victoria A.; Bock, Carl E.; Rich, Terrell D.; and Dobkin, David S.

In: Ecology and management of neotropical migratory birds: A synthesis and review of critical issues/ Finch, Deborah M. and Martin, Thomas E.

New York: Oxford University, 1995; pp. 311-353.

Notes: ISBN: 0195084403

NAL Call #: QL680.E28 1995

Descriptors: animals and man/ disturbance by man/ commercial activities/ conservation/ conservation measures/ ecology/ habitat/ terrestrial habitat/ man made habitat/ land and freshwater zones/ Nearctic Region/ North America/ Aves: farming and agriculture/ habitat management/ recommendations to reduce impact of grazing livestock on migrants/ population dynamics/ abundance/ effect of livestock grazing/ forest and woodland/ grassland/ riparian habitat/ cultivated land habitat/ USA/ livestock grazing/ consequences for migrants/ recommendations/ Aves/ birds/ chordates/ vertebrates

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1252. Local gradients of cowbird abundance and parasitism relative to livestock grazing in a western landscape.

Goguen, Christopher B. and Mathews, Nancy E.

Conservation Biology 14(6): 1862-1869. (2000)

NAL Call #: QH75.A1C5; ISSN: 0888-8892

Descriptors: livestock grazing/ mixed conifer forest: habitat/ parasitism rate/ pinyon juniper forest: habitat/ species abundance

Abstract: We studied local patterns of Brown-headed Cowbird (*Molothrus ater*) abundance, parasitism rates, and nest success of a common host, the Plumbeous Vireo (*Vireo plumbeus*), in relation to the distribution of livestock grazing in an undeveloped region of northeastern New Mexico, 1992-1997. We predicted that both cowbird abundance and parasitism rates of vireo nests would decrease with increasing distance from active livestock grazing, and that the nesting success of vireos would increase. We measured cowbird abundance and host density and located and monitored vireo nests in pinyon-juniper and mixed-conifer habitats that ranged from actively grazed to isolated from livestock grazing by up to 12 km. Cowbird abundance declined with distance from active

livestock grazing and was not related to host density or habitat type. Brood parasitism levels of vireo nests ($n = 182$) decreased from >80% in actively grazed habitats to 33% in habitats that were 8-12 km from active grazing but did not vary by habitat type or distance to forest edge. Vireo nesting success was higher in mixed-conifer habitat than in pinyon-juniper but was unrelated to distance from active livestock grazing. Nest losses due to parasitism declined with distance from active livestock grazing. Our results suggest that cowbird abundance and parasitism rates of hosts may be distributed as a declining gradient based on distance from cowbird feeding sites and that isolation from feeding sites can reduce the effects of parasitism on host populations. These findings provide support for management techniques that propose to reduce local cowbird numbers and parasitism levels by manipulating the distribution of cowbird feeding sites. The presence of parasitized nests >8 km from active livestock grazing suggests that, in some regions, management efforts may need to occur at larger scales than previously realized.

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1253. Migratory bird responses to grazing.

Wetlands Reserve Program Grasslands Workgroup Natural Resources Conservation Service, U.S. Department of Agriculture, 2005.

<ftp://ftp-fc.sc.egov.usda.gov/NHQ/ecs/Wild/WRPgrassland.pdf>

Descriptors: grazing/ birds/ environmental impact

1254. Riparian bird communities in relation to land management practices in floodplain woodlands of south-eastern Australia.

Jansen, Amy and Robertson, Alistar I.

Biological Conservation 100(2): 173-185. (2001)

NAL Call #: S900.B5; ISSN: 0006-3207

Descriptors: agricultural regions/ community composition/ floodplain woodlands: habitat/ grazing/ habitat quality: degradation/ land clearing/ land management practices/ lowland rivers/ off river watering points/ shrub cover/ species abundance/ species diversity/ stocking rates

Abstract: Bird communities are declining in south-eastern Australia and riparian woodlands are critical habitats for birds in this agricultural region. We investigated how terrestrial bird communities varied with different land management practices (levels of grazing by domestic livestock and extent of clearing) and with habitat quality on the floodplains of the Murrumbidgee and Murray Rivers. Bird community composition in ungrazed and lightly grazed sites was significantly different to that in more heavily grazed sites, and these differences were related to tree and shrub cover, as well as tree species diversity and abundance of standing dead trees. Grazing appeared to have an effect on bird communities separate from that caused by clearing. Indicator species were identified for the effects of grazing and clearing. Grazing by livestock has had negative impacts on riparian birds through degradation of habitat quality. A combination of lower stocking rates, strategic placement of off-river watering points for stock, and the introduction of rotational grazing practices may be used to restore riparian habitat quality. The grazing-sensitive species we identified could be used as indicator species for the success of rehabilitation efforts.

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1255. Small mammal community composition in relation to cattle grazing and associated burning in eucalypt forests of the Northern Tablelands of New South Wales.

Tasker, Elizabeth M. and Dickman, Christopher R.
In: Conservation of Australia's forest fauna/ Lunney, Daniel.
Mosman: Royal Zoological Society of New South Wales,
2004; pp. 721-740.

Notes: ISBN: 095860858X

Descriptors: animals and man/ disturbance by man/
commercial activities/ conservation/ conservation
measures/ ecology/ habitat/ terrestrial habitat/ abiotic
factors/ physical factors/ land zones/ Australasian Region/
Australasia/ Australia/ Mammalia: farming and agriculture/
habitat management/ cattle grazing and associated
burning/ community structure/ small taxa/ forest and
woodland/ fire/ burning regime/ effects on small taxa
community structure/ conservation implications/ New South
Wales/ Northern Tablelands/ small taxa community
structure/ cattle grazing and burning effects/ eucalypt
forests/ Mammalia/ chordates/ mammals/ vertebrates
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1256. Small mammal response to the introduction of cattle into a cottonwood floodplain.

Samson, F. B.; Knopf, F. L.; and Hass, L. B.
In: Management of amphibians, reptiles, and small
mammals in North America. (Held 19 Jul 1988-21 Jul 1988
at Flagstaff, Ariz.) Szaro, R. C.; Severson, K. E.; and
Patton, D. R. (eds.); Vol. GTR-RM-166.

Fort Collins, Colo.: U.S. Department of Agriculture Forest
Service, Rocky Mountain Forest and Range Experiment
Station; pp. 432-438; 1988.

Notes: ISSN: 0094-4823

NAL Call #: aSD11.A42 No. 166

Descriptors: ecology/ community/ habitat/ terrestrial
habitat/ land and freshwater zones/ Nearctic Region/ North
America/ USA/ Mammalia: community structure/
comparisons of grazed and ungrazed grassland/
community comparisons/ habitat exploitation/ grazed and
ungrazed grassland/ comparison/ grassland/ grazed and
ungrazed grassland communities/ comparisons/ Colorado/
Logan County/ South Platte State Wildlife Area/ comparison
of grazed and ungrazed grassland/ small taxa/ Mammalia/
chordates/ mammals/ vertebrates
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1257. Songbird community composition and nesting success in grazed and ungrazed pinyon-juniper woodlands.

Goguen, Christopher B. and Mathews, Nancy E.
Journal of Wildlife Management 62(2): 474-484. (1998)
NAL Call #: 410 J827; ISSN: 0022-541X

Descriptors: *Bos taurus*/ Fringillidae/ Passeriformes/
Molothrus ater/ Aves/ behavior/ birds/ communities/
ecosystems/ habitat alterations/ habitat use/ interspecies
relationships/ juniper/ nest parasitism/ nests/ nesting/
pinyon pine/ productivity/ wildlife/ livestock relationships/
wild birds/ reproduction/ woodlands/ land use/ neotropical
migrant songbirds/ breeding success/ livestock grazing/
natural resources/ animal science - animal ecology and
behavior/ plant science (general) - plant production
(general) - plant production (range and pasture grasses)/
abundance/ birds, passerine/ blackbirds and cowbirds/
cattle/ grazing/ habitat/ livestock/ nests and nesting/

parasitic habits/ sampling/ surveys/ vegetation/ agriculture/
prairie/ forest/ nest/ brood/ egg/ fertility/ recruitment/ brown-
headed cowbird/ songbird/ biotop/ vegetation/ North
America/ United States/ New Mexico/ Northeastern Region/
Colfax County/ Sangre de Cristo Mountains

Abstract: Livestock grazing is a dominant land use of
pinyon-juniper habitats in the western United States, yet the
effects of grazing on breeding bird communities in this
habitat have been poorly studied. The authors compared
habitat structure, songbird abundance, and nesting
productivity within pinyon-juniper woodlands on an actively
grazed site and a site experiencing long-term relief from
livestock grazing in northeastern New Mexico. From 1992
to 1995, they performed vegetation sampling, conducted
songbird point counts, and located and monitored nests on
8.35-ha study plots. Four of these plots experienced
moderate cattle grazing and four were ungrazed since
1973. They found no differences in habitat or vegetation
features between grazed and ungrazed plots. Bird
communities were similar, with only one of the 11 species
they tested more abundant on the ungrazed treatment
(western scrub-jay; *Aphelocoma californicus*). They
detected no differences in nesting success or cause-
specific rates of nest failure for seven common bird species
($P < 0.05$), and detected no differences in brown-headed
cowbird (*Molothrus ater*) parasitism rates for the major
hosts between grazed and ungrazed areas. Greater than
75% of the nests of the solitary vireo (*Vireo solitarius*),
western tanager (*Piranga ludoviciana*), and blue-gray
gnatcatcher (*Poliophtila caerulea*) were parasitized on both
treatments. These high parasitism rates may be the result
of high densities of local cowbirds because of abundant
feeding sites (i.e., livestock), the high mobility of cowbirds,
and the close proximity of ungrazed plots to grazed areas
(all < 4 km). The results suggest that 20 years of relief from
grazing had little influence on the habitat structure or bird
species composition of the pinyon-juniper woodlands on the
study site. However, livestock grazing has indirectly
affected the nesting success of some songbird species via
the influence of grazing on cowbird abundance. The
authors' findings highlight the need for studies that
incorporate nest monitoring and landscape-scale
approaches to better understand the relation between
cowbirds, livestock, and songbirds and the time required for
recovery from grazing effects.

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1258. Will conversion of Conservation Reserve Program (CRP) lands to pasture be detrimental for grassland birds in Kansas?

Klute, D. S.; Robel, R. J.; and Kemp, K. E.
American Midland Naturalist 137(2): 206-212. (1997)
NAL Call #: 410 M58; ISSN: 0003-0031

Descriptors: wild birds/ reproduction/ policy/ grasslands/
permanent grasslands/ abandoned land/ comparisons/
plant height/ seasonal variation/ nature conservation/
grazing/ grazing intensity/ farming systems/ land diversion/
setaside
Abstract: The Conservation Reserve Program (CRP)
involving land diversion was established by the 1985 Food
Security Act (Farm Bill). Unless renewed, most CRP
contracts will expire in 1997 and up to 70% of CRP fields in
Kansas may be converted to pasture. Data on vegetative
structure, avian abundance, and avian reproductive
success were collected on 5 CRP fields and 5 pastures

during summer 1993. Pastures had significantly greater vegetative cover and CRP fields had more bare ground. The sward was significantly taller in CRP fields late in the summer. Total avian abundance and that of dickcissels, grasshopper sparrows, meadowlarks, brown-headed cowbirds and upland sandpipers were greater in pastures than in CRP fields. Reproductive success and rates of nest parasitism by brown-headed cowbirds did not differ

between the habitats, but nests were more numerous in grazed pastures. If the CRP is not reauthorized in the 1995 Farm Bill and most of the Kansas land currently enrolled in CRP is converted to pasture, the conversion probably will not be detrimental to grassland bird populations provided that the grazing intensity is moderate.

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Plant Ecology, Biodiversity, and Other Environmental Effects

1259. Birch sapling responses to severity and timing of domestic herbivore browsing: Implications for management.

Hester, A. J.; Lempa, K.; Neuvonen, S.; Hoegh, K.; Feilberg, J.; Arnthorsdottir, S.; and Iason, G.

In: Plant ecology, herbivory, and human impact in Nordic mountain birch forests/ Wielgolaski, F. E.; Vol. 180; Series: Ecological Studies.

Berlin: Springer, 2005; pp. 139-155.

Notes: ISSN 0070-8356

NAL Call #: QH540.E288

Descriptors: economics/ herbivore grazing/ sapling responses/ domestic herbivore browsing/ browsing severity/ browsing timing/ locational effects/ birch forest area

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1260. Cattle grazing and the regeneration of totara (*Podocarpus totara* var. *waihoensis*) on river terraces, South Westland, New Zealand.

Miller, Craig and Wells, Andrew

New Zealand Journal of Ecology 27(1): 37-44. (2003)

NAL Call #: QH540.N43; ISSN: 0110-6465

Descriptors: cattle grazing/ forest type/ managed succession/ regeneration/ river terraces/ totara-matai forests

Abstract: Totara-matai forests are an under-represented forest type in Westland, relative to their original extent, and require protection and enhancement where possible. This study examined the regeneration of totara on gorse-covered river terraces of the Whataroa and Waiho Rivers, on a site grazed by cattle at Whataroa, and ungrazed sites at both locations. Totara is regenerating prolifically at all sites. Tall-seedling densities were significantly higher at the grazed Whataroa site than at the ungrazed Whataroa site. Conversely densities of small seedlings were significantly higher at the ungrazed Waiho site, with the majority of seedlings occurring on raised surfaces created by rafted logs or occasional silt patches, than at either of the Whataroa sites where seedlings established on the ground. Sapling and tree densities were similar at both Whataroa sites, but significantly greater than at the Waiho site. There was a significant relationship between the density of saplings and trees with terrace age at the Whataroa sites. Gorse cover and seedling density were significantly related at both ungrazed sites, but not at the grazed site. Grazing and gorse cover both appear to have roles in totara regeneration on river terraces. The implications of current management for future forest development are discussed, and it is considered that these areas warrant designation as areas of significant indigenous vegetation because of their conservation potential.

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1261. Cattle grazing effects on understory cover and tree growth in mixed conifer clearcuts.

Allen, B. H. and Bartolome, J. W.

Northwest Science 63(5): 214-220. (1989)

NAL Call #: 470 N81; ISSN: 0029-344X

Descriptors: white fir/ douglas fir/ deer/ vegetation reduction/ timber management/ Sierra Nevada/ California/ USA

Abstract: A long-term study of cattle grazing effects on shrub and herbaceous cover and tree growth in mixed conifer clearcuts began at Blodgett Forest Research Station on the west slope of the Sierra Nevada (California, USA) in 1977. Until that time, no studies had quantified the relationships between cattle grazing and reduction in non-tree vegetation, and grazing damage to tree regeneration. Yet, with the ban on use of herbicides in Federal forest management, alternative tools for reducing unwanted vegetation were needed. Cattle grazing reduced shrub and herbaceous canopy cover to 8 percent six years after harvesting, and 31 percent eight years after harvesting on two mixed conifer clearcuts. These cover levels were within timber management objectives for tree growth. No significant trampling damage occurred and browsing damage to white and Douglas-fir seedlings was primarily caused by deer. Tree seedlings showed no significant differences in height or basal diameter growth under any treatment. Thus, cattle grazing appears to be a viable tool for meeting brush/grass objectives in forest plantations.

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1262. Changes in composition and structure of a tropical dry forest following intermittent cattle grazing.

Stern, Margaret; Quesada, Mauricio; and

Stoner, Kathryn E.

Revista de Biología Tropical 50(3-4): 1021-1034. (2002)

NAL Call #: 442.8 R328; ISSN: 0034-7744

Descriptors: Shannon index of diversity/ community structure/ floristic composition/ forest composition/ forest structure/ intermittent cattle grazing/ species composition/ tropical dry forest

Abstract: In northwestern Costa Rica, cattle are being used as a "management tool" to reduce the amount of combustible material, mainly dominated by *Hyparrhenia rufa*, an African grass. This project is being developed within Parque Nacional Palo Verde and Reserva Biológica Lomas Barbudal, both of which form part of the only remaining tropical dry forests in Mesoamerica. To determine the short-term effects of cattle grazing on the natural vegetation, we compared the floristic composition within Palo Verde in an area under intermittent cattle grazing with an area that has not been grazed. There were significantly fewer plant species in the area with intermittent cattle grazing compared to the area with no grazing.

Floristic composition of these two habitats was different as reflected by both Fisher's alpha values and the Shannon index of diversity, both of which were significantly higher in the ungrazed site. The ungrazed area contained more plant species and was more similar to mature forest. The structure of the vegetation was significantly different between the intermittently grazed and ungrazed sites with more small stems (1-5 cm dbh) and fewer large stems (>5 cm dbh) in the intermittently grazed habitat. These results indicate that cattle grazing has an impact on the dry forest by reducing the relative abundance and density of larger tree species and by changing the species composition and structure of the community. The current management plan implemented in Palo Verde and Lomas Barbudal is not appropriate because of the impact that cattle have on the structure of the natural vegetation and should not be considered a viable alternative in other protected areas of dry forest in the Neotropics. We suggest that alternative fire prevention measures be evaluated including hand-cutting *H. rufa*, the creation of more frequent and larger fire breaks, and the development of green breaks.

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1263. Correlation of burning and grazing indicators with composition of woody understorey flora of dells in a temperate eucalypt forest.

Henderson, Meredith K. and Keith, David A.

Austral Ecology 27(2): 121-131. (2002)

NAL Call #: QH540 .A8; ISSN: 1442-9985

Descriptors: disturbance factors: fire, grazing/ temperate eucalypt forest: dell woody understorey flora

Abstract: Areas of warm temperate eucalypt forests of northern NSW escarpment, previously managed for cattle production, have recently been transferred into the conservation reserve system. The forests were seasonally grazed by cattle and were burnt frequently to promote green pick for stock feed. The hypothesis that disturbances associated with previous management had led to a simplification of the forest understorey, particularly a depletion in the density and species richness of shrubs was investigated. A disturbance history of the study area was constructed by compiling fire history records and using surrogate measures for recent and historical grazing. Shrub species composition was sampled in randomly located quadrats in dells within the forest, with a set of environmental and spatial covariables. Variation in shrub composition was partitioned among three sources (disturbance, environment and space) using a stepwise canonical correspondence analysis. Grazing and burning disturbance explained substantially more variation in vegetation than the environmental and spatial variables combined. Between 15 and 45% of total variation in adult shrub composition was attributable to the disturbance indicators. Similar results were obtained for composition of juvenile shrubs. Species richness and population densities of woody species were lower where disturbance was more intensive. It is concluded that historical grazing and burning practices had a substantial impact on the woody understoreys of the north-east escarpment forests. The species that were adversely affected spanned a range of life-history functional types. Estimates of the magnitude of grazing and burning impacts were limited by the lack of

spatially explicit disturbance history data over the full period of pastoral exploitation and the unavailability of suitable ungrazed 'controls' for sampling.

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1264. Cumulative effects of wild ungulate and livestock herbivory on riparian willows.

Brookshire, E. N. Jack; Kauffman, J. Boone; Lytjen, Danna; and Otting, Nick

Oecologia (Berlin) 132(4): 559-566. (2002)

NAL Call #: QL750.O3; ISSN: 0029-8549

Descriptors: nutrition/ diet/ feeding behaviour/ ecology/ habitat/ terrestrial habitat/ land and freshwater zones/ Nearctic Region/ North America/ USA/ *Cervus elaphus*/ *Odocoileus hemionus* (Cervidae): food plants/ *Salix boothii* and *Salix geyeriana*/ browsing effect on plant growth/ foraging/ browsing/ impact on habitat/ riparian habitat/ Oregon/ Blue Mountains/ Upper Meadow Creek/ browsing effect on food plant growth/ reproduction and structure/ Cervidae/ Artiodactyla/ Mammalia/ chordates/ mammals/ vertebrates

Abstract: We examined the effects of wild ungulates (deer and elk) and domestic sheep browsing on the growth, structure, and reproductive effort of two common willow species, *Salix boothii* and *S. geyeriana*, in a montane northeast Oregon riparian zone. With the use of exclosures, large herbivore effects on willows were studied in an area browsed by native mammals only and an adjacent area in which domestic sheep also lightly grazed during summer months. Growth variables were repeatedly measured on individual plants over a 5-year period to understand physiognomic and flowering responses of native willows to different levels of browsing pressure. At the beginning of the study, all willows were intensely browsed but were significantly taller in the area browsed only by native mammals than in the area also grazed by sheep (69 versus 51 cm, respectively). Willows inside exclosures responded with pronounced increases in height, crown area, and basal stem diameters while the stature of browsed plants outside exclosures stayed constant or declined. In the area browsed by both sheep and wild herbivores, the size of browsed plants remained at pre-treatment levels (<60 cm in height) for the duration of the study. There was no significant difference in growth rates of enclosed willows, indicating that current herbivory was the primary cause of growth retardation in the study area. Foliar area was strongly correlated with basal stem numbers for enclosed plants but much less so for browsed plants. Willows inside exclosures had more than twice as much foliar area per stem. Stem diameters were a positive function of crown area: stem-number ratios, suggesting lower photosynthetic potential was correlated with diminished radial growth among browsed plants. No flowering was observed until 2 years after exclusion when plants inside all exclosures and browsed willows in the wild ungulate area responded with a large pulse in flowering. Browsed plants in the sheep + wild ungulate area did not flower. The number of catkins produced per plant was significantly associated with willow height and plants <70 cm in height did not flower, thus suggesting a size threshold for reproduction in these species. Our results suggest that even relatively light levels of domestic livestock grazing, when coupled with intense wild ungulate browsing, can strongly affect plant structure and limit reproduction of riparian willows.

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1265. Effect of grazing management and fertilizer application on vegetation and soil properties of a moist temperate forest range in Siran Valley (Mansehra), NWFP.

Rafique, Sardar Mohammad

Pakistan Journal of Forestry 44(1): 20-29. (1994)

NAL Call #: 99.8 P17; ISSN: 0030-9818

Descriptors: bulk density/ forage production/ Northwest Frontier Province/ plant cover/ soil infiltration rate/ trampling

Abstract: Uncontrolled heavy grazing in blanks of moist temperate forests of the mountaineous tract of NWFP is a common practice of the local and nomad livestock herders. These blanks have been created as a result of compaction and trampling by livestock. This study was carried out in two blanks in moist temperate forest range at Kund, Manshra during June. 1989 and was maintained for 5 years. It study aimed at investigating the effects of grazing management and application of fertilizer on forage production, cover percent. soil protective cover, soil infiltration rate and soil bulk density. Three major treatments namely; one clipping (no grazing), two clippings (simulated rotational grazing) and conventional grazing (continuous seasonal grazing) were applied randomly in 3 plots of 10 times 10 meter size. Similarly, three sub plots of 10 times 5 meters size were fertilized with single dose of NPK (1:2:2) at the rate of 100 Kg N + 200 Kg P + 200 Kg K per ha. in split plot design. Ten permanent sample plots of 1 times 1 meter size (Braun-Blanquet's method) in each sub plot were established for estimation of forage production by clipping method, cover percentage and percentage soil protective cover. The study revealed 2.3 times improvement in forage production at present production level through protection (zero grazing) and fertilizer application. The percentage vegetation cover percentage and soil protective cover have also shown manifold increase in the treated plots. Further the study revealed appreciably higher soil porosity through decrease in soil bulk density and increase in water intake capacity (infiltration rate) with grazing management and application of fertilizer.

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1266. Effect of grazing on restoration of endemic dwarf pine (*Pinus culminicola* Andresen et Beaman) populations in northeastern Mexico.

Jimenez, Javier; Jurado, Enrique; Aguirre, Oscar; and Estrada, Eduardo

Restoration Ecology 13(1): 103-107. (2005)

NAL Call #: QH541.15.R45R515; ISSN: 1061-2971

Descriptors: grazing

Abstract: A pilot experiment designed to test the effect of cattle, small mammals, and elevation on the success of reforestation of an endemic dwarf pine species in northeastern Mexico was implemented. *Pinus culminicola* (Andresen et Beaman) grows only in four high peaks in the Sierra Madre Oriental and is under pressure from grazing, wildfires, and human activities such as mining, road development for timber extraction, and telecommunication and aerial navigation devices. We planted and monitored 2-year-old seedlings at three elevations within the natural distribution range of this species at Cerro El Potosi in Nuevo Leon, Mexico. At each elevation three treatments were established: (1) seedlings protected from cattle plus small mammals, (2) seedlings protected from cattle, and (3) seedlings with free access to cattle and small mammals.

Seedling survival was approximately 50% in (1) after 4 years, but there were no surviving seedlings with free access to cattle. Elevation in general did not account for variation in survival. Seedling growth was poor during the 4 years, which implies that seedlings remain susceptible to grazing and trampling by cattle and small mammals. The implications for a large-scale restoration program are discussed.

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1267. Effect of summer cattle grazing on aspen stem injury, mortality and growth.

Dockrill, C. W. M.; Blenis, P. V.; Bailey, A. W.; and King, J. R.

Forestry Chronicle 80(2): 257-261. (2004)

NAL Call #: 99.8 F7623; ISSN: 0015-7546

Descriptors: browsing/ cattle husbandry/ density/ foraging/ grazing/ growth/ injuries/ mortality/ plant height/ regeneration/ trampling

Abstract: Conflicts may arise between cattle and aspen (*Populus tremuloides*) fibre production if both occur on the same landbase. The effect of cattle on aspen regeneration was evaluated in Alberta (Canada) by determining the effect of four treatments (No grazing, June-only grazing, July-only grazing and continuous June-July grazing) on five variables (aspen height and density, percentage of aspen trampled, foraged and dead). Continuous June-July grazing impeded aspen regeneration relative to the control. The effect of cattle on aspen mortality was likely indirect, rather than a consequence of foraging and trampling. Reducing stocking levels or delaying cattle grazing may be necessary to reduce the adverse effect of cattle grazing on aspen regeneration.

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1268. Effects of cattle and deer on regenerating mixed conifer clearcuts.

Kosco, B. H. and Bartolome, J. W.

Journal of Range Management 36(2): 265-268. (1983)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1983/362/33kosc.pdf>

Descriptors: California

This citation is from AGRICOLA.

1269. Effects of cattle grazing on woodlands in central Iowa.

Mabry, Cathy

Journal of the Iowa Academy of Science 109(3-4): 53-60. (2002)

NAL Call #: Q11.J68; ISSN: 0896-8381

Descriptors: canopy loss/ grazing/ human disturbance/ human impact/ sod formation/ woodlands

Abstract: Iowa's forests have undergone a dramatic decline in area since settlement by Europeans. Most of the remaining forests have been degraded by an assortment of human impacts, with cattle grazing the most prominent among them. Using a matched pairs study designed to control for environmental differences among plots, I examined the impact of cattle grazing on the forest understory, canopy trees, and tree regeneration. There were distinct groups of understory species associated with ungrazed and grazed plots. Species associated with ungrazed plots were all native and tended to be perennial herbs with fleshy roots. Ungrazed plots also had species preferring moist forests with closed canopies, habitats

lacking human disturbance, and with ranges restricted to the eastern United States. In contrast, 30% of species associated with grazed plots were exotic, and the species associated with these sites were more likely to be annuals, have fibrous roots, occur in a wide variety of habitats, and have a cosmopolitan distribution. There were fewer seedlings found in grazed compared to ungrazed woods, and for canopy trees and seedlings, there was evidence for species specific responses to grazing. Woods that have been grazed, but not to the point of canopy loss and sod formation, are representative of the majority of the remaining woods in Iowa; thus, the results of this study are relevant to understanding the dynamics of Iowa forests and to developing plans for their restoration.

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1270. The effects of domestic livestock enclosure on broadleaved woodland regeneration in three Scottish environmentally sensitive areas.

Henderson, D. J.; Nolan, A. J.; Madden, S.; and Still, M. J. *Scottish Forestry* 51(1): 6-14. (1997)

NAL Call #: 99.8 SCO3; ISSN: 0036-9217

Descriptors: effects/ livestock/ protection of forests/ nature conservation/ broadleaves/ forest trees/ browsing damage/ wild animals/ climate/ seed production/ environmental protection/ vegetation types/ woodlands/ grazing/ natural regeneration

Abstract: The effects of stock enclosure on seedling and sapling numbers and sapling heights in broadleaved woodlands of the Breadalbane and Loch Lomond (Central Highlands) and Stewartry (Dumfries and Galloway) Environmentally Sensitive Areas (ESAs) between 1989 and 1993 are described. Seedling and sapling numbers generally increased both in woods where domestic livestock were excluded within the ESAs and at control sites grazed by domestic livestock without the ESAs, indicating that the sites may be more strongly influenced by natural variations of climate and seed production than by stock enclosure. Apart from a few woods within the Breadalbane ESA, saplings showed only small annual height increments, suggesting that wild herbivore browsing was maintaining the suppression of sapling growth in the absence of domestic herbivores. In the Breadalbane and Loch Lomond ESAs, the heights of ground vegetation strata (grasses, forbs and mosses) were greater in 1993 where stock had been excluded for 2-4 yr than on similar adjacent areas where domestic stock continued to graze. It is argued that individual site assessments are required for the formulation of appropriate site-specific management plans to promote successful broadleaved woodland regeneration.

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1271. Effects of grazing and cultivation on forest plant communities in Mount Elgon National Park, Uganda.

Reed, Mark S. and Clokie, Martha R. J.

African Journal of Ecology 38(2): 154-162. (2000)

NAL Call #: 409.6 Ea7; ISSN: 0141-6707

Descriptors: agricultural disturbance/ cultivation/ forest plant community/ grazing/ land use/ species composition

Abstract: Plant communities in the montane forest of Mount Elgon National Park were studied in order to assess the impact of grazing and cultivation on species composition. Present and former land uses, tree, shrub and herb species, soil properties and the percentage cover and height of trees, shrubs and herbs were determined in 40

plots. An indirect ordination of these plots showed that species composition was primarily determined by successional stage and agricultural disturbance. In forest plots (ordinated separately) where the widest range of former and current grazing intensities had occurred, evidence of grazing history, soil phosphorus and vegetation height correlated negatively with the strongest ordination axis. Least grazed forest plots had fewer tree seedlings and saplings than more intensively grazed plots. This may be due to the increase in *Mimulopsis alpina* (Acanthaceae) in less grazed forest where tree regeneration might otherwise be more advanced. Tree seedlings and saplings were uncommon in the forest, rarely exceeding 30 cm in height and there was no tree understorey. Although grazing is important for preserving species diversity in Mount Elgon National Park through the maintenance of species-rich grasslands, long-term effects on montane forest communities must be considered in future park management.

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1272. Effects of livestock grazing on forest habitats.

Dennis, Ann

In: Conservation in highly fragmented landscapes/ Schwartz, Mark W.

New York: Chapman and Hall, 1997; pp. 313-341.

Notes: ISBN 0412070316

NAL Call #: QH76.5.M53C66 1997

Descriptors: forest habitats/ livestock grazing effects/ long term conservation/ book chapter

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1273. Effects of livestock grazing on stand dynamics and soils in upland forests of the interior west.

Belsky, A. Joy and Blumenthal, Dana M.

Conservation Biology 11(2): 315-327. (1997)

NAL Call #: QH75.A1C5; ISSN: 0888-8892

<http://www.onda.org/library/papers/standdynamics.pdf>

Descriptors: pine (Coniferopsida)/ gymnosperms/ plants/ spermatophytes/ vascular plants/ conservation/ livestock grazing/ mixed conifer forests/ soil erosion/ species composition/ stand dynamics/ upland forests/ Western USA

Abstract: Many ponderosa pine and mixed-conifer forests of the western, interior United States have undergone substantial structural and compositional changes since settlement of the West by Euro-Americans. Historically, these forests consisted of widely spaced, fire-tolerant trees underlain by dense grass swards. Over the last 100 years they have developed into dense stands consisting of more fire-sensitive and disease-susceptible species. These changes, sometimes referred to as a decline in 'forest health,' have been attributed primarily to two factors: active suppression of low-intensity fires (which formerly reduced tree recruitment, especially of fire-sensitive, shade-tolerant species), and selective logging of larger, more fire-tolerant trees. A third factor, livestock grazing, is seldom discussed, although it may be as important as the other two factors. Livestock alter forest dynamics by (1) reducing the biomass and density of understory grasses and sedges, which otherwise outcompete conifer seedlings and prevent dense tree recruitment, and (2) reducing the abundance of fine fuels, which formerly carried low-intensity fires through forests. Grazing by domestic livestock has thereby contributed to increasingly dense western forests and to changes in tree species composition. In addition, enclosure

studies have shown that livestock alter ecosystem processes by reducing the cover of herbaceous plants and litter, disturbing and compacting soils, reducing water infiltration rates, and increasing soil erosion.

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1274. Fluvial disturbance patches and cottonwood recruitment along the Upper Missouri River, Montana.

Auble, G. T. and Scott, M. L.

Wetlands 18(4): 546-556. (1998)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: rivers/ cottonwood trees/ riparian vegetation/ seedlings/ grazing/ mortality/ geomorphology/ livestock/ disturbance/ recruitment/ streams (in natural channels)/ plants (see also aquatic macrophytes)/ death/ livestock (see also individual animals)/ USA, Montana, Missouri R./ fluvial/ cottonwood trees/ seedlings

Abstract: The disturbance patches most suitable for seedling establishment of pioneer riparian trees are also subject to future disturbances that produce high seedling mortality. We are monitoring plains cottonwood seedling establishment and mortality along the Wild and Scenic reach of the Missouri River upstream of Fort Peck Reservoir, Montana at four sites subject to livestock grazing and four paired, ungrazed exclosures. New seedlings at these sites were largely restricted to surfaces inundated by spring and summer flows. Winter ice drives and livestock grazing are important mortality factors along the study reach. Livestock grazing reduced seedling densities, although the position of these seedlings in normal flow years means it is unlikely that they will survive future disturbance. Average values of the maximum density parameter of a Gaussian curve of seedling distribution along a hydraulic gradient of inundating discharge were 30 and 114 seedlings/m² on ungrazed sites in 1996 and 1997, compared to 19 and 18 seedlings/m² for grazed sites. Water-surface elevations produced by ice drives and damming in the severe winter of 1995-1996 corresponded to inundating discharges of 1,670 to 4,580 m³/s. No existing trees at the study sites occurred at inundating discharges below 1,625 m³/s. Seedlings established as a result of maximum summer flows of 827 and 1,201 m³/s in 1996 and 1997 were all below the elevation of the 10-year return flow of 1,495 m³/s. Recruitment of plains cottonwood trees along this reach of the Missouri River is strongly dependent on infrequent high flows that position moist, bare disturbed patches high enough for seedlings to establish and survive subsequent flooding and ice scour, in contrast to other reaches and streams where hydrogeomorphic processes of channel meandering and narrowing produce different patterns of disturbance patches.

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1275. Forest stand dynamics and livestock grazing in historical context.

Borman, M. M.

Conservation Biology 19(5): 1658-1662. (2005)

NAL Call #: QH75.A1C5; ISSN: 0888-8892

Descriptors: climate/ environmental impact/ fire suppression/ forest fires/ forest health/ forest plantations/ grazing/ grazing intensity/ grazing systems/ grazing time/ history/ livestock/ logging

Abstract: Livestock grazing has been implicated as a cause of the unhealthy condition of ponderosa pine forest

stands in the western United States. An evaluation of livestock grazing impacts on natural resources requires an understanding of the context in which grazing occurred. Context should include timing of grazing, duration of grazing, intensity of grazing, and species of grazing animal. Historical context, when and under what circumstances grazing occurred, is also an important consideration. Many of the dense ponderosa pine forests and less-than-desirable forest health conditions of today originated in the early 1900s. Contributing to that condition was a convergence of fire, climate, and grazing factors that were unique to that time. During that time period, substantially fewer low-intensity ground fires (those that thinned dense stands of younger trees) were the result of reduced fine fuels (grazing), a substantial reduction in fires initiated by Native Americans, and effective fire-suppression programs. Especially favorable climate years for tree reproduction occurred during the early 1900s. Exceptionally heavy, unregulated, unmanaged grazing by very large numbers of horses, cattle, and sheep during the late nineteenth and early twentieth centuries occurred in most of the U.S. West and beginning earlier in portions of the Southwest. Today, livestock numbers on public lands are substantially lower than they were during this time and grazing is generally managed. Grazing then and grazing now are not the same.

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1276. Grazing animals as weed control agents.

Popay, Ian and Field, Roger

Weed Technology 10(1): 217-231. (Mar. 1996)

NAL Call #: SB610.W39; ISSN: 0890-037X

Descriptors: agriculture/ agronomy/ forestry/ grazing/ pest assessment, control, and management/ weed control

Abstract: Literature on the effectiveness of grazing animals (especially cattle, goats, and sheep) in controlling weeds is reviewed. Availability of animals and the ability to fence them onto or off weed infestations are essential. Weeds of pastures are the most suitable subjects for control, although weeds of arable crops, forestry, and waste places are sometimes amenable to control by grazing animals. Although grazing animals themselves often cause weed problems in pasture, adjusting grazing timing or intensity or both can sometimes redress the balance. Increasing sheep or cattle stocking rates prevents animals from grazing selectively and can help control some weeds. Adjusting grazing pressure can also improve the growth of desirable pasture species so that these are more competitive and able to resist invasion of annual or biennial weeds. Introducing a different class of stock, like sheep into a cattle system or goats into a sheep system can control many weeds. Goats are capable of browsing on and controlling spiny or poisonous brush weeds, including gorse and poison ivy, without suffering adverse effects. Examples are given of the use of grazing animals for weed control in crops and forestry.

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1277. Grazing impacts on spatial distribution of soil and herbaceous characteristics in an Australian tropical woodland.

Northup, B. K.; Brown, J. R.; and Ash, A. J.

Agroforestry Systems 65(2): 137-150. (2005)

NAL Call #: SD387 .M8A3; ISSN: 0167-4366

Descriptors: tropical forests/ woodlands/ grazing/ spatial variation/ silvopastoral systems/ soil chemistry/ forage

grasses/ soil-plant interactions/ soil fertility/ nitrogen/ carbon/ soil organic matter/ forage/ grazing management/ plant communities/ Queensland
This citation is from AGRICOLA.

1278. Grazing management of ruminant animals in sustainable agriculture.

DeRamus, H. A.
Outlook on Agriculture 33(2): 93-100. (June 2004)
NAL Call #: 10 Ou8; ISSN: 0030-7270
Descriptors: grazing/ ruminants/ ruminant nutrition/ sustainable agriculture/ soil nutrient balance/ range management/ forage/ digestibility
This citation is from AGRICOLA.

1279. Grazing on regeneration sites encourages pine seedling growth.

Ratliff, R. D. and Denton, R. G.
Albany, Calif.: Pacific Southwest Research Station; Research Paper PSW-RP-223, 1995. 11 p.
NAL Call #: A99.9 F7652P
Descriptors: Pinus ponderosa/ seedlings/ seedling growth/ grazing/ cattle/ artificial regeneration/ national forests/ California
This citation is from AGRICOLA.

1280. Influence of deer, cattle grazing and timber harvest on plant species diversity in a longleaf pine bluestem ecosystem.

Brockway, Dale G. and Lewis, Clifford E.
Forest Ecology and Management 175: 49-69. (2003)
NAL Call #: SD1.F73; ISSN: 0378-1127
http://www.srs.fs.usda.gov/pubs/ja/ja_brockway024.pdf
Abstract: Despite a recent slowing in the negative historical trend, losses of naturally-regenerated longleaf pine forests currently continue, largely as a result of conversion to plantations of faster growing pine species. Comparing the impacts of type conversion with silvicultural approaches that maintain longleaf pine and ascertaining their interaction with the influence of other resource management practices, such as grazing, on plant species diversity are essential in discerning the effects of these activities on the long-term sustainability of these ecosystems. A flatwoods longleaf pine bluestem ecosystem, which naturally regenerated following timber harvest during the early 20th century, on the coastal plain of southern Alabama was thinned to a residual basal area of 17 m²/ha or clearcut, windrowed and planted with slash pine (*Pinus elliotii*) seedlings in 1972 and then fenced in 1977 to differentially exclude grazing by deer and cattle. Neither grazing by deer alone nor deer in combination with cattle significantly altered vascular plant cover or species diversity; however, substantial differences were noted between the understory plant communities in the thinned forests and clearcut areas. Woody understory vegetation steadily increased through time, with woody plant cover in clearcuts (41%) dominated by the tree seedlings of *Pinus elliotii* and *Quercus* spp. being greater than that in thinned forests (31%) which were dominated by shrubs, principally *Ilex glabra*. While grass cover dominated by *Schizachrium scoparium* and *Andropogon* spp. remained stable (~81%), the foliar cover of all forbs declined through time (from 42 to 18%) as woody plant cover increased. Although the overall species richness and diversity declined and evenness increased through time, understory species richness and diversity were consistently

higher in thinned forests than in artificially-regenerated clearcuts. Despite a modest short-term decline in this differential, indicating a partial recovery of the clearcut areas over time, the disparity in understory plant diversity between thinned forests and clearcuts persisted for at least a decade. Whether grazing includes domestic cattle or is limited to native ungulates, such as white-tailed deer, we recommend that longleaf pine forests not be clearcut and replaced by plantations of other pines, if the ecological diversity is to be conserved, high quality habitat is to be maintained and longleaf pine ecosystems are to be sustained.

This citation is from Treeseearch.

1281. Livestock grazing influences on community structure, fire intensity, and fire frequency within the Douglas fir/ninebark habitat type.

Zimmerman, G. T. and Neuenschwander, L. F.
Journal of Range Management 37(2): 104-110. (1984)
NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1984/372/3zimm.pdf>
Descriptors: Idaho
This citation is from AGRICOLA.

1282. Long-term changes in the vegetation after the cessation of livestock grazing in *Eucalyptus marginata* (jarrah) woodland remnants.

Pettit, N. E. and Froend, R. H.
Austral Ecology 26(1): 22-31. (2001)
NAL Call #: QH540 .A8; ISSN: 1442-9985
Descriptors: DCA/ floristics/ life form/ ordination/ regeneration/ vegetation dynamics/ vegetation model
Abstract: This paper documents changes in the floristic composition of *Eucalyptus marginata* Donn (jarrah) woodlands over 7 years of recovery from continual, intensive livestock grazing. In remnants of native woodland left after agricultural clearing, which have been subjected to livestock grazing, comparisons were made between the floristics of fenced enclosure plots and open plots that continued to be grazed. The vegetation in nearby remnants, which had not been subjected to livestock grazing, was also surveyed. An initial increase in annual exotic pasture species after grazing relief was only temporary and highly influenced by fluctuations in annual climatic patterns, particularly rainfall distribution and abundance. Subsequent years saw a decrease in exotic annuals in enclosure plots and an increase in native perennials, in a trend towards becoming more floristically similar to the ungrazed sites. Germination of overstorey species was observed in the enclosure plots, however, development of seedlings and saplings was sparse. Results indicate that for jarrah woodland in southwestern Australia, natural regeneration is possible after the removal of livestock, with the return (within 6 years) of native species richness to levels similar to those found in ungrazed vegetation. Re-establishment of cover, however, appears to take longer. The floristic dynamics are described in terms of a nonequilibrium model. Two vegetation states exist, degraded remnants with an understory dominated by annual species, and ungrazed vegetation with an understory dominated by perennial shrubs and herbs. The former state is maintained by continual heavy grazing by livestock. Upon relief from grazing, the vegetation undergoes a transition towards

floristic similarity to ungrazed vegetation. After 6 years, vegetation change in the enclosure plots appears to be continuing and therefore it is still in transition.

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1283. Management of forests combining pines and grazing in Australia.

Moore, R.

In: Forest management in Australia. (Held 18 Sep 1987-22 Sep 1987 at Perth, Western Australia, Australia.) McKinnell, F. H.; Hopkins, E. R.; and Fox, J. E. D. (eds.)

Chipping Norton, New South Wales, Australia: Surrey Beatty and Sons; pp. 364-374; 380 p.; 1991.

Notes: Biennial Conference of the Institute of Foresters of Australia

NAL Call #: SD243.F67; ISBN: 0949324361

Descriptors: tree growth/ easy access/ pasturage/ resource utilization

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1284. Nitrous oxide emissions from grazed grassland.

Oenema, O.; Velthof, G. L.; Yamulki, S.; and Jarvis, S. C. *Soil Use and Management* 13(4 [supplement]): 288-295. (1997)

NAL Call #: S590.S68; ISSN: 0266-0032

Descriptors: nitrous oxide: emission, greenhouse gas/ livestock (Mammalia): grazer/ animals/ chordates/ mammals/ nonhuman mammals/ nonhuman vertebrates/ vertebrates/ agriculture/ climate change/ grazed grassland

Abstract: Grazing animals on managed pastures and rangelands have been identified recently as significant contributors to the global N₂O budget. This paper summarizes relevant literature data on N₂O emissions from dung, urine and grazed grassland, and provides an estimate of the contribution of grazing animals to the global N₂O budget. The effects of grazing animals on N₂O emission are brought about by the concentration of herbage N in urine and dung patches, and by the compaction of the soil due to treading and trampling. The limited amount of experimental data indicates that 0.1 to 0.7% of the N in dung and 0.1 to 3.8% of the N in urine is emitted to the atmosphere as N₂O. There are no pertinent data about the effects of compaction by treading cattle on N₂O emission yet. Integral effects of grazing animals have been obtained by comparing grazed pastures with mown-only grassland. Grazing derived emissions, expressed as per cent of the amount of N excreted by grazing animals in dung and urine, range from 0.2 to 9.9%, with an overall mean of 2%. Using this emission factor and data statistics from FAO for numbers of animals, the global contribution of grazing animals was estimated at 1.55 Tg N₂O-N per year. This is slightly more than 10% of the global budget.

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1285. Plant responses to pine management and deferred-rotation grazing in north Florida.

Lewis, C. E.; Tanner, G. W.; and Terry, W. S.

Journal of Range Management 41(6): 460-465. (1988)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1988/416/2lewi.pdf>

Descriptors: Pinus elliottii/ Pinus palustris/ Aristida stricta/ wiregrass/ growth disturbance/ community structure/ burning

Abstract: Responses of herbaceous and woody plants to combinations of 4 pine management and 4 grazing

management systems were tested on a wet-flatwoods site in the pine-wiregrass vegetation type of north Florida.

Frequency of occurrence of herbaceous species and foliar cover of woody species were determined in natural strands of 50-year-old slash and longleaf pine (*Pinus elliotti* Englem. and *P. palustris* Mill.) and compared to similar forest sites that were harvested and site prepared by double-chopping and not replanted with slash pine, or replanted to 1,112 trees/ha in single- and double-row configurations. In addition, these sites were ungrazed or grazed using 3 deferred-rotation systems. Prescribed burning in the natural stands increased occurrence of most herbs and stimulated new species to occur, but had little effect on woody plant composition. However, harvesting of pines and double-chopping resulted in the occurrence of many new herbaceous species and increased occurrence of most initially present. Pineland threeawn (*Aristida stricta* Michx.), the major herb, initially decreased in occurrence with intensive site disturbance. Six years after disturbance, most herbaceous species were declining in occurrence. Grazing or growth of replanted pines had little influence on occurrence of herbaceous species. Both burning and mechanical disturbances initially reduced foliar ground cover of most woody species; however, few species were eliminated from the community. Most woody species were recovering within 6 yr from treatment, but succession was somewhat slower on mechanically treated areas. Survival and growth of planted pines were not affected by grazing, nor did planting configuration affect pine growth.

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1286. Quantitative effects of grazing on vegetation and soils over a global range of environments.

Milchunas, D. G. and Lauenroth, W. K.

Ecological Monographs 63(4): 327-366. (1993)

NAL Call #: 410 Ec72; ISSN: 0012-9615

Descriptors: aboveground net primary production/ plant animal interactions/ productivity/ root biomass/ soil nutrients/ statistical analysis management

Abstract: Multiple regression analyses were performed on a worldwide 236-site data set compiled from studies that compared species composition, aboveground net primary production (ANPP), root biomass, and soil nutrients of grazed vs. protected, ungrazed sites. The objective was to quantitatively assess factors relating to differential sensitivities of ecosystems to grazing by large herbivores. A key question in this assessment was: Do empirically based, broad-scale relationships correspond to ecological theories of plant-animal interactions and conceptual frameworks for management of the world's grazing lands? Changes in species composition with grazing were primarily a function of ANPP and the evolutionary history of grazing of the site, with level of consumption third in importance. Changes in species composition increased with increasing productivity and with longer, more intense evolutionary histories of grazing. These three variables explained 50% of the variance in the species response of grasslands or grasslands-plus-shrublands to grazing, even though methods of measurement and grazing systems varied among studies. Years of protection from grazing was a significant variable only in the model for shrublands. Similar variables entered models of change in the dominant species with grazing. As with species composition, sensitivities of change in dominant species were greater to varying ecosystem-environmental variables than to varying

grazing variables, from low to high values. Increases of the dominant species under grazing were predicted under some conditions, and decreases were more likely among bunch grasses than other life-forms and more likely among perennials than annuals. The response of shrublands was different from that of grasslands, both in terms of species composition and the dominant species. Our analyses support the perception of grazing as a factor in the conversion of grasslands to less desirable shrublands, but also suggest that we may be inadvertently grazing shrublands more intensively than grasslands. Percentage differences in ANPP between grazed and ungrazed sites decreased with increasingly long evolutionary histories of grazing and increased with increasing ANPP, levels of consumption, or years of treatment. Although most effects of grazing on ANPP were negative, some were not, and the statistical models predicted increases in ANPP with grazing under conditions of long evolutionary history, low consumption, few years of treatment, and low ANPP for grasslands-plus-shrublands. The data and the models support the controversial hypothesis that grazing can increase ANPP in some situations. Similar to species variables, percentage differences in ANPP between grazed and ungrazed treatments were more sensitive to varying ecosystem-environmental variables than to varying grazing variables. Within levels not considered to be abusive "overgrazing," the geographical location where grazing occurs may be more important than how many animals are grazed or how intensively an area is grazed. Counter to the commonly held view that grazing negatively impacts root systems, there was no relationship between difference in ANPP with grazing and difference in root mass; as many positive as negative differences occurred, even though most ANPP differences were negative. Further, there was a weak relationship between change in species composition and change in ANPP, and no relationship with root mass, soil organic matter, or soil nitrogen. All three belowground variables displayed both positive and negative values in response to grazing. Current management of much of the world's grazing lands based on species composition criteria may lead to erroneous conclusions concerning the long-term ability of a system to sustain productivity.

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1287. Regulating competition on conifer plantations with prescribed cattle grazing.

Karl, M. G. and Doescher, P. S.

Forest Science 39(3): 405-418. (1993)

NAL Call #: 99.8 F7632; ISSN: 0015-749X

Descriptors: forest plantations/ *Pseudotsuga menziesii*/ *Pinus ponderosa*/ cattle/ water stress/ *Dactylis glomerata*/ roots/ soil water/ plant competition/ grazing/ Oregon

Abstract: On conifer plantations, competitive understory vegetation often retards growth and establishment of tree seedlings. Livestock grazing exemplifies a method of controlling the understory vegetation and increasing the availability of site resources to tree seedlings. We hypothesized that prescribed cattle grazing ameliorates water stress of young tree seedlings by reducing root growth of competing understory species. On a Douglas-fir (*Pseudotsuga menziesii* [Mirb.] Franco) and ponderosa pine (*Pinus ponderosa* Dougl.) plantation in southwest Oregon planted in 1986, seedling water stress was evaluated with the pressure chamber technique and supplemented with gravimetric sod water determinations in

1986-1989. Root growth of orchardgrass (*Dactylis glomerata* L.), the major understory competing species, was quantified in 1988 and 1989 with the root periscope/mini-rhizotron technique. Seedling water stress levels during spring and summer were similar in a cattle-grazed vs. ungrazed area in 1986 through 1988, but in summer 1989, water stress was reduced significantly in the grazed area. Soil water content was higher in the grazed area in 1989, especially at the 10-20 cm soil depth. End of season (July) orchardgrass root growth was reduced 18% and 15% with grazing in 1988 and 1989, respectively. We conclude that repeated cattle grazing of orchardgrass reduced transpirational surface area and root growth sufficiently to increase soil water availability to seedlings. Thus, prescribed cattle grazing on conifer plantations can enhance seedling physiological status by acting as a regulator of above- and belowground competition. This citation is from AGRICOLA.

1288. Relationship of native and introduced grasses with and without cattle in a young ponderosa pine plantation.

McDonald, Philip M. and Fiddler, Gary O.

Western Journal of Applied Forestry 17(1): 31-36. (2002)

NAL Call #: SD388.W6; ISSN: 0885-6095

Descriptors: agroforestry/ fencing effect/ grass density/ grazing effect/ native plant community response/ plant community/ seeding effect

Abstract: On an above-average site in northern California, an early shrub-forb-grass plant community was treated by artificially seeding two forage grass species at plantation age 3, cattle grazing with and without seeded grasses, and applying a soil-active chemical (Velpar). Planted ponderosa pines (*Pinus ponderosa* var. *ponderosa*) were part of this community. Results for a 10 yr period (1988-1997) are presented for a native, naturally invading needlegrass (*Achnatherum nelsonii*), introduced orchard grass (*Dactylis glomerata*) and introduced pubescent wheatgrass (*Agropyron trichophorum*). In general, all three grasses became established, grew well, and spread throughout the study area. Density of needlegrass was highest in the Velpar, fenced control, and grazed control treatments (more than 72,000 plants/ac). Orchard grass density was highest in the seeded and grazed and seeded and fenced treatments (more than 14,000 plants/ac) and relatively high in the Velpar treatment (8,400 plants/ac). Pubescent wheatgrass established well in both seeded treatments (more than 24,000 plants/ac) and spread best to the grazed control (6,950 plants/ac). Ecologically, the introduced grasses had no major effect on the native plant community, and, economically, their effect was positive, although minor.

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1289. Responses of main shrub species to different grazing regimes in Galicia.

Rigueiro Rodriguez, A.; Lopez Diaz, M. L.; and Mosquera Losada, M. R.

In: Towards the sustainable use of Europe's forests - Forest ecosystem and landscape research: Scientific challenges and opportunities/ Andersson, Folke; Birot, Yves; and Päivinen, Risto; Series: EFI Proceedings 49. Finland: European Forest Institute, 2004; pp. 301-307.

Notes: ISSN: 1237-8801

NAL Call #: SD177 .E44 no. 49

<http://www.efi.fi/publications/proceedings/49.html>

Descriptors: continuous grazing/ crude protein/ grasslands/ grazing/ rotational grazing/ silvopastoral systems/ sown grasslands

Abstract: The objective of the experiment was to evaluate the effect of two grazing systems (rotational and continuous) on crude protein and pasture production under a 25-year old plantation of *Pinus radiata* (800 trees/ha). Horse grazing reduces pasture production and therefore the risk of fire. Differences in pasture production between treatments were not important, which makes a continuous grazing system more recommendable. Species' persistence depends on the horses' preferences. They preferred gorses instead of fern or bramble. Differences in pasture protein percentages were not important, with the exception of *Pteridium*, which had higher protein content when lamina percentage was higher.

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1290. Riparian restoration through grazing management: Considerations for monitoring project effectiveness.

Medina, A. L.; Rinne, J. N.; and Roni, P.

In: *Monitoring stream and watershed restoration*. Bethesda, USA: American Fisheries Society, 2005; pp. 97-126.

Notes: ISBN: 1888569638

Descriptors: case studies/ design/ fisheries/ grazing/ monitoring/ riparian vegetation

Abstract: This paper provides the reader with practical information on issues of monitoring riparian areas, with emphasis on fisheries. First, an overview of considerations in designing a monitoring and evaluation programme (e.g., questions and hypotheses, study design, and duration) and selecting useful monitoring parameters, is given. Then, presents three grazing case studies wherein the purpose of the study, problems and issues, methods, and what was measured and what was learned. Finally, the general principles from the case studies that should apply for any monitoring programme when addressing grazing and fencing in riparian areas are synthesized.

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1291. Sheep as a silvicultural management tool in temperate conifer forest.

Sharrow, S. H.

Sheep Research Journal: 97-104. (1994)

NAL Call #: SF371.R47; *ISSN:* 1057-1809

Descriptors: sheep/ grazing intensity/ agroforestry/ brush control/ browsing/ coniferous forests/ ecological competition/ liveweight gain/ costs and returns/ grazing/ literature reviews

This citation is from AGRICOLA.

1292. Sheep grazing effects on coastal douglas fir forest growth: A ten-year perspective.

Sharrow, S. H.; Leininger, W. C.; and Osman, K. A.

Forest Ecology and Management 50(1-2): 75-84. (1992)

NAL Call #: SD1.F73; *ISSN:* 0378-1127

Descriptors: *Pseudotsuga menziesii*/ *Alnus rubra*/ timber industry/ livestock effects/ biological control/ weed control

Abstract: Interest in using livestock as a biological control agent to suppress unwanted vegetation in conifer plantations has expanded rapidly in the last 10 years.

Additional information concerning the silvicultural implications of livestock grazing, particularly the effects of

browsing and competition suppression on timber tree growth, are needed if grazing is to be widely adopted as a forest management tool. Tree diameter and height growth were measured during 1981-1990 for ungrazed and grazed tree stands in a coastal Oregon Douglas fir (*Pseudotsuga menziesii*) forest. Grazed stands were intensively used by a herded flock of 700-900 sheep for 3-4 days each May and August in 1981 and 1982. Understory vegetation phytomass and its utilization by sheep was evaluated using a before-and-after technique in 1981 and 1982. Sheep removed 28% and 64% of new tree lateral branches in 1981 and 1982, respectively. The major effect of browsing, however, appeared to be removal of terminal leaders which reduced 1990 Douglas fir tree height by 61 cm and diameter at breast height (dbh) by 1.9 cm for each terminal removed. Sheep browsed terminal leaders of 38% and 77% of grazed-plantation trees in 1981 and 1982, respectively. Grazing proved very effective in reducing red alder (*Alnus rubra*) establishment and growth. Total tree basal area in 1990 was similar for grazed and ungrazed stands. However, alder trees contributed over 45% of the tree basal area present on ungrazed stands compared to only 19% on grazed stands. Vegetation control by sheep, without associated browsing of terminal leaders, increased 1990 Douglas fir height by 16% and dbh by 34%. The net effect of grazing, reflecting the negative impacts of browsing together with the positive effects of reduced competing vegetation, was to increase the 1990 Douglas fir height by 6% and dbh by 22% on grazed compared to ungrazed timber stands.

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1293. Shifting mosaics in grazed woodlands driven by the alternation of plant facilitation and competition.

Olf, H.; Vera, F. W. M.; Bokdam, J.; Bakker, E. S.;

Gleichman, J. M.; De Maeyer, K.; and Smit, R.

Plant Biology 1(2): 127-137. (1999)

NAL Call #: QK1.P436; *ISSN:* 1435-8603

Descriptors: cyclical successional competition/ woodlands: grazing, shifting mosaics

Abstract: Free-ranging large grazers, such as cattle and horses, are increasingly reintroduced to former agricultural areas in Western Europe in order to restore natural and diverse habitats. In this review we outline mechanisms by which large grazers induce and maintain structural diversity in the vegetation (mosaics of grasslands, shrub thickets and trees). This variation in vegetation structure is considered to be important for the conservation of biodiversity of various plant and animal groups. The process of spatial association with unpalatable plants (associational resistance) enables palatable plants to establish in grasslands maintained by large grazers. In this way, short unattractive (thorny, low quality or toxic) species facilitate taller unattractive shrubs, which facilitate palatable trees, which in turn outshade the species that facilitated their recruitment. Established trees can, therefore, not regenerate under their own canopy, leading to cyclic patch dynamics. Since this cyclical dynamic occurs on a local scale, this contributes to shifting mosaics. The mechanisms involved in creating and maintaining the resulting shifting mosaics are described for temperate floodplain and heathland ecosystems, including the effects on nutrient transport within grazed landscapes. How grazing leads to shifting mosaics is described in terms of plant functional types, allowing potential generalisation to other

ecosystems. The resulting interaction web of grasses, unpalatable forbs and shrubs, palatable light-demanding trees and shade-tolerant trees is discussed, and was found to contain various interesting direct and indirect effects. The key process contributing to spatial diversity in vegetation structure is the alternation of positive (facilitation) interactions between plant species at one life cycle stage, and competitive displacement at another stage. Grazing thus causes directional successional sequences to change to shifting mosaics. The implications of this theory for nature conservation are discussed, including the relevant management problems, possible choices and practical solutions. We conclude that the theoretical framework outlined in this review provides helpful insights when coping with nature conservation issues in temperate woodland habitats.

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1294. Short-term responses of rehabilitating coastal dune forest ground vegetation to livestock grazing.

Wassenaar, Theo D. and Van Aarde, Rudi J.
African Journal of Ecology 39(4): 329-339. (2001)
NAL Call #: 409.6 Ea7; ISSN: 0141-6707

Descriptors: coastal dune forest ground vegetation/ grazing/ rainfall/ rehabilitation/ species richness/ vegetation cover

Abstract: We investigated the responses of the ground vegetation in a 17-year-old coastal dune forest plant community to four levels of experimentally applied livestock grazing (three grazing levels and one ungrazed control) from May 1994 to March 1996. The effects of grazing were apparently subordinate to site-specific intrinsic vegetation change and there were some indications that rainfall interacted with grazing level. Grazing had some apparent but no significant effects on plant species composition, significantly affected plant species richness over time, and significantly increased the range of species richness and vegetation cover values as well as the relative abundance and numbers of plant species with erect growth forms. Vegetation cover changed significantly over time, independently of grazing. Our results point to two important, easily measured mechanisms for the conservation management of coastal dune forests—the interaction of disturbance type with plant growth form and the increase of variation in community structural variables under disturbance. These mechanisms, although they potentially have wide application and predictive power, have not been studied adequately.

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1295. Soil phosphorus and tree cover modify the effects of livestock grazing on plant species richness in Australian grassy woodland.

Dorough, J.; Moxham, C.; Turner, V.; and Sutter, G.
Biological Conservation 130(3): 394-405. (2006)
NAL Call #: S900.B5; ISSN: 0006-3207

Descriptors: fertilizer/ grassland/ herbivory/ productivity/ soil nutrients/ species diversity/ tree clearing

Abstract: The effects of grazing on the richness of understorey plant communities are predicted to vary along gradients of resources and tree cover. In temperate Australia livestock management has involved phosphorus addition and tree removal but little research has examined how the effects of grazing on plant species richness may vary with these management regimes. Patterns of

understorey plant species richness were examined in 519, 0.09 ha quadrats in grazed pastures and remnant grassy forests and woodlands in southern Australia. Sheep grazing was the primary land use and sites varied widely in grazing frequency and density, tree cover and phosphorus fertiliser history. Using an information theoretic approach the available data provides strong evidence that the effect of grazing on total species richness varies according to available phosphorus and tree cover. Intermittent grazing and no grazing were associated with high total and native plant richness, but only at low phosphorus concentrations. Phosphorus was strongly negatively correlated with richness, particularly at low grazing frequency. Total species richness was positively correlated with tree cover except under frequent grazing at high stocking rates, suggesting that heavy grazing eliminates spatial and temporal heterogeneity imposed by trees. Native plant species richness was negatively correlated with a history of cultivation, positively correlated with tree cover and varied according to landscape position and geological substrate. Frequent high density grazing, particularly when associated with clearing, cultivation and fertiliser addition, was associated with the persistence of very few native plant species. In contrast, the richness of exotic plant species was relatively invariant and performance of the best model was low. While several studies have highlighted the importance of the grazed and cleared matrix for the conservation of native plant species, this benefit may be limited in landscapes where intensive grazing management systems dominate. Strong evidence for interactions between grazing, phosphorus and tree cover suggest that failure to consider other land use practices associated with grazing management systems could lead to erroneous conclusions regarding vegetation responses to livestock grazing. © 2005 Elsevier Ltd. All rights reserved. © 2006 Elsevier B.V. All rights reserved.

1296. Subsoiling and grazing effects on growth of nitrogen-fixing species.

Java Sharpe, B.; Everett, R.; Zabowski, D.; and Radek, K.
In: Proceedings of a symposium on sustaining rangeland ecosystems. (Held 29 Aug 1994-31 Aug 1994 at Eastern Oregon State College, La Grande, Oregon.) Edge, W. D. and Olsen-Edge, S. L. (eds.); Vol. Special Report 953. Corvallis, Ore.: Oregon State University Extension Service; pp. 201-205; 1996.
NAL Call #: 100 Or3M no.953

Descriptors: revegetation/ logging effects/ inceptisols/ grazing/ forest management/ silvopastoral systems/ reclamation/ disturbed land/ soil compaction/ establishment/ trees/ cultivation/ subsoiling/ site preparation/ nitrogen fixing trees/ nitrogen fixation/ *Lupinus albicaulis*

Abstract: Three methods for alleviating compaction on logging tracks at 1707 m altitude in Okanogan National Forest, Washington State were compared on a loamy-skeletal mixed andic cryochrepts. The soil was subsoiled or not subsoiled, grazing was excluded or allowed to continue and broadcast sowing of *Trifolium hybridum*, *Medicago lupulina*, *Lupinus albicaulis* or *Alnus sinuata* took place. Soil compaction was unaffected by the treatments. Subsoiling increased root penetration but not root numbers. *Trifolium hybridum* grew the most roots and they extended deeper

into the soil profile than the other species. *L. albicaulis* growth was variable, *A. sinuata* did not germinate until the 2nd year and *M. lupulina* was unsuited to the area.

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1297. Timber thinning and prescribed burning as methods to increase herbage on grazed and protected longleaf pine ranges.

Wolters, G. L.

Journal of Range Management 34(6): 494-497. (1981)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1981/346/13wolt.pdf>

This citation is from AGRICOLA.

1298. Tree/wood quality in slash pine following longterm cattle grazing.

Cutter, B. E.; Hunt, K.; and Haywood, J. D.

Agroforestry Systems 44: 305-312. (1999)

NAL Call #: SD387 .M8A3; ISSN: 0167-4366

http://www.srs.fs.usda.gov/pubs/ja/ja_cutter01.pdf

Descriptors: growth rate/ *Pinus elliottii*/ specific gravity/ tracheid length/ tree grade

Abstract: Tree height, diameter, and grade were measured on 14 cattle grazing trial plots located on the Palustris Experimental Forest in Louisiana's Kisatchie National Forest. These plots had been established in the early 1960s. Mensurational data was gathered on 28 trees from grazed sites and another 28 from ungrazed plots. Increment cores were also taken from these trees. Statistical analyses showed no effect attributable to grazing on any of the variables measured: tree height, tree diameter at breast height, tree grade, growth rate, amount of latewood, unextracted specific gravity, or tracheid length. This citation is from Treearch.

1299. The use of sheep in forest vegetation management.

Newsome, T.

Frd Report 251: 67-74. (Sept. 1996)

NAL Call #: SD14.B7F7; ISSN: 0835-0752

Descriptors: forests/ sheep/ predation/ plant communities/ weeds/ grasses/ weed control/ *Epilobium angustifolium*/ *Poaceae*/ *Populus tremuloides*/ *Salix*/ *Valeriana*/ seedlings/ wildlife/ plant competition/ feeding preferences/ grazing/ diameter/ literature reviews/ British Columbia

This citation is from AGRICOLA.

1300. Vegetational and faunal changes in an area of heavily grazed woodland following relief of grazing.

Putman, R. J.; Edwards, P. J.; Mann, J. C. E.; How, R. C.; and Hill, S. D.

Biological Conservation 47(1): 13-32. (1989)

NAL Call #: S900.B5; ISSN: 0006-3207

Descriptors: birch/ beech/ oak/ scots pine/ douglass fir/ holly/ herbivore conservation

Abstract: Two 5.6 ha inclosures were established in 1963 within an area of heavily grazed deciduous woodland in the New Forest, Hampshire. In one, a constant grazing pressure was maintained (at c. 1 fallow deer ha⁻¹); the other was kept free of all large herbivores. The vegetation of both was surveyed 6 years, 14 years and 22 years after inclosure. Changes over time in species composition and age structure of trees in the two areas are discussed, as are changes in composition, diversity and biomass of the ground flora and shrub layer. Clear differences were

apparent between the two and also, within the ungrazed site, over time. While in the grazed plot no regeneration was apparent, rapid regeneration of birch, beech, oak, Scots pine, Douglas fir and holly had occurred in the ungrazed plot by 1969; by 1985, with closure of the canopy, establishment had virtually ceased. Clear differences were also recorded in species composition of both trees and ground flora, with species resistant to grazing more abundant in the grazed plot and with many graze-sensitive or palatable species absent in that plot becoming re-established in the ungrazed area. Analysis of the three-dimensional profile of the vegetation also showed clear differences in vertical distribution in the two plots. Surveys were undertaken in 1983-84 and in 1985 of the small mammal communities and ground invertebrates in the two areas. Marked differences in species composition again reflect structure and species composition of the vegetation under the grazed and ungrazed regimes. The factors affecting the succession which followed relief of grazing are discussed. Even after 22 years, the vegetation of the ungrazed area remains strikingly species-poor, and reasons for this-and implications for conservation-are considered.

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1301. Vegetative trends in a young conifer plantation after 10 years of grazing by sheep.

McDonald, P. M. and Fiddler, G. O.

Albany, Calif.: Pacific Southwest Research Station; Research Paper PSW-RP-215, 1993. 13 p.

NAL Call #: A99.9 F7652P

Descriptors: forest plantations/ *Pinus ponderosa*/ ewes/ sheep/ seedlings/ seedling growth/ mortality/ plant competition/ grasses/ shrubs/ grazing/ California
This citation is from AGRICOLA.

1302. Water relations and growth of conifer seedlings during three years of cattle grazing on a southwest Oregon plantation.

Doescher, P. S.; Tesch, S. D.; and Drewien, W. E.

Northwest Science 63(5): 232-240. (1989)

NAL Call #: 470 N81; ISSN: 0029-344X

Descriptors: *Pseudotsuga menziesii*/ *Pinus ponderosa*/ stomatal conductance/ predawn xylem potential/ competition/ soil moisture/ resource management/ pressure chamber

Abstract: Cattle grazing, beginning one year after planting, was found to enhance water relations and growth of conifer seedlings on a young plantation in southwest Oregon. During 1984, because of the rocky nature of soils on the study area, availability of soil moisture to seedlings was assessed using the pressure chamber. Predawn xylem potentials of Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco) and ponderosa pine (*Pinus ponderosa* Laws.) seedlings were evaluated within three levels of competing vegetation that included ungrazed, grazed, and no competition environments. For ponderosa pine, little difference in predawn xylem potentials during 1984 were detected among the three levels of competition. For Douglas-fir, seedlings on the ungrazed plots exhibited significantly more negative predawn xylem potentials earlier in the growing season in comparison to the grazed and no competition treatments. Comparison of both ponderosa pine and Douglas-fir in 1986 between grazed and ungrazed treatments revealed significantly less negative predawn

potentials and significantly greater stomatal conductance on grazed plots early in the growing season. Improved water relations was one factor felt to increase growth and vigor of conifer seedlings on the grazed area. After 3 years, significantly greater seedling volume was found for both ponderosa pine and Douglas-fir on the grazed plots. Controlled cattle grazing improved plant water relations and enhanced the growth performance of young conifer seedlings.

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1303. Woodland regeneration in relation to grazing and fencing in Coed-Gorswen, North Wales.

Linhart, Y. B. and Whelan, R. J.

Journal of Applied Ecology 17(3): 827-840. (1980)

NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: oak/ *Quercus*/ alder/ *Alnus glutinosa*/ ash/ *Fraxinus excelsior*/ rowan/ *Sorbus aucuparia*/ hawthorn/ *Crataegus monogyna*/ sycamore/ *Acer pseudoplatanus*/ sheep/ gap replacement

Abstract: Seedling regeneration of tree species was studied in woodland composed primarily of oak (*Quercus*), alder (*Alnus glutinosa*), ash (*Fraxinus excelsior*), rowan (*Sorbus aucuparia*) and hawthorn (*Crataegus monogyna*). Species diversity and abundance of seedlings and saplings did not reflect the relative abundances of mature trees. Most seedlings were of ash but most saplings of sycamore and ash. Oak regeneration was almost non-existent. The effects of grazing on regeneration were studied by comparing species diversity and numbers of seedlings and saplings in fenced and unfenced 0.1 ha plots. There were many seedlings throughout the plots, but in unfenced, grazed plots, few seedlings survived beyond 2 yr. Sycamore (*Acer pseudoplatanus*) seemed most susceptible to grazing and hawthorn least susceptible. Observations made on seedlings and saplings when sheep broke into fenced areas suggest that grazing pressure may reduce sycamore regeneration without influencing that of ash and rowan. In fenced areas, saplings of sycamore and ash had the greatest probabilities of filling gaps caused by death of mature trees. In unfenced grazed areas, saplings of hawthorn and ash were the most likely to replace mature trees.

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