

HIGHLIGHTS



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Invited Synthesis Paper: State-and-Transition Models, Thresholds, and Rangeland Health: A Synthesis of Ecological Concepts and Perspectives

D.D. Briske, S.D. Fuhlendorf, and F.E. Smeins

The ecological concepts that underpin the development of state-and-transition models, thresholds, and rangeland health are reviewed and synthesized. The multiple-stable-state concept made these alternative evaluation procedures possible by hypothesizing that multiple stable plant communities may potentially occupy individual ecological sites. State-and-transition models can accommodate the occurrence of multiple stable communities, as well as continuous, reversible vegetation dynamics associated with the traditional range model. Rangeland health and state-and-transition models have not been integrated into a single framework because they rely on unique criteria for categorizing thresholds separating multiple stable states.

Interactive Effects of Drought and Grazing on Northern Great Plains Rangelands

R.K. Heitschmidt, K.D. Klement, and M.R. Haferkamp

Research addressed the interactive effects of spring drought and grazing during and after drought on rangeland productivity. The study involved using an automated rainout shelter to create severe drought situations from April 1 to July 1 during both 1998 and 1999 with and without periodic grazing during the drought years and the 1st post-drought recovery year (2000). Results showed that spring drought reduced total annual herbage production by 20%–40%, largely by reducing cool-season grass production. Study findings, in concert with previous findings, emphasize dependence of the region on spring precipitation and potential risks associated with applying grazing strategies whose success is dependent upon summer rather than spring precipitation.

Shrub Effects on Carbon Dioxide and Water Vapor Fluxes Over Grasslands

A.B. Frank and J.F. Karn

The effect of shrub invasion on CO₂ fluxes in northern Great Plains grasslands is not known. The Bowen ratio/energy balance technique was used to determine CO₂ and water vapor

fluxes over a grazed mixed-grass prairie (prairie site) and a mixed-grass prairie that has extensive invasion of shrubs (shrub prairie site). Total growing season CO₂ fluxes were similar in prairie and shrub prairie sites, averaging about 350 g CO₂ m⁻² (positive flux is CO₂ uptake), but the presence of shrubs altered the seasonal pattern of fluxes. These results suggest that shrub invasion on northern Great Plains grasslands does not reduce the potential of grasslands to sequester atmospheric CO₂.

Soil CO₂ Efflux Responses to Soil Loss on Two Rangeland Ecosystems

Mark S. Thorne, M. J. Trlica, Wayne C. Leininger, R. Dennis Child, and Donald A. Klein

How accelerated rates of soil loss affect the balance of carbon (C) in western rangelands, where rates of C accumulation without disturbance are relatively slow, is not well understood. The purpose of this study was to determine the effects of soil loss on total, bare soil, and plant respiration rates at short-grass prairie and sagebrush steppe sites. Increased total respiration rates observed on the short-grass prairie resulted primarily from increased plant respiration rather than from changes in bare soil respiration. Thus, changes in plant respiration following disturbance may be more important to total soil CO₂ efflux than soil flora and faunal respiration, which appeared to be more resistant to disturbance.

Emergence of Dallisgrass as Affected by Soil Water Availability

P.S. Cornaglia, G.E. Schrauf, M. Nardi, and V.A. Deregibus

It is very difficult to incorporate Dallisgrass into humid temperate grasslands through interseeding. We studied the effects of water availability on seed germination and seedling growth under controlled conditions to determine which step of the establishment process was most affected. This species showed high sensitivity to water stress during germination and early emergence. High emergence was obtained from the daily irrigation treatment. High availability of water, combined with the high temperatures required for breaking seed dormancy, occur infrequently, explaining the difficulty of achieving successful establishment of Dallisgrass. Water availability during these processes is a critical factor for survival of this species.

Clipping Frequency Affects Canopy Volume and Biomass Production in Planeleaf Willow (*Salix planifolia* var. *planifolia* Prush)

Mark S. Thorne, Paul J. Meiman, Quentin D. Skinner, Michael A. Smith, and Jerrold L. Dodd

Little is understood about how the frequency of browsing affects aboveground and belowground willow production. The objectives of this study were to determine how the frequency of simulated browsing events in a controlled environment affected 1) the aboveground, belowground, and total biomass production, and 2) the canopy volume of planeleaf willow (*Salix planifolia* var. *planifolia* Prush) plants. Results suggested that frequency of clipping alone did not explain differences in aboveground and belowground willow production. Instead, willow production was influenced by an accumulation of specific combinations of seasonal clipping events that were dependent on the clipping history of the plants. These results have important management implications that should be considered when grazing riparian areas.

Vizcacha's Influence on Vegetation and Soil in a Wetland of Argentina

Santiago M. Arias, Rubén D. Quintana, and Marcela Cagnoni

The vizcacha's activity strongly affects its habitat by grazing, trampling, and soil removal. To evaluate these effects, we carried out a vegetation and soil survey. Our results show that vizcachas diminished plant cover and grass biomass in their grazing areas, and that a few characteristic plant species dominated the disturbed areas. These areas also had higher cation exchange capacity and electric conductivity, and higher clay and sodium contents than did undisturbed areas. The rodents' activity introduces a recurrent disturbance factor to the landscape, the outcome of which is the alteration of both the composition and structure of the botanical communities, and of some soil properties.

Nutritional Value of Guajillo as a Component of Male White-Tailed Deer Diets

Tyler A. Campbell and David G. Hewitt

To examine the nutritional value of guajillo to white-tailed deer more thoroughly, we present a comparison of mixed diets of 0%, 25%, 50%, and 75% guajillo in male white-tailed deer. Four in vivo metabolism trials were completed with each diet. Nitrogen requirements for body growth and antler development were met by diets containing < 60% guajillo, whereas energy requirements for maintenance and antler growth were met with diets containing < 20% guajillo. The primary function of guajillo may be to facilitate maintenance of adult deer, which have fewer obligatory productive processes than young deer, during periods of drought.

Wyoming Big Sagebrush Recovery and Understory Response With Tebuthiuron Control

K.C. McDaniel, L.A. Torell, and C.G. Ochoa

Wyoming big sagebrush (*Artemisia tridentata* Nutt. ssp. *wyomingensis* Beetle and Young) recovery following chemical control with tebuthiuron was investigated over a 20-year

period at 8 study sites in northwestern New Mexico. The herbicide treatment was found to be long lasting with a substantial response of the herbaceous understory. Treatment life is projected to exceed 35 years for 6 of 8 study sites. Annual average grass yield increased about 3 times on most treated areas.

Economics and Optimal Frequency of Wyoming Big Sagebrush Control With Tebuthiuron

L.A. Torell, K.C. McDaniel, and C.G. Ochoa

The economics and optimal frequency of Wyoming big sagebrush (*Artemisia tridentata* Nutt. ssp. *wyomingensis* Beetle and Young) control using tebuthiuron were evaluated based on the expected rate of recovery following herbicide application, and how the brush overstory suppresses grass yield. This long-lasting control treatment was found to be an economical alternative for landowners participating in available cost-share programs. Tebuthiuron treatments were generally projected to last 35 or more years, but a 2nd brush control treatment should optimally be implemented before herbage production is fully depleted by the recovering sagebrush. The economic threshold abundance of big sagebrush was found to vary from a canopy cover of 6% to 14%, depending on site productivity and assigned forage value.

Mauto (*Lysiloma divaricatum*, Fabaceae) Allometry as an Indicator of Cattle Grazing Pressure in a Tropical Dry Forest in Northwestern Mexico

A. Breceda, V. Ortiz, and R. Scrosati

Determining reliable, quick indicators of cattle grazing pressure is important in rangeland ecology and management. We compared plant height, canopy cover, and basal trunk diameter of mauto (*Lysiloma divaricatum*), an arborescent legume, from grazed and ungrazed areas in a tropical dry forest in northwestern Mexico. The height-diameter and cover-diameter allometric relationships differed significantly between the 2 areas, with basal diameter increasing faster per unit increase in height or cover in the grazed area than in the ungrazed area. Therefore, mauto allometry might be used to quickly assess cattle grazing pressure in tropical dry forests.

An Evaluation of Arizona Cooperative Extension's Rangeland Monitoring Program

Maria E. Fernandez-Gimenez, George Ruyle, and Susan Jorstad McClaran

Arizona Cooperative Extension has been teaching rangeland monitoring for many years, but had no information on whether this program influenced rancher or agency monitoring practices. To address this gap, we conducted a program evaluation using focus groups and a mail survey. We found that Extension contact is associated with monitoring adoption and with implementation of other beneficial management practices, and that in many cases monitoring by permittees improved agency-permittee relationships. Rangeland monitoring is a social as well as a technical process, and Cooperative Extension plays an important role in both the technical and social dimensions of monitoring. ♦