HIGHLIGHTS

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Spatially Explicit Representation of State-and-Transition Models

Caitriana M. Steele, Brandon T. Bestelmeyer, Laura M. Burkett, Philip L. Smith, and Steven Yanoff

Broad-scale assessment of rangeland health and restoration requires knowledge of the spatial distribution of natural resources. We introduce a multifactor classification system based on ecological sites and state-and-transition models (STMs) that is directly linked to recent concepts of vegetation dynamics in rangelands. This classification was used in conjunction with aerial photo interpretation, supplemented with existing inventory data, and supported by rapid field assessments to create a spatial database and maps of ecological states. The resulting state map provides a means to connect STM concepts to specific land areas by generating and storing spatially explicit data that result from tests of the propositions in STMs.

Assessing the Carbon Consequences of Western Juniper (*Juniperus occidentalis*) Encroachment Across Oregon, USA

John L. Campbell, Robert E. Kennedy, Warren B. Cohen, and Richard F. Miller

Juniper encroachment might have a significant impact on continental carbon stocks because the area potentially subject to encroachment in North America is so vast. Using aerial photography and Landsat satellite imagery for eastern Oregon, we determined that locations 1) exhibiting unusually high rates of encroachment and 2) those where juniper was removed by fire, were as important in defining regional carbon stocks as undisturbed locations with typical encroachment rates. This study illustrates the capacity of woody removal over very small areas to offset encroachment over very large areas. We caution against scaling site-level encroachment studies over entire regions.

Soil Moisture Enhancement Techniques Aid Shrub Transplant Success in an Arid Shrubland Restoration

Tamera J. Minnick and Richard D. Alward

In arid and semiarid rangelands, re-establishment of perennial vegetation can be enhanced with modest increases in soil moisture. We evaluated methods to enhance transplant survival of big sagebrush, (*Artemisia tridentata*), four wing saltbush (*Atriplex canescens*), and rubber rabbitbrush (*Ericameria nauseosa*) seedlings. Placing a piece of wood immediately south of each seedling and adding a hydrogel to the root zone was useful; however, the addition of mycorrhizae spores did not significantly enhance transplant survivorship. We recommend the wood treatment; it increased survival of big sagebrush, a species of conservation concern, and slash is often readily available onsite and has low labor requirements.

Ecosystem Performance Monitoring of Rangelands by Integrating Modeling and Remote Sensing

Bruce K. Wylie, Stephen P. Boyte, and Donald J. Major

Monitoring rangelands performance provides critical information about rangeland health and trend information which is especially important because of urban expansion, climate change, and increased disturbances. We integrated satellite and weather data into ecological models to map 9 years of rangeland performance in the Owyhee Uplands, highlighting disturbance-related performance anomalies. We found that when accounting for weather, Owyhee rangelands performed reasonably well over the 9 years, but some areas, especially recently disturbed areas, could have benefited from management activities. Land managers can use weather-based ecosystem performance models to help identify sites that have reduced function and resilience.

Postfire Restoration of Soil Hydrology and Wildland Vegetation Using Surfactant Seed Coating Technology

Matthew D. Madsen, Stanley J. Kostka, Aaron Inouye, and Daniel L. Zvirzdin

Nonionic soil surfactants have been shown to be effective in enhancing infiltration and improving root-zone water reserves in water-repellent soils. However, the application of soil surfactants in wildland ecosystems can be logistically and economically prohibitive. We evaluated a potential solution for applying soil surfactant using seed coating technology. Laboratory and greenhouse studies indicated that surfactant seed coating (SSC) increased soil water infiltration, percolation, and retention within the microsite surrounding the seed, which subsequently led to improved seedling emergence and plant survival. These results demonstrate that it might be plausible for SSC(s) to improve postfire reseeding efforts.

Smoke Water and Heat Shock Influence Germination of Shortgrass Prairie Species

Yi-Fang Chou, Robert D. Cox, and David B. Wester

Smoke and heat from burning vegetation can influence the germination of native seeds in several shrubby, fire-prone ecosystems. Little is known, however, about whether the same is true for grasslands. We tested seeds of 10 species native to shortgrass prairie in the United States for response to smoke and heat, and found that nine of the 10 responded to smoke, heat, or both. These results could be useful in managing shortgrass prairie by allowing managers to preferentially stimulate germination of specific species.

Vegetation Response to Mowing Dense Mountain Big Sagebrush Stands

K. W. Davies, J. D. Bates, and A. M. Nafus

Sagebrush-reducing treatments might be needed in dense mountain big sagebrush (*Artemisia tridentata*) stands to increase herbaceous vegetation. Mowing treatments are increasingly used because they are more controllable than prescribed burning. We evaluated vegetation responses to mowing for 3 years posttreatment in mountain big sagebrush plant communities. Mowing reduced sagebrush cover and generally increased herbaceous cover, density, and production. However, perennial forbs and exotic annual grasses did not respond to mowing. Because plant functional group responses were variable, our results suggest that careful consideration of whether mowing will meet management objectives is needed.

Evaluation of Herbicide and Disking to Control Invasive Bluestems in a South Texas Coastal Prairie

Marvin E. Ruffner and Thomas G. Barnes

Several species of exotic Old World bluestem grasses (*Bothriochloa* and *Dichanthium* spp.) have been characterized as "invasive" in rangelands of the central and southern United States. We evaluated the effectiveness of three regimens to control exotic bluestem grasses in a south Texas coastal prairie. Disking followed by herbicide treatments (glyphosate, imazapyr, or imazapyr + glyphosate) reduced exotic bluestem abundance for more than 52 weeks after treatments, but herbicide-only treatments and herbicide treatments followed by disking provided less than 20 weeks control. Additional integrated management strategies need to be investigated for long-term control of exotic bluestem invasions in rangelands of the central and southern United States.

Spotted Knapweed Utilization by Sequential Cattle and Sheep Grazing

Stacee L. Henderson, Tracy K. Mosley, Jeffrey C. Mosley, and Rodney W. Kott

Targeted sheep grazing can suppress spotted knapweed (*Centaurea stoebe*); however, some land managers resist using this tool over concerns that sheep might consume too much grass. These concerns can potentially be minimized by grazing spotted knapweed infestations first with cattle, immediately followed by sheep. Our results indicate that targeted sheep grazing can be applied immediately after cattle grazing in early or mid-summer to effectively suppress spotted knapweed without overgrazing desirable grasses. Cattle and sheep will eat less grass and more spotted knapweed if cattle and sheep graze sequentially when spotted knapweed is in its late-bud/early flowering stage rather than its bolting stage.

Does Cattle Grazing Affect Ant Abundance and Diversity in Temperate Grasslands?

Amanda C. Schmidt, Lauchlan H. Fraser, Cameron N. Carlyle, and Eleanor R. L. Bassett

Ants perform an important functional role in rangelands, and yet, little is known about the effects of livestock grazing on ant communities. We used pitfall traps to study ant abundance and diversity in grazed and ungrazed areas at two grassland types along an elevation–productivity gradient. We found a higher number of ants at high-productivity sites that were grazed, whereas grazing on low-productivity sites reduced ant numbers. Ant species richness and diversity followed a similar pattern. Because ants impact ecosystem functioning, they should be considered in management of grasslands.

Behavioral Interference Between Sympatric Reindeer and Domesticated Sheep in Norway

Jonathan E. Colman, Diress Tsegaye, Christian Pedersen, Ruben Eidesen, Herbjørg Arntsen, Øystein Holand, Alex Mann, Eigil Reimers, and Stein R. Moe

We investigated behavioral interference between wild- and semi-domestic reindeer (*Rangifer tarandus tarandus*) and sheep on summer grazing lands. Although free-ranging, reindeer and sheep interrupted each other at less than 200 m and 30 m, for wild and semidomestic reindeer, respectively, and neither species consistently dominated the other. When new reindeer or sheep were introduced into enclosures already occupied by reindeer, new reindeer caused significantly more interference and confrontations among individuals compared to new sheep. For all study areas, confrontations decreased with time after "first encounter," indicating cohabituation.

Female White-Tailed Deer Body Condition and Diet After a Large Spring Wildfire

John S. Lewis, Robert D. Kaiser III, David G. Hewitt, and David R. Synatzske

To better understand short-term effects of large rangeland wildfires on white-tailed deer (*Odocoileus virginianus*), we harvested deer biweekly after a spring wildfire in southern Texas. Body condition of deer did not decline and pregnancies proceeded normally during the sampling period. Deer consumed primarily prickly pear (*Opuntia engelmannii*) pads 3 weeks after the fire, switched to forbs and browse for several weeks, and ate primarily mesquite (*Prosopis glandulosa*) and prickly pear fruit 3 months after the fire. White-tailed deer can survive and reproduce after large-scale wildfires because broad food habits enable them to respond to the rapidly changing foraging environment.

Historical Changes in Stocking Densities on Texas Rangelands

Bradford P. Wilcox, Michael G. Sorice, Jay Angerer, and Cynthia L. Wright

We tracked the density of domestic livestock from the early 1900s to the present for rangelands in Texas. Stocking densities have declined across the state by 40–75%. This decline reflects poorly understood socioeconomic changes, including changing land ownership, fragmentation of land holdings, and increasing emphasis on wildlife conservation. The potential consequences of these changes include increased risks of large fires, increased carbon sequestration, improved hydrological conditions, and, in many cases, improve habitat for wildlife and have implications for managers and policy makers.