

# Highlights

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## **Incorporating Biodiversity into Rangeland Health: Plant Species Richness and Diversity in Great Plains Grasslands**

Amy J. Symstad and Jayne L. Jonas

A clear understanding of how various management practices, human-induced stressors, and natural phenomena affect plant diversity is critical for interpreting biodiversity changes in rangelands. We synthesized results from published studies on this topic for Great Plains grasslands. Moderate grazing in tallgrass prairies and nitrogen fertilization in shortgrass prairies had the largest effects on plant species richness and diversity, but substantial information gaps exist, particularly for shortgrass prairies. Augmenting current methods of evaluating rangeland health with a measure of plant biodiversity would reduce these shortcomings and provide information critical to managing for biodiversity under continuing and new stressors in rangeland ecosystems.

## **Energy and Carbon Costs of Selected Cow-Calf Systems**

Cody J. Zilverberg, Phillip Johnson, Justin Weinheimer, and Vivien G. Allen

Fossil fuel-derived inputs, including fertilizer, fuel, and machinery, can increase cow-calf productivity per unit of land or labor but also raise financial and environmental concerns. Eleven cow-calf systems from Iowa, South Dakota, Tennessee, and Texas were analyzed to determine quantities of energy used and carbon emitted. Energy and carbon per cow increased rapidly as stocking rates increased; in addition, the most important energy inputs (fertilizer vs. diesel fuel, for example) differed for intensive and extensive systems. Potential strategies to improve energy efficiency include replacing hay with dormant forage and protein supplementation, and concurrently reducing fertilizer use and stocking rates.

## **Extent of Coterminous US Rangelands: Quantifying Implications of Differing Agency Perspectives**

Matthew Clark Reeves and John E. Mitchell

We determined rangeland areal extent in the United States using the LANDFIRE model according to definitions used by the Natural Resources Inventory (NRI) administered by the Natural Resources Conservation Service (NRCS) and the Forest Inventory and Analysis Program (FIA) administered by the US Forest Service (USFS). The NRI and FIA models differed in tree canopy cover requirements. The biggest discrepancies between area estimates derived from NRI and FIA models occurred in oak, pinyon-juniper, and mesquite woodlands. These differences demonstrate the need for development of unified, objective methods for determining rangeland extent that can be applied consistently to all rangelands regardless of ownership or jurisdiction.

## **An Assessment of State-and-Transition Models: Perceptions Following Two Decades of Development and Implementation**

Corrine N. Knapp, Maria E. Fernandez-Gimenez, David D. Briske, Brandon T. Bestelmeyer, and X. Ben Wu

Significant resources have been invested in developing state and transition models (STMs) as a rangeland assessment and management tool, but the utility of STMs for these goals has not been formally evaluated. We interviewed 47 rangeland managers and researchers about their perceptions and use of STMs. Interviewees saw STMs as a decision-making tool, a way to represent complex ecosystem dynamics, and a communication tool, and identified five major issues requiring further development and refinement. Greater dialogue among researchers and managers is needed to clarify STM terminology and develop standard protocols for STM development, validation, peer review, and revision.

## **Ranching and Multiyear Droughts in Utah: Production Impacts, Risk Perceptions, and Changes in Preparedness**

D. Layne Coppock

Droughts commonly occur in rangeland systems, but little is known about how ranchers cope with and modify their management in response to drought. We surveyed 509 Utah ranchers in 2009 to assess the effects of a major drought during 1999–2004 on ranch resources and rancher coping tactics. Results indicated that 75% of operations were negatively affected by this drought and that this experience—in conjunction with a recent expansion of drought-mitigation programs—led to significant improvements in drought preparedness across the population. Increased rancher awareness of drought hazards provides opportunities to further enhance risk management and improve grazing land stewardship.

## **Animal and Vegetation Response to Modified Intensive-Early Stocking on Shortgrass Rangeland**

Keith R. Harmony and John R. Jaeger

Stocker cattle thrive on native pasture under early season intensive stocking when forage quality is high, and by selecting high-quality forage under season-long stocking systems. Animal gains and vegetation trends were compared between a continuous season-long stocking system and a modified intensive-early stocking system with late-season grazing on shortgrass native rangeland. Total beef gain was 17 pounds per acre greater on the modified intensive-early stocked system. Key vegetation characteristics were similar between the two systems. The modified intensive-early stocking system is an option for producers to include stocker animals in their management program and to have flexibility in preparation for drought.

## **Cattle Selection for Aspen and Meadow Vegetation: Implications for Restoration**

Bobette E. Jones, David F. Lile, and Kenneth W. Tate

There is concern about aspen decline due to browsing by cattle. We examined nutritional quality and utilization by cattle on adjacent aspen and meadow vegetation in US Forest Service grazing allotments. Aspen suckers had greater nutritional quality than both aspen understory and meadow vegetation, particularly as the summer grazing season progressed. To reduce cattle preference for aspen, managers can set stocking rates to ensure adequate herbaceous forage throughout the growing season, provide nutritional supplements to reduce demand for nutritious aspen, construct protective fencing, and/or implement grazing systems that ensure regular rest from browsing.

## **Topoedaphic Variability and Patch Burning in Sand Sagebrush Shrubland**

Stephen L. Winter, Samuel D. Fuhlendorf, Carla L. Goad, Craig A. Davis, and Karen R. Hickman

Patch burning typically has been discussed within a framework of imposing heterogeneity on a homogeneous landscape or management unit, yet most landscapes are actually distinguished by an inherent level of heterogeneity. We applied patch burning in Oklahoma sand sagebrush shrubland across sites already heterogenous due to variable topography and soils. Shrub-dominated sand dunes were readily altered by the patch-burning treatment while level short-grass-dominated areas between dunes were relatively unaffected. In landscapes characterized by preexisting heterogeneity, patch burning can have an additive effect but may influence sites with distinct topography and soils differently.

## **Can Imazapic Increase Native Species Abundance in Cheatgrass (*Bromus tectorum*) Invaded Native Plant Communities?**

Adrien C. Elseroad and Nathan T. Rudd

Native plant communities invaded by cheatgrass (*Bromus tectorum*) are at risk of high-intensity fires and conversion to cheatgrass monocultures. We tested whether the selective herbicide Imazapic is effective in temporarily reducing cheatgrass and allowing native species to increase in abundance without reseeding. We found that Imazapic suppressed cheatgrass and other nonnative annuals for 3–4 years, depending on the site, but only two native perennial species increased in sprayed plots. These results suggest that a short-term reduction in cheatgrass alone is not an effective strategy for increasing the abundance of most native perennial plant species.

## **Ecotypic Variation in *Elymus elymoides* subsp. *brevifolius* in the Northern Intermountain West**

Matthew C. Parsons, Thomas A. Jones, Steven R. Larson, Ivan W. Mott, and Thomas A. Monaco

Bottlebrush squirreltail's great ecotypic variation requires that genetic material be matched to restoration site as much as possible. We evaluated 32 populations of a newly identified squirreltail subspecies from the northern Intermountain West for biomass, phenological, and functional traits and characterized these populations with DNA markers. Based on correlations among phenotypic, genotypic, and climatic variables and geographic distance among collections, we concluded that this ecotypic variation has been driven by natural selection and shaped by environmental heterogeneity and geographic isolation. To increase restoration success, we identified four phenotypic zones useful for matching plant material to restoration site.

### **Pyric-Herbivory and Cattle Performance in Grassland Ecosystems**

Ryan F. Limb, Samuel D. Fuhlendorf, David M. Engle, John R. Weir, R. Dwayne Elmore, and Terrance G. Bidwell

Economically optimal livestock production on rangelands can conflict with conservation strategies that require a lower stocking rate to maintain wildlife habitat. We combined fire and grazing (pyric-herbivory) as a conservation-based management approach to increase rangeland biodiversity by creating heterogeneous vegetation structure and composition. Stocker cattle weight gain, calf weight gain, and cow body condition score were similar between traditional and conservation-based management in tallgrass prairie, but stocker cattle in conservation management outgained those in traditional management on mixed-grass prairie. We conclude that pyric-herbivory is a conservation-based rangeland management strategy that returns fire to the landscape without reduced stocking rate, deferment, or rest.

### **Cattle Grazing Toxic *Delphinium andersonii* in South-Central Idaho**

James A. Pfister, Daniel Cook, and Dale R. Gardner

This study examined cattle consumption of toxic Anderson larkspur (*Delphinium andersonii*) in central Idaho. Toxic

alkaloid concentrations in Anderson larkspur were relatively high, at or above 0.5%, during 2008 and 2009. In the first year cows averaged 3% of their diets as larkspur during the late flower and pod stages; in the second summer, heifers ate more (5.1% of diets) larkspur than did mature cows (2.9%). Management to reduce losses to Anderson larkspur should include timed grazing to avoid infested pastures during full flower to pod stages and grazing with mature animals.

### **Juniper Consumption Does Not Adversely Affect Meat Quality in Boer-Cross Goats**

Matthew W. Menchaca, Cody B. Scott, Kirk W. Braden, Corey J. Owens, and Loree A. Branham

Goats will consume juniper (*Juniperus* spp.) on pasture, but the effect of juniper consumption on meat quality is unknown. We determined if juniper consumption affected meat quality (i.e., carcass characteristics) or flavoring of Boer-cross kid carcasses. Goats were fed juniper at 0%, 10%, 20%, and 30% of the diet for 28 days in individual pens prior to harvesting them. Carcass and sensory characteristics were similar ( $P > 0.05$ ) among treatments. Landowners can utilize goats as a biological management tool without adversely affecting goat meat quality or flavoring.