

HIGHLIGHTS

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Climate Change and North American Rangelands: Trends, Projections, and Implications

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Climate science indicates that increasing concentrations of atmospheric CO₂ and other greenhouse gases are warming Earth's atmosphere and will alter precipitation patterns. Specific consequences of climate change vary geographically because of regional differences in current environmental conditions and the rate and magnitude of climate change. Climate change consequences include modifications to plant community composition and species distributions, forage quality and quantity, fire regimes, soil carbon content, and livestock performance and production systems. Climate change is occurring and will impact rangelands. The rangeland profession has a critical role in developing and promoting strategies and policies to help managers and society adapt.

Climate Change and North American Rangelands: Assessment of Mitigation and Adaptation Strategies

Linda A. Joyce, David D. Briske, Joel R. Brown, H. Wayne Polley, Bruce A. McCarl, and Derek W. Bailey

Climate change will affect goods and services produced on rangelands; this review synthesizes options to mitigate greenhouse gas emissions, as well as actions to adapt to climate change. While adaptation strategies are numerous, carbon sequestration for mitigation is much less viable as a policy or enterprise alternative. Adaptations specific to livestock production systems may include flexible herd management, alternative breeds or species, innovative pest management, modified enterprise structure, and relocation. Sustaining livelihoods on rangeland ecosystems will require an iterative learning process, increasing the adaptive capacity of individuals, enterprises, and social organizations to respond to changing social, economic, and ecological conditions.

Contrasting Preference for Grassland Landscapes Among Population Groups in the Central and Southern Great Plains

Terrie A. Becerra, David M. Engle, R. Dwayne Elmore, and Samuel D. Fuhlendorf

Agricultural production drives rangeland management focused on homogeneity and uniformity even though heterogeneity provides a broader suite of ecosystem services. We determined preference for heterogeneous grassland landscapes expressed by three study populations (ranchers, grassland/rangeland specialists, and the general population) using surveys that included photographs of landscapes and patterned images. All three population groups generally preferred homogeneous landscapes, consistent with the central paradigm of managing rangeland for homogeneity, but they preferred heterogeneous patterned images to homogeneous patterned images. This suggests that preference for homogeneity is acquired and can be altered through an intervention strategy that increases appreciation of heterogeneity.

Wolf (*Canus lupis*) Predation Impacts on Livestock Production: Direct Effects, Indirect Effects, and Implications for Compensation Ratios

Jordan R. Steele, Benjamin S. Rashford, Thomas K. Foulke, John A. Tanaka, and David T. Taylor

Compensation for wolf (*Canus lupis* L.) damage is used to reduce conflicts between livestock production and wolf conservation. Current compensation, however, considers only wolf depredation; indirect effects may also reduce livestock profitability. We use a cow-calf budget for northwest Wyoming to estimate financial impacts of direct (depredation and injured calves) and indirect effects (decreased weaning weights and conception rates and increased cattle sickness). Our results suggest the indirect effects can be larger than the direct effects, and therefore full compensation ratios (number of calves compensated per confirmed depredation) need to be two to three times larger than the current 7:1 ratio.

Tick Abundance and Levels of Infestation on Cattle in Response to Patch Burning

Victoria J. Polito, Kristen A. Baum, Mark E. Payton, Susan E. Little, Samuel D. Fuhlendorf, and Mason V. Reichard

Ticks cause reduced weight gains, irritation, pruritus, and gotch ear, induce stress, and transmit disease agents to cattle. Patch burning in addition to the focal grazing of cattle creates variation in plant communities and should reduce tick populations by creating less favorable microhabitats. To determine if patch burning reduces tick populations, we estimated tick abundance in patch burned pastures and tick burden on cattle. Tick burden was significantly reduced on cattle in patch burned pastures compared to animals in control pastures. Significant reductions of tick burden on cattle indicates that patch burning can be used to help control ticks in pastures.

Fire and Nitrogen Effects on Purple Threeawn (*Aristida purpurea*) Abundance in Northern Mixed-Grass Prairie Old Fields

Dustin J. Strong, Lance T. Vermeire, and Amy C. Ganguli

Purple threeawn (*Aristida purpurea*) dominated plant communities present problems to rangeland managers because they can be a stable community of relatively poor forage quality. We tested the efficacy of summer and fall fire as a tool to reduce purple threeawn abundance and improve community composition. Summer fire had the greatest effect on purple threeawn, reducing current-year production and basal cover as much as 90% and 94%, respectively, while having a neutral to positive effect on other species. These results indicate fire can reduce purple threeawn and improve the overall palatability of a purple threeawn-dominated community.

Grazing Method Effect on Topographical Vegetation Characteristics and Livestock Performance in the Nebraska Sandhills

Mitchell B. Stephenson, Walter H. Schacht, Jerry D. Volesky, Kent M. Eskridge, Eric M. Mousel, and Dennis Bauer

Deferred rotation and short duration grazing methods are commonly used, but little is known about how these methods affect vegetation over the long term at varying topographic positions. We compared change in plant species frequency, standing crop of plant functional groups, and livestock weight gains between grazing methods. Specific warm-season grasses tended to increase more on deferred rotation pastures, but there were minimal differences between the grazing methods for other plant species, standing crop, or livestock weight gains. Overall, short duration grazing was not superior to deferred rotation grazing in terms of vegetation characteristics, at any topographic position, and livestock performance.

The Drought Calculator: Decision Support Tool for Predicting Forage Growth During Drought

Gale H. Dunn, Megan Gutwein, Timothy R. Green, Ashley Menger, and Jeff Printz

We developed and evaluated the Drought Calculator, a spreadsheet-based decision support tool, to help ranchers and range managers predict reductions in forage production due to drought. Forage growth potential was predicted using monthly precipitation from January through June in Colorado, North Dakota, and Wyoming. Forage was most sensitive to precipitation in April through June, or some combination of these months. We correctly predicted 67%, 82%, and 83% of the years with forage reduced by drought at the test sites, demonstrating the potential of the Drought Calculator to help producers make stocking decisions.

Linking Phenology and Biomass Productivity in South Dakota Mixed-Grass Prairie

Matthew Rigge, Alexander Smart, Bruce Wylie, Tagir Gilmanov, and Patricia Johnson

Biomass production and phenology are critical factors in rangeland health, species composition, and grazing impacts assessments. We evaluated the productivity and phenology of mixed-grass prairie using a satellite vegetation index that was integrated over the growing season to represent annual biomass production and integrated seasonally to represent production by cool and warm season species. Remotely sensed metrics were responsive to site conditions and land management and were strongly related to field-collected biomass and community composition. Maps of productivity and phenology can be used to improve land management by adjusting stocking rates and season of use to maximize rangeland productivity and achieve conservation objectives.

Herbicide-Assisted Restoration of Great Basin Sagebrush Steppe Infested With Medusahead and Downy Brome

Guy B. Kyser, Robert G. Wilson, Jimin Zhang, and Joseph M. DiTomaso

Downy brome (*Bromus tectorum*) and medusahead (*Taeniatherum caput-medusae*) are the most problematic invasive annual grasses in rangelands of the western United States. We evaluated the effect of three fall-applied herbicides, imazapic, rimsulfuron, and chlorsulfuron + sulfometuron, and a spring-application of glyphosate on the control of both species in sagebrush communities of northeastern California. All fall treatments produced greater than 93% control of both species in the first year, but imazapic maintained good control two years after treatment. Thus, ranchers have several options for short-term control of downy brome and

medusahead, but imazapic provided the best management while also increasing native forb cover.

Plant Establishment in Masticated Utah Juniper Woodlands

Kert R. Young, Bruce A. Roundy, and Dennis L. Eggett

Juniper trees (*Juniperus* spp.) that have encroached sagebrush-bunchgrass communities are mechanically masticated to reduce the risk of crown fire and property damage and improve plant communities. We compared grass seedling establishment between masticated and untreated areas at three locations

in Utah to determine potential of either annual or perennial grasses to dominate after mastication. Juniper mastication reduced Anatone bluebunch wheatgrass (*Pseudoroegneria spicata*) and cheatgrass (*Bromus tectorum*) emergence, but increased their aboveground biomass and number of tillers indicating that annual or perennial grasses could dominate following mastication. Perennials should be seeded in areas where they have been depleted and cheatgrass density is high.

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