HIGHLIGHTS

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Aboriginal Precedent for Active Management of Sagebrush-Perennial Grass Communities in the Great Basin

J. Kent McAdoo, Brad W. Schultz, and Sherman R. Swanson

Through literature review, the authors concluded that “active management” by aboriginal firing in the Great Basin was widespread and significant, resulting in mosaic vegetation patterns that subsequently moderated the behavior of “natural fires.” Based on this prehistoric precedent, current historically unprecedented conditions (fuel load and exotic weed invasion threats), and predicted climate change, contemporary active management of sagebrush-perennial grass communities is paramount. Restoration measures should be scientifically based and tailored to achieve ecological resilience in specific sites. Contemporary challenges require that we learn from the past and judiciously adapt best management practices to address ecosystem health and functionality into the future.

Models for Predicting Fuel Consumption in Sagebrush-Dominated Ecosystems

Clinton S. Wright

Fuel consumption predictions are necessary to accurately estimate or model fire effects, including pollutant emissions during wildland fires. Fuel and environmental measurements were made on a series of operational prescribed fires and used to develop models for predicting fuel consumption in big sagebrush (*Artemisia tridentata*) ecosystems. By using the models presented, fire managers will be able to develop data-based estimates of fuel consumption rather than relying on expert opinion and the “rules-of-thumb” that are currently used. More accurate estimates of consumption will produce better estimates of emissions during fires in big sagebrush, a widespread and commonly burned shrub-dominated ecosystem type.

Different Fire Frequency Impacts Over 27 Years on Vegetation Succession in an Infertile Old-Field Grassland

Wenjin Li, Xiaoan Zuo, and Johannes M. H. Knops

Fire is often a key driver of grassland vegetation composition. Using an experiment with four different fire frequencies over a 27-year period on an infertile, old field grassland in Minnesota, we found only small changes in the vegetation composition. Two species that did respond to fire were a legume (*Lespedeza capitata*) that increased with fire but only after decades and Kentucky bluegrass (*Poa pratensis*), which decreased with fire. However, changes in abundance of these two species did not cause other vegetation changes. Fire can lower abundance of Kentucky bluegrass; however, decreases in this introduced, invasive grass, does not lead to other vegetation changes.

Hydrologic and Erosion Responses of Sagebrush Steppe Following Juniper Encroachment, Wildfire, and Tree Cutting

Frederick B. Pierson, C. Jason Williams, Stuart P. Hardegree, Patrick E. Clark, Patrick R. Kormos, and Osama Z. Al-Hamdan

Burning and tree-cutting are commonly prescribed treatments to reduce the negative impacts of woodland-encroachment on vegetation structure and hydrologic function in sagebrush steppe. We used rainfall and concentrated flow simulations to evaluate short-term effects of burning and tree-cutting on woodland runoff and erosion. The results indicate that burning may amplify runoff/erosion immediately postfire, but that burn treatments that stimulate intercanopy herbaceous recovery may provide a hydrologic restoration pathway for sagebrush steppe. Further, our results indicate cut-tree treatments should focus on establishing tree debris contact with the soil surface if immediate erosion reductions are desired during the postcut understory recruitment period.

Fire, Defoliation, and Competing Species Alter *Aristida Purpurea* Biomass, Tiller, and Axillary Bud Production

M. L. Russell, L. T. Vermeire, N. A. Dufek, and D. J. Strong

Purple threeawn (*Aristida purpurea*) is a competitive native perennial grass with monoculturistic tendencies and poor palatability. We examined effects of two fire, four defoliation, and three interspecific/intraspecific planting treatments on purple threeawn, blue grama (*Bouteloua gracilis*), and western wheatgrass (*Pascopyrum smithii*) biomass, aboveground production, tillers, and axillary buds. Fire killed 36% of threeawn and reduced surviving threeawn biomass 61%, production 27%, and axillary buds 25%. Clipping of regrowth after fire further reduced threeawn production. A combination of fire and postfire grazing may cause rapid reductions in threeawn dominance and provide opportunity for more fire-resilient species, such as blue grama and western wheatgrass, to become established.

Woody Vegetation Persistence and Disturbance in Central Texas Grasslands Inferred From Multidecadal Historical Aerial Photographs

Darrel B. Murray, Joseph D. White, and Pamela Swint

Woody plant encroachment in grasslands has important ecological and economic consequences. To document and interpret changes in woody plant cover within the eastern Edwards Plateau region of central Texas we used historical aerial photographs taken approximately every 13 years between 1937 and 2004. We found that although the total area of woody plants changed minimally (62.0% to 64.2%) between 1937 and 2004, a high percentage (32%) of the study area changed between woody and nonwoody plant cover between each photograph date. This implies woody plant encroachment may have occurred prior to 1937, with perceived recent encroachment related to loss and regrowth.

Site, Competition, and Plant Stock Influence Transplant Success of Wyoming Big Sagebrush

J. Kent McAdoo, Chad S. Boyd, and Roger L. Sheley

Success rates for establishing Wyoming big sagebrush (*Artemisia tridentata* var. *wyomingensis*) from seed are very low using traditional broadcast or drill methods. We quantified the effect of seedling source (nursery seedling vs. juvenile wildling) and reduction of herbaceous vegetation on the survival of transplants. Our results indicate that transplanting seedling or juvenile sagebrush is a viable technique for establishing sagebrush and that establishment can be increased by using herbicide to remove competing vegetation at the time of planting. The survival of seedlings depended more on their

size and amount of root damage from harvesting than whether the transplants were nursery or wild stock.

Simulating Current Successional Trajectories in Sagebrush Ecosystems With Multiple Disturbances Using a State-and-Transition Modeling Framework

Louisa B. Evers, Richard F. Miller, Paul S. Doescher, Miles Hemstrom, and Ronald P. Neilson

Multiple disturbances interact to shape sagebrush (*Artemisia* spp.) ecosystems but rarely are examined. We constructed two sagebrush models to explore how natural disturbances, certain management activities, and cheatgrass (*Bromus tectorum*) might shape the abundance of sagebrush community phases. Key influences were fire, insect outbreaks, juniper (*Juniperus occidentalis*) encroachment, livestock grazing during severe drought, postfire seeding success rates, and juniper treatment rates. We found passive management would not restore sagebrush ecosystems where cheatgrass and juniper are present, livestock grazing was problematic primarily during severe drought, and postfire seeding success and juniper treatment rates were critical to effective restoration.

Integrating Conservation and Financial Objectives on Private Rangelands in Northern Colorado: Rancher and Practitioner Perceptions

Megan Gutwein and Joshua H. Goldstein

Payments for ecosystem services (PES) and other approaches seek to expand rangeland conservation on working ranches, yet information is lacking on how to make these strategies attractive to ranchers. We interviewed ranchers and natural resource practitioners in northern Colorado to examine current and possible future strategies to achieve conservation, agricultural, and financial objectives. Interviewees reported broad interest in PES and other new approaches, yet also emphasized potential barriers related to management challenges, financial capacity, shifting regional characteristics, and other factors. This suggests the need to examine how ranch-scale and regional factors open up or constrain opportunities for new conservation strategies.

Historical Forage Productivity and Cost of Capital for Cow-Calf Production in California

Philip Brownsey, Jose L. Oviedo, Lynn Huntsinger, and Barbara Allen-Diaz

Exposure to forage productivity and market variation could have an impact on the risk of investment from cow-calf operations. We use historical forage productivity data from three sites in California, and cattle and hay prices, to compare the

performance of cow-calf operations to the actual performance of a diversified portfolio of assets using the Capital Asset Pricing Model. Results show that cow-calf production carries low systematic risk and that its theoretical cost of capital (~5%) is greater than the historical return from livestock production in the western US (2–3%), adding further backing to the point that ranchers receive benefits beyond commercial returns.

Does Stocking Rate Manipulation Promote Pasture Sustainability in the Humid Tropics?

William Bruce Campbell, Jesús Jarillo-Rodríguez, Silvia López-Ortiz, and Epigmenio Castillo-Gallegos

While increased stocking rates can improve forage value and utilization in tropical native pastures, early reductions in these parameters may occur because such systems are not historically adapted to grazing ungulates. Plant species richness, phylogenetic and functional diversity, and sampling effort were analyzed over three stocking levels after 5 years. Increased stocking rates were associated with fewer perennial and more undesired species and decreased spatial variability among and within paddocks; analyses of diversity estimates were inconclusive. Such changes serve as rapid early warnings that continued or increased grazing pressure may further alter the pasture plant community, contradicting pasture sustainability objectives.

Economic Risks of Cheatgrass Invasion on a Simulated Eastern Oregon Ranch

Anna T. Maher, John A. Tanaka, and Neil Rimbey

Understanding the impact of fire return intervals on ranches is an important component of the economic risks from cheatgrass (*Bromus tectorum*) invasions. A representative ranch was modeled under conditions of the beginning stages of cheatgrass invasion. Results of increased wildfire risk indicated decreases in profitability, optimal stocking rate, and the ability to meet full costs of livestock production (even with the forage benefit of cheatgrass). Current and future rangeland policy that considers the impact of changes in wildfire frequency on ranch operations will more fully reflect the costs and benefits of these policies.

Assessing Impacts of Roads: Application of a Standard Assessment Protocol

Michael C. Duniway and Jeffrey E. Herrick

Adaptive management of road networks depends on timely data that accurately reflect the impacts those systems are having on ecosystem processes and associated services. We developed and tested an approach for using the Interpreting Indicators of Rangeland Health (IIRH) qualita-

tive assessment technique to systematically evaluate road impacts across large, diverse arid and semiarid landscapes. The test application in southern New Mexico, USA, demonstrates the approach is sensitive to road impacts across a broad range of ecological sites. IIRH can be successfully applied to landscapes with diverse impacts and provide information needed to support adaptive management decision processes.

Combining Glyphosate With Burning or Mowing Improves Control of Yellow Bluestem (*Bothriochloa ischaemum*)

Scott Robertson, Karen R. Hickman, Keith R. Harmoney, and David M. Leslie, Jr.

The invasive yellow bluestem (*Bothriochloa ischaemum*) threatens native biodiversity, and its control is of interest to land managers involved in restoration of invaded grasslands. To determine the most effective control method, we used single, double, and triple applications of glyphosate over one growing season with and without a mechanical treatment of mowing or burning. With the exception of three herbicide applications, combining burning or mowing with herbicide applications provided more effective control of yellow bluestem than any individual herbicide applications. During restoration projects requiring control of invasive yellow bluestem, an effective management option is a combination of mechanical and chemical control.

Distinguishing Cattle Foraging Activities Using an Accelerometry-Based Activity Monitor

Rena Yoshitoshi, Nariyasu Watanabe, Kensuke Kawamura, Seiichi Sakanoue, Ryo Mizoguchi, Hyo-Jin Lee, and Yuzo Kurokawa

Various sensors and analytic tools have been developed to collect and analyze activity data of animals. This study tested a simple, cost-effective accelerometry-based activity monitor, the Kenz Lifecorder EX, to differentiate between foraging and other activities of beef cows in a steeply sloping pasture. Based on the 4-day grazing trial, accurate measures (90.6–94.6% correct discrimination among cows) were obtained by linear discriminant analysis to identify the foraging activity. The combination of the activity timeline and tracking data can determine the spatiotemporal distribution of cattle foraging activity on pasture or rangeland.

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