

Highlights

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Applying Ecologically-Based Invasive Plant Management

R. Sheley, J. James, B. Smith, and E. Vasquez

Currently no ecological framework to help make invasive plant management decisions is available. We amended a successional management framework into a comprehensive decision tool for ecologically-based invasive plant management (EBIPM). The new model is a step-by-step planning process integrating Rangeland Health Assessment, using ecological principles to identify ecological processes in need of repair and adaptive management. By using EBIPM in three case studies, restoration success increased 66% over traditional integrated weed management. We believe this holistic decision framework will enhance ability to design and implement sustainable invasive plant management.

Hydrologic Vulnerability of Sagebrush Steppe Following Pinyon and Juniper Encroachment

Frederick B. Pierson, C. Jason Williams, Patrick R. Kormos, Stuart P. Hardegree, Patrick E. Clark, and Benjamin M. Rau

Rainfall simulations and concentrated-flow experiments were conducted on pinyon (*Pinus monophylla* Torr. and Frm) and juniper (*Juniperus osteosperma* [Torr.] Little) woodlands to help understand the hydrologic vulnerability of Great Basin sagebrush-steppe following woodland encroachment. The influence of canopy and soil-cover characteristics and soil repellency on infiltration, runoff, and erosion was quantified. In areas between shrubs, runoff and erosion were linearly related and increased exponentially where bare soil and rock cover exceeded 50%. Areas with tree canopy appear to be hydrologically more stable than the intercanopy areas, which are vulnerable to runoff and erosion.

Estimating Juniper Cover From National Agriculture Imagery Program (NAIP) Imagery and Evaluating Relationships Between Potential Cover and Environmental Variables

Kirk W. Davies, Steven L. Petersen, Dustin D. Johnson, D. Bracken Davis, Matthew D. Madsen, Daniel L. Zvirzdin, and Jon D. Bates

Expansion of western juniper woodlands is causing significant declines of other plant communities. However, landscape-scale restoration projects are hindered by time-consuming and expensive methods of making an inventory of juniper cover and of prioritizing landscapes based on the phase of juniper encroachment. We successfully used color aerial photographs (NAIP imagery) to measure juniper cover. We also found that site slope, aspect, and elevation explained 40% of the variation in juniper cover at stand closure. These site characteristics, combined with juniper cover estimates obtained from aerial photographs, can be used to help determine the phase of juniper encroachment to assist in restoration planning and prioritization.

Tallgrass Prairie Plant Community Dynamics Along a Canopy Cover Gradient of Eastern Redcedar (*Juniperus virginiana* L.)

Ryan F. Limb, David M. Engle, Aaron L. Alford, and Eric C. Hellgren

Declines in herbaceous richness are well documented with eastern redcedar encroachment; however, studies examining this relationship are largely limited to individual trees. We documented herbaceous composition, abundance, and biomass within a tallgrass prairie invaded by eastern redcedar in which canopy cover of eastern redcedar ranged from 0% to 80%. Herbaceous species richness and biomass declined with increased canopy cover and subsequent loss of grassland, but changes did not follow predictions based on individual trees. Declines followed a species-area

relationship and were without abrupt change typical of ecological thresholds. This suggests that prairie with eastern redcedar encroachment has high restoration potential.

Perceptions of Landowners Concerning Conservation, Grazing, Fire, and Eastern Redcedar Management in Tallgrass Prairie

Lois Wright Morton, Elise Regen, David M. Engle, James R. Miller, and Ryan N. Harr

Private landowners with agricultural and recreational use goals have been slow to adopt prescribed burning and grazing management practices to control invasive species and encroachment of woody plants. A mail survey of all landowners in the Grand River Grasslands of southern Iowa and northern Missouri revealed that 68% viewed grazing as a legitimate land management tool and that 50% thought fire was a legitimate tool. The survey explores why management decisions vary based on which land use, agriculture or recreation, landowners view as more important. We conclude that effective intervention should consider landowner goals as part of the educational and promotion process.

Supplements Containing Escape Protein Improve Redberry Juniper Intake by Goats

Chad H. George, Cody B. Scott, Travis R. Whitney, Corey J. Owens, Brian J. May, and Richard Brantley

Goats receiving protein supplements consume more redberry juniper (*Juniperus pinchotii* Sudw.), but it is unknown whether the source of protein affects juniper intake. This study compared juniper intake by goats receiving protein supplements with low, moderate, or high amounts of amino acids that escape digestion in the rumen. Goats supplemented with cottonseed meal and distiller's dried grain (high escape value) ate more juniper than goats only receiving alfalfa, possibly due to increased escape of glucogenic amino acids. Supplementation with feeds high in protein escape values should increase juniper intake by goats on rangelands.

Effects of Long-Term Livestock Grazing on Fuel Characteristics in Rangelands: An Example From the Sagebrush Steppe

Kirk W. Davies, Jonathan D. Bates, Tony J. Svejcar, and Chad S. Boyd

Knowing the long-term impacts of livestock grazing on fuel characteristics is important because fuel characteristics are a primary factor determining the risk and severity of wildfires. This study compared the impact of long-term, moderate grazing to livestock exclusion (since 1936) on fuels in sagebrush-steppe plant communities. Moderate grazing decreased fuel accumulation, continuity, and height, which would reduce the risk and severity of wildfires on such rangelands. This suggests that moderate livestock grazing

may be critical to protecting sagebrush obligate wildlife habitat by decreasing the risk of catastrophic wildfires.

Pyric-Herbivory to Promote Rangeland Heterogeneity: Evidence From Small Mammal Communities

Samuel D. Fuhlendorf, Darrell E. Townsend II, R. Dwayne Elmore, and David M. Engle

Patchy interactions of fire and grazing can be used to create heterogeneity in grassland ecosystems to influence biodiversity. Discrete patches of fire and grazing promoted a shifting vegetation mosaic across the landscape that created unique habitats for diverse small mammal species. Managing for heterogeneity through transient focal patches could be a new central paradigm for conservation of rangeland ecosystems that can enhance biological diversity and can maintain livestock production at broad scales.

Restoring Tallgrass Prairie and Grassland Bird Populations in Tall Fescue Pastures With Winter Grazing

Tracey N. Johnson and Brett K. Sandercock

Tall fescue is a widespread, introduced grass that is harmful to livestock and wildlife. We investigated whether elimination of fertilization combined with winter-only livestock grazing could decrease tall fescue and restore native warm-season grasses and grassland bird populations in Kansas pastures. Tall fescue was not eliminated, but native grasses and several species of grassland birds were more abundant in winter-grazed pastures compared to traditionally managed pastures. Winter-grazing could be most beneficial during initial stages of restoration. It should be used in conjunction with elimination of fertilization and other restoration methods for an integrated approach to reduce tall fescue.

Replication of a 1970s Study on Domestic Sheep Losses to Predators on Utah's Summer Rangelands

Brian C. Palmer, Michel R. Conover, and S. Nicole Frey

We repeated a sheep depredation study conducted from 1972 through 1975 on Cedar Mountain, Utah, to determine how predation rates have changed in the last three decades. Total lamb losses decreased from the 1970s (9.5%) to present (5.8%). Predators were responsible for 87% of all verified lamb losses during our study versus 83% during the 1970s. Coyote predation has decreased, while cougar and black bear predation has increased from the 1970s to present. California condors (*Gymnogyps californianus* Shaw) have begun to scavenge lamb carcasses since the 1970s. Changing predator populations have complicated the task of protecting lambs.

Phenotypic and Genetic Characterization of Western Prairie Clover Collections From the Western United States

Kishor Bhattarai, B. Shaun Bushman, Douglas A. Johnson, and John G. Carman

Using regional seed sources for rangeland revegetation programs can minimize the concerns of maladaptation and outbreeding depression. Twenty-two collections of western prairie clover from the western United States were evaluated for phenotypic variation and population genetic structure. Two genetically differentiated groups and a third admixed group were identified. Flowering date played a significant role in discriminating those groupings. Based on the molecular and phenotypic groupings, we recommend that two seed sources be developed, one from the Deschutes River watershed and the other from southeastern Washington, eastern Oregon, and Idaho.

Potential of *Kochia Prostrata* and Perennial Grasses for Rangeland Restoration in Jordan

Derek W. Bailey, Raed Al Tabini, Blair L. Waldron, James D. Libbin, Khalid Al-Khalidi, Ahmad Alqadi, Mohammad Al Oun, and Kevin B. Jensen

Rangelands in Jordan are often deteriorated and require revegetation. Six varieties of forage kochia (*Kochia prostrata*) and four varieties of perennial wheatgrasses were evaluated at two sites in the Badia rangelands of Jordan. Although the study was conducted in extreme drought conditions, forage kochia and perennial wheatgrasses germinated at both sites and persisted at the wetter site. Forage kochia appears to be an excellent forage resource for revegetation of Jordanian rangelands if precipitation is >70 mm, and perennial wheatgrasses may be useful if precipitation is >100 mm.



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