Nevada Society for Range Management Suggested Reading: December 2014

Abstracts of Recent Papers on Range Management in the West

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Resilience and Resistance of Sagebrush Ecosystems: Implications for State and Transition Models and Management Treatments

Jeanne C. Chambers, Richard F. Miller, David I. Board, David A. Pyke, Bruce A. Roundy, James B. Grace, Eugene W. Schupp, and Robin J. Tausch (*2014*) Resilience and Resistance of Sagebrush Ecosystems: Implications for State and Transition Models and Management Treatments. Rangeland Ecology & Management: September 2014, Vol. 67, No. 5, pp. 440-454.

View the article on SRM Journals here, or on BioOne here.

Abstract

In sagebrush ecosystems invasion of annual exotics and expansion of piñon (*Pinus monophylla* Torr. and Frem.) and juniper (*Juniperus occidentalis* Hook., *J. osteosperma* [Torr.] Little) are altering fire regimes and resulting in large-scale ecosystem transformations. Management treatments aim to increase resilience to disturbance and enhance resistance to invasive species by reducing woody fuels and increasing native perennial herbaceous species. We used Sagebrush Steppe Treatment Evaluation Project data to test predictions on effects of fire vs. mechanical treatments on resilience and resistance for three site types exhibiting cheatgrass (*Bromus tectorum* L.) invasion and/or piñon and juniper expansion: 1) warm and dry Wyoming big sagebrush (WY shrub); 2) warm and moist Wyoming big sagebrush (WY PJ); and 3) cool and moist mountain big sagebrush (Mtn PJ). Warm and dry (mesic/aridic) WY shrub sites had lower resilience to fire (less shrub recruitment and native perennial herbaceous response) than cooler and moister (frigid/xeric) WY PJ and Mtn PJ sites. Warm (mesic) WY Shrub and WY PJ sites had lower resistance to annual exotics than cool (frigid to cool frigid) Mtn PJ sites. In WY shrub, fire and sagebrush mowing had similar effects on shrub cover and, thus, on perennial native herbaceous and exotic cover. In WY PJ and Mtn PJ, effects were greater for fire than cut-and-leave treatments and with high tree cover in general because most woody vegetation was removed increasing resources for other functional groups. In WY shrub, about 20% pretreatment perennial native herb cover was necessary to prevent increases in exotics after treatment. Cooler and moister WY PJ and especially Mtn PJ were more resistant to annual exotics, but perennial native herb cover was still required for site recovery. We use our results to develop state and transition models that illustrate how resilience and resistance influence vegetation dynamics and management options.

Region-Wide Ecological Responses of Arid Wyoming Big Sagebrush Communities to Fuel Treatments

David A. Pyke, Scott E. Shaff, Andrew I. Lindgren, Eugene W. Schupp, Paul S. Doescher, Jeanne C. Chambers, Jeffrey S. Burnham, and Manuela M. Huso (*2014*) Region-Wide Ecological Responses of Arid Wyoming Big Sagebrush Communities to Fuel Treatments. Rangeland Ecology & Management: September 2014, Vol. 67, No. 5, pp. 455-467.

View the article on SRM Journals here, or on BioOne here.

Abstract

If arid sagebrush ecosystems lack resilience to disturbances or resistance to annual invasives, then alternative successional states dominated by annual invasives, especially cheatgrass (*Bromus tectorum* L.), are likely after fuel treatments. We identified six Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis* Beetle & Young) locations (152–381 mm precipitation) that we believed had sufficient resilience and resistance for recovery. We examined impacts of woody fuel reduction (fire, mowing, the herbicide tebuthiuron, and untreated controls, all with and without the herbicide imazapic) on short-term dominance of plant groups and on important land health parameters with the use of analysis of variance (ANOVA). Fire and mowing reduced woody biomass at least 85% for 3 yr, but herbaceous fuels were reduced only by fire (72%) and only in the first year. Herbaceous fuels produced at least 36% more biomass with mowing than untreated areas during posttreatment years. Imazapic only reduced herbaceous biomass after fires (34%). Tebuthiuron never affected herbaceous biomass. Perennial tall grass cover was reduced by 59% relative to untreated controls in the first year after fire, but it recovered by the second year. Cover of all remaining herbaceous groups was not changed by woody fuel treatments. Only imazapic reduced significantly herbaceous cover. Cheatgrass cover was reduced at least 63% with imazapic for 3 yr. Imazapic reduced annual forb cover by at least 45%, and unexpectedly, perennial grass cover by 49% (combination of tall grasses and Sandberg bluegrass [*Poa secunda* J. Presl.]). Fire reduced density of Sandberg bluegrass between 40% and 58%, decreased lichen and moss cover between 69% and 80%, and consequently increased bare ground between 21% and 34% and proportion of gaps among perennial plants >2 m (at least 28% during the 3 yr). Fire, mowing, and imazapic may be effective in reducing fuels for 3 yr, but each has potentially undesirable consequences on plant communities.

Response of Conifer-Encroached Shrublands in the Great Basin to Prescribed Fire and Mechanical Treatments

Richard F. Miller, Jaime Ratchford, Bruce A. Roundy, Robin J. Tausch, April Hulet, and Jeanne Chambers (*2014*) Response of Conifer-Encroached Shrublands in the Great Basin to Prescribed Fire and Mechanical Treatments. Rangeland Ecology & Management: September 2014, Vol. 67, No. 5, pp. 468-481.

View the article on SRM Journals here, or on BioOne here.

Abstract

In response to the recent expansion of piñon and juniper woodlands into sagebrush-steppe communities in the northern Great Basin region, numerous conifer-removal projects have been implemented, primarily to release understory vegetation at sites having a wide range of environmental conditions. Responses to these treatments have varied from successful restoration of native plant communities to complete conversion to nonnative invasive species. To evaluate the general response of understory vegetation to tree canopy removal in conifer-encroached shrublands, we set up a region-wide study that measured treatment-induced changes in understory cover and density. Eleven study sites located across four states in the Great Basin were established as statistical replicate blocks, each containing fire, mechanical, and control treatments. Different cover groups were measured prior to and during the first 3 yr following treatment. There was a general pattern of response across the wide range of site conditions. There was an immediate increase in bare ground and decrease in tall perennial grasses following the fire treatment, but both recovered by the second or third growing season after treatment. Tall perennial grass cover increased in the mechanical treatment in the second and third year, and in the fire treatment cover was higher than the control by year 3. Nonnative grass and forb cover did not increase in the fire and mechanical treatments in the first year but increased in the second and third years. Perennial forb cover increased in both the fire and mechanical treatments. The recovery of herbaceous cover groups was from increased growth of residual vegetation, not density. Sagebrush declined in the fire treatment, but seedling density increased in both treatments. Biological soil crust declined in the fire treatment, with no indications of recovery. Differences in plant response that occurred between mechanical and fire treatments should be considered when selecting management options.

Piñon–Juniper Reduction Increases Soil Water Availability of the Resource Growth Pool

Bruce A. Roundy, Kert Young, Nathan Cline, April Hulet, Richard F. Miller, Robin J. Tausch, Jeanne C. Chambers, and Ben Rau (*2014*) Piñon–Juniper Reduction Increases Soil Water Availability of the Resource Growth Pool. Rangeland Ecology & Management: September 2014, Vol. 67, No. 5, pp. 495-505.

View the article on SRM Journals here, or on BioOne here.

Abstract

Managers reduce piñon (*Pinus* spp.) and juniper (*Juniperus* spp.) trees that are encroaching on sagebrush (*Artemisia* spp.) communities to lower fuel loads and increase cover of desirable understory species. All plant species in these communities depend on soil water held at >−1.5 MPa matric potential in the upper 0.3 m of soil for nutrient diffusion to roots and major growth in spring (resource growth pool). We measured soil water matric potentials and temperatures using gypsum blocks and thermocouples buried at 0.01–0.3 m on tree, shrub, and interspace microsites to characterize the seasonal soil climate of 13 tree-encroached sites across the Great Basin. We also tested the effects of initial tree infilling phase and tree control treatments of prescribed fire, tree cutting, and tree shredding on time of available water and soil temperature of the resource growth pool on nine sites. Both prescribed fire and mechanical tree reduction similarly increased the time that soil water was available (matric potential >−1.5 MPa) in spring, but this increase was greatest (up to 26 d) when treatments were applied at high tree dominance. As plant cover increased with time since treatment, the additional time of available water decreased. However, even in the fourth year after treatment, available water was 8.6 d and 18 d longer on treatments applied at mid and high tree dominance compared to untreated plots, indicating ongoing water availability to support continued increases in residual plants or annual invaders in the future. To increase resistance to invasive annual grasses managers should either treat at lower or mid tree dominance when there is still high cover of desirable residual vegetation or seed desirable species to use increased resources from tree reduction. This strategy is especially critical on warmer sites, which have high climate suitability to invasive species such as cheatgrass (*Bromus tectorum* L.)

Ecological Scale of Bird Community Response to Piñon-Juniper Removal

Steven T. Knick, Steven E. Hanser, and M. Leu (*2014*) Ecological Scale of Bird Community Response to Piñon-Juniper Removal. Rangeland Ecology & Management: September 2014, Vol. 67, No. 5, pp. 553-562.

View the article on SRM Journals here, or on BioOne here.

Abstract

Piñon (*Pinus* spp.) and juniper (*Juniperus* spp.) removal is a common management approach to restore sagebrush (*Artemisia* spp.) vegetation in areas experiencing woodland expansion. Because many management treatments are conducted to benefit sagebrush-obligate birds, we surveyed bird communities to assess treatment effectiveness in establishing sagebrush bird communities at study sites in Utah, Nevada, Idaho, and Oregon. Our analyses included data from 1 or 2 yr prior to prescribed fire or mechanical treatment and 3 to 5 yr posttreatment. We used detrended correspondence analysis to 1) identify primary patterns of bird communities surveyed from 2006 to 2011 at point transects, 2) estimate ecological scale of change needed to achieve treatment objectives from the relative dissimilarity of survey points to the ordination region delineating sagebrush bird communities, and 3) measure changes in pre- and posttreatment bird communities. Birds associated with sagebrush, woodlands, and ecotones were detected on our surveys; increased dissimilarity of survey points to the sagebrush bird community was characterized by a gradient of increased juniper and decreased sagebrush cover. Prescribed fires burned between 30% and 97% of our bird survey points. However, from 6% to 24% cover of piñon-juniper still remained posttreatment on the four treatment plots. We measured only slight changes in bird communities, which responded primarily to current vegetation rather than relative amount of change from pretreatment vegetation structure. Bird communities at survey points located at greater ecological scales from the sagebrush bird community changed least and will require more significant impact to achieve changes. Sagebrush bird communities were established at only two survey points, which were adjacent to a larger sagebrush landscape and following almost complete juniper removal by mechanical treatment. Our results indicate that management treatments that leave residual woodland cover and are not adjacent to extensive sagebrush stands are unlikely to establish sagebrush birds.

Mowing Reduces Exotic Annual Grasses but Increases Exotic Forbs in a Semiarid Grassland

Prevéy, J. S., Knochel, D. G. and Seastedt, T. R. (2014), Mowing Reduces Exotic Annual Grasses but Increases Exotic Forbs in a Semiarid Grassland. Restoration Ecology, 22 (6): 774–781.
doi: 10.1111/rec.12140

View the article on Wiley Online Library here.

Abstract

Cheatgrass (*Bromus tectorum*) and other exotic winter-active plants can be persistent invaders in native grasslands, growing earlier in the spring than native plants and pre-empting soil resources. Effective management strategies are needed to reduce their abundance while encouraging the reestablishment of desirable native plants. In this 4-year study, we investigated whether mowing and seeding with native perennial grasses could limit growth of exotic winter-actives, and benefit growth of native plants in an invaded grassland in Colorado, United States. We established a split-plot experiment in October 2008 with 3 mowing treatments: control, spring-mowed, and spring/summer-mowed (late spring, mid-summer, and late summer), and 3 within-plot seeding treatments: control, added *B. tectorum* seeds, and added native grass seeds. Cover of plant species and aboveground biomass were measured for 3 years. In March and June of 2010, 2011, and March of 2012, *B. tectorum* and other winter-annual grasses were half as abundant in both mowing treatments as in control plots; however, cover of non-native winter-active forbs increased 2-fold in spring-mowed plots and almost 3-fold in spring/summer-mowed plots relative to controls. These patterns remained consistent 1 year after termination of treatments. Native cool-season grasses were most abundant in spring-mowed plots, and least abundant in control plots. There was higher cover of native warm-season grasses in spring/summer-mowed plots than in control plots in July 2011 and 2012. The timing of management can have strong effects on plant community dynamics in grasslands, and this experiment indicates that adaptive management can target the temporal niche of undesirable invasive species.