Nevada Section Society for Range Management Suggested Reading: Winter 2017

Abstracts of Recent Papers on Range Management in the West

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NV-SRM Suggested Reading 2-2017

Coates, P. S., B. G. Prochazka, M. A. Ricca, K. B. Gustafson, P. Ziegler and M. L. Cassazza. 2017. **Pinyon and Juniper Encroachment into Sagebrush Ecosystems Impacts Distribution and Survival of Greater Sage-Grouse**. Journal Rangeland Ecology and Management 70(1):25-38.
View on Science Direct

Abstract

In sagebrush (*Artemisia* spp.) ecosystems, encroachment of pinyon (*Pinus* spp.) and juniper (*Juniperus* spp.; hereafter, "pinyon-juniper") trees has increased dramatically since European settlement. Understanding the impacts of this encroachment on behavioral decisions, distributions, and population dynamics of greater sage-grouse *(Centrocercus urophasianus)* and other sagebrush obligate species could help benefit sagebrush ecosystem management actions. We employed a novel two-stage Bayesian model that linked avoidance across different levels of pinyon-juniper cover to sage-grouse survival. Our analysis relied on extensive telemetry data collected across 6 yr and seven subpopulations within the Bi-State Distinct Population Segment (DPS), on the border of Nevada and California. The first model stage indicated avoidance behavior for all canopy cover classes on average, but individual grouse exhibited a high degree of heterogeneity in avoidance behavior of the lowest cover class (e.g., scattered isolated trees). The second stage modeled survival as a function of estimated avoidance parameters and indicated increased survival rates for individuals that exhibited avoidance of the lowest cover class. A post hoc frailty analysis revealed the greatest increase in hazard (i.e., mortality risk) occurred in areas with scattered isolated trees consisting of relatively high primary plant productivity. Collectively, these results provide clear evidence that local sage-grouse distributions and demographic rates are influenced by pinyon-juniper, especially in habitats with higher primary productivity but relatively low and seemingly benign tree cover. Such areas may function as ecological traps that convey attractive resources but adversely affect population vital rates. To increase sage-grouse survival, our model predictions support reducing actual pinyon-juniper cover as low as 1.5%, which is lower than the published target of 4.0%. These results may represent effects of pinyon-juniper cover in areas with similar ecological conditions to those of the Bi-State DPS, where populations occur at relatively high elevations and pinyon-juniper is abundant and widespread.

Severson, J. P., C. A. hagen, J. D. Maestas, D. E. Naugle, J. T. Forbes and K. P. Reese. 2017. **Short-Term Response of Sage-Grouse Nesting to Conifer Removal in the Northern Great Basin**. Journal Rangeland Ecology and Management 70(1):50-58.
View on Science Direct

Abstract
Conifer woodlands expanding into sage-steppe (*Artemisia* spp.) are a threat to sagebrush obligate species including the imperiled greater sage-grouse *(Centrocercus urophasianus).* Conifer removal is accelerating rapidly despite a lack of empirical evidence to assess outcomes to grouse. Using a before-after-control-impact design, we evaluated short-term effects of conifer removal on nesting habitat use by monitoring 262 sage-grouse nests in the northern Great Basin during 2010–2014. Tree removal made available for nesting an additional 28% of the treatment landscape by expanding habitat an estimated 9603 ha (3201 ha [± 480 SE] annually). Relative probability of nesting in newly restored sites increased by 22% annually, and females were 43% more likely to nest within 1000 m of treatments. From 2011 (pretreatment) to 2014 (3 yr after treatments began), 29% of the marked population (9.5% [± 1.2 SE] annually) had shifted its nesting activities into mountain big sagebrush habitats that were cleared of encroaching conifer. Grouping treatments likely contributed to beneficial outcomes for grouse as individual removal projects averaged just 87 ha in size but cumulatively covered a fifth of the study area. Collaboratively identifying future priority watersheds and implementing treatments across public and private ownerships is vital to effectively restore the sage-steppe ecosystem for nesting sage-grouse.

Holmes, A. L., J. D. Maestas and D. E. Naugle. 2017. **Bird Responses to Removal of Western Juniper in Sagebrush-Steppe.** Journal Rangeland Ecology and Management 70(1):87-94.
View on Science Direct

Abstract
We investigated bird abundance in response to western juniper *(Juniperus occidentalis)* removal using a short-term chronosequence approach and generated estimates of density and responses to management for the most abundant species. Stands targeted for tree removal were primarily in the middle stages of juniper encroachment (Phase II, 7 851 ha). Trees were removed using hand felling combined with either lop and scatter, single tree burning, or jackpot burning, which were carried out to minimize loss of shrub cover. Brewer's sparrow *(Spizella breweri)* density was greater at treated versus untreated portions of the study area. At sites in the third year following tree removal, Brewer's sparrow density was 23.6 (95% confidence interval [CI]: 19.4–27.8) territories per km^2 higher than locations that had not yet been treated. This equates to a net increase of 1 212 − 1 737 nesting pairs within the project area. Green-tailed towhee increased by 4.6 (95% CI: 3.1–6.1) territories per km^2 for an estimated project-wide increase of 194–381 nesting pairs, and vesper sparrow *(Poocetes gramineus)* increased by 6.5 (95% CI: 4.6–8.4) territories per km^2 corresponding to an estimated increase of 460–559 nesting pairs within the project area. Density of gray flycatcher *(Empidonax wrighti)* was lower in cut areas, and over the

entire project area we estimate a net loss of 183–486 nesting pairs as a result of juniper tree removal. This study demonstrates that conifer removal projects designed to retain shrub cover and structure can have benefits to multiple species of ground and shrub nesting birds, including several species of conservation concern.

Bates, J. D., K. W. Davies, A. Hulet, R. F. Miller and B. Roundy. 2017. **Sage Grouse Groceries: Forb Response to Piñon-Juniper Treatments.** Journal Rangeland Ecology and Management 70(1):106-115.
View on Science Direct

Abstract
Juniper and piñon coniferous woodlands have increased 2- to 10-fold in nine ecoregions spanning the Intermountain Region of the western United States. Control of piñon-juniper woodlands by mechanical treatments and prescribed fire are commonly applied to recover sagebrush steppe rangelands. Recently, the Sage Grouse Initiative has made conifer removal a major part of its program to reestablish sagebrush habitat for sage grouse (*Centrocercus urophasianus*) and other species. We analyzed data sets from previous and ongoing studies across the Great Basin characterizing cover response of perennial and annual forbs that are consumed by sage grouse to mechanical, prescribed fire, and low-disturbance fuel reduction treatments. There were 11 sites in western juniper (*Juniperus occidentalis* Hook.) woodlands, 3 sites in singleleaf piñon (*Pinus monophylla* Torr. & Frém.) and Utah juniper (*Juniperus osteosperma* [Torr.] Little), 2 sites in Utah juniper, and 2 sites in Utah juniper and Colorado piñon (*Pinus edulis* Engelm). Western juniper sites were located in mountain big sagebrush (*A. tridentata* ssp. *vaseyana*) steppe associations, and the other woodlands were located in Wyoming big sagebrush (*A. tridentata* ssp. *wyomingensis*) associations. Site potential appears to be a major determinant for increasing perennial forbs consumed by sage grouse following conifer control. The cover response of perennial forbs, whether increasing (1.5- to 6-fold) or exhibiting no change, was similar regardless of conifer treatment. Annual forbs favored by sage grouse benefitted most from prescribed fire treatments with smaller increases following mechanical and fuel reduction treatments. Though forb abundance may not consistently be enhanced, mechanical and fuel reduction conifer treatments remain good preventative measures, especially in phase 1 and 2 woodlands, which, at minimum, maintain forbs on the landscape. In addition, these two conifer control measures, in the short term, are superior to prescribed fire for maintaining the essential habitat characteristics of sagebrush steppe for sage grouse.

Limb, R. F., S. D. Fuhlendorf, D. M. Engle and R. F. Miller. 2017. **Synthesis Paper: Assessment of Research on Rangeland Fire as a Management Practice.** Journal Rangeland Ecology and Management 69(6):415-422.
View on Science Direct

Abstract
Rangelands are fire-dependent ecosystems severely altered through direct fire suppression and fuels management. The removal of fire is a dominant cause of ecological sites moving across thresholds with the majority of North American rangelands currently showing moderate or high departure from reference conditions. Recognizing the need to restore fire on rangelands and incorporate prescribed fire into management plans, the Natural Resource Conservation Service initiated the Conservation Effects Assessment Project (CEAP) to evaluate the validity current practices through peer-reviewed scientific literature. We updated the CEAP review and broadened the discussion of prescribed fire as a global management practice. We reviewed and summarized prescribed fire literature available through Web of Science using search terms in the title. The majority of literature (40%) evaluated plant responses to fire with fire behavior and management (29%), wildlife and arthropods (12%), soils (11%), and air quality (4%) evaluated less frequently. Generally, fire effects on plants are neutral to positive and the majority of negative responses lasted less than 2 years. Similarly, soil responses were recovered within 2 yr after burning. However, most studies did not report how long treatments were in place (62%) or the size of experimental units (52%). The experimental literature supporting prescribed burning is in need of greater managerial relevance that can be obtained by directly addressing spatial scale, temporal scale, and interaction with other disturbances, including drought and grazing. Reliance on information from single fires applied on small plots tracked for a relatively short time interval greatly constrains inferences and application to ecosystem management and information should be applied with caution. Therefore, conservation purposes need to incorporate temporal dynamics to the extent that this information is available. The complex interaction of scientific knowledge, social concerns, and variable policies across regions are major limitations to the successful and critical restoration of fire regimes.

Berleman, S. A., K. N. Suding, D. L. Fry, J. W. Bartolome and S. L. Stephens. 2017.

Prescribed Fire Effects on Population Dynamics of an Annual Grassland. Journal Rangeland Ecology and Management 69(6):423-429.
View on Science Direct

Abstract
Medusahead (*Elymus caput-medusae* [L.] Nevski) is a highly damaging invasive annual grass in California rangelands. While it has been shown that prescribed fire can be a successful tool in controlling medusahead populations, fire treatments are not always successful. Given the sociological and economic constraints of prescribed fire use, it is critically important that we maximize likelihood of treatment success. We conducted experimental investigation of population dynamics of competing species from different functional groups: invasive annual

medusahead, naturalized but forageable nonnative wild oat (*Avena* spp. Pott ex Link), and native perennial purple needlegrass (*Stipa pulchra* [Hitchc.] Barkworth). We observed population dynamics at the 1-m^2 scale before and after treatments of prescribed fire and seed-limitation (weed whipping in a 1-m buffer area). We asked 1) what is the role of seed dispersal from burn edges on subsequent medusahead population size? and 2) how do density and fecundity of the dominant species respond to fire? Results showed that 1) seed dispersal is an important factor in recovery dynamics and 2) wild oat fecundity significantly increases in the year after fire while medusahead and needlegrass fecundity seem minimally affected. Ultimately, managers should consider fire as a preferable first-entry tool and should thoroughly consider shape and size of planned burns, as well as what vegetation is present to play a role in post-treatment seed-dispersal dynamics.

Davies, K. W. andc J. D. Bates. 2017. **Restoring big sagebrush after controlling encroaching western juniper with fire: aspect and subspecies effects.** Restoration Ecology 25(1):33-41. View on Wiley Online Library

Abstract
The need for restoration of shrubs is increasingly recognized around the world. In the western United States, restoration of mountain big sagebrush (*Artemisia tridentata* Nutt. ssp. *vaseyana* [Rydb.] Beetle) after controlling encroaching conifers is a priority to improve sagebrush-associated wildlife habitat. Conifers can be cost effectively removed with prescribed burning when sagebrush is codominant; however, burning removes sagebrush and natural recovery may be slow. We evaluated seeding mountain and Wyoming big sagebrush (*A. tridentata* Nutt. ssp. *wyomingensis* Beetle & Young) on north and south aspects after western juniper (*Juniperus occidentalis* ssp. *occidentalis* Hook) control with prescribed burning. We included seeding Wyoming big sagebrush, a more drought tolerant subspecies of big sagebrush, because it might grow better than mountain big sagebrush on hot, dry south slopes, during drought, or after juniper encroachment. Seeding mountain big sagebrush increased sagebrush cover and density compared to unseeded controls. In mountain big sagebrush-seeded plots, sagebrush cover was 19 times greater on north compared to south aspects in the fourth year after seeding. At this time, sagebrush cover was also greater on mountain compared to Wyoming big sagebrush-seeded plots. Natural recovery (i.e. unseeded) of sagebrush was occurring on north aspects with sagebrush cover averaging 3% 4 years after fire. Sagebrush was not detected on unseeded south aspects at the end of the study. These results suggest that postfire sagebrush recovery, with and without seeding, will be variable across the landscape based on topography. This study suggests seeding sagebrush after controlling junipers with burning may accelerate sagebrush recovery.

McAdoo, J. K., J. C. Swanson, P. J. Murphy and N. L. Shaw. 2017. **Evaluating strategies for facilitating native plant establishment in northern Nevada crested wheatgrass seedings.** Restoration Ecology 25(1):53-62.
View on Wiley Online Library

Abstract
Non-native crested wheatgrasses (*Agropyron cristatum* and *A. desertorum*) were used historically within the Great Basin for the purpose of competing with weed species and increasing livestock forage. These species continue to be used in some areas, especially after wildfires occurring in low elevation/precipitation, formerly Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*)/herbaceous communities. Seeding native species in these sites is often unsuccessful, and lack of establishment results in invasion and site dominance by exotic annuals. However, crested wheatgrass often forms dense monocultures that interfere competitively with the establishment of desirable native vegetation and do not provide the plant structure and habitat diversity for wildlife species equivalent to native-dominated sagebrush plant communities. During a 5-year study, we conducted trials to evaluate chemical and mechanical methods for reducing crested wheatgrass and the effectiveness of seeding native species into these sites after crested wheatgrass suppression. We determined that discing treatments were ineffective in reducing crested wheatgrass cover and even increased crested wheatgrass density in some cases. Glyphosate treatments initially reduced crested wheatgrass cover, but weeds increased in many treated plots and seeded species diminished over time as crested wheatgrass recovered. We concluded that, although increases in native species could possibly be obtained by repeating crested wheatgrass control treatments, reducing crested wheatgrass opens a window for invasion by exotic weed species.

Gooch, A. M., S. L. Peterson, G. H. Collins, T. S. Smith, B. R. McMillan and D. L. Eggett. 2017. **The impact of feral horses on pronghorn behavior at water sources.** Journal of Arid Environments 138:38-43.
View on Science Direct

Abstract
Feral horses (*Equus callabus*) occur throughout the world on all continents except Antarctica. In North America, feral horses occupy 31.6 million acres throughout western North America. Throughout their range, feral horses often share habitat with American pronghorn (*Antilocapra americana)*. Since horses are larger and more aggressive than pronghorn, they are considered socially dominant. In the Great Basin of western North America, pronghorn often access water sources where horses occur since habitat preferences are similar. If pronghorn are excluded where water is used by both species, pronghorn fitness may be impaired, especially during dry or droughty periods. The purpose of this study was to investigate interference competition between pronghorn and feral horses at water sources within the Great Basin. We observed horses and pronghorn at high-use water sources and recorded all occurrences and outcomes of pronghorn/horse interactions. We assessed differences in pronghorn behavior in the presence or

absence of horses. Pronghorn invested more time on vigilance behavior and less time foraging or drinking in the presence of horses than in their absence. Nearly half of pronghorn/horse interactions resulted in pronghorn exclusion from water. We conclude that as feral horse numbers increase, competition for water will subsequently increase.

Crawford, K. M. and T. M. Knight. 2017. **Competition overwhelms the positive plant–soil feedback generated by an invasive plant.** Oecologia 183(1):211-220.
View on Springer

Abstract
Invasive plant species can modify soils in a way that benefits their fitness more than the fitness of native species. However, it is unclear how competition among plant species alters the strength and direction of plant–soil feedbacks. We tested how community context altered plant–soil feedback between the non-native invasive forb *Lespedeza cuneata* and nine co-occurring native prairie species. In a series of greenhouse experiments, we grew plants individually and in communities with soils that differed in soil origin (invaded or uninvaded by *L. cuneata*) and in soils that were live vs. sterilized. In the absence of competition, *L. cuneata* produced over 60% more biomass in invaded than uninvaded soils, while native species performance was unaffected. The absence of a soil origin effect in sterile soil suggests that the positive plant–soil feedback was caused by differences in the soil biota. However, in the presence of competition, the positive effect of soil origin on *L. cuneata* growth disappeared. These results suggest that *L. cuneata* may benefit from positive plant–soil feedback when establishing populations in disturbed landscapes with few interspecific competitors, but does not support the hypothesis that plant–soil feedbacks influence competitive outcomes between *L. cuneata* and native plant species. These results highlight the importance of considering whether competition influences the outcome of interactions between plants and soils.