Nevada Section Society for Range Management Suggested Reading: Spring 2017

Abstracts of Recent Papers on Range Management in the West

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NV-SRM Suggested Reading

Spring 2017

Wonkka, C. L., J. B. West, D. Tidwell and W. E. Rogers. 2017. **Grass Mortality and Turnover Following Core Rangeland Restoration Practices.** Rangeland Ecology and Management 70(3):290-300.

View on Science Direct: http://www.sciencedirect.com/science/article/pii/S1550742416301063

Abstract:

In rangelands, management interventions have sought to minimize disturbances that decrease survival of perennial grasses to avoid compositional shifts toward less desirable species. However, the effects of rangeland management techniques on perennial grass survival and turnover are not known for individual species because the discipline has largely focused on structural metrics, measuring cover or biomass rather than tracking individual plants. In this study, we quantified perennial grass survival and recruitment in response to core rangeland restoration practices across multiple soil types to determine the potential for different interventions to cause shifts to undesirable grass community assemblages. We mapped individual grass tufts and recorded basal area annually. We used these maps to track survival and recruitment of grasses in response to mechanical brush removal, chemical woody plant control, and low-intensity prescribed burning. Additionally, we performed ordinations of the grass community to explore compositional shifts resulting from management interventions. We found perennial grass mortality to be higher for mechanically treated plots on all soil types than it was in chemically treated plots, burned plots, or untreated controls. Levels of mortality from fire were similar to baseline mortality in control plots for all soil types. However, relative species turnover was variable among soils and treatments. Brush removal only resulted in compositional shifts on sandy soils, where annual grasses and species capable of rapid expansion following disturbance became dominant. Differential responses are related to differences in species turnover, which is a function of individual grass species mortality and recruitment mediated by interactions between management approach and abiotic conditions. Given this response variability, understanding effects of management actions on perennial grass turnover and the potential for those actions to result in a community shift toward less desirable species is necessary for managers to achieve restoration goals on encroached rangelands.

Bates, J. D., T. Svejcar, R. Miller and K. W. Davies. 2017. **Plant Community Dynamics 25 Years After Juniper Control.** Rangeland Ecology and Management 70(3):356-362.

View on Science Direct: http://www.sciencedirect.com/science/article/pii/S1550742416301105

Abstract:

The expansion of piñon-juniper woodlands over the past 100 − 150 yr in the western United States has resulted in large-scale efforts to kill trees and recover sagebrush steppe rangelands. Western juniper (*Juniperus occidentalis* spp. *occidentalis* Hook.) expansion in the northern Great Basin has reduced sagebrush-steppe productivity and habitat. Chainsaw cutting of western juniper woodlands is a commonly applied practice to kill trees and restore shrub-understory composition. Studies reporting vegetation response following juniper cutting have been limited to early successional stages. This study assessed successional dynamics spanning 25 yr following tree cutting on Steens Mountain, southeast Oregon. Herbaceous standing crop and yield and plant densities were compared between chainsaw cut (Cut) and uncut woodland (Control) treatments. Cut plots were treated in 1991. In the Cut, total standing crop and yield have remained fairly consistent since 1996 and on average were 8 times greater than the Control. Perennial grass yield was 2- to 20-fold greater in the Cut than the Control across measurement years and peaked 14 yr (2005) after treatment. Perennial bunchgrass yield declined to 30 − 40% of its peak value, and bunchgrass density declined from about 11 plants m^{-2} in 2005 to 7 plants m^{-2} between 2005 and 2016. Invasive annual grasses increased in yield and as a percentage of total yield from 3% to 20%, between 2005 and 2016. Juniper and shrub cover and density increases and greater annual grass yields in the Cut have likely contributed to declines in perennial bunchgrass density and yields. Juniper control will be necessary within 5 yr to maintain progression to sagebrush steppe, indicating a treatment longevity of about 25 − 30 yr. To lengthen the life expectancy of cutting and other mechanical control of piñon-juniper woodlands requires that all age classes of trees be controlled in the initial treatment.

Stonecipher, C. A., K. E. Panter, K. B. Jensen, C. W. Rigby and J. J. Villalba. 2017. **Revegetation of Medusahead-Invaded Rangelands in the Channeled Scablands of Eastern Washington.** Rangeland Ecology and Management 70(3):388-395.

View on Science Direct: http://www.sciencedirect.com/science/article/pii/S1550742416301099

Abstract:

Vegetation on the Channeled Scablands of eastern Washington has been altered to a community dominated by medusahead (*Taeniatherum caput-medusae* [L.] Nevski). Medusahead is used by livestock but becomes unpalatable as the plant matures and seed heads develop, thus decreasing carrying capacity. The objective of this study was to determine if improved cool-season grasses could establish and persist on medusahead-infested rangelands in the region. A split-plot randomized complete block design consisting of four blocks was established at three different locations. Plots were treated with herbicides to remove all vegetation and seeded in 2010. Seeded species included introduced cool-season grass cultivars: Hycrest II crested wheatgrass (*Agropyron cristatum* [L.] Gaertn.), Vavilov II Siberian wheatgrass (*Agropyron fragile* [Roth] P.

Candargy), Bozoisky II Russian wildrye (*Psathyrostachys juncea* [Fisch.] Nevski), and a native cool-season grass mix composed of Sherman big bluegrass (*Poa secunda* J. Presl), Secar Snake River wheatgrass (*Elymus wawawaiensis* J. Carlson & Barkworth), Bannock Thickspike wheatgrass (*Elymus lanceolatus* [Scribn. & J. G. Sm.] Gould), and Recovery Western wheatgrass (*Pascopyrum smithii* [Rydb.] Á Löve). Sherman big bluegrass was the only native species that established, and frequency was 65% at the end of the study. Hycrest II frequency was 48% at the end of the study. Vavilov II frequency was 50% at the end of the study. Sherman big bluegrass matured early in the season and had greater biomass production than Hycrest II and Vavilov II in May. The later-maturing Hycrest II and Vavilov II were similar in biomass production to Sherman big bluegrass in July. Bozoisky II had poor stand establishment and did not persist. Hycrest II, Vavilov II, and Sherman big bluegrass are forages that can be used for revegetation on the Channeled Scablands of eastern Washington.

Monaco, T. A., J. M. Mangold, B. A. Mealer, R. D. Mealer and C. S. Brown. 2017. **Downy Brome Control and Impacts on Perennial Grass Abundance: A Systematic Review Spanning 64 Years.** Rangeland Ecology and Management 70(3):396-404.

View on Science Direct: http://www.sciencedirect.com/science/article/pii/S1550742416300896

Abstract:

Given the high cost of restoration and the underlying assumption that reducing annual grass abundance is a necessary precursor to rangeland restoration in the Intermountain West, United States, we sought to identify limitations and strengths of annual grass control methods and refine future management strategies. We systematically reviewed all published journal articles spanning a 64-yr period (1948 − 2012; n = 119) reporting data on research efforts to either directly or indirectly reduce the abundance of the most common invasive annual grass, downy brome (*Bromus tectorum* L.). The seven most common control methods studied were herbicide, burning, revegetation, woody removal, defoliation or grazing, soil disturbance, and soil amendment. In addition, the majority of control methods were 1) applied at scales of 10 − 100 m^2, 2) sampled within small plots (i.e., 0.1 − 1.0 m^2), 3) implemented only once, and 4) monitored at time scales that rarely exceeded 5 yr. We also performed summary analyses to assess how these control methods affect downy brome and perennial grass abundance (i.e., cover, density, biomass). We found conflicting evidence regarding the assumption that reducing downy brome abundance is necessary to enhance the growth and establishment of perennial grasses. All methods, with the exception of woody plant removal, significantly reduced downy brome in the short term, but downy brome abundance generally increased over time and only herbicide and revegetation remained reduced in the long term. Only burning, herbicide, and soil disturbance led to long-term increases in perennial grass abundance. We suggest that future research should prioritize a broader array of ecological processes to improve control efficacy and promote the reestablishment of desirable rangeland plant communities.

Chambers, J. C., J. D. Maestas, D. A. Pyke, C. S. Boyd, M. Pellant and A. Wuenschel. 2017. **Using Resilience and Resistance Concepts to Manage Persistent Threats to Sagebrush Ecosystems and Greater Sage-grouse.** Rangeland Ecology and Management 70(2):149-164.

View on Treesearch:
https://www.fs.fed.us/rm/pubs_journals/2017/rmrs_2017_chambers_j001.pdf

Abstract:

Conservation of imperiled species often demands addressing a complex suite of threats that undermine species viability. Regulatory approaches, such as the US Endangered Species Act (1973), tend to focus on anthropogenic threats through adoption of policies and regulatory mechanisms. However, persistent ecosystem-based threats, such as invasive species and altered disturbance regimes, remain critical issues for most at-risk species considered to be conservation-reliant. We describe an approach for addressing persistent ecosystem threats to at-risk species based on ecological resilience and resistance concepts that is currently being used to conserve greater sage-grouse *(Centrocercus urophasianus)* and sagebrush ecosystems. The approach links biophysical indicators of ecosystem resilience and resistance with species-specific population and habitat requisites in a risk-based framework to identify priority areas for management and guide allocation of resources to manage persistent ecosystem-based threats. US federal land management and natural resource agencies have adopted this framework as a foundation for prioritizing sage-grouse conservation resources and determining effective restoration and management strategies. Because threats and strategies to address them cross-cut program areas, an integrated approach that includes wildland fire operations, postfire rehabilitation, fuels management, and habitat restoration is being used. We believe this approach is applicable to species conservation in other largely intact ecosystems with persistent, ecosystem-based threats.

Clark, P. E., D. E. Johnson, D. E Ganskopp, M. Varva, J. G. Cook, R. C. Cook, F. B. Pierson and S. P. Hardegree. 2017. **Contrasting Daily and Seasonal Activity and Movement of Sympatric Elk and Cattle.** Rangeland Ecology and Management 70(2):183-191.

View on Science Direct: http://www.sciencedirect.com/science/article/pii/S1550742416300847

Abstract:

Elk (*Cervus elaphus* L.) and cattle (*Bos taurus* L.) co-occur on rangelands throughout western North America. Literature regarding range relations between elk and cattle, however, is contradictory, describing interspecific competition in some cases and complementary or facilitative relations in others. A better understanding of how sympatric elk and cattle behave at fine spatiotemporal scales is needed to properly allocate resources for these species. We used intensively sampled Global Positioning System (GPS) tracking data (1-sec intervals) to classify elk and cattle behavior and investigate their activity and movement strategies in the Blue Mountains of northeastern Oregon, United States, during summer and fall 2007. An ensemble classification approach was used to identify stationary, foraging, and walking behavior classes within the GPS datasets of mature beef and captive elk cows grazing in forested pastures during two randomized experiments, one in summer and the other fall. During summer, elk traveled

farther per day, had larger walking budgets, exhibited more and longer walking bouts, and had higher walking velocities than beef cows. Cattle tended to emphasize intensive foraging over extensive movement and thus displayed larger foraging budgets and longer foraging bouts than elk. Site-by-species interactions, however, were detected for some foraging responses. During fall, when forage quality was limiting, elk exhibited a more foraging-centric mobility strategy while cattle emphasized an energy conservation strategy. These differing movement and energetic strategies tended to support the concept that elk and cattle occupy differing behavioral niches. Extensive foraging by elk and intensive foraging by cattle during summer correspond well with behaviors expected for elk searching out forbs in graminoid-dominated habitats and cattle foraging intensively on graminoids. Behaviors exhibited in the fall were consistent with elk continuing to exercise more selectivity among the available forage than cattle. These differing strategies, consequently, would moderate the potential for direct interspecific competition during summer and fall.

Brownsey, P., J. J. James, S. J. Barry, T. A. Becchetti, J. S. Davy, M. P. Doran, L. C. Forero, J. M. Harper, R. E. Larson and S.R. Larson-Praplan. 2017. **Using Phenology to Optimize Timing of Mowing and Grazing Treatments for Medusahead *(Taeniatherum caput-medusae)*.** Rangeland Ecology and Management 70(2):210-218.

View on Science Direct: http://www.sciencedirect.com/science/article/pii/S1550742416300793
Abstract:

The invasive annual grass medusahead (*Taeniatherum caput-medusae* [L.] Nevski) poses a substantial threat to the health and function of rangelands across the western United States. On rangelands containing other desirable annual grasses, selective control of medusahead is difficult as this invasive species has traits similar to those of desired species. One key trait that differs between medusahead and other annual grasses is the rate and timing of phenological development. In this study we define management states for medusahead on the basis of the patterns of variation of forage palatability and susceptibility of seed production to defoliation over phenological stages. We integrate these management states with field observations to model the rates and timing of phenology-based management states to identify when targeted grazing or mowing treatments are most appropriate using Dirichlet regression and multistate modeling. While defoliation at any phenological stage from V3 (boot) to R8 (milk stage) was effective in reducing medusahead seed head production, clipping after anthesis almost eliminated seed production. However, the observed decline in crude protein at this point (11 − 8%) suggests that the transition from R4 (emergence of awns) to R5 (anthesis) is also the point at which medusahead becomes both unpalatable and not adequately nutritious to livestock. As a consequence there was a window of 10 to 15 days when 90% or more of medusahead reproductive tillers are susceptible to grazing but could also support nutritional needs of cattle and sheep to prevent avoidance in diet selection. In contrast, the window of opportunity for mowing, on average, extended for about 35 days. In a given year, the timing in which different medusahead populations entered each phenological stage varied at both the landscape and pasture scale, which creates both challenges and opportunities in using grazing animals and other defoliation mechanisms to control medusahead.

Pilliod, D. S., J. L. Welty and G. R Toevs. 2017. **Seventy-Five Years of Vegetation Treatments on Public Rangelands in the Great Basin of North America.** Rangelands 39(1):1-9.

View on Science Direct: http://www.sciencedirect.com/science/article/pii/S019005281630102X

Abstract:

Land treatments occurring over millions of hectares of public rangelands in the Great Basin over the last 75 years represent one of the largest vegetation manipulation and restoration efforts in the world. The ability to use legacy data from land treatments in adaptive management and ecological research has improved with the creation of the Land Treatment Digital Library (LTDL), a spatially explicit database of land treatments conducted by the U.S. Bureau of Land Management. The LTDL contains information on over 9,000 confirmed land treatments in the Great Basin, composed of seedings (58%), vegetation control treatments (24%), and other types of vegetation or soil manipulations (18%). The potential application of land treatment legacy data for adaptive management or for retrospective analyses of effects of land management actions on physical, hydrological, and ecological patterns and processes is considerable and just beginning to be realized.

Gibson, A. L., L. Fishman and C. R. Nelson. 2017. **Polyploidy: a missing link in the conversation about seed transfer of a commonly seeded native grass in western North America.** Restoration Ecology 25(2):184-190.

View on Wiley Online Library: http://onlinelibrary.wiley.com/doi/10.1111/rec.12408/full

Abstract:

The use of local, native plant materials is now common in restoration but testing for polyploidy in seed sources is not. Diversity in cytotypes across a landscape can pose special seed transfer challenges, because the methods used to determine genetically appropriate materials for seed transfer do not account for cytotypic variation. This lack of consideration may result in mixing cytotypes through revegetation, which could reduce long-term population viability. We surveyed nine populations of a native bunchgrass, *Pseudoroegneria spicata*, in three EPA Level III Ecoregions in the western United States to determine the frequency of polyploidy, whether there are differences in traits (phenotype, fecundity, and mortality) among plants of different cytotypes, and whether cytotype frequency varies among ecoregions. We assessed trait variation over 2 years in a common garden and determined ploidy using flow cytometry. Polyploidy and mixed cytotype populations were common, and polyploids occurred in all ecoregions. Four of the nine populations were diploid. The other five had tetraploids present: three had only tetraploid individuals whereas two had mixed diploid/tetraploid cytotypes. There was significant variation in traits among cytotypes: plants from tetraploid populations were larger than diploid or mixed populations. The frequency and distribution of cytotypes make it likely that seed transfer in the study area will inadvertently mix diploid and polyploid cytotypes in this species. The increasing availability of flow cytometry may allow ploidy to be incorporated into native plant materials sourcing and seed transfer.

Monroe, A. P., C. L. Aldridge, T. J. Assal, K. E. Veblen, D. A. Pyke and M. L. Casazza. 2017. **Patterns in Greater Sage-grouse population dynamics correspond with public grazing records at broad scales.** Ecological Applications March 2017:1-12.

View on Wiley Online Library: http://onlinelibrary.wiley.com/doi/10.1002/eap.1512/full

Abstract:

Human land use, such as livestock grazing, can have profound yet varied effects on wildlife interacting within common ecosystems, yet our understanding of land-use effects is often generalized from short-term, local studies that may not correspond with trends at broader scales. Here we used public land records to characterize livestock grazing across Wyoming, USA, and we used Greater Sage-grouse (*Centrocercus urophasianus*) as a model organism to evaluate responses to livestock management. With annual counts of male Sage-grouse from 743 leks (breeding display sites) during 2004–2014, we modeled population trends in response to grazing level (represented by a relative grazing index) and timing across a gradient in vegetation productivity as measured by the Normalized Vegetation Difference Index (NDVI). We found grazing can have both positive and negative effects on Sage-grouse populations depending on the timing and level of grazing. Sage-grouse populations responded positively to higher grazing levels after peak vegetation productivity, but populations declined when similar grazing levels occurred earlier, likely reflecting the sensitivity of cool-season grasses to grazing during peak growth periods. We also found support for the hypothesis that effects of grazing management vary with local vegetation productivity. These results illustrate the importance of broad-scale analyses by revealing patterns in Sage-grouse population trends that may not be inferred from studies at finer scales, and could inform sustainable grazing management in these ecosystems.

Charles, G. K., L. M. Porensky C. Riginos, K. E. Veblen and T. P. Young. 2017. **Herbivore effects on productivity vary by guild: cattle increase mean productivity while wildlife reduce variability.** Ecological Applications 27(1):143-155.

View on Wiley Online Library: http://onlinelibrary.wiley.com/doi/10.1002/eap.1422/full

Abstract:

Wild herbivores and livestock share the majority of rangelands worldwide, yet few controlled experiments have addressed their individual, additive, and interactive impacts on ecosystem function. While ungulate herbivores generally reduce standing biomass, their effects on aboveground net primary production (ANPP) can vary by spatial and temporal context, intensity of herbivory, and herbivore identity and species richness. Some evidence indicates that moderate levels of herbivory can stimulate aboveground productivity, but few studies have explicitly tested the relationships among herbivore identity, grazing intensity, and ANPP. We used a long-term exclosure experiment to examine the effects of three groups of wild and domestic ungulate herbivores (megaherbivores, mesoherbivore wildlife, and cattle) on herbaceous productivity in an African savanna. Using both field measurements (productivity cages) and satellite imagery,

we measured the effects of different herbivore guilds, separately and in different combinations, on herbaceous productivity across both space and time. Results from both productivity cage measurements and satellite normalized difference vegetation index (NDVI) demonstrated a positive relationship between mean productivity and total ungulate herbivore pressure, driven in particular by the presence of cattle. In contrast, we found that variation in herbaceous productivity across space and time was driven by the presence of wild herbivores (primarily mesoherbivore wildlife), which significantly reduced heterogeneity in ANPP and NDVI across both space and time. Our results indicate that replacing wildlife with cattle (at moderate densities) could lead to similarly productive but more heterogeneous herbaceous plant communities in rangelands.