Nevada Section Society for Range Management Suggested Reading: Fall 2019

Abstracts of Recent Papers on Range Management in the West

Prepared by Charlie Clements, Rangeland Scientist, USDA Agricultural Research Service, Reno, NV

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Davy, J. S. and M. J. Rinella. 2019. **Targeted grazing for native forbs in annual grasslands.** Rangeland Ecology and Management. 72(3):501-504.

Access full-text from ResearchGate: https://www.researchgate.net/publication/331711827_Targeted_Grazing_for_Native_Forbs_in_Annual_Grasslands

Abstract:

Targeted grazing is a promising strategy for addressing management issues in annual grasslands. We evaluated targeted cattle grazing strategies for tarweed (*Hemizonia fitchii* A. Gray) and vinegarweed (*Trichostema lanceolatum* Benth.). These native annual forbs provide biodiversity to annual grass-dominated landscapes, in addition to being important pollinator plants that discourage yellow starthistle (*Centaurea solstitialis* L.) invasion. However, these forbs can form dense stands that interfere with grazing. Therefore, we sought grazing strategies that promote sparse stands to maintain livestock production while supporting other ecosystem services. Treatments were 1) early grazing when dominant annual grasses were vegetative, 2) late grazing when grasses were senescing, 3) repeated grazing, and 4) a nongrazed control. These treatments were applied in 2011, 2012, and 2013. In 2012, neither tarweed nor vinegarweed were observed regardless of treatment, likely due to low water availability during their major growth period. In 2011 and 2013, grazing grasses repeatedly throughout the growing season increased tarweed to $3-5$ plants m^{-2}, compared with < 1 plants m^{-2} in the control, and in 2011 repeated grazing also increased vinegarweed. Therefore, although environmental factors can prevent tarweed and vinegarweed from forming stands some years, defoliating grasses repeatedly from vegetative through senesced stages is the most reliable way to encourage these forbs in annual grasslands. However, a single period of defoliation can also encourage tarweed: In 2011 and 2013, we found a single period of grazing as annual grasses senesced and tarweed began rapid growth increased tarweed, possibly by increasing light availability. Finally, we found grazing once early in the growing season provided low tarweed and vinegarweed densities, likely because the long post-grazing period allowed annual grasses to recover and competitively suppress these forbs. Therefore, early grazing may reduce/prevent overly dense tarweed and vinegarweed stands.

Pennington, V. E., J. B. Bradford, K. A. Palmquist, R. R. Renne and W. K. Lauenroth. 2019. **Patterns of big sagebrush plant community composition and stand structure in the western United States**. Rangeland Ecology and Management. 72(3):505-514.

View at Science Direct: https://www.sciencedirect.com/science/article/pii/S1550742418303385

Abstract:

Big sagebrush (*Artemisia tridentata* Nutt.) plant communities are found in western North America and comprise a mix of shrubs, forbs, and grasses. Climate, topography, and soil water availability are important factors that shape big sagebrush stand structure and plant community composition; however, most studies have focused on understanding these relationships at sites in a small portion of the big sagebrush region. Our goal was to characterize detailed stand structure and plant composition patterns and identify environmental variables related to those patterns by sampling 15 sites distributed across the western United States. In each site, we characterized stand structure at the individual shrub level and at the site level. We quantified size distributions

and assessed relationships among canopy volume, age, and height. We also characterized functional type cover and species composition and related those to climatic, topographic, and edaphic variables. Mean big sagebrush age ranged from 21 (± 8) to 57 (± 22) yr at individual sites, mean height ranged from 0.23 (± 0.12) to 0.67 (± 0.23) m, and mean canopy volume ranged from 0.03 (± 0.04) to 0.62 (± 0.51) m^3. Bare ground and litter contributed the most cover (mean = 64%), followed by big sagebrush (mean = 39% of vascular plant cover). There was a negative relationship between big sagebrush cover and grass and forb cover. Species composition was related to both climate and elevation, likely because these variables influence water availability. Although our study was limited to 15 field sites, our detailed descriptions of widely distributed sites provide insight into the magnitude of variability in big sagebrush plant community structure.

Linkrandal, S. O. and W. H. Sheelbansal. 2019. **Fire risk in revegetated bunchgrass communities infested with *Bromus tectorum***. Rangeland Ecology and Management. 72(3):539-541.

View at Science Direct: https://www.sciencedirect.com/science/article/pii/S1550742418301155

Abstract:

In rangeland ecosystems, invasive annual grass replacement of native perennials is associated with higher fire risk. Large bunchgrasses are often seeded to reduce cover of annuals such as *Bromus tectorum* L. (cheatgrass), but there is limited information about how revegetation reduces fire risk over the long term. We assessed how revegetated community composition influences fire risk at three sites in Columbia National Wildlife Refuge in Grant County, Washington that were revegetated with large bunchgrasses 8 − 18 years before the study. At each site, five replicates of 10 plots (10 × 10 m) were established. Fire risk was determined as the probability that a plot would completely burn following ignition at a randomly located point in each plot (i.e., if 8 of 10 plots burned, then fire risk was 80%). Preignition, cover of bunchgrasses, cheatgrass, forbs, and surface characteristics were determined for each plot. Fire risk was < 100%. However, fire risk was still relatively high around 73% and did not differ significantly among sites despite differences in cheatgrass and bunchgrass cover, which may have been attributable to other characteristics, such as high total fuels cover (> 80% at all sites) and unvegetated gap cover (soil and soil cryptogams, < 17%). This information can provide guidance for future studies with larger ranges of cover characteristics to develop robust fire risk models, which ultimately will be used to aid rangeland managers who need to specify reduction of fire risk after reestablishing large bunchgrasses in rangelands infested with cheatgrass.

Riginos, C., K. E. Veblen, T. Thacker, K. L. Gunnel and T. A. Monaco. 2019. **Disturbance type and sagebrush community type affect plant community structure after shrub reduction.** Rangeland Ecology and Management. 72(4):619-631.

View at Science Direct: https://www.sciencedirect.com/science/article/pii/S1550742418301106

Abstract:

Treatments to reduce shrub cover are commonly implemented with the objective of shifting community structure away from shrub dominance and toward shrub and perennial grass codominance. In sagebrush (*Artemisia* L.) ecosystems, shrub reduction treatments have had variable effects on target shrubs, herbaceous perennials, and non-native annual plants. The factors mediating this variability are not well understood. We used long-term data from Utah's Watershed Restoration Initiative project to assess short-term (1 − 4 yr post-treatment) and long-term (5 − 12 yr post-treatment) responses of sagebrush plant communities to five shrub reduction treatments at 94 sites that span a range of abiotic conditions and sagebrush community types. Treatments were pipe harrow with one or two passes, aerator, and fire with and without postfire seeding. We analyzed effect sizes (log of response ratio) to assess responses of sagebrush, perennial and annual grasses and forbs, and ground cover to treatments. Most treatments successfully reduced sagebrush cover over the short and long term. All treatments increased long-term perennial grass cover in Wyoming big sagebrush (*A. tridentata* Nutt. ssp. *wyomingensis* Beetle & Young) communities, but in mountain big sagebrush (ssp. *vaseyana* [Rydb.] Beetle) communities, perennial grasses increased only when seeded after fire. In both sagebrush communities, treatments generally resulted in short-term, but not long-term, increases in perennial forb cover. Annual grasses (largely invasive cheatgrass, *Bromus tectorum* L.) increased in all treatments on sites dominated by mountain big sagebrush but stayed constant or decreased on sites dominated by Wyoming big sagebrush. This result was unexpected because sites dominated by Wyoming big sagebrush are typically thought to be less resilient to disturbance and less resistant to invasion than sites dominated by mountain big sagebrush. Together, these results indicate some of the benefits, risks, and contingent outcomes of sagebrush reduction treatments that should be considered carefully in any future decisions about applying such treatments.

Davies, K. W. and A. E. Dean. 2019. **Prescribed summer fire and seeding applied to restore juniper-encroached and exotic annual grass-invaded sagebrush steppe**. Rangeland Ecology and Management. 72(4):635-639.

View at Science Direct: https://www.sciencedirect.com/science/article/pii/S1550742419300120

Abstract:

Western juniper (*Juniperus occidentalis* Hook.) encroachment and exotic annual grass (medusahead [*Taeniatherum caput-medusae* L. Nevski] and cheatgrass [*Bromus tectorum* L.]) invasion of sagebrush (*Artemisia* L.) communities decrease ecosystem services and degrade ecosystem function. Traditionally, these compositional changes were largely confined to separate areas, but more sagebrush communities are now simultaneously being altered by juniper and exotic annual grasses. Few efforts have evaluated attempts to restore these sagebrush communities. The Crooked River National Grassland initiated a project to restore juniper-encroached and annual grass-invaded sagebrush steppe using summer (mid-July) applied prescribed fires and postfire seeding. Treatments were unburned, burned, burned and seeded with a native seed mix, and burned and seeded with an introduced seed mix. Prescribed burning removed all juniper and initially reduced medusahead cover but did not influence cheatgrass cover. Neither the native nor introduced seed mix were successful at increasing large bunchgrass cover, and 6 yr post fire, medusahead cover was greater in burned treatments compared with the unburned treatment. Large bunchgrass cover and biological soil crusts were less in treatments

that included burning. Exotic forbs and bulbous bluegrass (*Poa bulbosa* L.), an exotic grass, were greater in burned treatments compared with the unburned treatment. Sagebrush communities that are both juniper encroached and exotic annual grass invaded will need specific management of both juniper and annual grasses. We suggest that additional treatments, such as pre-emergent herbicide control of annuals and possibly multiple seeding events, are necessary to restore these communities. We recommend an adaptive management approach in which additional treatments are applied on the basis of monitoring data.

King, S. R., K. A. Schoenecker and D. J. Manier. 2019. **Potential spread of cheatgrass and other invasive species by feral horses in western Colorado**. Rangeland Ecology and Management. 72(4):706-710.

Access full-text from ResearchGate: https://www.researchgate.net/publication/331930442_Potential_Spread_of_Cheatgrass_Bromus_tectorum_and_Other_Invasive_Species_by_Feral_Horses_Equus_ferus_caballus_in_Western_Colorado

Abstract:

The invasive grass cheatgrass (*Bromus tectorum* L.) presents major challenges for land management and habitat conservation in the western United States. Feral horses *(Equus ferus caballus)* have become overabundant in some areas of the West and can impact fragile semiarid ecosystems. Amid ongoing efforts to control cheatgrass in the Great Basin, we conducted a study to determine if feral horses contribute to the spread of cheatgrass through distribution via their feces. We collected feral horse fecal samples from Little Book Cliffs Herd Management Area in western Colorado in 2014. Fecal samples were dried, and 20 from each of 3 collection sessions were cultivated to examine germination success. Six species germinated from 18 samples (30%; mostly one plant per sample where germination occurred), including cheatgrass from 8% of samples. In a separate study we examined the diet of this same horse population using fecal plant DNA barcoding. Plant species that germinated were rare in the diet and germinated from fewer samples than expected relative to their detection in the diet. Our results suggest that feral horses could be contributing to cheatgrass propagation. Native ungulates and domestic cattle also have this potential. Although management of all large ungulates is necessary to mitigate cheatgrass spread, control of feral horse numbers is particularly necessary.

Smith, K. T., J. R. LeVan and J. L. Beck. 2019. **Forb and invertebrate response to treatments for greater sage-grouse in Wyoming big sagebrush.** Rangeland Ecology and Management. 72(4):791-795.

View at Science Direct: https://www.sciencedirect.com/science/article/pii/S1550742419300296

Abstract:

Treatments in big sagebrush (*Artemisia tridentata* Nutt.) are often implemented to improve habitat conditions for species such as greater sage-grouse *(Centrocercus urophasianus).* These treatments aim to increase the availability of forbs and invertebrates critical to juvenile and adult sage-grouse during the breeding season. However, information regarding the response of forbs in

treated sagebrush are often conflicting, dependent on the type of sagebrush community treated and time after treatment. In addition, there is little information on the response of invertebrates to treatments, particularly herbicide treatments in Wyoming big sagebrush (*A.t.* ssp. *wyomingensis* Beetle & Young) communities. We evaluated the response of forbs and invertebrates in Wyoming big sagebrush that had been mowed or aerially treated with tebuthiuron compared with untreated reference areas. We also compared forb and invertebrate dry matter (DM) between treated plots and locations used by brood-rearing females. Forb and invertebrate DM in mowed and tebuthiuron treatments did not differ from untreated plots up to 4 yr after treatment and were equal to or less than locations used by brood-rearing grouse up to 2 yr after treatment. Our findings corroborate best available science that suggest treating Wyoming big sagebrush may not increase food availability for sage-grouse.

Sawalhah, M. N., J. L. Holechek, A. F. Cibils, H. M. Geli and A. Zaied. 2019. **Rangeland livestock production in relation to climate and vegetation trends in New Mexico.** Rangeland Ecology and Management. 72(5):832-845.

View at Science Direct: https://www.sciencedirect.com/science/article/pii/S1550742418303257

Abstract:

A large statewide historical database involving livestock numbers, vegetation cover, precipitation, air temperature, and drought frequency and severity allowed us to explore relationships between climate and rangeland livestock grazing levels and livestock productivity from 1920 to 2017. Trends in vegetation cover and livestock grazing levels from 1984 to 2017 were also explored. Our climate time series was divided into two periods, 1920 − 1975 and 1976 − 2017, based on an apparent accelerated increase in mean annual air temperatures that began in the mid-1970s. Both mean annual precipitation (MAP) and mean annual air temperature (MAT) differed ($P \leq 0.05$) between the two periods. MAP and MAT were 9.6% and 3.4% higher in period 2 compared with period 1, respectively. From the 1920s to 2010s the livestock grazing level and weaned calf numbers fell 30% and 40%, respectively, despite a significant increase in MAP. Long-term declines in livestock grazing levels and in weaned calf numbers were significantly ($P \leq 0.05$) correlated with increasing MAT ($r = -0.34$ and $r = -0.43$, respectively). No long-term trends (1984–2017) in woody or perennial herbaceous cover were detected at the level of the entire state of New Mexico. Woody plant cover dynamics for New Mexico were not related to livestock grazing levels. However, at the county level we detected a 2% increase in woody plant cover coupled with a 9% decrease in cattle animal units between 2000 and 2002 and 2015 and 2017 for 19 select counties well distributed across New Mexico. Increases in woody plant cover varied greatly among counties and were higher for eastern than western New Mexico. Both global and New Mexico data show the climate warming trend is accelerating. Our findings have relevance to several other parts of the world because New Mexico occurs at midlatitude, has varied topography and climatic conditions, and several different range vegetation types.

Ebenhoch, K., D. Thornton, L. Shipley, J. A. Manning and K. White. 2019. **Effects of post-release movements on survival of translocated sage-grouse.** Journal of Wildlife Management. 83(6):1314-1325.

View from the Journal of Wildlife Management:
https://wildlife.onlinelibrary.wiley.com/doi/full/10.1002/jwmg.21720

Abstract:

Translocation is a vital tool in conservation and recovery programs, and knowledge of factors that determine demographic rates of translocated organisms is important for assessing the efficacy of translocations. Greater sage-grouse (*Centrocercus urophasianus*) have been the subject of recent translocation efforts because of their declining range and their usefulness as an umbrella species for conservation. Using a long-term data set on sage-grouse in central Washington, USA, we compared movement and demographic rates of translocated and resident birds. Because newly translocated birds experience physiological stress during translocation and are released in unfamiliar habitat, we hypothesized their demographic rates would differ from residents. We analyzed 18 years of radio-tracking data acquired from resident, newly translocated (<1 yr post-translocation; T1), and previously translocated (>1 yr post-translocation; T2) sage-grouse between 1989 and 2017 to estimate movement rates, survival, and productivity. Newly translocated sage-grouse exhibited farther daily movements (0.58 km/day) and smaller 95% home ranges (89 km^2) than residents and previously translocated birds. Daily movements and sex influenced survival, but survival did not differ according to residency status. Furthermore, birds that survived to a second year after translocation exhibited shorter daily movements compared to their first year ($\hat{\beta} = -0.727 \pm 0.157$ [SE]), which corresponded with increased survival the second year (T1 = 0.526, T2 = 0.610). This decrease in movements and increase in survival the second year was not apparent in the control group of resident birds, indicating a possible behavioral link to survival of newly translocated sage-grouse. Most productivity metrics were similar for translocated and resident birds, except for nest propensity (i.e., nest initiation rate), which was lower for newly translocated birds (35%) compared to residents and previously translocated birds. Our results reveal that translocated sage-grouse exhibit temporary differences in some demographic parameters in their first year, which later align with those of resident birds in subsequent years. Similarities in adult and nest survival according to residency status further suggest that translocation may prove to be a viable tool for restoring and conserving this species. Continued declines in sage-grouse populations in Washington, however, indicate that habitat conversion and fragmentation may be reducing demographic rates of residents and translocated birds, which warrants further study.

Rich, L. N., S. R. Beissinger, J. S. Brashares and B. J. Furnas. 2019. **Artificial water catchments influence wildlife distribution in the Mojave Desert.** Journal of Wildlife Management. 83(4):855-865.

Access full-text from ResearchGate:
https://www.researchgate.net/publication/331593176_Artificial_water_catchments_influence_wildlife_distribution_in_the_Mojave_Desert

Abstract:

Water often limits the distribution and productivity of wildlife in arid environments. Consequently, resource managers have constructed artificial water catchments (AWCs) in deserts of the southwestern United States, assuming that additional free water benefits wildlife. We tested this assumption by using data from acoustic and camera trap surveys to determine whether AWCs influenced the distributions of terrestrial mammals (>0.5 kg), birds, and bats in the Mojave Desert, California, USA. We sampled 200 sites in 2016–2017 using camera traps and acoustic recording units, 52 of which had AWCs. We identified detections to the species-level, and modeled occupancy for each of the 44 species of wildlife photographed or recorded. Artificial water catchments explained spatial variation in occupancy for 8 terrestrial mammals, 4 bats, and 18 bird species. Occupancy of 18 species was strongly and positively associated with AWCs, whereas 1 species (i.e., horned lark [*Eremophila alpestris*]) was negatively associated. Access to an AWC had a larger influence on species' distributions than precipitation and slope and was nearly as influential as temperature. In our study area, AWCs functioned as an important influence on wildlife occupancy, which supports the long-held assumption that AWCs may benefit wildlife in arid habitats. We encourage managers to maintain existing AWCs, particularly those in areas forecasted to have the largest decrease in water availability. We also recommend long-term, systematic monitoring of AWCs, which will facilitate more informed management decisions.

Clark, S. L., D. J. Sebastian, S. J. Nissen and J. R. Sebastian. 2019. **Effect of indaziflam on native species in natural areas and rangeland.** Invasive Plant Science and Management 12(1):60-67.

Abstract:

Minimizing the negative ecological impacts of exotic plant invasions is one goal of land management. Using selective herbicides is one strategy to achieve this goal; however, the unintended consequences of this strategy are not always fully understood. The recently introduced herbicide indaziflam has a mode of action not previously used in non-crop weed management. Thus, there is limited information about the impacts of this active ingredient when applied alone or in combination with other non-crop herbicides. The objective of this research was to evaluate native species tolerance to indaziflam and imazapic applied alone and with other broadleaf herbicides. Replicated field plots were established at two locations in Colorado with a diverse mix of native forbs and grasses. Species richness and abundance were compared between the nontreated control plots and plots where indaziflam and imazapic were applied alone and in combination with picloram and aminocyclopyrachlor. Species richness and abundance did not decrease when indaziflam or imazapic were applied alone; however, species abundance was reduced by treatments containing picloram and aminocyclopyrachlor. Species richness was only impacted at one site 1 yr after treatment (YAT) by these broadleaf herbicides. Decreases in abundance were mainly due to reductions in forbs that resulted in a corresponding increase in grass cover. Our data suggest that indaziflam will control downy brome (Bromus tectorum L.) for multiple years without reduction in perennial species richness or abundance. If B. tectorum is present with perennial broadleaf weeds requiring the addition of herbicides like picloram or

aminocyclopyrachlor, forb abundance could be reduced, and in some cases there could be a temporary reduction in perennial species richness.

Haight, J. D., S. C. Reed and A.M. Faist. 2019. **Seed bank community and soil texture relationships in a cold desert.** Journal of Arid Environments 164:46-52.

View at BioOne: https://bioone.org/journals/invasive-plant-science-and-management/volume-12/issue-1/inp.2019.4/Effect-of-indaziflam-on-native-species-in-natural-areas-and/10.1017/inp.2019.4.full

Abstract:

Sustainable dryland management depends on understanding environmental factors driving the composition of current and future ecological communities. While there has been extensive research on aboveground plant communities, less is known about belowground soil seed bank communities. In the Colorado Plateau of the western United States, we simultaneously explored aboveground and belowground plant communities and how they varied across sites with similar climate but contrasting soil textures. We found that aboveground vegetation and belowground seed bank community composition each varied significantly among sites. We also observed marked aboveground-belowground compositional dissimilarity across sites, suggesting that the two spatially-associated communities may respond differently to the same environmental gradient. Lastly, we found that abundances of cheatgrass (*Bromus tectorum*) – one of the region's major exotic invasive plants – varied strongly with soil texture, a finding with implications for invasive species management. From our results, we highlight two general patterns for dryland managers. First, we show that aboveground and belowground plant communities can respond to the same environmental variation in a strongly divergent manner. Second, the data underscore a large potential role for soil texture and its associated factors in mediating plant community responses to a range of environmental conditions.