

Nevada Section Society for Range Management Suggested Reading: Winter 2020
Abstracts of Recent Papers on Range Management in the West

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Perkins, L.B., K.R. Ducheneaux, G. Hatfield and S.R. Abella. 2019. [Badlands, seed banks, and community disassembly](#). *Rangeland Ecology and Management*. 72(5): 736-741.

Abstract:

Soil seed banks are a key component of ecological resilience as they provide a temporal reserve for plant species richness and diversity. Soil seed banks depend on on-site reproduction, seed longevity, and seed immigration for maintenance. When immigration of seeds is lost due to a change in land use or a disturbance, such as fragmentation, seed banks rely on on-site reproduction and longevity for maintenance. Within a fragment without seed immigration, seed banks become vulnerable to extinction debt leading to community disassembly over a long time scale. Therefore, we investigated how long-term fragmentation impacts community disassembly in seed banks. Seed bank samples were taken from grassland fragments (sod tables, $n = 28$) and from the surrounding area (matrix, $n = 28$). Seed banks were germinated, and emerging plants were identified. We found that community disassembly was not predictable in regard to species identity, and specialist ($P < 0.001$) and perennial ($P < 0.001$) species were lost from fragments. However, seed banks in fragments maintained a similar grass-to-forb ratio compared with the surrounding vegetation. Therefore, the ability of seed banks to provide ecological resilience may be limited after long-term fragmentation and land managers may need to reseed specialist species and perennials into grassland fragments.

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(5):791-795.

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.

Bailey, D., J.C. Mosley, R.E. Estell, A.F. Cibils, M. Horney, J.R. Hendrickson, J.W. Walker, K.L. Launchbaugh, and E.A. Burritt. 2019. [Synthesis paper: Targeted livestock grazing: Prescription for healthy rangelands](#). *Rangeland Ecology and Management*. 72(6): 685-877.

Abstract:

Targeted livestock grazing is a proven tool for manipulating rangeland vegetation, and current knowledge about targeted livestock grazing is extensive and expanding rapidly. Targeted grazing prescriptions optimize the timing, frequency, intensity, and selectivity of grazing (or browsing) in combinations that purposely exert grazing/browsing pressure on specific plant species or portions of the landscape. Targeted grazing differs from traditional grazing management in that the goal of targeted grazing is to apply defoliation or trampling to achieve specific vegetation management objectives, whereas the goal of traditional livestock grazing management is generally the production of livestock commodities. A shared aim of targeted livestock grazing and traditional grazing management is to sustain healthy soils, flora, fauna, and water resources that, in turn, can sustain natural ecological processes (e.g., nutrient cycle, water cycle, energy flow). Targeted grazing prescriptions integrate knowledge of plant ecology, livestock nutrition, and livestock foraging behavior. Livestock can be focused on target areas through fencing, herding, or supplement placement. Although practices can be developed to minimize the impact of toxins contained in target plants, the welfare of the animals used in targeted grazing must be a priority. Monitoring is needed to determine if targeted grazing is successful and to refine techniques to improve efficacy and efficiency. Examples of previous research studies and approaches are presented to highlight the ecological benefits that can be achieved when targeted grazing is applied properly. These cases include ways to suppress invasive plants and ways to enhance wildlife habitat and biodiversity. Future research should address the potential to select more adapted and effective livestock for targeted grazing and the associated animal welfare concerns with this practice. Targeted livestock grazing provides land managers a viable alternative to mechanical, chemical, and prescribed fire treatments to manipulate rangeland vegetation.

Zomorodi, T. and T.R. Walker. 2019. [Management strategies of free-roaming horses in Alberta compared with other jurisdictions](#). *Rangeland Ecology and Management*. 72(6): 907-915.

Abstract:

Management strategies of free-roaming species are subject to polarizing debates around the world. This paper provides perspectives on free-roaming horse management strategies practiced in Alberta and compares them against national management strategies used in Canada and internationally (United States and Australia) to illustrate importance of science-based and socially inclusive management schemes. Owing to their pluralistic status as an introduced and culturally significant species of western Canada, free-roaming horse populations are a contentious environmental management issue in Alberta. Some stakeholders (e.g., indigenous

people, horse and animal rights advocates) believe the government aims to extirpate free-roaming horses in favor of cattle grazing. However, the Albertan government and ranchers believe it is important to conserve and manage free-roaming horse populations for all land users while minimizing adverse environmental effects in sensitive foothill and mountain grasslands and associated riparian areas in Alberta. Despite this contention, a systematic approach that is mindful of the history and cultural value of horses to society is required to properly manage this species. Best management practices from case studies were used to compare against four main concerns identified from the literature of free-roaming horse management used in Alberta. Concerns include 1) cultural heritage values, 2) free-roaming (or wild) horse designation, 3) lack of scientifically rigorous population monitoring, and 4) societal considerations. Ecological effects of free-roaming horses and human dimensions of their management are discussed. It is recommended that lessons learned from other jurisdictions be applied to free-roaming horse management in Alberta to provide a more holistic framework as the government develops a “feral horse management strategy.”

Jones, T.A. 2019. [Native seeds in the market place: Meeting restoration needs in the Intermountain West United States](#). *Rangeland Ecology and Management*. 72(6): 1017-1029.

Abstract:

The scale of ecological restoration in the Intermountain West (IW), United States is likely greater than anywhere else in the world. This is largely driven by response to accelerating ecological disturbances and government programs that divert privately owned cropland into soil, water, and wildlife conservation use. While restoration in the IW is challenging due to the region’s aridity, over the past few decades considerable improvement in restoration seeding success has been achieved using native plants instead of the exotic species that have predominated previously. The IW is blessed with an extensive research infrastructure for native plant material development through the Natural Resources Conservation Service, the Agricultural Research Service, and the US Forest Service. A high demand for native seeds in the IW allows for a large and diverse product base of grasses, shrubs, and forbs in the form of cultivars, selected-class prevaryety germplasms, and source-identified populations. Two sister native seed industries, one based on field cultivation and another based on collection from public wildlands, are likely the largest of their kind in the world. Seed is offered, mostly on a speculative basis, to major markets (e.g., Bureau of Land Management consolidated seed buy, Utah Division of Wildlife Resources seed buy, Conservation Reserve Program). Elements of the IW native seed marketplace (e.g., plant material development and cultivated seed production), may be instructive for the development of broadscale-restoration models appropriate for other parts of the world.

Davies, K.W., C.S. Boyd, J.D. Bates, E.P. Hamerlynck, and S.M. Copeland. 2020. [Restoration of sagebrush in crested wheatgrass communities: Longer-term evaluation in northern Great Basin](#). *Rangeland Ecology and Management*. 73(1): 1-8.

Abstract:

Crested wheatgrass (*Agropyron cristatum* [L] Gaertm. and *Agropyron desertorum* [Fisch.] Schult.), an introduced bunchgrass, has been seeded on millions of hectares of sagebrush steppe. It can establish near-monocultures; therefore, reestablishing native vegetation in these communities is often a restoration goal. Efforts to restore native vegetation assemblages by controlling crested wheatgrass and seeding diverse species mixes have largely failed. Restoring sagebrush, largely through planting seedlings, has shown promise in short-term studies but has not been evaluated over longer timeframes. We investigated the reestablishment of Wyoming big sagebrush (*Artemisia tridentata* spp. *wyomingensis* [Beetle & A. Young] S.L. Welsh) in crested wheatgrass communities, where it had been broadcast seeded (seeded) or planted as seedlings (planted) across varying levels of crested wheatgrass control with a herbicide (glyphosate) for up to 9 yr post seeding/planting. Planting sagebrush seedlings in crested wheatgrass stands resulted in full recovery of sagebrush density and increasing sagebrush cover over time. Broadcast seeding failed to establish any sagebrush, except at the highest levels of crested wheatgrass control. Reducing crested wheatgrass did not influence density, cover, or size of sagebrush in the planted treatment, and therefore, crested wheatgrass control is probably unnecessary when using sagebrush seedlings. Herbaceous cover and density were generally less in the planted treatment, probably as a result of increased competition from sagebrush. This trade-off between sagebrush and herbaceous vegetation should be considered when developing plans for restoring sagebrush steppe. Our results suggest that planting sagebrush seedlings can increase the compositional and structural diversity in near-monocultures of crested wheatgrass and thereby improve habitat for sagebrush-associated wildlife. Planting native shrub seedlings may be a method to increase diversity in other monotypic stands of introduced grasses.

Johnston, D.B. and M. Garbowski. 2020. [Response of native plants and downy brome to a water-conserving soil amendment](#). Rangeland Ecology and Management. 73(1):19-29.

Abstract:

Restoring native plants in rangelands threatened by downy brome (*Bromus tectorum* L.) presents a serious challenge to land managers. Higher, more consistent soil moisture, as well as slightly compacted soils, may reduce the competitive abilities of downy brome. We manipulated these factors with three treatments: superabsorbent polymer (SAP), a soil-binding agent, and roller compaction at two restoration sites, Wagon Road Ridge (WRR) and Sagebrush (SGE), in northwestern Colorado. SAPs absorb water when soils are wet and then gradually release it, often reducing plant water stress. The binding agent we used is purported to increase water infiltration while reducing soil movement. In Experiment 1, we crossed an SAP, a binding agent, and rolling and found that SAP benefitted perennial grass establishment at the WRR site only. SAP also decreased downy brome cover and biomass at WRR. The binding agent increased soil moisture at both sites, and the highest level of binding agent reduced downy brome cover in the absence of SAP at the SGE site. In Experiment 2, we examined only SAP, with larger plots and a more complex seed mix. Again, SAP benefitted perennial grass establishment at WRR only. SAP reduced initial perennial forb density at both sites but did not affect forb cover in subsequent years. SAP effects on downy brome were site-specific. There was a trend for reduced downy brome cover with SAP at WRR, but SAP caused a large increase in downy brome cover in yr 3 at SGE. Granulated SAP can be applied easily along with drill seeding, making it potentially

applicable for dryland restoration. However, site specific factors may influence whether perennial grasses or downy brome most benefit from SAP application.

Koby, L.E., T.S. Prather, H. Quicke, J. Beuschlein, and I.C. Burke. 2019. [Management of *Ventenata dubia* in the inland Pacific Northwest with indaziflam](#). Invasive Plant and Science Management. 12(4): 223-228.

Abstract:

Ventenata [*Ventenata dubia* (Leers) Cross] is a winter annual grass relatively new to the inland Pacific Northwest that is capable of displacing desired vegetation. Indaziflam was evaluated for the management of *V. dubia* on two Conservation Reserve Program (CRP) sites near Moscow, ID, and Pullman, WA. While perennial grasses were dormant, applications of indaziflam in mixture with various herbicides were made in spring 2016. Treatment effects were evaluated for 2 yr by visual assessments of community composition and canopy cover of *V. dubia* and other non-weedy species (assessments occurred 3 to 6 mo after treatment, depending on location) and by representative cover class assessments. Biomass samples of all plant species were collected in the summer of 2017. Reduced *V. dubia* cover was observed in 2016, except when glyphosate was used alone. In 2017 indaziflam applied alone or in mixture with rimsulfuron effectively controlled *V. dubia* with minimal impact on desirable vegetation. Plant biomass from nontreated plots averaged 40 g m⁻² for *V. dubia* and 100 to 179 g m⁻² for perennial grasses. Plant biomass averaged <11 g m⁻² for *V. dubia* and 371 to 490 g m⁻² for perennial grasses when indaziflam at 102 g ai ha⁻¹ plus glyphosate at 474 g ai ha⁻¹ was applied. Smooth brome (*Bromus inermis* Leyss.) biomass was positively associated with the reduction of *V. dubia*, and there was a decrease in diversity associated with the removal of *V. dubia* through effective treatments. Indaziflam is an effective tool for the management of *V. dubia* in perennial grass stands, and spring applications of indaziflam should be in mixture with herbicides with POST activity.

Hamerlynck, E.P. and L.L. Ziegenhagen. 2020. [Seed head photosynthetic light responses in clipped and unclipped sagebrush steppe bunchgrasses](#). Journal of Arid Environments. 172: 104013

Abstract:

Low seedling establishment limits the long-term success of sagebrush steppe restoration, and the physiological mechanisms underlying this remain unclear. To address this, we measured the photosynthetic light responses and seed head specific length (mg cm⁻¹) of shaded and unshaded seed heads in clipped and unclipped plants to determine if grazing affects reproductive photosynthesis in sagebrush steppe bunchgrasses. We measured responses in an exotic species, *Agropyron cristatum* (crested wheatgrass) that readily establishes from seed, and two native grasses, *Elymus elymoides* (squirreltail wild rye) and *Psuedoroegneria spicata* (bluebunch wheatgrass), which do not. Defoliation did not affect seed head light saturation responses in any of the grasses. *Agropyron cristatum* seed heads attained higher light-saturated photosynthesis and

higher photosynthetic light use efficiencies than the native grasses, consistent with its ability to produce viable seed crops. Defoliation and shading reduced post-anthesis seed head specific masses only in *E. elymoides*, suggesting this species reproductive effort relies on carbon fixed by the seed head itself. These findings could help in the selection and development of native plant materials with characteristics similar to the successful exotic grass to improve restoration efforts in degraded sagebrush steppe ecosystems.

Howard, A.L., M.J. Clement, F.R. Peck, and E.S. Rubin. 2020. [Estimating mountain lion abundance in Arizona using statistical population reconstruction](#). *Journal Wildlife Management*. 84(1): 85-89.

Abstract:

Directly monitoring abundance of cryptic species, such as mountain lions (*Puma concolor*), over large areas is a challenge for wildlife managers because traditional population estimation techniques may be impractical and expensive. We generated annual estimates of mountain lion abundance in Arizona, USA, for 2004–2018 by employing statistical population reconstruction methods, which use available age-at-harvest data and auxiliary information such as estimated survival rates, harvest probabilities, and hunter effort. Using PopRecon 2.0 software, we estimated that the statewide abundance of all mountain lions including kittens ranged from 1,848 (95% CI = 650–3,046) to 4,661 (95% CI = 393–9,030) during 2004–2018. Abundance for subadults and adults was more stable and precisely estimated, ranging from 1,166 (95% CI = 622–1,709) to 1,715 (95% CI = 872–2,558). Our results suggest a stable statewide mountain lion population. This approach provides a practical and cost-effective option for monitoring Arizona's mountain lion population, and will improve the ability of managers to monitor the population annually to respond to changes in abundance and to evaluate factors that influence mountain lion abundance.