Nevada Society for Range Management Suggested Reading: June 2015

Abstracts of Recent Papers on Range Management in the West

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NV-SRM Suggested Reading 6-2015

K.W. Davies, C.S. Boyd, D.D. Johnson, A.M. Nafus, M.D. Madsen. 2015. Success of Seeding Native Compared with Introduced Perennial Vegetation for Revegetating Medusahead-Invaded Sagebrush Rangeland. Rangeland Ecology and management 68(3):224-230

http://www.bioone.org/doi/abs/10.1016/j.rama.2015.03.004

Abstract

Millions of hectares of Wyoming big sagebrush (*Artemisia tridentata* Nutt. subsp. *wyomingensis* Beetle &Young) rangeland have been invaded by medusahead (*Taeniatherum caput-medusae* [L.] Nevski), an exotic annual grass that degrades wildlife habitat, reduces forage production, and decreases biodiversity. Revegetation of medusahead-invaded sagebrush plant communities is necessary to restore ecosystem services. Disagreement, however, exists over whether to seed native or introduced perennial species to revegetate communities after controlling medusahead. Though native species generally do not establish as well as introduced species, interference from co-seeded introduced species has often been attributed to the limited success of natives. The potential for seeding natives to revegetate communities after medusahead control is relatively unknown because they have been largely co-seeded with introduced species. We compared the results of seeding native and introduced perennial species after controlling medusahead with prescribed burning followed with an imazapic herbicide application at five sites. Perennial bunchgrass cover and density were 5- and 10-fold greater in areas seeded with introduced compared with native species 3 years post seeding. Furthermore, exotic annual grass cover and density were less in areas seeded with introduced compared with native species. Seeded introduced and native shrubs largely failed to establish. High perennial bunchgrass density (15 individuals $\cdot$ m^{-2}) in areas seeded with introduced species in the third year post seeding suggests that the succession trajectory of these communities has shifted to becoming perennial dominated. Average perennial bunchgrass density of 1.5 individuals $\cdot$ m^{-2} with seeding native species will likely not limit medusahead and appears to already be converting back to exotic annual grass-dominated communities. These results suggest that seeding introduced compared with native species after medusahead control will likely be more successful. Our results also imply that if natives are selected to seed after medusahead control, additional resources may be necessary to recontrol medusahead and repeatedly sow native species.

Madsen, M. D., D. L Zvirzdin, S. L. Peterson, B. G. Hopkins and B. A. Roundy. 2015. Anchor Chaining's Influence on Soil Hydrology and Seeding Success in Burned Piñon-Juniper Woodlands. Rangeland Ecology and Manaegment 68(3):231-240.

http://www.bioone.org/doi/abs/10.1016/j.rama.2015.03.010

Abstract

Broadcast seeding is one of the most commonly applied rehabilitation treatments for the restoration of burned piñon and juniper woodlands, but the success rate of this treatment is notoriously low. In piñon-juniper woodlands, postfire soil−water repellency can impair seeding success by reducing soil−water content and increasing soil erosion. Implementing anchor chaining immediately after seeding can improve establishment of seeded species by enhancing seed-to-soil contact and may improve restoration success by decreasing soil−water repellency through soil tillage. The objectives of this research were to 1) determine if anchor chaining in postfire pinyon-juniper woodlands diminishes soil−water repellency, and 2) determine meaningful relationships between soil−water repellency, unsaturated hydraulic conductivity [$K(h)$], and the establishment of seeded and invasive species. Research was conducted on two study sites, each located on a burned piñon-juniper woodland that had severe water repellency and that was aerially seeded. At each location, plots were randomly located in similar ecological sites of chained and unchained areas. At one location, anchor chaining considerably improved soil hydrologic properties, reducing the severity and thickness of the water-repellent layer, and increasing soil $K(h)$ 2- to 4-fold in the first 2 yr following treatment. At this same location, anchor chaining increased perennial grass cover 16-fold and inhibited annual grass and annual forb cover by 5- and 7-fold, respectively. Results from the second site only showed improvements in soil $K(h)$; other hydrologic and vegetative treatment responses were not significantly improved. Overall, this research suggests that anchor chaining has the potential to improve restoration outcomes, though additional research is warranted for understanding the direct impact of anchor chaining on soil−water repellency without the interaction of a seeding treatment.

Warren, S. D., L.L. St. Clair, J. R. Johansen, P. Kugrens, L. S. Baggett and B. J. Bird. 2015. Biological Soil Crust Response to Late Season Prescribed Fire in a Great Basin Juniper Woodland. Rangeland Ecology and Management 68(3):241-247.

http://www.bioone.org/doi/abs/10.1016/j.rama.2015.03.007

Abstract

Expansion of juniper on U.S. rangelands is a significant environmental concern. Prescribed fire is often recommended to control juniper. To that end, a prescribed burn was conducted in a Great Basin juniper woodland. Conditions were suboptimal; fire did not encroach into mid- or late-seral stages and was patchy in the early-seral stage. This study evaluated the effects of the burn on biological soil crusts of early-seral juniper. Fire reduced moss cover under sagebrush and in shrub interspaces. Mosses were rare under juniper; their cover was unaffected there. Lichens were uncommon under juniper and sagebrush and therefore not significantly impacted there. Their cover was greater in shrub interspaces, but because the fire was spotty and of low intensity, the effects of burning were minimal. Compared with unburned plots, the biomass of cyanobacteria was diminished under juniper and sagebrush; it was reduced in the interspaces in both burned and unburned plots, presumably in response to generally harsher conditions in the postburn environment. Nitrogen fixation rates declined over time in juniper plots and interspaces but not in sagebrush plots. Although fire negatively affected some biological soil crust organisms in some parts of the early-seral juniper woodland, the overall impact on the crusts was minimal. If the intent of burning is to reduce juniper, burning of early-seral juniper woodland is appropriate, as most affected trees were killed. Control of sagebrush can likewise be accomplished by low-intensity, cool season fires without eliminating the crust component. Intense fire should be avoided due to the potential for greater encroachment into the shrub interspaces, which contain the majority of biological soil crust organisms. Burning early-seral juniper may be preferred for controlling juniper encroachment on rangeland.

Liu, G. X., F. He, L. Q. Wan and X. L. Li. 2015. Management Regimen and Seeding Rate Modify Seedling Establishment of *Leymus chinensis*. Rangeland Ecology and Mqanagement 68(2):204-210.

http://www.bioone.org/doi/abs/10.1016/j.rama.2015.01.007

Abstract:

Broadcasting of Chinese wild rye, *Leymus chinensis* seeds (without plowing) is the long-standing recommendation for reseeding degraded grasslands in Northern China. However, no experimental assessments have been made to determine which management options, including presow harrowing, postsow cutting, nitrogen fertilizer, and seeding rate, may influence the establishment of *L. chinensis* seedlings after broadcasting. We conducted a 2-year field study that quantified the relative impacts of these factors on seedling emergence, survival, and growth on a degraded short-grass steppe site at SaiBei, Hebei Province, China. Broadcast seeding of *L. chinensis* after harrowing resulted in the highest seedling emergence (16.4%), seedling survival (62.5%), and plant height (8.5 cm) compared with the other management regimens assessed. By Year 2, survival was 10 times greater in plots where harrowing had been implemented. This finding was especially important because of the drought conditions that occurred during the study period. The lowest seeding rate (400 seeds m^{-2}) was linked with 15% seedling emergence and average heights of 7.3 cm at the end of the 2 years. It is our recommendation that seedling establishment is optimized when harrowing is used for initial soil preparation and seed dispersal. Harrowing improved seed–soil contact, increased the number of seed safe sites on the soil surface, and reduced competition from the already existing sward.

Nafus, A. M., T. J. Svejcar, D. C. Ganskopp and K. W. Davies. 2015. Abundances of Coplanted Native Bunchgrasses and Crested Wheatgrass after 13 Years. Rangeland Ecology and Management 68(2):211-214.

http://www.bioone.org/doi/abs/10.1016/j.rama.2015.01.011

Abstract:

Crested wheatgrass (*Agropyron cristatum* [L] Gaertm) has been seeded on more than 5 million hectares in western North America because it establishes more readily than native bunchgrasses. Currently, there is substantial interest in reestablishing native species in sagebrush steppe, but efforts to reintroduce native grasses into crested wheatgrass stands have been largely unsuccessful, and little is known about the long-term dynamics of crested wheatgrass/native species mixes. We examined the abundance of crested wheatgrass and seven native sagebrush steppe bunchgrasses planted concurrently at equal low densities in nongrazed and unburned plots. Thirteen years post establishment, crested wheatgrass was the dominant bunchgrass, with a 10-fold increase in density. Idaho fescue (*Festuca idahoensis* Elmer), Thurber's needlegrass (*Achnatherum thurberianum* (Piper) Barkworth), basin wildrye (*Leymus cinereus* [Scribn. & Merr.] A. Löve), and Sandberg bluegrass (*Poa secunda* J. Presl) maintained their low planting density, whereas bluebunch wheatgrass (*Pseudoroegneria spicata* [Pursh] A. Löve), needle-and-thread (*Hesperostipa comata* [Trin. & Rupr.] Barkworth), and squirreltail (*Elymus elymoides* [Raf.] Swezey) densities declined. Our results suggest that densities of native bunchgrasses planted with crested wheatgrass are unlikely to increase and that some species may only persist at low levels. The high recruitment of crested wheatgrass suggests that coplanting of some native bunchgrasses may be a viable way of avoiding crested wheatgrass monocultures when this species is necessary for rehabilitation or restoration.

Burnett, S. A. and B. A. Mealor. 2015. Imazapic Effects on Competition Dynamics Between Native Perennial Grasses and Downy Brome (*Bromus tectorum*). Invasive Plant Management and Science 8(1):72-80.

http://www.bioone.org/doi/10.1614/IPSM-D-14-00032.1

Abstract

Downy brome inhibits revegetation efforts following ecosystem disturbance. Imazapic is a commonly used herbicide for downy brome management, but more information is needed regarding effective application timing for restoration efforts. We wished to determine (1) if native species establishment exhibited a tradeoff between downy brome competition and injury from herbicide and (2) if this differed between pre- and post-emergent applications of imazapic. We used a standard replacement series design and overlaid herbicide treatments. Nine weeks after planting, aboveground biomass was harvested and relative yield (RY) indices calculated. Both imazapic applications reduced downy brome biomass by 91% or more ($P < 0.05$). Imazapic caused drastic reductions in native biomass but less than what was caused by downy brome competition ($P < 0.05$). Natives were less injured by a pre- than post-emergent application ($P < 0.05$). In situations where downy brome may impact restoration efforts, pre-emergent applications of imazapic at 70 g ai ha^{-1} (0.06 lb ai ac^{-1}) may reduce downy brome with less negative impacts on newly-seeded native grasses than post-emergent applications. Ensuring sufficient proportions of native species seeds on restoration sites may reduce downy brome.

Herget, M. E., Hufford, K. M., Mummey, D. L., Mealor, B. A. and Shreading, L. N. (2015), Effects of competition with *Bromus tectorum* on early establishment of *Poa secunda* accessions: can seed source impact restoration success? Restoration Ecology, 23: 277–283.
doi: 10.1111/rec.12177

http://onlinelibrary.wiley.com/doi/10.1111/rec.12177/full

Abstract:

When landscapes are heavily impacted by biological invasion, local populations of native plant species may no longer be adapted to altered environmental conditions. In these cases, it is useful to investigate alternative sources of germplasm, such as cultivated varieties, for planting at restoration sites. This study compared cultivated and wild (local) varieties of the native perennial bunchgrass, *Poa secunda* J. Presl, grown with and without the exotic, invasive *Bromus tectorum* L. in a greenhouse setting. While *P. secunda* cultivars emerged and grew more rapidly than wild seed sources, this advantage declined in the presence of *B. tectorum* and cultivated germplasm did not outperform wild accessions in the presence of an invasive species. Given the novel genetic background of cultivars and their potential to alter patterns of dominance in native plant communities, we recommend the use of local or regional wild seed sources when possible to conserve regional patterns of genetic diversity and adaptation. Use of multiple seed sources may increase the potential for capturing vigorous genotypes in the restoration seed mix. In cases where sites are heavily impacted by exotic, invasive species, other control measures will be necessary to improve establishment of native species in grassland restoration programs.