Nevada Section Society for Range Management Suggested Reading: Fall 2017

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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NV-SRM Suggested Reading

Fall 2017

Mosely, J. C., R. A. Frost, B. L. Roeder and R. W. Kott. 2017. **Targeted Sheep Grazing to Suppress Sulfur Cinquefoil *(Potentilla recta)* on Northwestern Montana Rangeland.** Rangeland Ecology and Management. 70(5): 560-568.

View on Science Direct: http://www.sciencedirect.com/science/article/pii/S1550742417300258

Abstract:

Sulfur cinquefoil (*Potentilla recta* L.), a perennial forb native to the eastern Mediterranean region of Eurasia, is a major noxious weed on rangelands of the northwestern United States and southwestern Canada. We assessed targeted sheep grazing to suppress sulfur cinquefoil in a 2-yr rangeland field experiment in northwestern Montana. We evaluated targeted sheep grazing with and without protein-energy supplementation (37 g crude protein [CP] $sheep^{-1}$ d^{-1} and 0.17 kg total digestible nutrients [TDN] $sheep^{-1}$ d^{-1}) during late June (sulfur cinquefoil in early flowering stage) and mid-July (sulfur cinquefoil in late flowering − early seedset stage). Sheep readily consumed sulfur cinquefoil stems, leaves, flowers, and developing seed heads, with or without supplementation. Sulfur cinquefoil comprised the largest proportion of sheep diets during both late June and mid-July, averaging 46%, but more sulfur cinquefoil dry matter (DM) was consumed by sheep during mid-July (0.6 vs. 1.0 kg DM $sheep^{-1}$ d^{-1} in June vs. July, respectively). Supplementation did not increase DM intake (DMI) of sulfur cinquefoil, nor did supplementation improve the nutritive quality of sheep diets. We also documented that 1) targeted sheep grazing achieved heavy utilization of sulfur cinquefoil (67%) while keeping perennial graminoid use light to moderate (18 − 41%); 2) targeted sheep grazing reduced viable seed production of sulfur cinquefoil by 97% in June-grazed paddocks and 95% in July-grazed paddocks; and 3) targeted sheep grazing reduced sulfur cinquefoil yield the next summer by 41% in June-grazed paddocks and 47% in July-grazed paddocks without decreasing yield or plant community composition of perennial graminoids. We conclude that supplemented or non-supplemented targeted sheep grazing applied in either late June or mid-July can effectively suppress sulfur cinquefoil. Sheep nutrition and sulfur cinquefoil DMI will be optimized by targeted sheep grazing applied during mid-July.

Davies, K. W., M. D. Madsen and A. Hulet. 2017. **Using Activated Carbon to Limit Herbicide Effects to Seeded Bunchgrass When Revegetating Annual Grass-Invaded Rangelands.** Rangeland Ecology and Management. 70(5): 604-608.

View on Science Direct: http://www.sciencedirect.com/science/article/pii/S1550742417300398

Abstract:

Revegetation of exotic annual grass − invaded rangelands is challenging as annuals rapidly reinvade after control treatments. The most effective control of exotic annual grass is usually achieved with pre-emergent herbicides; however, species seeded simultaneously with these herbicides will likely experience nontarget damage. Thus, seeding often occurs 1 yr later to reduce herbicide effects to seeded vegetation, but by this time annual grasses may already be reinvading and limiting revegetation success. Activated carbon can be used to protect seeded species from herbicide damage because it has a high absorption capacity that can deactivate many herbicides. A pot study in a grow-room suggested that a pod containing activated carbon and seeds, herbicide protection pods (HPPs), may allow desired species to be seeded simultaneously with annual grass control with the pre-emergent herbicide imazapic. However, HPPs have not been field tested. We evaluated two seeding treatments (crested wheatgrass (*Agropyron desertorum* [Fisch.] Schult.) incorporated into HPPs and bare seed, simultaneously with an imazapic application to control annual grasses at two sites invaded by cheatgrass (*Bromus tectorum* L.) and medusahead (*Taeniatherum caput-medusae* [L.] Nevski). Crested wheatgrass abundance was 300% greater with HPPs compared with bare seed in late June. Imazapic application reduced exotic annual grass density at both sites by approximately half. These results suggest that HPPs can be used to allow desired species to be seeded simultaneously with imazapic application. This will allow seeded species a longer window to become established before experiencing pressure from exotic annuals and enable a single-entry approach compared with multiple entries currently employed to revegetate annual grass − invaded rangelands. Though further field testing is needed, in particular with multiple species and higher herbicide applications rates, these results suggest that HPPs could improve our ability to restore and revegetate exotic annual grass − invaded rangelands.

Havrilla, C. A., A. M. Faist and N. N. Barger. 2017. **Understory Plant Community Responses to Fuel-Reduction Treatments and Seeding in an Upland Piñon-Juniper Woodland.** Rangeland Ecology and Management 70(5):609-620.

View on Science Direct: http://www.sciencedirect.com/science/article/pii/S1550742417300374

Abstract:

Woody plant expansion and infilling into nonwooded rangeland ecosystems have been observed worldwide. Such expansion may lead to declines in herbaceous understory plant communities and increased fuel loads in rangelands. Under the US National Fire Plan, fuel-reduction treatments have been implemented over vast expanses of western forest types to reduce the risk

of catastrophic wildfire and restore historical ecosystem structure, function, and diversity. The benefits of fuel-reduction may, however, also carry inherent ecological risk such as promoting non-native species colonization. Here, we compare understory plant community responses to three commonly used fuel-reduction treatments with seeding applications in an upland piñon (*Pinus edulis* Engelm.)–juniper (*Juniperus osteosperma* [Torr.] Little) woodland on the Colorado Plateau: 1) mechanical mastication, 2) lop and slash piled then burned (pile burn), and 3) lop and scatter followed by a broadcast burn (broadcast burn). Data were collected pretreatment (2009) and one (2010), two (2011), and six (2015) growing seasons post treatment. We found while understory perennial herbaceous plant cover remained low 1 and 2 yr post treatment, it increased by > 700% in all fuel-reduction treatment plots six growing seasons post treatment. Furthermore, while we observed minor increases in invasive annual grass, *Bromus tectorum* L. (cheatgrass), colonization in 2010 and 2011, there were substantial increases in *B. tectorum* cover by 2015. *B. tectorum* cover varied among treatments with the greatest cover in the unseeded mastication plot at nearly 30%. Seeding applications did not increase overall seed mix species cover but enhanced seed mix species richness and, thus, may have increased resistance to *B. tectorum* invasion in seeded treatment plots. Our findings offer valuable insights to the ecological consequences of fuel-reduction activities in piñon-juniper woodlands through comparison of common fuel-reduction treatments and seeding applications and highlight differences in understory plant community responses to treatments across short to longer time scales.

Boyd, C. S., K. W. Davies and J. A. Lemos. 2017. **Influence of Soil Color on Seedbed Microclimate and Seedling Demographics of a Perennial Bunchgrass.** Rangeland Ecology and Management. 70(5): 621-624.

View on Science Direct: http://www.sciencedirect.com/science/article/pii/S1550742417300337

Abstract:

Perennial bunchgrasses are critical to maintaining sagebrush plant communities, but seeding of native bunchgrasses following fire has had limited success. Previous research indicated that blackened soils beneath burned sagebrush canopies have increased bunchgrass seeding success when compared with interspace locations. We investigated soil moisture and temperature across white, neutral, and black soils and tested the relationship between soil color and seedling demographics for bluebunch wheatgrass. We used a randomized block design with three treatments and five replications conducted in a Wyoming big sagebrush community in southeast Oregon. The study site was rototilled before establishing 50 x 50 cm plots in each of 2 yr. We installed soil temperature/moisture probes at 3-cm depth in each plot. Plots were seeded in November of each year with 125 viable seeds and covered in a $\leq$ 1-mm layer of white, brown, or black aquarium sand. We counted emergent seedlings weekly through May of the year following planting. Soil moisture during the emergence period (March–May) was highest for white soils and lowest for black or neutral soils ($P \leq 0.001$); soil temperature was highest for black or neutral soils and lowest for white soils ($P \leq 0.001$). Year 1 was characterized by a relatively warm and dry emergence period, and year 2 was relatively cool and moist. Emergent seedling density was highest ($P \leq 0.05$) for white soils; surviving seedling density (on June 1) was highest

($P \leq 0.05$) for white soils in year 1 and black soils in year 2. Black soils had greater success in a year with lower soil temperatures and adequate soil moisture. When soil moisture was limited, and spring temperatures warmer, increased soil temperature on black soils led to seedling desiccation and death.

Ott, J. E., R. D. Cox and N. L. Shaw. 2017. **Comparison of Post-fire Seeding Practices for Wyoming Big Sagebrush.** Rangeland Ecology and Management. 70(5): 625-632.

View on Science Direct: http://www.sciencedirect.com/science/article/pii/S1550742417300349

Abstract:

Wildfires in the Great Basin have resulted in widespread loss of Wyoming big sagebrush (*Artemisia tridentata* Nutt. ssp. *wyomingensis* Beetle & Young), an ecologically important shrub that has proven difficult to establish from seed. We sought to identify optimal seeding practices for Wyoming big sagebrush in the context of postfire seeding operations involving rangeland drills. In an experiment replicated at three burned sites in the northern Great Basin, we compared Wyoming big sagebrush establishment across treatments differing by seed delivery technique, timing, and rate of seed application. A seed mix containing bunchgrasses was drill-seeded in alternate rows using one of two drill-types (conventional or minimum-till), and a mix containing sagebrush was either delivered by drill to the soil surface in remaining rows or broadcast by hand (simulating aerial seeding) following drilling in fall or winter. Drill-delivery of sagebrush seed was accompanied by drag chains (conventional drill) or imprinter wheels (minimum-till drill) to improve seed-soil contact and was carried out at multiple seeding rates (ca. 50, 250, and 500 pure live seed m^{-2}). During 2 yr following seeding, sagebrush establishment was lower at two sites (yr 1: ≤ 1.2 plants m^{-2}; yr 2: ≤ 0.8 plants m^{-2}) compared with a third site (yr 1: ≤ 4.1 plants m^{-2}; yr 2: ≤ 2.0 plants m^{-2}) where treatment differences were more pronounced and significant. Wherever density differed between treatments, it was consistently higher in certain treatment levels (minimum-till > conventional drill, drill-delivery > broadcast-delivery, fall broadcast > winter broadcast, and higher rates > lower rates). Densities declined between years at two sites, but we did not find evidence that declines were due to density-dependent mortality. Results indicate that seeding success can likely be enhanced by using a minimum-till imprinter seeding method and using seeding rates higher than typical postfire seeding recommendations for Wyoming big sagebrush.

Boyd, C. S., K. W. Davies and G. H. Collins. 2017. **Impacts of Feral Horse Use on Herbaceous Riparian Vegetation Within a Sagebrush Steppe Ecosystem.** Rangeland Ecology and Management. 70(4): 411-417.

View on Science Direct: http://www.sciencedirect.com/science/article/pii/S1550742417300192

Abstract:

Feral horses inhabit rangeland ecosystems around the world, and their impacts on riparian ecosystems are poorly understood. We characterized impacts of a free-ranging horse population on the structure and composition of riparian plant communities in the sagebrush steppe ecosystem in the western United States. We used a randomized block design with single 25 × 50 m exclosures and grazed plots on four study sites within Sheldon National Wildlife Refuge in northwestern Nevada. Exclosures were constructed in 2008. Herbaceous plant utilization was measured from 2009 to 2013 by clipping within excluded and grazed plots. Herbaceous production and vertical structure were measured in 2013, and plant functional group and ground cover components were estimated in 2012–2013. Herbaceous utilization ranged from 27% to 84%, and herbaceous production did not differ by grazing treatment ($P = 0.472$). Grazed plots had seven-fold higher bare ground cover ($P < 0.001$), 60% less litter cover ($P < 0.001$), and the basal cover index was 65% higher. Grazing increased rush density by 50% ($P = 0.041$) but did not affect sedge density ($P = 0.514$). Grazing decreased herbaceous stubble height up to 80% and visual obstruction by about 70% ($P < 0.05$). Deep-rooted hydrophytic plant species did not increase with grazing exclusion, but greater vertical structure in excluded plots could improve hiding and nesting habitat for some riparian-associated wildlife species. Additionally, decreased bare ground with grazing exclusion could reduce erosion potential and susceptibility to invasive plant species.

Sebastian, D. J., S. J. Nissen, J. R. Sebastian and K. G. Beck. 2017. **Seed Bank Depletion: The Key to Long-Term Downy Brome (*Bromus tectorum* L.) Management.** Rangeland Ecology and Management. 70(4): 477-483.

View on Science Direct: http://www.sciencedirect.com/science/article/pii/S1550742416301270

Abstract:

Invasive winter annual grasses such as downy brome (*Bromus tectorum* L.) are a threat to native ecosystems throughout the United States. Downy brome is able to exploit moisture and nutrients throughout the fall and early spring before native plants break dormancy. This results in decreased native species abundance and development of monotypic downy brome stands. Short-term downy brome management has been shown to be effective; however, the soil seed reserve has often been overlooked, although it's the mechanism responsible for rapid reestablishment. This field study was conducted at two sites in Colorado to evaluate the longevity of the downy brome soil seed reserve and its implications on long-term downy brome control. Glyphosate plus adjuvant applications were made for 0, 1, 2, 3, 4, or 5 consecutive years. Downy brome and perennial grass biomass harvests were conducted yearly to determine changes in species composition. In addition, soil cores were collected to evaluate the yearly variation and depletion of the downy brome soil seed bank in response to consecutive glyphosate applications. We found

that 1 − 3 yr of consecutive glyphosate treatments were insufficient to deplete the downy brome soil seed bank. Downy brome biomass and the soil seed bank recovered within 1 − 2 yr after glyphosate treatments were terminated; however, 4 and 5 consecutive yr of glyphosate applications were sufficient to control downy brome through depletion of the soil seed bank. Managing downy brome for 4 − 5 consecutive yr resulted in a 4- to 9-fold increase in perennial grass biomass. These data suggest that long-term management of downy brome is dependent on eliminating the soil seed bank using a multiyear approach.

Gaskin, J. F. and J. L. Littlefield. 2017. **Invasive Russian Knapweed (*Acroptilon repens*) Creates Large Patches Almost Entirely by Rhizomic Growth.** Invasive Plant Science and Management. 10(2): 119-124.

View on BioOne: http://www.bioone.org/doi/abs/10.1017/inp.2017.9

Abstract:

Russian knapweed is an outcrossing perennial invasive weed in North America that can spread by both seed and horizontal rhizomic growth leading to new shoots. The predominant mode of spread at the local scale and dispersal at the long-distance scale informs control but has not been quantitatively researched. We used amplified fragment-length polymorphisms (AFLPs) of DNA collected from 174 shoots in two discrete patches of Russian knapweed at each of three locations in Montana. Out of the 174 shoots collected, we found nine AFLP genotypes. Three out of the six patches were monotypic; the other three patches each had one rare genotype. No genotypes were shared between patches. The maximum diameter of a genet (a genetic individual) was 56.5 m. These results indicate that patch expansion at the local scale is almost entirely by rhizomes that spread and develop new shoots. At the long-distance scale, dispersal is by seed. Controlling seed development through biological control and herbicide use may be effective at stopping long-distance dispersal but may not affect expansion of existing patches.

Gordon, C. E., O. F. Price and E. M. Tasker. 2017. **Mapping and exploring variation in post-fire vegetation recovery following mixed severity wildfire using airborne LiDAR.** Ecological Applications. 27(5): 1618-1632.

View on Wiley Online Library: http://onlinelibrary.wiley.com/doi/10.1002/eap.1555/full

Abstract:

There is a public perception that large high-severity wildfires decrease biodiversity and increase fire hazard by homogenizing vegetation composition and increasing the cover of mid-story vegetation. But a growing literature suggests that vegetation responses are nuanced. LiDAR technology provides a promising remote sensing tool to test hypotheses about post-fire vegetation regrowth because vegetation cover can be quantified within different height strata at fine scales over large areas. We assess the usefulness of airborne LiDAR data for measuring post-fire mid-story vegetation regrowth over a range of spatial resolutions (10 × 10 m, 30 × 30 m, 50 × 50 m, 100 × 100 m cell size) and investigate the effect of fire severity on

regrowth amount and spatial pattern following a mixed severity wildfire in Warrumbungle National Park, Australia. We predicted that recovery would be more vigorous in areas of high fire severity, because park managers observed dense post-fire regrowth in these areas. Moderate to strong positive associations were observed between LiDAR and field surveys of mid-story vegetation cover between 0.5–3.0 m. Thus our LiDAR survey was an apt representation of on-ground vegetation cover. LiDAR-derived mid-story vegetation cover was 22–40% lower in areas of low and moderate than high fire severity. Linear mixed-effects models showed that fire severity was among the strongest biophysical predictors of mid-story vegetation cover irrespective of spatial resolution. However much of the variance associated with these models was unexplained, presumably because soil seed banks varied at finer scales than our LiDAR maps. Dense patches of mid-story vegetation regrowth were small (median size 0.01 ha) and evenly distributed between areas of low, moderate and high fire severity, demonstrating that high-severity fires do not homogenize vegetation cover. Our results are relevant for ecosystem conservation and fire management because they: indicate that native vegetation are responsive and resilient to high-severity fire, and show the usefulness of remote sensing tools such as LiDAR to monitor post-fire vegetation recovery over large areas in situ.