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Stability of water temperature attributes over a 20-yr period

Larry Larson and P.A. Larson

The stability of water temperature attributes (i.e., air and water temperatures of daily heating and cooling cycles) in three streams in 1998, 2013, 2014, 2016, and 2018 in Grant County, Oregon were measured. Average air and water temperatures were stable at each stream. Each year mean air and water temperatures were within 1–2°C and no significant differences were observed between rates of heating between years or streams.

Suppression of cheatgrass by perennial bunchgrasses

Robert R. Blank, Charlie Clements, Tye Morgan, Dan Harmon, and Fay Allen

The authors compared the ability of “Hycrest” crested wheatgrass (a non-native grass) and Snake River wheatgrass and bluebunch wheatgrass (two native grasses) in suppressing cheatgrass in a greenhouse experiment. After 96 days, reduced nitrogen availability along with occupation of soil space by perennial roots and attenuation of the nitrogen cycle contributed to cheatgrass suppression. They found that established perennial grasses differed in their ability to suppress cheatgrass and suppression depended on the distance cheatgrass was sown from the established perennial grasses. “Hycrest” crested wheatgrass was found to be more effective at suppressing cheatgrass than the two native grasses.

Challenges and potentials for soil organic carbon sequestration in forage and grazing systems

Reshmi Sarkar, Vanessa Corriher-Olson, Charles Long, and Anil Somenahally

Under the currently changing climate, there is a need for climate-resilient forage and grazing systems. Intensively managed forage and grazing lands are often heavily fertilized to maximize yields, which leads to loss of soil organic carbon. However, diversifying forage and grazing species within strategic grazing plans can increase soil organic carbon sequestration. Furthermore, extreme climate events can lead to a decline in soil fertility, soil organic carbon sequestration, and forage and grazing systems productivity. Models can be helpful in simulating forage and grazing systems and choosing suitable management practices. Ultimately, participatory research with novel views and improved perceptions of the value of soil organic carbon sequestration and implementation of suitable management practices along with education and outreach materials will provide needed knowledge to producers.

Agrosilvopastoral systems and well-managed pastures increase soil carbon stocks in the Brazilian Cerrado

Igor Costa de Freitas, Juliana Martins Ribeiro, Nayara Christina Almeida Araújo, Maria Vitória Santos, Reginaldo Arruda Sampaio, Luiz Arnaldo Fernandes, Alcinei Místico Azevedo, Brigitte Josefine Feigl, Carlos Eduardo Pellegrino Cerri, and Leidivan Almeida Frazão

The authors tested the hypothesis that conversion of low-productivity pasture into agrosilvopastoral systems leads to improvement in soil quality as well as carbon and nitrogen stocks in the Brazilian Cerrado. They collected soil samples in 2016 and 2018 from an integrated crop-livestock-forest, marandu grass (*Brachiaria brizantha*) monoculture, low productivity pasture of signal grass (*B. decumbens*) monoculture, and native vegetation. The integrated crop-livestock-forest and the marandu grass monoculture promoted faster recovery of soil carbon and nitrogen compared to the pasture of signal grass monoculture. Overall, their findings support their hypothesis.

Adaptive, multipaddock rotational grazing management: A ranch-scale assessment of effects on vegetation and livestock performance in semi-arid rangeland

David J. Augustine, Justin D. Derner, María E. Fernández-Giménez, Lauren M. Porensky, Hailey Wilmer, David D. Briske, and the CARM Stakeholder Group

The authors designed an experiment to compare vegetation and cattle responses in an adaptively managed, multipaddock, rotational grazing system compared to a season-long continuous system. They found little evidence that grazing management affected abundance of C3 grass or production during the 5-year study. Adaptive rotational grazing resulted in a 12-16% reduction in total cattle weight compared to continuous grazing. Managers of semiarid rangelands should strive to maintain cattle at stock densities low enough to allow for maximum weight gains and enhance long-term sustainability of forage production.

Divergent responses of plant communities under increased land-use intensity in Oasis-desert ecotones of Tarim Basin

Xiaobing Zhou, Ye Tao, Lin Wu, Yonggang Li, and Yuanming Zhang

The authors evaluated the impacts of land use type and disturbance on plant communities in an oasis-desert ecotone in the southern Taklimakan Desert. Results showed that plant community structure and the growth of dominant species varied with landscape heterogeneity or land-use type, and distance effects were dependent on the land-use type. Over a short time period, irrigation was beneficial for the establishment of annual plants around farmland but not beneficial for perennial plants that use ground water.

Forb cover increases after solarization and winter fire in a grassland invaded by yellow bluestem

Charlotte Murray Reemts, Rebecca L. Neill, and Corbin Neill

Yellow bluestem (*Bothriochloa ischaemum*), an invasive perennial C4 grass common throughout the southern Great Plains, is difficult to control with winter prescribed fire. The authors tested solarization (covering vegetation and soil with black plastic) combined with winter fire to reduce cover of yellow bluestem. Results showed that cover of yellow bluestem was lower, and forb cover higher in solarized plus fire plots than in other treatments. This technique may need repeated application for full control of yellow bluestem.

Breeding bird use of production stands of native grasses—a working lands conservation approach

Patrick D. Keyser, Andrew S. West, David A. Buehler, Christopher M. Lituma, John J. Morgan and Roger D. Applegate

Restoration of native grasses may benefit grassland birds which have experienced long-term population declines. Native warm-season grass (NWSG) agricultural production

fields (e.g., hay, pasture, biofuel feedstock) may provide benefits to breeding birds. The authors compared relative abundance of 9 breeding bird species in three NWSG and control fields in Kentucky and Tennessee. Relative abundance and species richness of breeding birds did not differ between production types and control fields. They conclude that NWSG production stands could be a viable approach for increasing habitat for breeding birds and may provide benefits similar to those provided by conservation programs.

Rapid succession of orthopteran assemblages driven by patch size and connectivity

Zoltán Kenyeres

In this study, the author examined the effect of patch size and connectivity on the early succession of orthopteran assemblages in Central European sand habitats. Diversity of orthopterans in mid-successional states (4 to 5 years following restoration) was similar to control areas. Grazing can preserve low-productivity dry grassland habitats in the recommended state with open surfaces, closed patches, and fallen foliage cover in optimal proportions for orthopterans.

Change in piñon-juniper woodland cover since Euro-American Settlement: Expansion versus contraction associated with soil properties

Noah Amme, Chris A. Pague, and Miranda D. Redmond

Woodland ecosystems have expanded and increased in density across western North America since the early 1900s, but information on the historic distribution of these ecosystems is sparse. This study used historic U.S. General Land Office surveys to establish the extent of piñon-juniper woodlands in the late 19th century in southeastern Colorado and compares it to 2017 aerial imagery of woodland cover. The authors found that approximately 61% of historically dense woodland is now savanna or open (treeless), whereas 57% of historically open areas are now savannas or woodlands. This study provides mixed support for the common assumption that woodlands in western North America have expanded since Euro-American settlement.

Departures of rangeland fractional component cover and land cover from landsat-based ecological potential in Wyoming, USA

Matthew Rigge, Collin Homer, Hua Shi, and Bruce Whlie

In this study, the authors created maps of ecological potential (EP, potential natural vegetation cover expected by environmental conditions in the absence of human and natural disturbance) for sagebrush (*Artemisia spp.*), perennial herbaceous vegetation, litter, and bare ground fractional cover in Wyoming, USA. Examining departure from EP for 2015, the authors were able to evaluate changes from potential land cover. The 2015 conditions showed reduced shrub, sagebrush, litter, and perennial herbaceous cover and increased bare ground relative to EP. Only part of the departure in EP could

be explained by disturbance, the remaining change is likely related to climate change and land management practices.

Characterizing temporal ecophysiology for herbicide management of huisache (*Acacia farnesiana* [L.] Willd.)

Pablo C. Teveni III, Robert D. Cox, and Ronald E. Sosebee

The authors of this study characterized the optimal timing and environmental conditions in South Texas for herbicide control of huisache (*Vachellia farnesiana*), a woody species native to the western hemisphere that can invade a variety of native rangeland habitats around the world. Results indicated that huisache is best treated with chemicals when soil temperature is near 24.5°C and during the full canopy stage. In the coastal plains of South Texas these variables coincide with two optimal windows for huisache treatment: May and September–November.

Improving drought preparedness among Utah cattle ranchers

D. Layne Coppock

Because drought impacts are accelerating due to climate change, drought preparedness on western rangelands is more important than ever. This study examined why ranchers often do not adopt recommended drought-mitigation tactics. Results indicated that non-adoption decisions were dominated by perceptions that tactics and operational needs were incompatible and that producer situations were not understood by experts. Non-adoption was strongly influenced by rancher age. Drought policies for ranchers should: (1) eliminate perverse incentives that foster inappropriate risk taking; (2) reward pro-active, risk-management behaviors; and (3) facilitate recruitment of a younger, innovative cohort of new producers.

Special section of articles on weed-suppressive bacteria studies in the western United States

Synthesis of weed-suppressive bacteria studies in Rangelands of the western United States: Special section of articles in *Rangeland Ecology & Management* provides little evidence of effectiveness

Matthew J. Germino and Brynne E. Lazarus

Five studies on weed-suppressive bacteria provide a robust test of control and replication across a gradient of environmental and experimental contexts as well as different application techniques. Each study was independently conceived and conducted. None of these studies found weed-suppressive bacteria affected annual grasses and there were only moderate reductions in targeted invasive annual grasses in one study at two of three sites in 1 out of 3 years. Weed-suppressive bacteria effectiveness cannot be ruled out, but the collective results of these studies suggests weed-suppressive bacteria is unlikely to reduce exotic annuals. Weed-suppressive bacteria studies should be replicated within and across landscapes with appropriate controls and quantitative

monitoring to best learn from weed-suppressing bacteria applications.

Post-fire management-scale trials of bacterial soil amendment MB906 show inconsistent control of invasive annual grasses

Brynne E. Lazarus, Matthew J. Germino, Martha Brabec, Logan Peterson, Ryan N. Walker, and Ann Moser

The response of native and invasive grasses to MB906, a weed-suppressive strain of the bacterium *Pseudomonas fluorescens* were assessed alone and with an herbicide treatment in three previously burned sagebrush steppe landscapes. Replicate plots of each treatment were established, and plant cover was measured for three years. MB906 was not effective at controlling invasive-annual grasses and it reduced the effectiveness of the herbicide. The results of these field experiments do not provide support for MB906 as a method for controlling invasive-annual grasses, but further research may be needed.

Weed-suppressive bacteria applied as a spray or seed mixture did not control *Bromus tectorum*

David A. Pyke, Scott E. Shaff, Michael A. Gregg, and Julie L. Conley

The authors report on two case studies that test the effectiveness of *Pseudomonas fluorescens* strain D7 (i.e., a soil-borne bacteria) in a native seed mix after a fire and when sprayed on a native plant community with high abundance of *Bromus tectorum*. Each case study had four replicates in a randomized design. Response variables were foliar cover, aboveground biomass, density of *B. tectorum*, and density of sown native plants, which were measured pretreatment and each year for 3 years after treatment. No difference was found between areas treated with D7 and untreated areas, which contrasts with previous studies. However, reporting negative results is important for gauging the likelihood of weed-suppressive bacteria for controlling weeds.

Effect of the bioherbicide *Pseudomonas fluorescens* D7 on downy brome (*Bromus tectorum*)

Daniel R. Tekiela

The bioherbicide *Pseudomonas fluorescens* D7 is of interest of land managers in Wyoming for controlling downy brome (*Bromus tectorum*), an invasive plant species. A spatially replicated field trial was performed, but no response of any fitness metrics of downy brome to D7 was observed. However, synthetic herbicides reduced the cover of downy brome. Either D7 is not a viable product for downy brome control or more information about field conditions to obtain a positive result is needed.

Weed-suppressive bacteria have no effect on exotic or native plants in sagebrush steppe

Matthew J. Germino and Brynne E. Lazarus

Defensible experimental tests of target and nontarget effects of weed-suppressive bacteria in the field are needed. The authors conducted an experiment using D7 and MB906

strains of *Pseudomonas fluorescens* in sagebrush steppe areas invaded by cheatgrass (*Bromus tectorum*), medusahead (*Taeniatherum caput-medusae*), and other exotic annual grasses. In addition, they applied herbicide in some areas and disced other areas. Each treatment was replicated across three ecoregions with different soils and climate. Neither strain of weed-suppressive bacteria affected cover of exotic annual grasses, perennial bunchgrasses or the total community nor were any differences observed between treated and untreated herbicide areas or disced or non-disced areas. The authors recommend that weed-suppressive bacteria be experimentally applied with robust experimental design and response measurements until its effects can be documented.

Weed-suppressive bacteria fail to control *Bromus tectorum* under field conditions

Kurt O. Reinhart, Chris H. Carlson, Kevin P. Feris, Matthew J. Germino, Clancy J. Jandreau, Brynne E. Lazarus, Jane Mangold, Dave W. Pellatz, Phillip Ramsey, Matthew J. Rinella, and Morgan Valliant

Little is known about the efficacy of the weed-suppressive bacteria *Pseudomonas fluorescens* (ACK55 and D7 strains) in controlling *Bromus tectorum* outside of Washington. Using Petri-plate and plant-soil bioassays as well as field experiments in Montana and Wyoming, the authors found no effect on plants during plant-soil bioassays or field experiments, but did observe reduced *B. tectorum* germination, and root and shoot lengths in Petri-plates. The ACK55 and D7 strains of *P. fluorescens* are not effective in controlling *B. tectorum* in the Northern Great Plains nor the Central Rocky Mountains.