



University of Idaho
students

Browsing the Literature

This edition of Browsing the Literature is written entirely by graduate students enrolled in the Science Synthesis and Communication graduate class taught by Dr. Jason Karl at the University of Idaho. The students used the criteria established for selection and summarization of the most recent literature. Each student is acknowledged below the narrative summary he/she provided.

I would be delighted to have other student or professional groups provide similar editions of the column.

If interested, please reach out to me at mgermino@usgs.gov.

-Matt Germino, 17 February 2021

Papers that are global in scope or impact

Climate change, rangelands, and sustainability of ranching in the western United States
Holechek, J. L. et al. 2020. *Sustainability* 12:8–14.

This review suggests climate change from increased greenhouse gas emissions threatens to decrease rangeland ecosystem sustainability covering 50-70% of the global land area while producing 80-85% of the food needs globally. Sustainable rangeland management plays a critical role in the fate of the global climate and humanity to ensure ecosystem services and process, food production, cultural services, together-with aiding in climate stability. The authors identified four main risks to rangelands; climatic, biological, financial, and political, and proposed multiple sustainable strategies for each main risk. These strategies range from decreasing greenhouse gas emissions to using more heat-resistant species of cattle and additionally, incorporating other species of ungulates for hunting as financial opportunities. Ensuring these finite rangelands prosper through optimal adaptations, mitigations, management techniques, and government policy is imperative to ensure environmental and socio-economic sustainability for the future as part of the global solution to climate change.

-Tommy Hooper

Exposure to climate change drives stability or collapse of desert mammal and bird communities

Riddell, E.A., Iknayan, K.J., Hargrove, L., Tremor, S., Patton, J.L., Ramirez, R., Wolf, B.O., and Beissinger, S.R. 2021. *Science* 371:633–636. doi:[10.1126/science.abd4605](https://doi.org/10.1126/science.abd4605)

Surveys of birds and mammals in the Mojave Desert were conducted and compared to historical surveys of the same scope to determine the effects of climate change on population stability. Occupancy and species richness declined significantly in birds but not in mammals; microhabitat buffering was identified as a key factor in an animal's ability to limit exposure and reduce thermoregulatory costs. Differences in animal behavior and physiology need to be considered in modeling the effects of climate change on species' persistence because responses vary across taxa.

-Brittney Osborn

Social, economic, and translation science

Valuation of drought information: Understanding the value of the US drought monitor in land management

Liu, T., Krop, R., Haigh, T., Smith, K. and Svoboda, M. 2021. *Water* 13:112. <https://doi.org/10.3390/w13020112>

This article evaluates the cost avoided when the Bureau of Land Management uses the U.S. Drought Monitor instead of monitoring drought in house. The study determined the total savings by using the U.S. Drought Monitor is between \$0.2 Million and \$18 Million with an average savings of \$4.33 million at each office surveyed. This is a novel approach to valuation of common product and is generalizable to other national products currently in use or not yet thought of.

-Zach Palmer

National monuments and economic growth in the American West

Walls, M., Lee, P., and Ashenfarb, M. 2020. *Science Advances* 6. doi:[10.1126/sciadv.aay8523](https://doi.org/10.1126/sciadv.aay8523)

Walls et al. utilized regression analyses to investigate the effect of National Monument designation on communities within 25 kilometers of 14 monuments throughout the Mountain West region. They used data covering the period from 1991 to 2014 to evaluate several variables including the number of jobs per establishment, the total number of establishments and jobs, and establishment and job growth rates. They observed growth in average wage and the number of establishments and jobs, a reduced share of jobs in agriculture and a growth in the share of jobs in manufacturing and services in both treated and control areas.

-Alex Teitelbaum

Rangeland condition assessment in the Gobi Desert: A quantitative approach that places stakeholder evaluations front and Centre

Sinclair, S. J. et al. 2021. *Ecological Economics* 181:106891 doi:[10.1016/j.ecolecon.2020.106891](https://doi.org/10.1016/j.ecolecon.2020.106891)

Finding consensus regarding the condition of rangelands among stakeholders is important to equitable land management. The authors asked stakeholders to use their own judgment to score Gobi Desert field sites and plausible computer-generated sites for condition on a scale between 0 and 100 based on site metrics including total foliar cover, shrub cover, and forb richness. They compared aggregate condition scores for sites against the metrics, creating a model that predicts condition scores from the landscape metrics. They propose cautious application of the same approach to predicting perceived condition to other regions.

-Nelson Stauffer

Restoration and rehabilitation

Lessons learned 5+ years after transplanting and seeding restoration sites in the Sonoran Desert, USA

Rowe, H. I. et al. 2020. *The American Midland Naturalist* 184:129–149. <https://doi.org/10.1637/0003-0031-184.2.129>

Choosing restoration treatments for degraded lands in arid environments can be time-consuming, expensive, and challenging. In desert environments, reseeding is relatively ineffective, and transplanting has minimal impacts on overall species density and richness. In arid environments, the most cost-effective action for restoration may be to prevent continued degradation rather than utilizing reseeding or transplanting. Alternatively, restoration practitioners should explore multiple seeding treatments and ongoing local interventions to support seedings.

-Christine Mellick

Evaluation of soil treatment techniques on remediated brine spill sites in semi-arid rangelands

Dornbusch, M.J., Limb, R., Tomlinson, H.A.K, Daigh, A.L.M, and Sedivec K.K. 2020. *Journal of Environmental Management* 260:110100. doi:[10.1016/j.jenvman.2020.110100](https://doi.org/10.1016/j.jenvman.2020.110100)

In the Bakken region of North Dakota, unconventional oil and gas development (UOG), also known as hydraulic fracturing or fracking, creates large quantities of flowback and produced water, which is commonly spilled or released to the soil. Since natural attenuation of this contamination is a slow process in semi-arid regions, different remediation techniques were compared both *in situ* (on-site) and *ex situ* (off-site). Flowback and produced water contains high quantities of soluble salts, so soil electrical conductivity was used as an indicator of soil salinity, and other indicators of remediation included vegetation cover, biomass production, bare ground, and litter. Generally, *in situ* treatment was considered more effective, resulting in less bare ground and less disturbance to the site.

-Jacob Odekirk

Rapidly quantifying drought impacts to aid reseeding strategies

Reeves, M. C., Hanberry, B. B., and Burden, I. 2020. *Rangelands* 42:151. doi:[10.1016/j.rala.2020.07.001](https://doi.org/10.1016/j.rala.2020.07.001)

Landsat imagery was used to estimate losses in annual net primary productivity in northeastern Arizona using a Normalized Difference Vegetation Index (NDVI) across ecological sites. Sites were then classified in order to select those which are the highest priority for reseeding (sites which experience >80% reduction in forage). This technique provides a rapid tool for directly assessing loss of vegetation, rather than traditional drought metrics which are based on precipitation, and ultimately better highlights areas which should be reseeded in a shorter timeframe.

-Georgia Harrison

Temporal heterogeneity has no effect on the direction of succession in abandoned croplands in a semiarid area of northwest China

Hu, A., Chang, S. H., Chen, X. J., Hou, F. J., and Nan, Z. B. 2021. *Land Degradation & Development* 32:91-100

Space for time substitution is often used in ecological studies of community succession; however, the effects of temporal heterogeneity on succession has received little attention. This problem has application in government cost-share programs aimed at reclaiming degraded croplands such as the Grain for Green Program in China and USDA-NRCS programs in the U.S. To determine the differences in succession caused by temporal heterogeneity, the authors analyzed plant community structure and diversity of four croplands abandoned over three sequential years in northwest China. Time of abandonment had a significant effect on taxonomic diversity early in succession; however, taxonomic and functional diversity differences were minimal over longer time spans.

-Derek Tilley

Fire

Effects of late summer prescribed fire on botanical composition, soil cover, and forage production in Caucasian bluestem-infested rangeland in the Kansas Smoky Hills: Year 2 of 4

Ramirez, M. P. et al. 2021. *Kansas Agricultural Experiment Station Research Reports* 7 doi:[10.4148/2378-5977.8019](https://doi.org/10.4148/2378-5977.8019)

The effects of late summer prescribed fire on soil cover, botanical composition and forage production on Caucasian bluestem-infested rangelands were examined in Kansas. Eighteen one-acre plots were assigned to one of three treatments: no burn (control), single burn (burned Aug 2019), and biennial burn (burned Aug 2019, will be burned again in 2021). While total grass cover and native grass cover were not affected ($P \geq 0.16$) by treatment, Caucasian bluestem decreased ($P=0.03$) in burned plots compared with non-burned plots.

-Peter Ross

Liability and the use of prescribed fire in the southern plains, USA: A survey of district court judges

Hinojosa, A., Kreuter, U.P., and Wonkka, C.L. 2020. *Land* 9:318 doi:[10.3390/land9090318](https://doi.org/10.3390/land9090318)

Prescribed fire is a beneficial land management practice for grasslands to restore grazing productivity and biodiversity in regions that have seen a reduction in historical fires. Even though prescribed fire is beneficial land management practice, many private landowners are hesitant to implement prescribed fire due to the legal liability of an escaped fire and/or smoke impacts. The authors conducted a survey of 200 randomly selected district court judges (100 from Texas and 100 from Oklahoma) to determine their perception of prescribed fire and how they would apply law when a civil suit arises from damages due to an escaped prescribed fire. The information gathered from this study provided insight in how a case in-

volving damages from an escaped prescribed fire may be adjudicated in Texas or Oklahoma.

-Greg Gilbert

Plant biology and primary production

An assessment of seed head and flag leaf contributions to reproductive effort in sagebrush steppe bunchgrasses

Hamerlynck, E.P., and O'Connor, R.C. 2021. *Journal of Arid Environments* 187:104442. doi:[10.1016/j.jaridenv.2021.104442](https://doi.org/10.1016/j.jaridenv.2021.104442)

Persistence of bunchgrasses in the sagebrush-steppe requires seed production. Carbohydrate production and storage in reproductive tissues, including the leaf subtending seed heads (flag leaf), may contribute to understanding variability in seed production. The authors experimentally removed flag leaves and shaded seed heads of crested wheatgrass (*Agropyron cristatum*) and squirreltail (*Elymus elymoides*) to determine their value in the reproductive process. Both grasses showed seed head photosynthetic activity indicating an adapted reproductive process; however, flag leaf removal in crested wheatgrass indicated there may be long-term adaptation from the different grazing pressures of the two grasses. Furthermore, resource allocation to reproductive photosynthetic activity likely make grasses more resistant to herbivory and more successful within the sagebrush-steppe ecosystem.

-Daniel Lauritzen

Understanding spatial variability of forage production in California grasslands: delineating climate, topography, and soil controls

Liu, H., Jin, Y., Roche, L., O'Geen, A. and Dahlgren, R. 2021. *Environmental Research Letters* 16:014043.

Using satellite imagery and independent field measurements this research was able to accurately map the effects of precipitation timing and amount on forage production evaluating the impacts of climate and environmental factors on forage production variation. This research will better inform decisions of ranchers and other land managers. This approach was a cost-effective way to evaluate annual forage production in near real time.

-Zach Palmer

Grazing responses and effects

Effects of long-term removal of sheep-grazing in a series of British upland plant communities: Insights from plant species composition and traits

Alday, J. et al. 2021. *Science of the Total Environment* 759:143508. doi:[10.1016/j.scitotenv.2020.143508](https://doi.org/10.1016/j.scitotenv.2020.143508).

Long-term sheep grazing has significant effects on plant communities and vegetation richness, and one potential solution is land abandonment, or wilding strategies. These strategies have environmental and land management implications, requiring the study of plant composition and vegetation

richness in sites where sheep grazing has been removed. Researchers found that these communities have stable dominant plant species compositions, and a no-stock grazing strategy will not bring about significant short-term change in the plant communities of agricultural land.

-*Jessica Sharp-Miner*

Chemical pattern of vegetation and topsoil of rangeland fertilized over 21 years with phosphorus sources and limestone

Somavilla, A., Caner, L., da Silva, I.C.B., Camotti Bastos, M.C., Moro, L., Schaefer, G.L., Gatiboni, L.C., and dos Santos, D. R. 2021. *Soil and Tillage Research* 205:104759. doi:[10.1016/j.still.2020.104759](https://doi.org/10.1016/j.still.2020.104759)

In the Pampa's rangeland in South America, phosphorus fertilizer and limestone treatments were applied to test the long-term effects of phosphorus availability, aluminum neutralization in deep soil layer and rangeland productivity over a 21-year period. These treatments showed some promise with a deepening of phosphorus to 7.5 cm when using phosphate rock, and the deepening of the neutralizing front to >10 cm when applying limestone.

-*Scott Hatch*

Synergistic effects of long-term herbivory and previous fire on fine-scale heterogeneity of prescribed grassland burns

Werner, C.M., Kimuyu, D., Veblen, K.E., Sensenig, R.L., LaMalfa, E. and Young, T.P. 2020. *Ecology* doi:[10.1002/ecy.3270](https://doi.org/10.1002/ecy.3270)

In ecosystems around the world, vegetation levels are driven by two main factors, herbivores, and fire. Their interactions have huge influences on the landscape. The research in this article focuses on the burn patterns within the Kenyan Longterm Exclosure Experiment and investigating the effect of pre-fire disturbances on the scale and consumption of prescribed fire.

-*Nicholas Ford*

Are bison movements dependent on season and time of day? Investigating movement across two complex grasslands

McMillan, N.A., Fuhlendorf, S.D., Luttbeg, B., Goodman, L.E, Davis, C.A., Allred, B.W., and Hamilton, R.G. 2021. *Ecosphere* 12(1). doi:[10.1002/ecs2.3317](https://doi.org/10.1002/ecs2.3317)

Diurnal and seasonal rhythms likely exert greater influence than habitat characteristics on bison movement probability and distance. The authors analyzed GPS telemetry data tracking two American bison herds in contrasting ecological sites on the Southern Great Plains of Oklahoma.

-*Luc Bibeau*