By Jason W. Karl

Browsing the Literature

For our December issue, we are bringing back the Browsing the Literature section of Rangelands with a bit of a twist. We asked a handful of leading rangeland researchers a question: "If you could recommend one paper or book that you've read recently that everybody in rangeland science or management should read, what would it be?" The recommended articles and book below paint a diverse and revealing picture of the current issues and directions of our profession. Each contributor also offered his or her view on what makes an article one you really should read. Articles can be obtained by following the link in each citation. Open-access articles (noted below) are free for anyone to read and download. Suggestions for items to include in future issues of *Browsing the Literature* are welcomed and encouraged. Contact Jason Karl at jkarl@uidaho.edu

Accounting for the world's rangelands. Lund, H.G. 2007. *Rangelands* 29(1):3–10. https://doi.org/10.2458/azu_rangelands_v29i1_lund **(OPEN ACCESS)**.

I think the single most important issue in drylands research today is how we define this entity we have invested a good part of our careers working within. My career has focused on determining the degree of degradation in dryland ecosystems from a remote sensing perspective, and my number one issue has been bounding this entity. Lund shows that we have over 250 definitions for "Forests and Rangelands" and suggests two sets of criteria for reconciling these definitions.

Robert Washington-Allen, Department of Geography, University of Tennessee, Knoxville, TN

Refining the cheatgrass-fire cycle in the Great Basin: Precipitation timing and fine fuel composition predict wildfire trends. Pilliod, D.S., J.L. Welty, and R.S. Arkle. 2017. *Ecology and Evolution* 2017(19):8126–8151. https://doi.org/10.1002/ece3.3414 **(OPEN ACCESS)**.

The exotic annual grass–driven increase in the presence of wildfire on sagebrush rangelands is reducing native plant diversity, decreasing livestock forage availability, and negatively affecting habitat for sagebrush-associated wildlife species at an unprecedented spatial scale. To date, both fire suppression and post-fire restoration efforts have not been successful enough to alleviate these issues. The work of Pilliod et al. (2017) suggests that large wildfire years are not random, but are instead predictable based on precipitation patterns over time. This research provides an empirical basis for fuel management actions to mitigate fire and fire effects in anticipation of large wildfire years.

Chad Boyd, USDA Agricultural Research Service, Range and Meadow Forage Management Research Unit, Burns, OR

Albedo feedbacks to future climate via climate change impacts on dryland biocrusts. Rutherford, W.A., T.H. Painter, S. Ferrenberg, J. Belnap, G. S. Okin, C. Flagg, and S.C. Reed. 2017. *Nature: Scientific Reports* 7:44188. https://doi.org/10.1038/srep44188 **(OPEN ACCESS)**.

Warming and altered precipitation treatments of biological soil crusts on the Colorado Plateau are shown to result in large changes in surface albedo due to changes in cyanobacteria cover and

reduced surface roughness after moss and lichen mortality. Surface albedo moderates the energy balance and climate. Regional climate and management-induced changes in biocrusts and surface albedo can create feedbacks to future climate, thus affecting ecosystem function, wind and water erosion, and foundational ecosystem services that support rangeland communities.

Nick Webb, Jornada Experimental Range, New Mexico State University, Las Cruces, NM

Competition drives the response of soil microbial diversity to increased grazing by vertebrate herbivores. Eldridge, D. J., M. Delgado-Baquerizo, S.K. Travers, J. Val, I. Oliver, K. Hamonts, and B.K. Singh. 2017. *Ecology* 98(7):1922–1931. https://doi.org/10.1002/ecy.1879 **(OPEN ACCESS)**.

Although we do not see them, soil microbes play important roles in rangeland systems, one of which is helping maintain plant production for livestock. This study investigates how livestock grazing—which we already know influences the abundance of different plant species—influences the abundance of different types of microbes via its effects on soil carbon. It turns out that microbes behave a lot like plants. For example, grazing reduced dominant microbial species, which in turn released less common, subordinate species from competition and allowed them to increase.

Kari Veblen, Department of Wildland Resources & Ecology Center, Utah State University, Logan, UT

SoilGrids250m: Global gridded soil information based on machine learning. Hengl, T., J. Mendes de Jesus, G.B.M. Heuvelink, M. Ruiperez Gonzalez, M. Kilibarda, A. Blagotić, W. Shangguan, M.N. Wright, X. Geng, B. Bauer-Marschallinger, M.A. Guevara, R. Vargas, R.A. MacMillan, N.H. Batjes, J.G.B. Leenaars, E. Ribeiro, I. Wheeler, S. Mantel, and B. Kempen. 2017. *PLoS ONE* 12(2):e0169748. https://doi.org/10.1371/journal.pone.0169748 **(OPEN ACCESS)**.

Researchers and practitioners within the field of rangeland ecology and management have long recognized the importance of soils and soil maps for the work we all do. However, the world of soil mapping is changing rapidly, evolving from one of static polygons to raster maps of soil properties and soil class probabilities that can be easily updated as new data and methods become available. The work by Hengl et al. (2017) demonstrates the power of these digital soil mapping approaches (DSM) for improving global soil maps. Keep an eye on the DSM literature—this work will likely change the way rangeland researchers and managers use soil information over the coming years and decades.

Mike Duniway, US Geological Survey, Southwest Biological Science Center, Moab, UT

Precondition for integration: In support of standalone social science in rangeland and silvopastoral research. Sherren, K., and I. Darnhofer. In Press. *Rangeland Ecology & Management* (*Available online 27 September 2017*). https://doi.org/10.1016/j.rama.2017.08.003.

It has become increasingly evident that we cannot view natural resource issues without considering humans as part of the natural resource system. However, there is a disproportionate amount of research in natural science journals regarding the social sciences needed to implement any ecosystem changes. This paper discusses issues related to the integration of the social sciences with the natural sciences (or lack thereof) and highlights the potential contributions of the social sciences in providing critical insights for achieving real-world impact of natural science research.

David Toledo, USDA Agricultural Research Service, Northern Great Plains Research Laboratory, Mandan, ND

Interpreting variation to advance predictive restoration science. Brudvig, L.A., R.S. Barak, J.T. Bauer, T.T. Caughlin, D.C. Laughlin, L. Larios, J.W. Matthews, K.L. Stuble, N.E. Turley, and C.R. Zirbel. 2017. *Journal of Applied Ecology* 54(4):1018–1027. https://doi.org/10.1111/1365-2664.12938.

Rangeland science has increased its focus on restoration (including rehabilitation) as altered fire disturbances, plant invasions, and human impacts have expanded. Restoration is challenging, particularly in semiarid and arid environments that comprise much of the world's rangelands, and the outcomes are often variable and hard to conveniently categorize as "success" or "failure." Brudvig et al. (2017) make a compelling case that we need to embrace rather than ignore the variability in restoration treatments. They outline the types of experiments, measurements, quantitative analyses, and models needed to advance the field into a more predictive science. They provide testable and generalizable predictions for where and when variability in restoration outcomes should be expected. With an improved understanding of the drivers of variation in restoration, metrics of success can be better tuned to predicted outcomes. This paper is not on rangelands per se, but our persistent challenges in restoration of rangelands should motivate us to reach outside our "box" for ways forward.

Matt Germino, US Geological Survey, Forest and Rangeland Ecosystem Science Center, Boise, ID

Assessing the impacts of livestock production on biodiversity in rangeland ecosystems. Alkemade, R., R.S. Reid, M. van den Berg, J. de Leeuw, and M. Jeuken. 2013. *Proceedings of the National Academy of Sciences* 110(52):20900–20905. https://doi.org/10.1073/pnas.1011013108. **(OPEN ACCESS)**

My suggestion reflects a lot of the literature I have been reading lately on the past, present, and future extent and management of grazing lands. I think this look at global trends in rangelands and how it relates to biodiversity is an important contribution to understanding how future scenarios in food production may influence biodiversity in rangeland ecosystems around the globe.

Nichole Barger, Department of Ecology and Evolutionary Biology, University of Colorado at Boulder, Boulder, CO

The Arid Lands: History, Power, Knowledge. Davis, D.K. 2016. MIT Press. 296p. ISBN: 9780262034524. https://mitpress.mit.edu/arid-lands

The thesis of Davis's book is that efforts to "develop" the world's arid lands have repeatedly failed due to "the problematic notions of the desert that inform our understandings of arid lands." Namely, that they are "barren, deforested, overgrazed lands—wastelands with little value, aberrations that need to be

repaired and improved." She proceeds to spell out "the history of our changing understandings of arid lands over the last two thousand years" in clear, often-understated prose. By the end of this short book, widespread assumptions about rangelands—that they are desertified, for example—have been uprooted, exposed, and overturned.

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