SRM Society for Range Management

Usable Science for Sustainable Rangelands: Conclusions

By John A. Tanaka, Kristie A. Maczko, Lori Hidinger, and Chad Ellis

On the Ground

- Producers and users of scientific knowledge working together can identify future research directions that will produce usable science to address the challenges of managing for sustainable rangelands.
- Matching the scale of science to the scale of management and ecological and physical processes was a prominent theme identified.
- Similar activities in other regions with participants from the energy sector, wildlife organizations, and recreation enthusiasts can provide additional research directions for sustainable rangelands.

Keywords: Sustainable Rangelands Roundtable, usable science, rangeland research.

Rangelands 38(2):90–95
doi 10.1016/j.rala.2016.02.007

Bringing together ranchers, landowners, non-governmental organizations, scientists, and government agency managers and policymakers to discuss the concept of usable science was both a challenging and interesting opportunity. The workshop on Future Directions of Usable Science for Rangeland Sustainability (see Maczko et al. this issue) engaged producers and users of rangeland science to develop research questions for sustainable rangelands through a usable science approach. All of the workshop participants seemed dedicated to moving science for rangelands forward by helping define researchable questions that would be useful to the end users on rangelands. Discussions were lively, and everyone participated. The full record of the conference is available on the Sustainable Rangelands Roundtable website.[i] This special issue presents the major outcomes from those discussions, in the context of our current knowledge base. It is our hope that the information generated by workshop participants will offer guidance to research funding agencies and organizations as they develop future funding programs, as well as providing utility to producers and users of rangeland science in developing collaborative efforts to address the challenges facing the sustainability of rangelands.

[i] To read the Proceedings of the Workshop on the Future of Usable Science for Rangeland Sustainability, see http://sustainablerangelands.org/projects_usable_science.shtml.

Summary of Usable Science Research Questions

In this concluding paper, we summarize the main usable science research questions posed by the authors of the five previous articles in this issue on soil health (Table 1), water (Table 2), vegetation (Table 3), animals (Table 4), and social and economic (Table 5). We encourage you to read these preceding articles for the finer details and background on how these questions came to be deemed the most important.

In reviewing these recommendations, there are commonalities and overlap among the groups. For example, the vegetation group focused on landscape level analyses to elevate rangeland science to a new level. The water group similarly emphasized watershed level processes, while the socio-economic group highlighted understanding and creating incentives to improve stewardship across boundaries. Other groups also considered the scale of research and the need to better match it to the scale at which management decisions are made, as well as an appropriate scale on which ecological and physical processes occur.

The effect of various stressors such as fire, grazing, and climate change are identified by most of the groups. There is an emphasis on understanding management effects, both individual and synergistic, on the environment and associated ecosystem goods and services–and on the people who rely on them.

Communicating knowledge about rangelands and livestock was a theme explored by multiple groups. The socio-economic group identified the information needs of different audiences and the barriers and opportunities for information transfer to those audiences as a research focus. The animal group thought there was a need for a synthesis of and effective communication concerning environmental impacts of livestock on rangelands.

Table 1. Research questions identified by the soils group at the Usable Science for Sustainable Rangelands Workshop (see Derner et al. this issue).
How to characterize indicators of soil health for sensitivity to transitions/thresholds of state-and-transition models?
What are the influences of management practices, predicted climate change, and extreme events?
How is soil health affected by prescribed fires and wildfires?
What are the effects of conservation practices (e.g., prescribed grazing, prescribed fire, and brush management) on the chemical, physical, and biological components of soil health?
How can the chemical, physical, and biological components of soil health be enhanced through adaptive management to increase resilience of soils to weather variability and changing climate?
How can the tool kit be expanded to provide more robust and broad assessments of soil health and/or monitoring of the chemical, physical, and biological components for land managers in a timely and responsive manner to facilitate adaptive management?

Managing soil erosion on road restoration in the Tensleep Preserve, The Nature Conservancy in Wyoming. Photo by John Tanaka.

Table 2. Research questions identified by the water and watershed group at the Usable Science for Sustainable Rangelands Workshop (see Dobrowolski and Engle this issue).
How can we cultivate an awareness of the human and biophysical linkages within a rangeland watershed to develop foundational support necessary to achieve sustainable water use and management?
How do we define the threshold indicator values that tie levels of drought severity with appropriate responses to sustain production?
What are the linkages between rangeland drought management practices and ecosystem health, improved ecological monitoring, and technology adoption behavior?
Are drought management strategies such as 1) encouraging forage sharing; 2) promoting income diversification; and 3) diversifying from a cow/calf operation to both cow/calf and yearlings, among other strategies, going to be effective?
What policies impose obstacles to appropriate management of a rangeland watershed? How to effectively manage those obstacles and determine both intended and unintended consequences?
How can better ecosystem service valuation procedures be developed to assist managers, planners, and policy makers to understand that inherent soil, topography, or climatic restrictions limit rangeland suitability for intensive use, cropland conversion, or urban development?
What technologies can be developed to restore abandoned cropland back to productive rangeland, driven by aquifer depletion, drought, and climate change?

Managing salt cedar for snow geese and other wildlife species on the Bosque del Apache National Wildlife Refuge, New Mexico. Photo by John Tanaka.

The primary goal of this workshop was to identify usable science questions that apply to sustainable rangelands. While many of the research questions elaborated herein have been on the minds of many, research and extension funding to address these questions remain elusive and critical. The utility of research outcomes is a function of both how they can be used and the process of producing it.[1] By working together, producers and users of scientific knowledge can identify a decision that needs to be made and iteratively develop appropriate research questions that will result in science usable to inform that decision.[1] As has been discussed, usable science includes both what is termed basic and applied scientific research. We do not divide science into the two camps. In addition, while much of the basic science is done in a reductionist vein (changing one variable while holding everything else as constant as possible), applied science seeks to understand how those results will evolve in the real world. To be usable, basic science should feed into applied science where it can be made useful to society. After all, isn't that why society and institutions choose to fund research and extension?

Perhaps this is best summed up in the paper by Fuhlendorf and Brown (this issue), though their premise would be applicable to all areas of rangeland science.

Table 3. Research questions identified by the vegetation group at the Usable Science for Sustainable Rangelands Workshop (see Fuhlendorf and Brown this issue).

What determines landscape functions, especially resilience?
How can we motivate diverse groups to plan and manage for a more complex mix of ecosystem services at a landscape scale?
How can we predict and measure the effects of different kinds of disturbances on landscapes to improve decision-making?

Experimental treatment for managing big sagebrush in Nevada for greater sage-grouse and other wildlife species. Photo by John Tanaka.

We have the opportunity to increase both the quality and relevance of rangeland … science by expanding our ideas of what constitutes valid and relevant science. A much broader, integrative view of the space and time relevance of information, a more diverse approach to transdisciplinary interpretations, a greater acceptance of mixed experimental and observational approaches and a reduced reliance on the belief that there is a simple, best answer are the adjustments that will not only be more likely to solve existing and emerging problems, but will engage a broader audience in rangeland issues. Rangeland scientists, managers, advisors, and policy makers all have to be willing to make these adjustments.

Moving Forward

The workshop on Future Directions of Usable Science for Rangeland Sustainability was held in Ardmore, OK. While participants came from across the country, the majority were from the southern Great Plains. This is especially true of the ranchers and natural resource managers. Additionally, the workshop emphasized livestock producers as the end users of rangeland science. Future workshops in other regions of the country to engage other end users relevant to those regions (such as energy in the northern Great Plains or endangered species in public lands states) likely would provide a broader selection of usable science research questions.

To that end, the Sustainable Rangelands Roundtable has partnered with the USDA Natural Resources Conservation Service (NRCS), Forest Service (USFS), and USDI Bureau of Land Management (BLM) to further test usable science principles in Central Oregon. Focus groups will be held to engage interested publics in identifying concerns and associated monitoring indicator data related to resilience under changing climate conditions. This project also will incorporate data collected during the Oregon Multi-Agency Pilot Project (MAPP) that was conducted by NRCS, USFS, and BLM to test compatibilities of national resource inventory

Table 4. Research questions identified by the animal group at the Usable Science for Sustainable Rangelands Workshop (see Meiman et al. this issue).

What are the appropriate rangeland management decisions that make land resistant, and what are reliable drought and weather variation indicators, more drought effective triggers, and management actions before, during, and after drought that will help optimize management of sustainable working lands?
What are the major resource characteristics that drive production system options?
How can producers properly match animals (species, breed, class, nutrition) and production systems to the resource base?
What are the benefits of incorporating stocking rate flexibility into grazing management; how is this best implemented and how are the benefits most effectively demonstrated?
How can producers best exploit existing and expanding knowledge of animal behavior, distribution, and stockmanship to achieve rangeland management and production goals?
Is the full range of livestock effects on rangelands and associated natural resources (positive, negative, and neutral) adequately represented in the primary, peer-reviewed literature and communicated to society?

Cattle grazing in front of wind towers, juxtaposition of agriculture and energy development in Wyoming. Photo by John Tanaka.

Table 5. Research questions identified by the social and economic group at the Usable Science for Sustainable Rangelands Workshop (see Brunson et al. this issue).

How do rural communities best prepare for, adapt to, and/or recover from impacts of increased environmental and socio-economic variability?
What motivates landowners to cooperate across boundaries for environmental stewardship, and how can that information be used to create or improve incentives (or reduce disincentives) for cross-boundary cooperation?
What are the rangeland information needs of different audiences, and what are the barriers and opportunities for information transfer to those various audiences?
What are the barriers and opportunities for people to enter and persist in occupations, and how can we use information about barriers and rangeland opportunities to increase the number of adults who choose such careers?

platforms.[2] Outcomes from the focus groups will populate weighting factors to be used in analysis of MAPP data. It is anticipated that ecological, social, and economic data collected as part of the Oregon MAPP, in combination with focus group input collected in congruence with usable science principles, will facilitate a conceptual and statistical assessment to inform rangeland sustainability as it relates to public emphases for climate change resilience and adaptation. This project will offer additional insights into applications of usable science concepts to advance rangeland research and management, building upon outcomes of the workshop on future directions of usable science for rangeland sustainability.

Compared to many scientific disciplines, rangeland science has some history of scientific knowledge producers and users

Hiking in the Sonoran Desert National Monument, Arizona, human use in the environment. Photo by John Tanaka.

working together. Recent examples of successful efforts involving collaboration among ranchers, farmers, land managers, and scientists include the Sage Grouse Initiative and the Soil Health Partnership. This emphasis is due to extension efforts as well as the multiple-use missions of the federal rangelands research agencies. However, linear relationships among these groups continue to predominate, with scientists conducting their research, publishing their results, and perhaps using "tech transfer" to communicate their results to potential users. But even with the best "tech transfer" and communication, feedback suggests that research may not adequately answer management questions facing ranchers, land managers, and policy makers. To better meet the needs of the users of scientific knowledge, these users must be integrated and included throughout the research process. This experiment in usable science for rangeland sustainability in Ardmore was an initial step in what ideally will be an iterative process of knowledge producers and users working together to identify challenges facing rangelands, and collaboratively developing research directions to pursue and provide the necessary knowledge to those working on those challenges.

References

1. Dilling, L., and M.C. Lemos. 2011. Creating usable science: opportunities and constraints for climate knowledge use and their implications for science policy. *Glob Environ Chang* 21(2):680-689.
2. Patterson, P.L., J. Alegria, L. Jolley, D. Powell, J.J. Goebel, G.M. Riegel, K.H. Riitters, and C. Ducey. 2014. Multi-agency Oregon pilot: working towards a national inventory and assessment of rangelands using onsite data. Gen. Tech. Rep. RMRS-GTR-317. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 56 pp.

Authors are Associate Director, Wyoming Agricultural Experiment Station, Dept. 3354, University of Wyoming, Laramie, WY 82071 (Tanaka, jtanaka@uwyo.edu); Executive Director, Sustainable Rangelands Roundtable, University of Wyoming, Fort Collins, CO (Maczko); Managing Director, Consortium for Science, Policy & Outcomes, Arizona State University, Tempe, AZ 85281 (Hidinger); CLS Center Manager, The Samuel Roberts Noble Foundation, Ardmore, OK 73401 (Ellis).