Future Directions of Usable Science for Sustainable Rangelands

Introduction

As funding for rangeland research becomes scarcer, researchers and funding organizations must ensure that information needs of public and private land managers are met. Coupled with rangeland research funding constraints are ever-expanding environmental, financial, and societal pressures on land owners and managers, as well as competing land uses and opportunities. Given these challenges and a funding future that likely will remain quite competitive, great value can be gained by more closely aligning on-the-ground scientific information needs with topics being considered by university and agency rangeland researchers, and major research funding organizations. In an emerging era of budget constraints, usable science that involves the intended end users throughout the scientific enterprise and gives rise to improved outcomes on the ground should be highlighted. With this tenet in mind, the Sustainable Rangelands Roundtable (SRR), the Arizona State University Consortium for Science, Policy and Outcomes, and the Samuel Roberts Noble Foundation partnered to convene a workshop of university and agency researchers, public and private land managers and producers, non-governmental organizations, and representatives of funding agencies and organizations to initiate the process of charting a research agenda for future directions of usable science for rangeland sustainability.

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In the USA, rangelands cover over 300 million ha or one third of the country, mainly west of the 95th meridian. These lands provide commodity, amenity, and spiritual values that are vital to the well-being of our Nation. Since 2001, SRR, a partnership of rangeland scientists and ecologists, policy and legal experts, sociologists, economists, environmental advocates, and industry supporters, has distilled five criteria and 64 indicators embodying social, economic, and ecological factors for assessing rangeland sustainability. The criteria are:

Criterion I: Conservation & Maintenance of Soil & Water Resources on Rangelands

Criterion II: Conservation & Maintenance of Plant & Animal Resources on Rangelands

Criterion III: Maintenance of Productive Capacity on Rangelands

Criterion IV: Maintenance & Enhancement of Multiple Economic & Social Benefits for Current & Future Generations

Criterion V: Legal, Institutional & Economic Framework for Rangeland Conservation & Sustainable Management

Photo courtesy National Park Service

Sustainable Rangelands Roundtable Usable Science Workshop Team:

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Workshop Objectives

The SRR criteria provided a foundation for workshop structure, with work groups focusing on rangeland soil health, water, plants, animals, and socio-economic aspects of rangeland sustainability to capture research needs associated with rangelands' contributions to a broad spectrum of ecosystem goods and services. These work groups had four main objectives:

1. Define and discuss the concept of usable science (science developed with the end-user in mind) as it pertains to rangeland sustainability, with consideration of perspectives of agencies, funding organizations, land managers, producers, non-government organizations, and academics.
2. Develop a portfolio of recommendations for future directions of usable science for rangeland sustainability, incorporating stakeholder input to address soil health, water, plants, animals, and socio-economic aspects of sustainable rangelands and the varied ecosystem goods and services that intact, functioning rangeland systems provide.
3. Consider current and emerging issues in sustainable rangeland management and potential geographic (regional) variations throughout development of the research portfolio for usable science for sustainable rangelands.
4. Identify timeline, tasks, and responsibilities for dissemination of information generated during the workshop through conference workshop proceedings, peer-reviewed journal articles, general interest articles, executive summaries, and briefing activities for thought leaders and decision makers.

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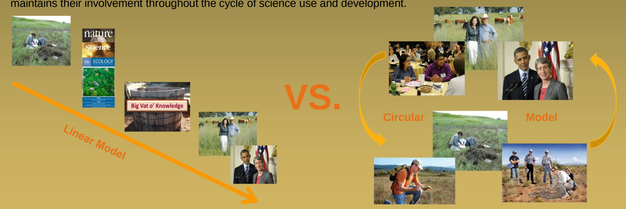
Defining Usable Science for Sustainable Rangelands

Much money is spent each year on research and development in the U.S. However, research is often not readily available to users, and gets lost in a "vat of knowledge" because it is inaccessible. Compounding this problem, users generally tend toward a linear model of science-user interaction to extract information from the "vat," rather than a circular model that maintains their involvement throughout the cycle of science use and development.



How do we decide what science to use? One way may be by implementing a working definition of usable science, positing that science best meets the needs of users and decision makers when those needs are considered throughout the scientific process. There are three attributes of usable science:

- **Pertinence** - understanding the perspectives and needs of those affected.
- **Quality** - the extent to which communities and cultural values are integrated.
- **Timeliness** - if and when the results will be available and useful to affect decision making.

The biggest myth about usable science is that it is synonymous with applied research; there may well be basic research desired by end users. Also, information should be assessed using a decision context as opposed to a discipline context. In order to produce usable science, we need to recognize the differences between research fields and integrate across these fields when necessary to obtain the desired information. Understanding the demand for science is crucial as well. As a researcher, how do you make your research more demand driven? Begin by responding to the problem, finding equity in research priorities, imagining solutions for future change, and engaging in knowledge co-creation.

		Demand: Can User Benefit from Research?	
		YES	NO
Supply: Is Relevant Information Produced?	NO	Research agendas may be inappropriate	Non-user
	YES	Empowered users taking advantage of well-deployed research capabilities	Disenfranchized or marginalized users, institutional constraints, or other obstacles prevent information use

Diagram by SP-MSC, Usable Science: A Handbook for Science Policy Decision Makers, April 2015.

Participant Perspectives

To set the stage for the workshop, participants were asked to provide their perspectives on perceived challenges and opportunities. Academics, agencies, producers, and funding bodies shared varied viewpoints and valuable insights.

Academic participants wondered aloud, "how did we arrive at a situation where we are rewarded for doing research that pays little attention to whether it is usable?" The response acknowledged dynamics of the social system in which researchers work; there is prestige in journal publications and doing science valued by other scientists. Perhaps the biggest challenge is trying to step out of this box. Training the next generation of researchers to think about usable science is another challenge. Scientists must be able to translate their science into terms that are understandable to intended users, as well as involving users throughout the overall scientific process.

Agencies self-identified as large producers and consumers of data. They need usable science to guide their management decisions and measure effects of management practices. Presently they feel that there is a distance between science and management. It was suggested that cross disciplinary research conducted at local and regional scales would be helpful, as well as synthesis articles combining ecological, social, and economic research.

Producers also endorsed an interdisciplinary approach and discussed how usable science has helped/will help them. People not only need to understand the ecological side of the science but also the social and economic sides to capture overall effects. Science needs to be presented in a way that is understandable, especially to teach producers new to the industry. Behavioral changes are needed from researchers and end-users in order to have research outcomes become usable science practices.

With this in mind, the USDA National Institute for Food and Agriculture now requires involvement of stakeholders and sociologists in the research process for their successful grants. All agreed this was a good starting point, but more modifications to standard research processes and practices are needed to engage end-users from the outset.

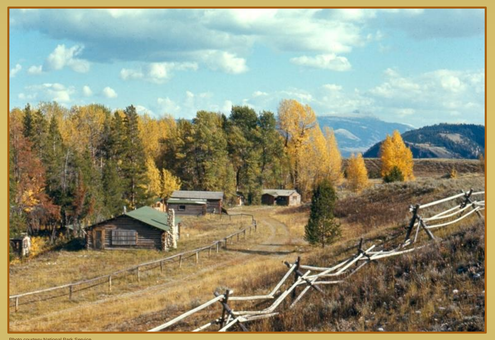


Photo courtesy National Park Service

Preliminary Outcomes of a Workshop on Future Directions of Usable Science for Sustainable Rangelands

Results from this interdisciplinary workshop reflect 20 hours of dialogue among the contributors. Outcomes are categorized according to the five aforementioned resource groups: vegetation (plants), soil health, socio-economic aspects, water and animals. Usable science considers the needs of its users throughout the basic to applied scientific enterprise, in this case to ensure that rangelands continue to provide a desired mix of economic, ecological, and social benefits to current and future generations. Ecological drivers identified as influencing socio-economic aspects included climate change, drought, flooding, fire, and invasive species.

Vegetation

Develop and adopt a landscape perspective for rangeland conservation and management

- Determine resilience of rangeland landscapes to extreme events.
- Understand motivations of different user groups for landscape level planning.
- Assess effects of spatial pattern of plants and soils on livestock production, wildlife habitat, water quality.
- Understand role of variability of space and time to better develop rangeland monitoring systems.
- Determine effects of invading native and exotic species on rangeland ecosystem goods and services.

Photo courtesy National Park Service

Soil Health

Photo courtesy NRCS

Relevance of soil survey & ecological site descriptions

- Spatial analysis and soil sampling for soil health to identify indicators.
- Characterization of soil health indicators; what are the sensitivity levels that affect thresholds and what management practices influence the indicators in a cost effective, positive or negative way?
- Completion and updates of soil surveys.
- Synthesis of current research identifying soil responses to range management practices and effects on climate change.

Soil mitigation: prescribed fire vs. wildfire

- What are soil responses to vegetation treatment? Effects of various ignition methods on soils.
- What are the soil nutrient responses to prescribed fire as compared to non-fire or wildfire?

Socio-Economic Aspects

Photo courtesy NRCS

Get the right kinds of information to knowledge users in a form they can use

- Who needs what information and what are the barriers and opportunities for information transfer?

Improve desirability and profitability for new generations to make a living in rangeland agriculture and environmental benefits

- What are the barriers/opportunities for new people to enter and persist in rangeland occupations and how can we use that information to increase numbers of adults who choose such careers?

Understand and manage for variability (climate, drought, fire), adaptation and recovery

- How do rural communities' best prepare for, adapt to, and/or recover from increased variability?

Understand and create incentives for improving land stewardship

- What motivates landowners to cooperate for environmental stewardship and how do we use that information to create and/or improve incentives and reduce disincentives?

Water

Photo courtesy National Park Service

Productively transition cropland to rangeland

- Restoration of abandoned cropland
- Cost/Benefit analysis - what are the costs to society of restoring a forage crop? Or not?

Drought

- Better monitoring tools, better prediction tools, better technology.
- Building adaptive capacity and resilience; how to build adaptability to long-term drought.

Proactive watershed management; protection of high quality rangeland watersheds

- Understand rangeland water budgets.

Animals

Proactive drought planning

- What are appropriate land management decisions to improve drought resistance?
- What are drought and weather indicators to optimize management of working lands?

Production/management systems & resources

- What are major resource characteristics that drive production systems?
- How do we properly match animals to resources?
- How do we demonstrate benefits of stocking rate flexibility?
- How do we exploit knowledge of animal behavior and stockmanship to achieve land management goals?

Photo courtesy NRCS

Next Steps

Planned next steps to build upon outcomes of this workshop include:

- A peer-reviewed special journal issue, featuring an article from each work group
- Poster presentations of results and recommendations
- Brown bag presentations/discussions with agency partners and other interested groups
- Briefing sessions for thought leaders and decision-makers
- Usable sustainable rangeland science projects for development of case studies

Thanks to our Workshop Sponsors

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Agricultural Research Service

CSPO

NRCS Natural Resources Conservation Service

Forest Service U.S. Department of Agriculture

The Samuel Roberts Noble Foundation

U.S. Department of the Interior Bureau of Land Management

University of Wyoming

http://sustainablerangelands.org