Enhancing Scientist-Manager Relationships to Foster Ecosystem Resilience

Melanie M. Colavito, School of Geography and Development, University of Arizona, Tucson, AZ

Abstract—*This extended abstract describes the preliminary results of a study that sought to determine the most effective ways to develop and apply sceintific information about resilience for on-the-ground management. Interviews were conducted with scientists, managers, and other stakeholders in the Southwest U.S. following a workshop on ecosystem resilience held in Tucson, Arizona in February 2014. The interviews asked respondents to consider how useful current scientific information is for decision-making, what research or products are most needed, how scientists and managers can most effectively work together, and what communication strategies are most effective. Results from this study are preliminary, but a number of recommendations for effectively developing and applying scentific information about resilience for on-the-ground management have already been identified.*

Introduction

Ecosystem resilience has recently become a buzzword in natural resource management as climate change has begun to alter many natural disturbance regimes. Natural resource managers are increasingly faced with the challenging question of how to manage for ecological resilience, especially after disturbances like large wildland fires that may result in novel fire effects or post-fire ecosystem trajectories. Addressing resilience is not simply a management concern, as there is also a great deal of scientific uncertainty around ecological, as well as social resilience before, during, and after disturbances. Interpreting what constitutes resilience, as well as identifying strategies for fostering resilience, is not yet well understood from management or scientific perspectives.

Natural resource managers are tasked to use the "best available science" to inform their decision-making (Sullivan and others 2006; USDA Forest Service 2009). However, this can be difficult with issues like resilience where there are still many unanswered scientific questions. Compounding this is what has been characterized as a disconnect between science, management, and policy (McNie 2007; Sarewitz and Pielke 2007). To better align these factions and corresponding processes, there have been increasing efforts to match the goals and needs of scientists, managers, and policymakers in order to facilitate the application of science to decision-making (Corburn 2009; Jacobs 2002; Rice and others 2009). However, developing and applying science with evolving decision-making circumstances remains a challenge.

In an effort to understand how to facilitate a better connection between science and management, a study was conducted with scientists, managers, and other stakeholders in the Southwest. The main question driving this study asked: what are the most effective ways to develop and apply scientific information about resilience for on-the-ground management? The primary goal was to develop actionable recommendations for more effectively connecting science and management in order to foster the relatively novel and pressing concept of ecosystem resilience, especially in light of climate change effects.

Methods

In February 2014, the Southwest Fire Science Consortium hosted a workshop in Tucson, Arizona, called "Fostering Resilience in Southwestern Ecosystems: A Problem-Solving Workshop." The purpose of the two-day workshop was to help managers and scientists in the Southwest better understand resilience and start to identify strategies for fostering resilient ecosystems. More than 180 participants with diverse backgrounds attended the workshop and provided input on the following topics: defining resiliency, fire preparedness, fire as a resiliency tool, post-fire management, fire-adapted communities, and strategy development.

Immediately following the workshop, post-workshop interviews were conducted with nine managers, eight scientists, and four individuals employed by non-profit or private organizations for a total of 21 interviews. The study attempted to capture a balanced number of scientists and managers. Respondents were differentiated as those who primarily conduct research (scientists), those who primarily work in land management at the local, state, or federal level (managers), and those who work for a non-profit or private organization involved in land management (other).

In: Keane, Robert E.; Jolly, Matt; Parsons, Russell; Riley, Karin. 2015. Proceedings of the large wildland fires conference; May 19-23, 2014; Missoula, MT. Proc. RMRS-P-73. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 345 p.

The interviews were open-ended (Dunn 2008), guided by 24 primary questions, and covered four topics: demographics, data and information use and needs, workshop outcomes, and future projection. They were conducted in-person and over the phone in March 2014 and lasted an average of 40 minutes. Interviews were recorded and transcribed and are being coded and analyzed for salient themes, patterns, and interactions among themes (Bazeley 2009; Cope 2008). The interviews sought to identify barriers and opportunities to the effective development and application of science for management, as well as to evaluate the workshop itself.

Results

Analysis of the interviews is still ongoing. However, a preliminary question-by-question analysis approach was initially used to review responses to specific interview questions from the data and information use and needs section. Responses to four of these questions are provided below. Responses to the first question are differentiated among the different categories of respondents, while responses to the following three questions are grouped among respondents.

Utility of Current Scientific Information for Management

Respondents were asked, "How useful is current scientific information on ecosystem resilience for on-the-ground application?" The majority of managers noted that the current scientific information is useful in a number of ways. Managers stated they use scientific information to write more robust prescriptions for on-the-ground management actions, to inform the larger planning process on projects, and to improve decision-making credibility with the public and other audiences. Managers also stated that scientific information is used to supplement and inform an individual's personal knowledge and experience in the field. One manager also described using scientific information to refute or clarify research taken out of context by special interest groups on controversial issues such as diameter caps or threatened and endangered species.

The majority of managers also noted that there are a number of limitations to the use of scientific information. Specifically, they noted that it is difficult to utilize scientific information when there is a mismatch between the scale of a study and the scale of management concerns. Research is inherently bound in space and time, and this can limit its utility and application in decision-making. This is especially apparent with the topic of resilience, where there is still scientific uncertainty. Managers also cited other forms of knowledge as being important, such as experience in the field, gut instinct, or local knowledge, and it can be challenging when scientific information conflicts with or overshadows these other forms of knowledge. Lastly, managers noted that because scientific information is constantly evolving, there are instances where the most recent research conflicts with legal mandates in Forest Plans or National Environmental Policy Act (NEPA) documents, for example, which can make for decision-making challenges.

The majority of scientists noted that scientific information is most useful when it directly addresses management concerns. Scientists noted that some research is too fundamental or theoretical to be directly applicable in management, but this research is still important and needs to be conducted. At the same time, scientists had some concerns about the utility of common scientific concepts, for example historic range of variability, for management application. Scientists were also concerned that new and evolving research, such as research on ecosystem resilience, may be difficult to apply in decision-making. The scale and generalizability of scientific information for on-the-ground application was also a concern for many scientists.

The respondents that represented the other group were generally pleased with the utility of current scientific information. These respondents noted that many of the tools and technologies for understanding and communicating scientific concepts have improved in recent years, making results much more accessible and useful. However, this group was concerned that scientific information is too easily brushed aside for political or economic concerns. In general, all respondents pinpointed both advantages and limitations about the utility of current scientific information and noted that there is still a great deal of room for improvement.

Research Needs

Respondents were also asked, "What research or products are most needed to improve our understanding of resilience for decision-making?" A common response from many respondents was the need for more experiments designed to test management actions. Respondents also cited the need for experiments and studies that are designed to answer landscape-scale questions, as opposed to many current studies, which tend to be plot or stand-scale and may not provide enough generalized information across the landscape to managers. Although it is impossible to design studies or management treatments across all scales, many respondents expressed a desire to better align the scale of scientific studies and management needs.

Numerous respondents noted that there is a need for more social science to address questions about social resilience, garnering public support for landscape-scale management, communication and networking strategies, and wildland urban interface issues. Additionally, while there is preponderance of research in ponderosa pine and dry mixed conifer ecosystem types in the Southwest, respondents who work in other ecosystems, such as woodlands or grasslands, expressed a need for more research in these understudied ecosystems. Respondents also expressed an interest in developing different reference conditions that better reflect potential future conditions, as there was some concern that pre-settlement reference conditions may become irrelevant as climate change effects are considered. Many respondents also noted that there is a need for spatially explicit data and models that more accurately depict

local conditions and topographic variation, such as locally downscaled climate models and fuel models with higher spatial resolution. Lastly, respondents expressed an interest in developing centralized and aligned interagency datasets in order to streamline the collection and use of data and results.

Strategies for Working Together

Respondents were also asked, "How can scientists and managers work together to effectively develop and apply scientific information on-the-ground?" Overwhelmingly, respondents emphasized that scientists and managers need to spend time together in the field and away from the office. Learning and relationship building is seen as most effective when it occurs within specific locations where research is being conducted or management actions are being applied. Respondents noted that it is critical for scientists to "put themselves in the managers' shoes" and learn about management challenges in order to be most effective. Additionally, some respondents felt that the first step of research design should include time spent in the field with the appropriate local managers.

Respondents also noted that it is critical to create structured opportunities, in addition to time in the field, for interaction and discussion of research design and results. These interactions may take the form of workshops or meetings, but it is important to plan for and facilitate engagement throughout the research process. These structured interactions help to develop open and sustained lines of communication, cited as being critical by the majority of respondents, as they ensure a steady flow of information and resources. Lastly, respondents noted that it is especially important that everyone be clear and consistent about what they can or cannot contribute to a partnership. Scientists need to explain what kinds of questions they can answer, and managers need to explain what kinds of actions they can take within the context of the laws and regulations by which they must abide.

Effective Communication

Respondents were also asked, "What are the most effective ways to communicate or share scientific information about resilience?" Again, many respondents noted that ongoing and sustained communication throughout the research process is crucial. However, once research results are available, the most frequently cited strategy for sharing results is in-person, whether in the field or in an informal meeting. Secondly, workshops and formal meetings, especially with small groups, were also cited as being effective. Webinars and presentations at conferences or interagency meetings were also cited as being helpful, though less so than the more personalized approaches. With written results, concise summary formats such as white papers or fact sheets are seen as most effective. These types of approaches allow for communication of key research results and recommendations to busy audiences. Lastly, while many mangers do access and utilize scientific journals, this should not be the only forum for communicating research. In general, respondents noted that it is important to tailor communication to each audience and to present results in a range of formats that appeal to different audiences.

Discussion

The preliminary results from this study indicate that scientific information is most useful when it directly addresses management concerns. Scientific information can be difficult to use when there is a scale mismatch between science and management, when scientific information conflicts with or overshadows other forms of knowledge, when recent research conflicts with legal regulations, or when scientific concepts are difficult to apply in management. The key research needs and products identified were experiments to test management actions, social science, research in understudied ecosystems, different reference conditions to reflect potential future conditions, spatially explicit data and models, and centrally aligned interagency datasets. More effective development and application of scientific information can occur through structured interactions and interactions in the field. It is also important that scientific results be shared in a wide range of formats and tailored to appeal to different audiences. These results suggest that there are still many challenges in developing and applying scientific information about resilience for management, but that there are a number of potential approaches to mitigate these issues.

Recommendations

Although results from this study are preliminary, the following recommendations may serve as a guide from which to continue discussion of strategies for developing and applying scientific information about resilience for on-the-ground management. While there are cultural and institutional differences between science and management that are difficult to overcome, the following recommendations may help to alleviate some of those differences.

1. Facilitate engagement between researchers and managers before the research process begins.
2. Develop and create time for ongoing, in-person interactions before, during, and after research and on-the-ground application.
3. Develop common goals and design projects to meet those goals while allowing all contributors to focus on their strengths and skills.

Conversations between scientists and managers need to be encouraged before requests for proposals to determine (1) what managers' concerns and needs are, as well as their legal and regulatory limitations (2) what the scientific community can contribute in terms of resources and capacity, and (3) where those needs and resources overlap, where there are gaps, and where those gaps can be filled. It is critical to

foster collaborations between research institutions, whether academic or agency-based, land management organizations, and funding organizations to ensure that there is communication and collaboration that allows individuals within these organizations to effectively work together while focusing on their strengths. These suggestions would allow scientific, management, and funding organizations to operate within their institutional bounds while still collaborating.

Future Research

Final results from this study will be completed by early 2015. Future research to test and refine the recommendations from this study is suggested help to identify the most actionable strategies for effectively connecting science and management about ecosystem resilience.

Literature Cited

Bazeley, P. 2009. Analysing qualitative data: more than 'identifying themes'. The Malaysian Journal of Qualitative Research. 2(2): 6-22.

Cope, M. 2008. Coding qualitative data. In Hay, I. Qualitative research methods in human geography. Oxford University Press: pages 223-233.

Corburn, J. 2009. Cities, climate change and urban heat island mitigation: localising global environmental science. Urban Studies 46(2): 413-427.

Dunn, K. 2008. Interviews. In Hay, I. Qualitative research methods in human geography. Oxford University Press: pages 79-105.

Jacobs, K. 2002. Connecting science, policy, and decision-making: a handbook for researchers and science agencies. Silver Spring, MD: NOAA Office of Global Programs.

McNie, E.C. 2007. Reconciling the supply of scientific information with user demands: an analysis of the problem and review of the literature. Environmental Science & Policy 10(1): 17-38.

Rice, J.L.; Woodhouse, C.A.; Lukas, J.J. 2009. Science and decision-making: water management and tree-ring data in the western United States. Journal of the American Water Resources Association 45(5): 1248-1259.

Sarewitz, D.; Pielke, R.A. 2007. The neglected heart of science policy: reconciling supply of and demand for science. Environmental Science & Policy 10(1): 5-16.

Sullivan, P.J.; Acheson, J.M.; Angermeier P.L.; Faast, T.; Flemma, J.; Jones, C.M.; Knudsen, E.E.; Minello, T.J.; Secor, D.H.; Wunderlich, R.; Zanetell, B.A. 2006. Defining and implementing best available science for fisheries and environmental science, policy, and management. Fisheries. 31(9): 460-465.

USDA Forest Service. 2009. Collaborative Forest Landscape Restoration Program Glossary. [Online]. http://www.fs.fed.us/restoration/CFLRP/glossary.shtml.

The content of this paper reflects the views of the authors, who are responsible for the facts and accuracy of the information presented herein.