Meeting Reviews

Special Session at 100th Ecological Society of America Meeting in Baltimore, Maryland

Using Science-Policy Integration to Improve Ecosystem Science and Inform Decision-Making: Lessons from U.S. LTERs

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Details of session

This Special Session took place on 12 August 2015 at the 100th Meeting of the Ecological Society of America in Baltimore, Maryland, and was conceived of and coordinated by the Science Policy Exchange. The Science Policy Exchange (SPE) is a boundary-spanning organization established to work at the interface of science and policy to confront pressing environmental challenges. SPE was created as a collaborative of six research institutions to increase the impact of science on environmental decisions.

This session was organized by Marissa Weiss and co-organized by Pamela Templer, Kathleen Fallon Lambert, Jill Baron, Charles Driscoll, and David Foster. Along the theme of ESA's Centennial meeting, the group of presenters represented collectively more than 100 years of experience in integration of science, policy, and outreach.

Meeting objectives

Since the initiation of ESA's Sustainable Biosphere Initiative in 1988, attention to policy concerns has strengthened ecosystem science and increased its impact on environmental decisions in clear and important ways. However, considering policy concerns when planning research projects is uncommon. It is consistently viewed as an extracurricular activity to do in addition to science rather than an activity that can add value to ecological research. Our first goal in this Special Session is to highlight examples of ecosystem research that have been strengthened by attention to policy. Our second goal is to show that the practice of policy integration can be accessible to all ecologists, particularly when ecologists partner with boundary-spanning professionals and organizations. Our overall objective is to promote expanded approaches to science policy integration to improve both basic research and its broader impacts.

Several examples offer useful lessons for working at the interface between science and environmental decision-making. Modeling ecosystem consequences of clean air policy alternatives has advanced understanding of recovery from acidic deposition and informed decisions about air quality management. Studies of land-use change, nitrogen deposition, and greenhouse gas fluxes have all benefited from incorporating policy-relevant questions into research, which ultimately improve both ecosystem science and policy outcomes.

This special session included a brief introduction by Lambert, talks by Baron, Foster, Templer, and Driscoll, and a discussion moderated by Lambert. Speakers drew on experiences from such pioneering initiatives as the Science Links and Science Policy Exchange programs, which both emerged from U.S. LTER sites. Baron focused on protecting national parks from air pollution through integration of science and policy. Foster spoke about modeling future land-use scenarios to inform decisions about conservation and sustainable use of natural resources. Templer gave a presentation about winter climate change in the northern forest and how science-policy integration can occur through engagement with stakeholders and amplification to the broader public through the media. Driscoll shared findings of an interdisciplinary modeling effort to estimate air quality and health and ecosystem benefits that could result from different strategies to reduce carbon dioxide emissions from U.S. power plants through the Clean Power Plan.

Each of the speakers described how engaging stakeholders and participating in science communication efforts improved their ecosystem science and increased its impact on decisions. The discussion period at the end was used to engage the audience by pooling experiences and brainstorming ideas to improve the practice of science policy integration.

Emergent themes from the Special Session

Six themes emerged from the Special Session about how to strengthen the bidirectional exchange between ecosystem science and societal decisions about ecosystem management. The themes are described here, along with examples from the session presentations and discussions.

Theme 1: Integration across science, policy, and outreach has clear benefits for ecological research and for ecologists

Too often, scientists categorize benefits of research to society as entirely separate from advances to science. This compartmentalization is reinforced by our vocabulary, with terms such as "broader

impacts" to distinguish activities which lead to societal benefits from the activities that lead to scientific advances. However, a critical message emphasized by all scientists in this session was that in an integrated project; the same activities produce both scientific advances and societal benefits.

Baron described a long-term science-manager partnership that has both advanced scientific understanding and resource stewardship in Rocky Mountain National Park. After documenting ecological responses to abundant nitrogen from atmospheric deposition, she was asked by managers to develop a scientifically justifiable critical load. Scientists, managers, and policy-makers formed a team to identify possible solutions after it was determined that critical loads for nitrogen were being exceeded in the park, degrading water quality and harming sensitive plants and organisms. Baron has worked with stakeholders in Colorado for over 20 years to understand what information they need in order to act upon the knowledge related to atmospheric deposition of nitrogen. By understanding the constraints of local farmers, through two-way dialog, they are trying out new approaches toward reducing nitrogen emissions from agriculture. She continues to study the effects of nitrogen pollution and the associated mitigation plans on nitrogen deposition and sensitive alpine and subalpine ecosystems in Rocky Mountain National Park.

Driscoll described a project characterizing and quantifying the cobenefits of different strategies for regulating carbon dioxide emissions from power plants, which would not have been possible without specific knowledge and consideration of the range of possible policy approaches. He and his colleagues were interested in understanding the magnitude and distribution of air quality, health, and ecosystem benefits resulting from a set of policy scenarios. Driscoll and Lambert assembled a team of collaborators and as the project got underway, there was a change in the U.S. national policy landscape. The Environmental Protection Agency (EPA) announced that they had begun to draft new rules to reduce carbon dioxide emissions from power plants, the nation's largest point-source of the greenhouse gas. The research team was on the cusp of beginning their analysis, and the news came at the perfect time for them to modify their approach. They modeled three scenarios that resembled different strategies for controlling carbon dioxide emissions from the power sector that bracketed a range of options that the EPA might consider. Because the researchers followed the policy landscape, the researchers were able to ask questions and learn about the consequences of different options for regulating carbon dioxide that would not have been known without integrating policy concerns. Their work resulted in peer-reviewed papers that examined how different policy scenarios would affect carbon dioxide emissions from power plants and co-benefits for human health and ecosystems.

Theme 2: Interdisciplinary teams are important for addressing complex environmental challenges

Each speaker offered examples of how interdisciplinary collaborators and partners from outside of academia were critical to the success of their projects. Templer described how working with an informal STEM professional and experienced facilitator was essential for developing and implementing the dialog protocol that scientists participated in. Driscoll noted that working with a boundary-spanning organization was critical to defining relevant research questions and communicating the results in a way that had impact. Moreover, his work showed that assembling a team of ecosystem scientists, atmospheric chemists, public health experts, and economists enabled their team to expand their analysis beyond ecosystems and make their results relevant to the public by quantifying and mapping near-term, local environmental and human health benefits, and quantifying their economic value.

Theme 3: Science can have a surprising impact on decisions made at a variety of scales

All four presentations emphasized benefits of focusing on local-scale consequences of environmental issues and decisions made at a variety of scales. Baron noted that working with stakeholders adjacent to the Rocky Mountains enabled her to share information with them that was relevant to their daily lives, connecting livestock and crop emissions of ammonia to a serious pollution problem in Rocky Mountain National Park from atmospheric nitrogen deposition. Foster worked on an issue that is important to residents in New England who have a stake in the landscape's future. Driscoll shared that modeling and mapping air quality and health benefits of carbon standards at the county level meant that individuals throughout the continental United States could look at the maps and understand how their local air quality and human health may be affected by federal carbon standards in the future.

Theme 4: Bidirectional exchange of information between scientists and stakeholders helps ensure relevance and legitimacy

The most basic form of communication between scientists and the public is for an expert to present their findings to the public and policy makers through lectures and other forms of one-way communication. The speakers emphasized the benefits of two-way dialog so that both scientists and the public can inform each other throughout the scientific process.

Foster described how holding workshops with private land owners, conservation organizations, and government agency officials was critical to the success of his group's efforts. They developed relevant and legitimate land-use scenarios for New England since past trends are not good predictors of future change and human activities are the driving force of change in the New England landscape that is dominated by private land ownership.

Templer described how she and colleagues learned about several long-term data sources from stakeholders, which enriched their research. The scientists and stakeholders came together through Roundtable discussions at the Hubbard Brook LTER through the Forest Science Dialogs project (www.nsf.gov/awardsearch/showAward?AWD_ID=1322871&HistoricalAwards=false). Templer and colleagues developed relationships with sugarbush and ski area owners and, through the Roundtable discussions, learned how local land owners and users of the forest already know firsthand that the winter climate has been changing over the last several decades. With reduced rates of snow accumulation in winter throughout the region, ski resort owners are adapting by relying more and more on artificial snow; sugarbush workers are tapping trees earlier and earlier; and snowmobile clubs are experiencing less predictable and more intermittent trails in winter. Through the Roundtable discussions, Templer and her colleagues learned about data sets that contain long-term records of snowmaking from ski resort owners and long-term records of maple sugar tapping dates from sugarbush owners. None of these datasets are available from peer-reviewed publications or traditional databases, but the relationships between the researchers and stakeholders helped more people benefit from those data.

The experience of the four scientists reinforced the idea that transparency and trust are critical for bidirectional exchange of information and successful collaborations among themselves and stakeholders. As Driscoll explained, "transparency and disclosure are important in high-stakes policy-relevant research." For Baron, building trust means years of hosting field trips, attending

barbecues, touring farms, and listening to concerns of stakeholders in order to match the stakeholder's concerns with a research trajectory. Foster noted that developing a trusting relationship with stakeholders helped the scientists gain new insights as they addressed new questions and developed new major science questions. It also helped to strengthen and increase the public exposure of their research, educational, and outreach programs. For Templer, the Forest Science Dialogues enable effective bidirectional communication by creating a safe forum for frank conversation that permits all parties to feel comfortable.

Theme 5: Boundary-spanning organizations are revolutionizing science policy integration and increasing the success of scientists at achieving research aims and policy impact

Boundary-spanning organizations bring together experts in science, communication, and policy to address interdisciplinary challenges. The benefits of working with boundary-spanning organizations that help scientists integrate research with policy and outreach were readily apparent. For example, Baron worked with the National Park Service to help them understand the effects of atmospheric nitrogen deposition so they could communicate effectively with policy makers and the public. Foster and colleagues worked with Highstead, a non-profit organization dedicated to conserving New England's natural landscapes. Highstead played a major role by providing staff, communicating with the public, and contributing funding for the core scientific work going into developing Future Scenarios of forested land for the region. Templer and colleagues work with the Hubbard Brook Research Foundation, whose mission is to promote understanding and stewardship of ecosystems through policy outreach and science education. This boundary-spanning organization works with scientists and students at Hubbard Brook to help them translate their work into meaningful information for policy-makers, educators, and the public. All of the scientists in this Special Session work with the Science Policy Exchange, a collaborative of six institutions interested in integrating science with policy, conservation, and natural resource management. Consistently, the use of boundary-spanning organizations made the science-policy-outreach integration more efficient and more effective than it would otherwise be.

Theme 6: There are strategies for creating positive interactions between science and media

Another theme that emerged from the discussion is the positive interactions many of the scientists have with the media. It is common for scientists to avoid interactions with the media due to concern that their message could be taken out of context or the wrong conclusions could be drawn from their work. Surprisingly, the scientists in this session had many positive interactions with reporters. The panelists highlighted two possible explanations. First, positive interactions seem very likely when the story was about the process of science rather than any controversy surrounding findings. Second, when it comes to communicating findings, the key to a positive outcome is practicing ways to describe findings that are clear, interesting, and accurate. The most common reason for cringe-inducing quotes is when scientists say something compelling that is unclear and/or inaccurate. Practicing and asking a trusted colleague or friend for help preparing for an interview can prevent these memorable, but unfortunate mistakes. Foster's work with a diverse group of stakeholders throughout New England shows that by engaging a variety of people and their perspectives, the stories that emerge in the media can focus on the productive work of scientists and stakeholders. Those accurate and compelling stories are a win–win for science and the public.

Moving forward: How to engage more ecosystem ecologists in science policy integration

One conclusion that emerged from the session and was discussed in detail following the four formal talks was the challenge of measuring success as scientists attempt to integrate their work with policy-makers and the public. While the impact on policy or outreach was viewed widely as the ultimate goal of any integration work, it was noted that scientists need some credit to advance in their field and have the incentives to begin or to continue this work. Some pointed out that for scientists, the number of peer reviewed papers is used as a marker of professional success; perhaps, the number of times work gets cited by the media or used by policy makers could be used to credit scientists with their integration efforts. Regardless of the metric used to gauge success in science policy projects, the panelists agree that a new suite of incentives needs to be developed to encourage more scientists to engage in this important work and to reward scientists for policy integration efforts. At the minimum, the disincentives inherent in the current system should be modified or mitigated.

This session resulted in a lively discussion at the 100th Ecological Society of America meeting in Baltimore, and highlights were shared on social media via Twitter during the session as well. Looking across the case studies presented at the workshop, it is clear that best practices for engaged scholarship that has impact in the world depend on context. The legal and regulatory context, the types of decisions and actions needed, and the status of the supporting science can vary with the issue being addressed. Therefore, the practices used to build a stronger interface between science and action should vary as well. For example, in the context of a contested legal or regulatory decision, the nature of the engagement with public officials has important limits and must adhere to set rules. Whereas in the context of informal decisions, such as voluntary adoption of best management practices by landowners, less rigid engagement strategies can apply. Further honing our understanding of how context should shape our approaches to engaged scholarship and science-policy integration represents an important future direction for effective boundary-spanning programs.

The authors are considering additional ways to make information about science-policy integration and effectively partnering with boundary-spanning organizations available to ESA members as well as LTER colleagues and the general public, such as through ESA webinars or additional conference sessions. For more information or with questions, see the Science Policy Exchange website (www.science-policy-exchange.org), follow the Science Policy Exchange on Twitter (@scixpolicy), or email Marissa Weiss at marissaweiss@fas.harvard.edu.