FORWARD

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INTRODUCTION

During the last few years, rhetoric extolling "sound science" as the basis for environmental policy has put a brighter spotlight on the nexus between science and policy. Such language has not necessarily made it any easier to understand how or when to blend science into the policy process. It has, however, alerted scientists to public expectations that their work be directly relevant to public problem-solving, policymaking, and resource management. These expectations challenge the science community to gain more insight into the trends and issues that might benefit from directed research, and proactively pursue those insights. What this implies for the process and quality of science or, for that matter, for the process and quality of policymaking, is justifiably a topic worth probing.

This issue of Water Resources Update brings together thoughtful perspectives from six scholars on the challenges of linking science and policy to enable decision-making under uncertainty. Each author develops his or her own facet of the issue, leading to an excellent foundation for further research and contemplation of these challenges. Indeed, as discussions with these authors during their writing did attest, each sees room for a great deal of additional discussion and debate on this topic at all levels of the research and policymaking communities.

Few mechanisms in governmental or academic institutions now ensure good correspondence between the questions that scientists pursue and those that policymakers ponder, yet it is not uncommon to hear voiced an assumption that better integration of science and policy is nonetheless likely to occur. As recently as the summer of 1998, as he introduced a House Science Committee hearing about the role of science in "making good decisions," Vice-Chair Vernon Ehlers (R-MI) noted the particular importance of environmental research to policymaking in the foreseeable future, emphasizing as he did so the need for close, substantive coordination between those two agendas.

> "In order to provide key decision makers with the information they need when they need it, the collection and organization of that information cannot be left to chance. In the future, science and engineering will increasingly be asked not just to produce new ideas and new products, but also to help Americans resolve the legal and ethical dilemmas raised by the ideas and products science and engineering has already generated. This is an important role for science and engineering, and may require researchers to pursue research in areas in which there is currently insufficient knowledge to make proper policy decisions. While the selection of these areas is itself a policy choice, it is clear that one of the top priorities must be further environmental research."[1]

Specific legislative initiatives, marked by revisions to the Farm Bill and the Safe Drinking Water Act and passage of the Food Quality Protection Act, have altered the environmental policy and regulatory landscape for legislators, regulators, and, less directly but no less profoundly, for scientists as well. Though no consensus has emerged about how fundamental these changes have been to the direction and implementation of policies, there is no doubt that a shift in focus has occurred. For instance, the language of "risk" has become rather central in discussions of how, where and when to implement environmental protections. Targeted interventions -- based on a solid understanding of how environmental conditions vary across the country and why -- tend to hold strong support among a broad

spectrum of interests, while "blanket" regulatory approaches are distinctly out of favor. In virtually any forum where environmental policy is seriously discussed, questions emerge about where environmental policy is headed; what it will look like in the "next generation." It may be an oversimplification to cast current trends as a paradigm shift in environmental policy, but it may not be much of an overstatement.

No matter what policy approaches and tools are ultimately adopted, the protection of water as a precious resource appears to be a common policy goal. Indeed, one theme has been relatively free of controversy: water quantity and quality are at the center of environmental priorities, and they will be for some time to come. It is hard to think of an environmental or resource issue that doesn't pertain to water in some way. Agriculture? Persistent issues of erosion and runoff, now heightened by concerns about livestock waste and source water protection, bring water to the forefront of conservation policy. Human health? The quality of drinking water has been gaining increasing attention from governmental and non-governmental entities. Consumer concerns about drinking water quality are fueling a dynamic market for bottled water and water filters and have prompted national legislation assuring them of a "right-to-know" what's in their tap water. Wildlife? The realization that waterborne pollutants could magnify up the food chain was seared into the public conscience by the plight of the bald eagle two decades ago and more recently by a spate of discoveries of deformed frogs. Books chronicling animal exposure to waterborne endocrine disrupters have engendered new concerns that are unlikely to dissipate in the near future. Habitat? The controversial legacy of dams in the western United States, in particular, heightens the stakes between preserving aquatic habitat for endangered and other species and supporting an expanding human population in semi-arid regions.

While using science to make policy about these and other issues seems pragmatic both to scientists and to policymakers, there is still very little understanding on the part of either about how to do this well. Uncertain knowledge, cost implications, and ideological differences set the stage for difficult political wrangling over what scientific evidence actually suggests and even over what constitutes sound science. The general inability of science to unequivocally tell policymakers what to do is at times perceived with dismay, though few would prefer to see policy made purely on technical grounds. Frustration is often directed at the almost stereotypical inability of scientists to translate their research in ways that make sense to policymakers. This stereotype is matched head-on by that of the mythically short attention span of policymakers.

Stereotypes of scientists and policymakers, like all stereotypes, are unfair. But they also reflect in some measure the very different epistemologies that underlie policymaking and scientific research. Perhaps an analogy that illustrates this difference is that policymakers care about the whole puzzle, while each scientific discipline is far more interested in the shape of its own puzzle piece. As policymakers seek to place one piece after another, they find with exasperation that the pieces have not been designed to interlock. At the same time, the creators of each puzzle piece express disappointment that the beauty of each respective form is not fully appreciated. This difference in orientation can quickly breed tension, yet the complexities of environmental decision-making urge us to build bridges across these differences instead of retreating to opposing sides of the gulf.

As scientific information becomes more extensive, more precise, and communicated more widely to a variety of environmental decisionmakers, questions emerge about the relevance of that information as well as about the appropriate role of science in policymaking. What questions might scientists most fruitfully address and within what timeframe? Which scientific disciplines need be involved? Do we need new models of interdisciplinary research and analysis or will historical uni-disciplinary models suffice? How can research programs plan ahead, adapt, enhance their ability to translate findings for the policy arena, and achieve balance between directed and undirected research? By the same token, to what degree ought science, though quite "sound," <u>not</u> guide policy development? Where are the limits to science in the policy process? Do policy priorities emerge directly from scientific findings, or is science just one part of a larger process? How do scientists and policymakers gain a better sense of how and when to seek each other out? The authors in this issue touch on many of these questions, in some cases providing answers while in others deepening our comprehension of the questions themselves.

In the case examples provided in the following pages, the substantial record of scientific involvement in the policy arena becomes apparent. The challenges for both science and policy come through just as clearly. Policymakers must continue to rely on scientists from many disciplines for the new ideas and new tools that enable new policy