Balancing Science and Politics in Environmental Decision-Making: A New Role for Science Impact Coordinators

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Abstract

For society to manage complex ecosystems effectively, including handling both the sudden and cumulative impacts of climate change, the integration of science-based knowledge with political and socioeconomic considerations is essential. To bridge the very different cultures of the citizen, scientist, and public official we need a new kind of environmental professional, one trained in traditional disciplinary skills, but who can also build consensus among a range of disciplines and communities and communicate complex information to diverse groups. The MIT-USGS Science Impact Collaborative (nicknamed MUSIC) has been experimenting with a field-based graduate training program aimed at providing instruction in both sets of skills. Students are involved in action-research to help them gain the interdisciplinary knowledge required to integrate the diverse fields involved in environmental decision-making. MUSIC, and there are similar programs at several other universities, teaches masters-level professionals to function as "Science Impact Coordinators," equipped to step into professional assignments immediately after graduation. The program balances the theoretical perspectives of a diverse mix of faculty with those of visiting scholars who bring practical experience to bear on the complex assignments that MUSIC takes on. Science Impact Coordinators in training work on field-based projects initiated by the regional offices of Federal agencies.

Introduction

It is essential that we find a better way to balance science and politics in environmental decision-making. That is the only way we will be able to manage complex ecosystems effectively, achieve sustainable development, and safeguard public health and safety. A major obstacle to doing this is the chasm that exists between the very different cultures of scientists, public officials, and citizens. One way to bridge these chasms, in our view, is to train a new generation of environmental professionals with the skills needed to manage interactions between scientific experts and those with other kinds of specialized knowledge. Even though this need has been talked about for more than a decade[1], few such professionals are being trained who can communicate scientific findings

[1] In the 1995 report, *Science, Policy, and the Coast—Improving Decisionmaking,* the National Research Council stated, "[m]ore effort is needed in the interpretation of fundamental science results for use in policymaking. Perhaps the most effective means of such integration is by …scientists who are engaged in both fundamental research and policy-relevant scientific activities, although such individuals are a rarity. They are able to extend the results of more applied, and often more descriptive, research by bringing in the understanding of processes resulting from fundamental research." To increase the number of scientists with these capabilities, the NRC has encouraged institutions of higher learning to "improve the cross-disciplinary training of natural and social scientists … and [to create] "programs of

to elected officials, citizen activists, and other stakeholders and help all three work together to design, implement and make sense of scientific studies that address their concerns. One of the obstacles, as Jane Lubchenco has noted, is that most university curricula and the reward system for professional scientists within and outside universities do not favor interdisciplinary and action-oriented field-based learning (Lubchenco, 1999).

When scientific advice is unheeded —because it is too "hard" for the average person to understand or because the media distorts the issues at stake in science-intensive policy disputes —we are at risk of pursuing public policies that waste natural resources, despoil the environment, destabilize natural systems, and jeopardize human health and safety. The selective use of scientific data to justify one's own and discredit an adversary's position regarding environmental management decisions is even more problematic. Such political manipulation generates long-term stalemates when timely action is required. We believe this problem will only get worse unless both the public and private sectors hire a new kind of professional we call Science Impact Coordinators (SICs). In partnership with the U.S. Geological Survey (USGS), MIT has begun to train a new generation of SICs at the Massachusetts Institute of Technology (MIT). Other universities have launched similar programs[2], although they are not yet organized under a common SIC banner.

Understanding the Problem

When science, policy and politics all come into play, the potential for miscommunication is enormous. Most scientists want nothing to do with policy or politics. Indeed, they have been taught that good science must remain aloof from decision-making and policy considerations. Moreover, they are only comfortable talking to other scientists, so even if they wanted to participate to helping to make policy choices (NB: they would not recommend or make policy, but inform policy makers of the likely impacts of various choices), they don't know how to talk about what they know and what they are doing in a way that can be understood by those who make policy.

Policy makers (by which we mean elected officials and stakeholder groups like business associations and non-governmental organizations) are focused on problems framed in ways that make sense in the political arena. They are also motivated much more by self-interest rather than by a broader, longer-term concern about the common good or the public interest. So, for example, in a dispute over the dangers associated with water allocation in times of drought, sports fishing interests will do almost anything they can to ensure that fishing is allowed. When data are presented suggesting that fish stocks have declined to dangerously low levels, the sports fishers will find scientific advisors to question the information used to make a case for a government-imposed ban on fishing.

training for 'science translators'." Science translator training programs "should include exposure to the natural and social sciences, policy development and implementation, and conflict management and communication skills"

[2] Examples of such programs that have, or are capable of, developing a curriculum that takes an interdisciplinary approach to training environmental management specialists with a consensus building and collaborative learning orientation include: Prof. Marina Alberti's Urban Ecology Research Laboratory at the University of Washington, Prof. Steven Yaffee's Ecosystem Management Initiative at the University of Michigan, Yale University's School of Forestry, and the School of Regional and Community Planning and the Institute for Resources, Environment & Sustainability at the University of British Columbia.

Elected officials (and the courts), who are actually the final arbiters of public policy, look at scientific controversies of this kind through procedural and electoral lenses. The courts think they can discern the "truth" through cross-examination of expert witnesses by judges and lawyers. Elected officials are interested in re-election and respond to the pressures imposed by the constituencies that support them. The media has little or no interest in educating anyone on the sources of such disagreement. Rather, they are interested in presenting scientific controversies as news. They don't feel it is their responsibility to enlighten their readers, listeners or viewers with regard to what is known and not known given sophisticated standards of evidence, proof, and argument pursuant to the scientific method. Indeed, few media outlets have staff capable of following the detailed technical arguments as they unfold. So, they simplify and appropriate elements of what is said ("sound bites") and present "both sides," regardless of where the weight of scientific opinion may fall.

The end result is that science and the scientific underpinnings of key public policy decisions are poorly understood and receive inadequate attention when public policy has to be made. In addition, policy-makers invariably refuse to invest in the kind of scientific and technical investigations needed to add to the stock of knowledge that would allow everyone involved to handle complexity and uncertainty more effectively. Finally, many elected officials believe they can put scientific considerations aside because it's possible "to find a scientific advisor to say anything." Frustration on all sides increases as science is manipulated in pursuit of political objectives. Lives are put at stake by policy decisions made with conscious disregard for what we don't know or understand. The natural environment is put at long-term risk (as are we ultimately) by the cumulative impact of collective decisions made with flagrant disregard for the costs and impacts (of all kinds) of the choices being made.

Increasingly and with greater urgency, scientists are recognizing "…how such things as human dynamics and institutional behavior can either enhance or impede the benefits to society of our research efforts."[3] To address these human and institutional factors they call for greater integration of disciplinary perspectives including biophysical science, social science, economics, engineering, and political science. A few published papers suggest that even broader collaborative processes are required (e.g., NRC, 1995; Kates and others, 2001). The problem is that no one has yet spelled out who will do this or how they will do it. Over the past thirty-five years, without much public attention, a theory and practice of consensus building and a set of best practices for managing participatory processes have evolved that enable well-informed collective choices when environmental decisions have to be made (e.g. Susskind and others, 1999, Innes and Booher, 1999; Susskind and Cruikshank, 2006). A recent National Research Council report documents that when done well the use of these public participation processes can lead to more effective environmental decisions (NRC, prepublication).

Toward a Solution

We postulate the need for environmental professionals whose life's work will be at the intersection of science, policy and politics. We assume they need science training equal to at least an undergraduate degree in one of the scientific disciplines from an accredited four-year college (although a graduate degree would be better). On top of that,

[3] Lane, Neal, 2006, Alarm bells should help us refocus, Science v. 312, p. 1847.

we believe they need a two year master's degree that could be offered in a number of professional schools including schools of urban and regional planning, geography, public management, public health, or communications -- as long a these schools commit to hire appropriate full time and adjunct faculty.

We envision a two-year master's degree with a required curriculum for SICs. Within the context of a four semester professional degree program, in environmental planning, for example, or in public health, students should be required to take at least four semester-long courses and to participate 15 hours a week in field-based assignment throughout their two years of study. SICs need to be familiar with the latest ideas in joint collaborative decision-making (Innes and Booher, 1999; Yaffee and Wondolleck, 2000), resiliency theory (Holling, 1986; Gunderson and Holling, 2002), complex adaptive systems (Holland, 1998; Levin, 1999), adaptive management (Holling, 1978; Walters, 1986), and cutting-edge approaches to social, economic, and environmental modeling (Parker and others, 2003; Epstein and Axtell, 1997).

Above all, we think SICs need to know how to manage joint fact-finding (Stinson and Ehrmann, 1999; Susskind and others, 2005; Karl and others, 2007) that is, practices that have evolved over the past decade or so for ensuring that science and politics are both given their due in environmental decision-making at the federal, state, and local levels. A well-managed JFF process seeks to balance the culture of science and that of policymakers and the general public in a way that preserves the impartiality of the scientist and the best practices of scientific inquiry while still honoring the values and preferences of stakeholders. It can help ensure that the best-quality science (from the standpoint of those committed to the norms of independent scientific inquiry) is used to inform decisions (Susskind and others, 2005).

Let's consider a hypothetical example that illustrates what a well-structured JFF process entails.[4] Imagine a contentious environmental issue that involves conflicting interpretations of scientific information and models—the "discovery" of a large deposit of DDT-laden sediment in the ocean off a coastal urban complex. The public is in an uproar. Citizens are concerned about heath and safety, fishermen are worried about their livelihoods, and environmentalists are upset about the adverse impact on the ecosystem. The central scientific question is, "Are sedimentation rates sufficiently high so that over time the deposit will be buried deeply enough not to pose a threat to the environment or to human health and safety?" The science is unclear and leading experts have different interpretations of what the sedimentation rate is and what the associated risks might be. The Army Corps of Engineers says it can easily solve the problem by putting a sand cap on the deposit. This would cost about one billion dollars. The Environmental Protection Agency decides to convene a group of stakeholders to meet with scientists who have opposing views on both the seriousness of the problem and the appropriate governmental response. EPA has agreed to take the findings of the group quite seriously when it makes its final decision about how to proceed. At the first meeting, managed by an independent facilitator trained as a Science Impact Coordinator, the scientists are asked to lay out the problem the way they see it and to suggest the research necessary to get a better fix on the

[4] For a more detailed look at how a joint fact finding process works look at the role-play games—Offshore Wind, Owl and Timber Harvest, Fisheries, and Rim Sim— on the MUSIC website http://web.mit.edu/dusp/epp/music/resources/games/windfarmgame.html

sedimentation rate and the associated risks. The stakeholders ask clarifying questions, and in the process, reshape the scope of the scientific inquiry -- pointing out that the problem of estimating and managing such risks are not merely scientific concerns. Opposing scientists and knowledgeable (but not expert) representatives of key stakeholder groups agree to a research plan and a budget that EPA staff help them formulate. The scientists also agree to meet regularly with the stakeholders as they proceed with their research – to present their preliminary findings and consult with the group before preparing a final report (for the group to consider at a formal decision-making session). Once agreement is reached, the whole group meets with top EPA officials to discuss the policy implications of the findings. The EPA, given its legal authority, will make a policy decision after weighing the risks, costs, benefits and uncertainties as they are now understood by everyone involved.

Science Impact Coordinators must learn how to help groups of stakeholders (like this hypothetical group) develop shared understandings of the socio-ecological problems that need to be addressed; shared models of the complex and dynamic systems involved; and possible ways of proceeding in the political world that will enable -- with constant monitoring of results, timely policy adjustments, and on-going collaboration -- policy makers, scientists, and stakeholders to make increasingly effective decisions in the face of uncertainty. To master these skills, SICs will need to take a specially tailored set of graduate level courses and engage in field-based training. The curriculum we have in mind would include at least four basic courses.

The Curriculum[5]

Environmental Policy and Planning

This course should review federal environmental policy-making in the United States along with the philosophical debates underlying past and proposed policy shifts. Students should be introduced to theories of public policy-making as well as to a range of analytic methods including impact assessment, sustainability analysis, risk assessment, cost-benefit analysis, and life-cycle analysis as well as process management tools that can aid group decision-making.

Complexity, Ecology, and Policy Design

This course should examine human and natural systems through the lens of system complexity. It should provide an introduction to the landscape perspective on resource management and teach resiliency theory and the basics of adaptive environmental management.

Environmental Leadership

This course should examine the various elements of high-performance situational leadership. Understanding and exercising leadership – particularly in the public arena -- is an important attribute of science impact coordination.

Synthesizing Science and Governance

This course should examine the theory and practice of adaptive management and adaptive governance. Ideally, students would be able to use this final course as a setting in which to reflect on their field work and pull together their own personal theories of SIC practice.

[5] MIT versions of these courses can be viewed at http://dusp.mit.edu

As part of a two-year master's curriculum, SICs should also complete a number of additional electives. At MIT these include:

- *Negotiation and Dispute Resolution in the Public Sector*
- *Science, Politics, and Environmental Policy*
- *Simulating Sustainable Futures*
- *Public Participation in Planning for Sustainable Development*

As stated earlier, several universities already have programs and curricula that parallel the Science Impact Coordination curriculum at MIT. These include University of California at Berkeley, Duke, University of Washington, University of Michigan, Yale, and the University of British Columbia. The University of New Hampshire intends to develop a curriculum modeled on the SIC program at MIT.

Field Assignments

Field assignments are *essential* to the training of SICs. Students need to be able to test what they are being taught by tackling "real world" assignments (through what is often called action research)[6]. This involves planned interventions – arranged jointly with client organizations, field-based advisors and stakeholders -- in the world-at-large coupled with careful reflection. Through these interventions, students should be able to contribute to improving collective resource management decisions in a range of actual situations while sharpening their own skills. Three representative field assignments illustrate the kinds of responsibilities students at MIT training to be SICs have been given and the types of products they have been able to generate.

Cooperative Sagebrush Initiative in the Western United States

The Cooperative Sagebrush Initiative (CSI) is a region-wide program covering the eleven western states that make up the historic range of the Greater Sage Grouse. The purpose of CSI is to restore and preserve the sagebrush ecosystem while at the same time allowing for development of oil and gas resources in the area. MIT SIC trainees are working with CSI partners including Environmental Defense, the U.S. Fish and Wildlife Service, the U.S. Geological Survey, private landowners, Encana USA and several other energy companies to design a conservation credit trading system. This system is designed to encourage the conservation of critical Sage Grouse habitat on a regional scale by allowing the swapping of land (across state borders) of equivalent habitat value. A student SIC has been working with Environmental Defense to determine how the new trading system can be integrated with existing habitat preservation and mitigation efforts in Colorado, Wyoming, and Utah (Lemphers, 2008).

Massachusetts: Permitting Process for Offshore Wind Farms

Two SICs have been working to document the changing regulatory framework for the siting of off shore wind farms in the United States. As a result of the 2005 National Energy Policy Act, responsibility for this activity was shifted from the U.S. Corps of Engineers to the Minerals Management Service in the U.S. Department of the Interior. Using the Cape Wind project in Massachusetts as a point of comparison, the interns are evaluating what it will take to site wind farms in deep water far off the shore as new floating turbine technology becomes available and as the new federal and state regulatory regime takes shape (Williams and Zhang, 2008).

Maine: Reforming the Management of Near Shore Ecosystems by Integrating Local Knowledge and Science

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[6] Handbook of Action Research: Participative Inquiry and Practice, P. Reason and H. Bradbury, editors.

SICs are working with two NGOs -- the Quebec-Labrador Foundation, Inc. and Environmental Policy Design -- to implement a collaborative approach to marine area management in mid-coast Maine. They are documenting lessons learned from four small community-based management organizations (in Maine and New Brunswick), which have successfully engaged local resource users in a variety of environmental management initiatives (Arpels and Lassiter, 2008). Insights from this work should help to inform the design of a consensus-building approach among scientists and resource users in Muscongus Bay. The process, once implemented, will lead to the development of a regional strategy for addressing this marine area's priority management issues. The Jessie B. Cox Charitable Trust has provided funding for the initial two years of this work.

Knowledge and Skills

The single most important skill that a SIC must have is the *ability to engage a range of individuals and groups in problem solving*. SICs need to be able to work with a wide range of interests through the use of consensus-building techniques to come to a common approach to the problems they face. A second critical skill is the *ability to reframe* policy choices and possible courses of action that will lead people toward plausible courses of action even in the face of key differences in interests and values. It is important to note that SICs do not advocate particular solutions. They work with a range of elected and appointed officials, self-designated stakeholders, and a variety of technical experts to jointly analyze problems and formulate ways of proceeding – given a shared understanding of the risks, costs, benefits and opportunities involved.

Because SICs almost always deal with multiple parties, a third critical skill is the *ability to conduct a stakeholder assessment* (i.e., a form of political and social mapping) as a first step to understand the range of perspectives, and hence, different ways of formulating problems. Once a problem is jointly defined, goal clarification is necessary to work toward an efficient, timely, and effective solution; without explicit goals no progress can be made. The task of getting agreement on ways to proceed is enormously difficult, but it is the task of the SIC to facilitate an appropriate consensus building process. In order to implement whatever agreements are reached, it is necessary to understand the mandates of the institutions involved—political, legal, and administrative— as well as what the groups involved don't know and will need to find out through on-going oversight and collaborative policy adjustments. SICs need to help groups gather all kinds of "intelligence," and not just scientific and technical information, so that they have a clear sense of the obstacles they face and what step-by-step interventions might be helpful.

Because SICs operate in a complex setting, a fourth critical skill is the *ability to synthesize*. By synthesizing we mean the ability to create something new out of the "intelligence" gathered by the group, many pieces of which are seemingly unlinked and not at all related. We contrast synthesis with compilation. Reports that are simply an amalgamation of compiled data (regardless of how many disciplines help to generate the information) are effectively useless until somebody extracts the important bits and forges them into a useful framework for action. This is not something we expect SICs to do entirely on their own. Rather, this is group task that SICs need to learn how to facilitate.

Finally, because balancing science and politics requires working with a wide range of experts and stakeholders, SICs, as a fifth critical skill, must facilitate development of a *common functional language* for the diverse actors to use in addressing one another. This is extremely difficult. Different biophysical science disciplines speak different languages (see for example, Galison, 1999). Engineers speak yet another language. And social scientists and political scientists still another. Scientific and technical jargon must be translated into a form easily understood by policy makers and stakeholders with various levels of technical competence.

A key element in training SICs is having the right mix of faculty *and* practitioners to teaching the required courses and advise students. Social scientists, political scientists, computer scientists, biophysical scientists, and practitioners from the environmental mediation field can all contribute. As we mentioned earlier, a number of graduate fields could offer a SIC degree if they had the right faculty or made better connections to faculty across their campus as well as to external practitioners.

Adjunct faculty are an essential part of the mix. At MIT, one of us (Karl) is a U.S. Geological Survey scientist. MIT is his permanent USGS duty station and he holds an appointment as a Lecturer. We complement adjunct faculty with Scholars-in-Residence. These distinguished scientists, often on assignment from federal agencies, serve as graduate student field advisors and research staff members. Two of the SIC required courses described above, were developed at MIT by Scholars-in-Residence.

Problem of Application

Prevailing Science Culture and Ethos

Most scientists do not want to engage with policy makers and the public. Of those that do, many lack the skills needed to function effectively in the public arena. On top of this, scientists and the agencies they work for fear that they will step over the line -- from informing to advocating policy. In our view, it is inappropriate for scientists *to advocate for particular policies*, but it is not inappropriate for them to *interact with policy-makers and stakeholders* to help them understand the implications of the policy options they are considering. Another reason scientists remain aloof from the political process is that scientists and the agencies for which they work are concerned about releasing scientific information before it has been peer reviewed. Scientists can, however, discuss the preliminary results of their investigations as long as they offer appropriate disclaimers. With proper precautions, there is no reason scientists cannot participate as advisors to policy-making efforts.

Building Institutional Capacity and Fostering Cultural Change

Conventional institutional structures of scientific management and governance are often not well adapted to respond to the uncertainties and complexities of a changing natural environment (Brunner and others, 2005; Scholz and Stiffel, 2005; Koontz and others, 2004). The often top-down administrative and regulatory approach with its attendant power dynamics and inflexibility[7] does not easily allow for collaborative approaches that engage all affected stakeholders. The overarching challenge, then, is to build the institutional capacity and adaptive governance[8] structures required to implement

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7 "Government must be flexible so that it can be adapted to greater or lesser intervals of time and geographic areas as more information is gathered…." NRC, 1995, Science, Policy and the Coast, p.74

8 "Adaptive governance integrates scientific and other types of knowledge into policies to advance the common interest in particular contexts through open decision-making structures." (Brunner and Steelman, 2005, p. 2.)

collective decision making, which we believe will lead to more effective use of science in natural resource management and sustainable policies.

Conclusion and Recommendation

A way to build institutional capacity for adaptive governance and to change agency scientific culture is to hire SICs. Some personnel in federal (and state and local) agencies perform some of the functions of SICs, but these individuals are not sufficiently trained or expert in the full range of techniques required to balance science and politics in collective decision-making. Usually people endeavoring to provide some of these services are trained as facilitators, public affairs officers, or media specialists. But SICs are different from each of them. They are brokers who manage the interplay of science, politics and policy. The National Oceanographic and Atmospheric Administration, the U.S. Forest Service, the U.S. Environmental Protection Agency, Resolve, Ceres, and the Rockefeller Foundation have hired graduates of the MIT program. Based on numerous conversations with agency personnel, and our own experience, there is an increasing demand in the world-at-large for SICs. To meet this demand, we have proposed legislation to fund 20 schools a year to support the training of 8-10 SICS a year for a five-year period. The conclusions and recommendations of the NRC report, "Public Participation in Environmental Assessment and Decision Making," enforce our view that SICs hold promise to help federal agencies reach more effective and durable environmental policy decisions.

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