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Science, Scientists, and the Policy Process: Lessons from Global Environmental Assessments for the Northwest Forest

Ronald B. Mitchell, William C. Clark, David W. Cash, and Frank Alcock

Scientific assessments related to forest management in the Pacific Northwest share several characteristics with the many recent "global environmental assessments" that have sought to bring scientific information to bear on global environmental problems. Like most global environmental problems, managing Pacific Northwest forests engages questions of considerable ecological uncertainty and complexity. Although policy makers seek out scientists to help them make decisions, scientific understanding of the state of the ecological system, its trends, and the underlying causal relationships that drive it remains incomplete. As with climate change, acid rain, and biodiversity, successful forest management requires understanding the science and also addressing the competing interests of the multiple policy actors affected by any policy responses that may stem from an assessment. Also like many global environmental problems, ecological and economic forces at the national, state, and local levels influence the health of Northwest forests, the value and viability of different management strategies, and the variety of actors who must be involved in any management effort. Although many of the specifics surely differ, this chapter offers some lessons for

Northwest forest management derived from the successes and failures of global assessments in contributing to the resolution of global environmental problems.

This chapter reports findings from a five-year research project that examined assessments of climate change, biotechnology, acid rain, persistent organic pollutants, fisheries, and water management in an attempt to explain why some assessments had significant influence while others had almost no influence. For example, the most influential of several assessments of acid rain in Poland and Bulgaria were those that involved consultation with a range of stakeholders, including various ministries, sulfur-emitting power plants, and environmental advocacy groups. Similarly, advice based on climate forecasts regarding the planting of drought-resistant plants in Zimbabwe was followed more consistently by those commercial farmers involved in developing that advice than by subsistence farmers who were simply handed planting advice by agricultural extension service agents. Qualitative comparisons both within and across ten such qualitative case studies have led to four main conclusions that are described in the first section. The second section then demonstrates how an assessment's influence depends on the extent to which different audiences judge the assessment as salient, credible, and legitimate. How assessment institutions respond to the many obstacles to assessment influence is covered in the third section. The final section examines scientific assessments of Pacific Northwest forests in light of our framework and suggests that careful, consistent institutional design may increase the chances of science contributing to government policy making and legal decision making.

A Framework for Understanding Assessment Influence

How does scientific information influence global environmental management, and what distinguishes influential assessments from those that “sink without a trace?” We summarize here several major findings.

1. *Influential assessments are rare. An assessment is more likely to have influence if multiple audiences perceive it as salient, credible, and legitimate. Assessment influence is usually indirect, altering an issue's development by identifying and defining a problem, mobilizing certain actors, and altering the goals, alternatives, and knowledge actors consider germane to that problem. Significant influence depends on three "attributions" multiple audiences make about an assessment, "attributions" that are not objective characteristics of an assessment but that reflect actor-specific criteria and standards:*
 - *Salience:* Is the assessment relevant for me either because it can inform my behavioral choices or because others who find it relevant to their choices are likely to use it?
 - *Credibility:* Is the assessment reliable in the sense of meeting my standards of scientific plausibility and technical adequacy better than other available sources of information on current and future states of the world, causal relationships, and likely outcomes from decisions?
 - *Legitimacy:* Is the assessment respectful and unbiased in addressing the values, concerns, and questions of myself and others I believe it should address?
2. *Assessments frequently lack influence due to barriers and boundaries that separate information "producers" from information "users" and that separate users from each other. Boundaries between science and policy, different countries, competing interests and ideologies, and actors operating at different scales inhibit use of an assessment's information. Producing any assessment requires bridging a wide variety of barriers. Producing an influential assessment requires being attentive to multiple audiences, each of which evaluates assessments using a different set of social, cultural, political, economic, and scientific criteria.*
3. *Assessment processes gain influence by recognizing the tensions and trade-offs among salience, credibility, and legitimacy. Making an assessment salient enough, credible enough,*

and legitimate enough to convince even a single audience to change its beliefs and actions is challenging since choices that increase salience often reduce credibility and legitimacy, and vice versa. And choices that increase salience (or credibility or legitimacy) with one audience often reduce its salience (or credibility or legitimacy) with one or more other audiences.

4. *Assessment institutions' formal and informal rules regarding participation, scope, content, process, and framing determine which audiences find an assessment salient, credible, and legitimate. The difficulty of making assessments influential makes procedures for institutional learning particularly important.* Our research highlights that no single institutional design consistently produces influential assessments. Influence derives from addressing questions, employing evidence and expertise, and following processes that reflect the multiple, intersecting, and competing interests and abilities of potential users of that particular assessment. Assessments have been made influential by involving relevant stakeholders, by regulating the assessment's scope and content, and by their framing of certain facts, beliefs, and options (and not others) as central to resolving a problem. Provisions for institutional learning and self-reflection are essential given the many obstacles to producing effective assessments.

These findings are drawn from some cases in which assessments produced direct and immediate changes in policies and behaviors. Policy makers may request an assessment and incorporate its findings into current debates or follow its recommendations. Likewise, assessments sometimes provide local economic and social decision makers with new information that clarifies their interests and the impact of their behaviors in ways that lead them to change those behaviors. Yet, our project has found such short causal chains between assessments and policy or behavior change are the exception; the influence of most assessments is less direct or immediate. Assessments often alter the policy realm in ways that take time before their effects are evident

in shifts in the policy debate or changes in the choices of policy makers and economic and social actors.

One major, indeed often intended influence of an assessment is to make “problems” out of policies and behaviors whose environmental impacts were previously ignored or considered benign. To alter policy and behavior, an assessment must convince policy makers that a problem exists. Thus, the several American and international assessments of carbon dioxide and global warming undertaken during the late 1970s and early 1980s failed to produce any significant political action on climate change. Indeed, the scientific conclusions of the 1985 “Villach” climate change assessment (produced under the auspices of the International Council of Scientific Unions, the World Meteorological Organization, and the United Nations Environment Programme) were almost identical to those of previous assessments. Unlike earlier assessments, this assessment convinced influential political actors of the need for action because the same science was now more salient to policy makers. This was due to more careful framing by the assessment’s authors and heightened global environmental concern in response to negotiations of the first ozone depletion agreement (Torrance in press). Assessments can also alter political debates because their nominally descriptive claims about the causes of an environmental problem become politically charged allocations of blame for the problem and responsibility for its resolution.

Putting an issue on the policy agenda or raising its visibility can lead many actors—and may require policy makers—to discuss the issue. Assessments increase the attention, concern, resources, and strategies that already engaged political and economic actors bring to an environmental issue. Those already active on an issue may publicize elements of an assessment to mobilize those with coincident interests without mobilizing their opponents (Litfin 1994). Media coverage of an assessment also leads some actors to mobilize (and others to demobilize) and makes some arguments easier (and others harder) to make.

Assessments also alter what goals and options are considered politically viable. Even if an assessment does not alter an actor’s core values and preferences, by drawing attention to an

issue an assessment can lead actors to increase the priority given to certain goals and decrease that given to others. Identifying the environmental consequences of a policy can introduce environmental goals into decisions previously viewed as economic or national security concerns. Assessments also introduce new options, alter perceived costs and benefits of existing options, and increase the costs of doing nothing.

Audience Attributions as Conditions for Assessment Influence

Our research was motivated by the recognition that, as the climate change example suggests, some assessments have considerable influence while others have little, if any. We have found the best explanation of this variation in the differences in judgments or attributions made by different audiences of an assessment's salience, credibility, and legitimacy. Each audience uses its own values and standards in making such judgments which, in turn, determine their responsiveness to an assessment.

Salience

An assessment's influence begins with salience; that is, actors must be both aware of the assessment and deem it relevant to their behavior. An assessment can be salient because an audience considers the information directly important to its choices or because so many other actors are thinking about, talking about, and acting on the information that it cannot be ignored. Assessments often lack salience because producers of an assessment focus on scientifically important rather than policy-relevant questions. Similarly, they may address relevant questions too late, after decisions they might inform have been made. Yet, they also can arrive too "soon," as evident in the early climate change assessments that lacked influence because policy makers were not yet receptive to scientific calls for action on this global environmental problem (Torrance in press). Assessments also lose salience when their solutions are not tailored to the scale, scope, or context needed by users (Cash in press, Moser in press, Patt in press).

Credibility

Assessments must also be credible. Audiences must see the assessment's facts, theories, causal beliefs, and options either as "true" or as better than competing information. Scientific assessments are useful precisely when complexity and uncertainty preclude most people from independently evaluating scientific information on a topic (Haas 1992). Thus, policy makers and other audiences must evaluate an assessment's credibility "by proxy" based on credentials and process. Usually credibility is based on expertise and trustworthiness. Audiences judge expertise by whether experts from requisite disciplines were involved and whether appropriate data and models were used (Botcheva-Andonova in press). Audiences judge trustworthiness based on an evaluation of whether assessment processes generally protected the biases and policy preferences of assessment producers from unduly influencing the knowledge creation and dissemination processes. Thus, credibility comes more readily for assessments that are consistent with existing knowledge or face few alternative sources of information. Credibility with many audiences can be undermined if "outside" scientists question an assessment's perspectives, assumptions, data, and models. Independent Canadian scientists undermined government fish stock assessments by criticizing their data sources and statistical methods (Alcock in press). American climate change "skeptics" have highlighted uncertainties about both the extent and causes of climate change (Franz 1998). Indian scientists have reduced the influence of Intergovernmental Panel on Climate Change (IPCC) reports by arguing that climate change is not caused primarily by the "normal, legitimate" activities of all countries but by the "aberrant, luxury" activities of a relatively few industrialized countries (Biermann in press).

Legitimacy

Lastly, assessment influence depends on attributions of legitimacy. Audiences want to know an assessment process was "fair" and considered appropriate values, concerns, and perspectives. Concerns regarding who participated and who did not, the processes for making those choices, and how information is produced, vetted, and disseminated play important roles

here. Legitimacy often requires either involving relevant stakeholders or taking their concerns, perspectives, and interests into account. Central to legitimacy is the notion that if scientific assessments are going to influence policy, then the interests of those affected by those policies should be considered in the assessment process. Actors contest the legitimacy of assessments supporting policies that disproportionately harm their interests. Thus, in biosafety negotiations, developing country governments have challenged assessments that promote a narrow definition of genetically modified organisms (GMOs) out of fear they will not be able to manage the flood of imports (and associated risks) that would result if only a limited list of GMOs are regulated (Gupta in press). Processes can be as important to legitimacy as outputs. Indeed, an actor may reject even those recommendations in an assessment that coincide with their interests if they believe the assessment process was controlled by those opposed to their interests.

How Institutions Foster Assessment Influence

Producing an assessment that is influential with multiple audiences requires managing boundaries that divide science and policy, diverse disciplines, and local, national, and even international jurisdictions. Strategies, mechanisms, and conditions that promote one attribution with one audience often undermine other attributions with other audiences. For instance, institutional efforts to enhance an assessment's credibility by involving the "most qualified" scientists may undermine salience and legitimacy with those who believe their perspectives and concerns would be ignored by an economically and politically nonrepresentative set of scientific elites. On the other hand, including nonscientists or poorly qualified scientists to enhance legitimacy or salience can undermine credibility with other audiences. Similarly, an assessment that limits itself to "the science" may have little salience for policy makers, and an assessment too attentive to policy debates may lack credibility with scientists. Institutions and entities conducting assessments therefore face a difficult

task of managing the many boundaries that impede assessment influence (Cash 2001, Guston et al. 2000).

Managing these boundaries effectively to minimize trade-offs and tensions among salience, credibility, and legitimacy involves choices regarding participation, scope, content, processes, and framing. Although assessment “institutions” sometimes consist simply of an ad hoc group of scientists who produce a single “state of the science” report on a given issue, many assessments result from the work of ongoing social institutions consisting of regular meetings and formalized procedures, as evident in the annual stock assessments common to much international fisheries management. The complexity of managing multiple attributions across multiple audiences dictates that assessment institutions (whether ad hoc or ongoing) usually succeed only by learning from, and improving on, either their own experience or that of other institutions.

Participation

Since most audiences’ evaluations of salience, credibility, and legitimacy involve asking “Who wrote this assessment?” increasing an assessment’s influence requires institutional designs that either involve members of an audience directly in an assessment or establish processes that ensure their knowledge, ideas, and concerns are incorporated in the assessment. For example, power plant operators, farmers, and fishermen have been far more supportive of and responsive to recommendations in those assessments of acid rain, drought forecasting, and fish stocks in which they have been involved (Botcheva-Andonova in press, Patt in press, Alcock in press). These strategies make it more likely that audiences on various sides of science–policy, national, scale, and interdisciplinary divides understand the concerns and perspectives of those on other sides of those divides. Participation influences salience by addressing an audience’s questions and concerns, incorporating information they have on a problem, and providing information and recommendations sensitive to the decisions they face and the context in which they face them. Participation influences credibility by determining

which audiences view assessors as having the necessary expertise and trustworthiness. Participation influences legitimacy by bringing relevant stakeholders' values and perspectives into the assessment and providing evidence that this occurred, thereby increasing the likelihood that findings and recommendations "make sense" to those the assessment seeks to influence. Participants also help communicate an assessment's results in ways that make it more salient, credible, and legitimate to their constituencies (Eckley in press).

Scope, Content, and Process

What an assessment does and does not assess also matters. Attributions of credibility depend on specific, not generic, notions of what expertise is relevant to a given problem. Legitimacy also declines when audiences view an assessment's scope as exceeding the expertise of those involved. Some institutions balance salience and credibility by involving nonscientific stakeholders in scoping an assessment and framing the final report while having scientific experts manage the analysis. The use of scientific findings by coastal zone managers in Hawai'i and Maine and water districts in the American Midwest has depended critically on ongoing discussions among government officials, local decision makers, and stakeholders to ensure relevant questions are asked and answered in a timely manner (Moser in press, Cash in press). At times, making an assessment salient to decision makers requires engaging social scientists as well as natural scientists and having the assessment directly address policy-relevant questions. Managing these tensions sometimes requires building rather than bridging boundaries: the IPCC enhanced its Third Assessment Report's credibility by relying on separate working groups to address aspects of climate change requiring different types of expertise (WG-1 on climate change science, WG-2 on impacts, adaptation, and vulnerability, and WG-3 on mitigation) but maintained its salience by producing a "Summary for Policymakers" explicitly designed to provide "policy-relevant, but not policy-prescriptive," answers to the questions of climate change negotiators (Watson and the Core Team 2001, 1).

Framing

How an assessment defines and discusses a problem and potential solutions also conditions its influence. Framing—how included information is worded, shaped, and contextualized—reflects both the self-conscious scientific and policy goals of assessors and their often less self-conscious interests, biases, and blind spots. Careful framing can increase the chances that an assessment disrupts an existing equilibrium of goals, options, and knowledge by convincing various audiences that current policies and behaviors are no longer the best ways to achieve their goals. “Marketing” assessments requires framing them in ways that audiences can understand and incorporate. An assessment in Maine made the far-off risks of climate change more salient to policy makers by noting that current decisions about shoreline developments would increase the state’s vulnerability to sea-level rise by limiting the state’s ability to respond to it (Moser in press). Salience depends on communicating assessment content to resonate with an audience’s current goals and concerns, definition of a problem, and preferred solutions. Those who conduct an assessment can influence but not control its framing since industry, nongovernmental organizations, and the media usually are central to the introduction of assessments into the policy debate. Beyond framing issues, increasing the chances that an assessment will alter behavior can require helping audiences develop the capacity to understand findings in an assessment (Gupta in press, Biermann in press). Many poor Zimbabwean farmers did not plant drought-resistant crops in response to climate forecasts because agriculture extension services did not devote resources to helping those farmers understand the forecasts (Patt in press).

Learning and Self-Reflection

Assessments perform these complex tasks better when they institutionalize critical self-reflection and evaluation (Gunder-son et al. 1995, Social Learning Group 2001a, Social Learning Group 2001b). Scientific assessments are social communication processes intended to manage the boundaries between experts and decision makers. Some institutions assemble an assessment

group, produce a single report, and disband; others produce sequences of assessments on different problems; and yet others dedicate considerable resources to ongoing assessments, for example, of fish stocks, acid rain, and climate change (Alcock in press, VanDeveer in press). These different designs pose different challenges to learning. Relatively transient assessments can tailor participant lists and processes to match particular problems and audiences but may also reinvent networks of participants, recommit obvious blunders, and leave behind few lessons for others (Eckley in press). More permanent assessment organizations, like those addressing water management in the American Midwest, capture lessons from prior assessments in personnel and procedures and develop networks of assessment producers and users who, over time, learn to work with and understand one another (Guston 1996, Guston 1999, Cash in press). But risk aversion, reluctance to admit error, reliance on a fixed set of participants, and other problems common to more permanent bureaucracies may also impede learning.

Environmental Assessments and Management of Pacific Northwest Forests

What lessons can global environmental assessments offer us regarding scientific assessments of Pacific Northwest forests? Examining over a dozen regional assessments of these forests described by Haynes and Perez (2001), Johnson (1997), and Yaffee (1994) confirms that they have faced pitfalls similar to those encountered by global assessments and have succeeded when using similar strategies. Most, though not all, have had little influence on forest management (Johnson 1997, 407–8). In part, this reflects inherent obstacles to the influence of science in a highly contested policy context. Forest science is already salient for many audiences in the Northwest and the nation, but the underlying conflict between economic and ecological perspectives on forest management has regularly led multiple audiences to reject scientific inputs as illegitimate and to call into question their credibility.

Participation rules help explain why some assessments have been more influential than others. The 1993 Forest Ecosystem Management Assessment Team (FEMAT) report had considerable influence on the policy debate, but its participation rules produced implementation difficulties. The decision to involve political appointees from the Clinton administration while excluding federal forest managers undercut FEMAT's scientific credibility. It also led to legal challenges and undermined the legitimacy and salience of FEMAT's findings with the very people charged with implementing its complex management procedures (Johnson 1997, 406–7). By contrast, the 1994 Northwest Forest Plan (NWFP) that emerged from the FEMAT process required creation of adaptive management groups to facilitate the use of science in forest management. The NWFP's promotion of interactions between scientists and managers has led "to research with greater policy relevance, altered the way in which some scientists selected and pursued research agendas, and altered notions of the process to ensure science quality." Additionally, it has helped managers devise "scientifically sound, new approaches to managing ecosystems," tested their efficacy in managing ecosystems for multiple uses, and demonstrated the relevance of research to ongoing forest management (Haynes and Perez 2001, 98–99, 101).

Even participation in basic data gathering can improve both the science being done and the acceptance of subsequent scientific findings. Although forest ecosystems do not hew to private/public distinctions, most assessments have analyzed data regarding forests on federal land because data for private forestlands are usually not available (Johnson 1997, 403). If they could be engaged in the assessment process, private landowners could offer scientists otherwise-unavailable data that would improve scientific research by providing both a more complete picture of Northwest ecosystems and more information about different strategies of forest management. Over time, an ongoing dialogue of private landowners and loggers with scientists and managers could facilitate mutual understanding that would make scientific findings more credible, especially if those findings reflected data provided by landowners. It may also ease implementation difficulties, as landowners come

to see their concerns reflected in forest management decisions. This type of positive dynamic between stakeholders, scientists, and managers was particularly evident in one of our case studies: although eastern European power companies had good reason to resist costly power plant regulations designed to meet European Union environmental standards, involving them in assessments of how to meet those standards produced more credible science. Corporate data was far more accurate than government data, and corporate involvement produced regulations that these companies were more willing to accept, since they saw their concerns addressed and treated with respect (Botcheva-Andonova in press).

A major obstacle to the influence of forest assessments stems from the deep conflict in the values, interests, and biases of loggers, environmentalists, and other audiences involved in the forest policy debate. Yet, the assessment process itself may help reduce these conflicts. Deeply held views do not change overnight, nor are they particularly susceptible to the influence of scientific information. But involving nonscientists (both stakeholders and managers) in ongoing and joint assessment processes to foster the short-term goal of increasing the incorporation of scientific insights into economic and political decisions can, over the long term, also foster deeper understanding among competing stakeholders. If scientists and forest managers can channel the shared interest of timber companies, woodland owners, and environmental groups in improved scientific understanding of forests into joint exercises in data collection, model building, and environmental monitoring, those joint assessment exercises can build trust and facilitate understanding among those with initially opposing views. In the best of circumstances (which, admittedly, are difficult to create), the focus of such efforts on “the science” rather than “the politics” can foster mutual understanding and even grudging respect, which in turn can be the foundation for subsequent consensus building on larger issues. Assessments will be taken more seriously by competing sides in the forest debate if those representatives of each side who are involved in the assessment can show how the questions asked make it salient, the process of conducting the science makes it credible, and the process for balancing interests and concerns makes it legitimate.

The NWFP already has elements that reflect the need for assessment processes to self-consciously learn from its experiences. Ideally, the Adaptive Management approach entails “learning partnerships” in which researchers, managers, and stakeholders can participate together in developing alternative management techniques, identifying their ecological and economic impacts, and discussing the valuation of those consequences (Haynes and Perez 2001). This produces a more coherent and integrated form of management in which assessments are long-term processes with experts and users “co-producing” a shared body of usable knowledge. The NWFP also has developed a “multiple pathways” approach of random allocation of two or more management treatments to similar areas to compare their impacts. This approach has obvious analytic benefits in providing “controlled case comparisons,” but has also required stakeholders (who often have “little tolerance” of other stakeholders’ values) to “temporarily suspend their opposition to alternative views to allow the comparison” (Haynes and Perez 2001, 41–42). Although the temporary suspension of opposition is accepted by stakeholders for scientific reasons, it starts a process of collaboration and mutual respect that can have important social consequences (Haynes and Perez 2001, 42).

President George W. Bush’s Healthy Forest Initiative of 2002 runs some risk of altering these positive trends (Bush 2002). Although the Initiative calls for a renewed commitment to the NWFP’s conservation strategy of balancing timber and environmental interests, it also calls for “long-term stewardship contracts with the private sector, non-profit organizations, and local communities” (Bush 2002, 3). If those contracts provide those who receive them exclusive authority in forest management, they are likely to undo recent gains in forest management made by having timber companies and loggers work with scientists, forest managers, and other interested stakeholders. If, instead, those contracts include provisions that require or foster such cooperation, they may allow continuing progress in incorporating improved science regarding what makes a “healthy” forest into improved practices that actually make our forests healthier.

Institutional design plays a crucial role in how much scientific information influences contentious policy debates, such as

the debate over the future of the Northwest forests. Ensuring that environmental assessments foster effective environmental policy requires ongoing cooperation among scientists, policy makers, resource managers, and stakeholders. But fostering such cooperation requires bridging the many boundaries between these different actors in the policy process. For forest science to contribute to sustainable ecosystem management, multiple audiences must simultaneously view the science as salient, credible, and legitimate. The current NWFP has already taken important steps away from the traditional conception of assessments as “a one-way transfer of information from scientists to managers” and stakeholders. Rather, it pays attention to manager and stakeholder interests and perspectives and thus increases the contribution science makes to policy by asking salient questions and taking account of legitimate social, political, and economic concerns. The NWFP’s ultimate success, however, will require going yet further to bridge the numerous boundaries that separate scientists, policy makers, managers, and stakeholders.

Notes

This chapter summarizes the findings reported in William C. Clark, Ronald B. Mitchell, David W. Cash, and Frank Alcock, *Information as Influence: How Institutions Mediate the Impact of Scientific Assessments on Global Environmental Affairs* (Cambridge, Mass.: Kennedy School of Government, Harvard University, Faculty Research Working Paper RWP02-044, 2002) and in Ronald B. Mitchell, William C. Clark, David W. Cash, and Frank Alcock, eds., *Global Environmental Assessments: Information, Institutions, and Influence* (book manuscript currently under review). These ideas were developed over five years of collaborative research, working closely with fellows and faculty engaged in the Global Environmental Assessments project. For more information on the Global Environmental Assessments project, please visit <http://environment.harvard.edu/gea/>. We wish to thank all the fellows and faculty involved in that project for their helpful insights throughout the project. The ideas in this chapter were influenced, in particular, by work with Robert O. Keohane and Barbara Connolly, to whom we are deeply indebted. The Global Environmental Assessment (GEA) project has been supported by

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