Credibility and Advocacy of Environmental Scientists in Resource Decision Making: A Regional Study[1]

Denise Lach, Ph.D., Center for Water Quality and Environmental Sustainability, Oregon State University and Peter List, Ph.D., Department of Philosophy, Oregon State University

Abstract. This paper discusses some results from a regional study of the proper roles of ecological research scientists in natural resource decision-making. The study was conducted in the Pacific Northwest by researchers at Oregon State University and focuses on scientists involved in the Long Term Ecological Research Program (LTER). Using data from interviews and mail-out surveys, the paper describes and compares the attitudes of two groups, scientists and natural resource managers, regarding preferred scientist roles, advocacy by scientists, and factors affecting the credibility of scientists. Two models about these roles are considered: a traditional model that separates scientists from resource decision-making and an emerging model that integrates them into resource management. Survey results indicate that scientists and resource managers favor the second model: both groups strongly support research scientists becoming more involved in management, though neither group prefers advocacy of particular management choices by research scientists. Moreover, while scientists and managers differ about the most important factors that affect the credibility of scientists, study results suggest that the credibility of research scientists in management will depend in part on their ability to communicate with non-scientific audiences, a factor highly valued by managers but not by scientists. Finally, the authors conclude that the results support Kai Lee's concept of civic science, in which research scientists assume a more activist, integrated role in adaptive environmental management.

Keywords: advocacy by scientists, Kai Lee's civic science, LTER, natural resource management, roles of research scientists, scientists' credibility

1.1 Introduction

While most theorists and participants have normative expectations that including ecological scientists and scientific information will improve the quality of complex natural resource decisions, there is little empirical evidence that clearly verifies such benefits. And, there is increasing experiential evidence that tensions between the distinct institutional needs and cultural values of decision makers and scientists may preclude the effective use of science in such decisions (e.g., Brown and Harris 1998; Collingridge and Reeves 1986; Meidinger and Antypus 1996).

Even as natural resource decisions are becoming more complex, public expectations for involvement in natural resource management has experienced noticeable growth over the past thirty years (Steel and Lovrich 1997). Requirements for public involvement have produced a wide-scale dilemma for resource managers: how is it possible to increase public involvement in decision processes, thereby enhancing their democratic quality, when management of ecoystems is scientifically and technically complex? There is concern that the increasing need for expertise will result in the critical erosion of democracy (Pierce et al 1992). On the other hand, some argue that the public's distrust of experts and resource managers may well hinder the effective management of ecosystems and other natural phenomena.

Adding to the complexity are the personal views of scientists about their role in making resource decisions. Traditionally, scientists have been reluctant to become "advocates" for specific management alternatives (Shrader-Frechette and McCoy 1993) or sometimes even to explain scientific results to non-scientific publics. Recently, however, some prominent scientists are suggesting that they and their colleagues need to take a more direct role in policy decisions (Lubchenco 1997), and research funding organizations are exhibiting increased expectations for greater scientist involvement in policy-relevant efforts (Lane 1997).

Our study examined this quandary from the perspective of ecological scientists, natural resource managers, representatives of public interest groups, and the interested public in the context of the Long Term Ecological Research Program (LTER), a multi-site research effort that has been supported by the National Science Foundation (NSF) since 1980. Ecological scientists at LTER sites around the country, Antarctica, and Puerto Rico are producing basic ecological

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knowledge that is changing the way scientists and lay people view the natural world (Luoma 1999). They are also increasingly expected to participate with non-scientists in efforts to develop and even implement natural resource policies.

We were particularly interested in LTER scientists for several reasons. First, scientists working at LTER sites are conducting a variety of basic research projects that are funded by the NSF at least in part because they meet the criteria of "social relevance." Second, scientists at LTER sites represent a wide range of research organizations including colleges and universities, private research laboratories, and federal and state agencies. At the same time, LTER participants also represent a wide range of investigative and policy involvement from early-career scientists, managers, and public participants to "old hands" who have lived through shifts in natural resource policy, public attention, and public values. Finally, some LTER scientists collaborate with natural resource managers and the public in resource decisions and provide input to policy makers at local, state, and national levels. For example, scientists from the H.J. Andrews LTER site located in Blue River, Oregon, in the Oregon Cascade Mountains, participated directly in developing President Clinton's Northwest Forest Plan (FEMAT 1993).

The objective of this presentation is to describe the attitudes and expectations of scientists and resource managers involved in natural resource decision-making in the Pacific Northwest. We address differences in attitudes about the perceived roles of ecological research scientists, advocacy by scientists, and factors that affect the credibility of scientists, set in a social context of decentralized governance, shared power, collaborative management, and citizen mistrust of experts and government resource agencies.

1.2 Research Approach

In 1999 and 2000 we collected information from four different groups involved in the management of natural resources in the Pacific Northwest (Oregon, Washington, Southeast Alaska, Northern California): natural resource scientists at universities and Federal agencies, managers of state and federal programs, members of natural resource organizations (e.g., environmental groups, industry associations), and the "interested public." [2] We conducted 50 face-to-face interviews and administered mail-out surveys to representatives of each of the four groups.[3]

This presentation looks specifically at comparisons between two of these groups, natural resource managers and scientists, on attitudes regarding preferred roles, advocacy, and credibility of ecological research scientists. 189 scientists received surveys and 155 were completed and returned; 216 managers received surveys and 167 were completed and returned.

1.3 Underlying Models of the Role of Scientists and Scientific Information in Natural Resource Management

The traditional model of the role of scientists[4] and scientific information in decision processes is an outgrowth of the philosophy of positivism, which clearly distinguishes between science and policy, facts and values, the roles of scientists and policy makers. It suggests that where science is relevant to policy processes, the role of scientists is to facilitate management decisions by providing objective scientific information to managers and policy makers, who in turn have the responsibility to debate management options, interpret scientific information, and make decisions. Laboratory or experimental scientists are not themselves to be directly involved in management or to make decisions. They are also not to be advocates of particular management options or alternatives, or to expect that their personal management preferences have any special weight or merit. They are not policy experts nor trained in the intricacies of resource management. Scientists are not to become biased by involvement in resource management or to become "advocates." In this model, science itself is revered by managers, and has a special authority in resource management, but scientists lose their credibility (as scientists) if they cross the line between science and policy, science and management. We get, then, a "separatist" role for scientists; they are removed from management and policy and serve as scientific experts only. They are called upon as the need arises and as policy-makers, managers, and the public require.

[2] We define "interested public" as those having participated in a public hearing, providing a comment on proposed plans, or in some other way identifying themselves as aware of and participating in the decision processes of natural resource decision making that are open to the public.

[3] Our response rate for the survey samples was as follows: scientists 82%; resource managers, 77%; members of interest groups, 60%; and the interested public, 76%.

[4] The term "scientists" is ambiguous and applied broadly to many individuals, including those who actively do research and those who work as advisors or managers. Sometimes we refer to the broad category; sometimes to research scientists.

What we discovered in our interviews, is the presence of two “cultures” – a culture of research scientists and of resource managers - each responding to its own requirements, standards, and rewards. While scientists and managers may interact, there is a certain tension between the two brought on by these cultural differences. For example, because of the nature of scientific processes and interactions, scientists are often cautious in formulating their scientific findings about ecosystems. They may not make decisive statements about the practical implications of their research; preferring instead, to recommend the need for additional evidence if it exists, additional confirmation if possible, and for more research if all else fails. Managers, on the other hand, have relatively brief decision time frames and are bounded by legal and bureaucratic demands that may pressure them not to wait until all the best scientific evidence is in or specific scientific theories are confirmed.

A second, emerging model challenges this first model, not so much on the authority of scientific information, as on the proper roles for research scientists in management. It proposes that such scientists should become more integrated into management and policy processes. It suggests that they need to come out of their labs and in from their field studies to directly engage in public environmental decisions within resource agencies and elsewhere (e.g., courts, public hearings). There is a need for more science in these processes and decisions, the model implies, but this can only be brought about if research scientists themselves become more actively involved. Moreover, the model suggests that scientists should not hesitate to make judgments that favor certain management alternatives, if the preponderance of evidence and their own experience moves them in certain practical directions. They, after all, are in the best position to interpret the scientific data and findings and thus are in a special position to advocate for specific management policies and alternatives.

The sources of this emerging model are various. One key factor is the increasing complexity of resource problems, now often described as “wicked problems.” And this complexity is enhanced by statutory requirements in federal and state laws, which have tended to democratize and localize resource decision-making. There is also the coincident perception that more science is needed to solve these problems. Moreover, public and other expectations about the role of scientists may also be changing, particularly with what appears to be an increasing public skepticism about the ability of bureaucracies to make sound environmental decisions, regardless of the scientific knowledge available. This emerging “integrative” model calls for personal involvement by individual research scientists in bureaucratic and public decision making, providing expertise and even promoting specific strategies that they believe are supported by the available scientific knowledge.

1.4 Preferred Roles for Research Scientists and Scientific Information

In order to assess orientations toward the two models described above, we developed a list of five potential roles of scientists. These “ideal types” reflect a complex relationship among expectations of science, attitudes about resource management, and decision-making styles. Through interviews, observations, and previous surveys of scientists and natural resource managers, we have found that these descriptions accurately describe distinct preferences for the role of research scientists in natural resource policy. While the categories reflect levels of preference for scientist involvement ranging from minimal to dominant roles, they also distinguish between “science as an activity separate from other, non-scientific activities” and “science as an activity integrated with management and other non-scientific activities.” The five roles for research scientists in natural resource decision making include:

- Scientists should only **report** scientific results and leave others to make natural resource management decisions.
- Scientists should report scientific results and then **interpret** the results for others involved in natural resource management decisions.
- Scientists should work closely with managers and others to **integrate** scientific results in management decisions.
- Scientists should actively **advocate** for specific natural resource management decisions they prefer.
- Scientists should be responsible for **making decisions** about natural resource management.

The first role limits research scientists to reporting results and letting others make resource decisions. This reflects the “traditional role” for scientists as discussed above. As part of the “emerging role,” we described two possibilities for the role of scientists. The first is for research scientists to interpret scientific results so that others can use them. This is often expressed as a scientist’s promise to granting organizations that the results will be “translated” for non-scientific users. A more involved role for research scientists is to work closely with managers and others to integrate scientific results in resource policies and decisions. Implementation of “adaptive management” experiments in Pacific Northwest forests often reflect this type of scientific integration in resource decision making. Another potential role is for research scientists to actively advocate for specific resource policies or management decisions that they prefer or believe flow from their scientific findings. A final role, reflecting the increasingly technical and complicated decisions facing natural resource managers, is to have such scientists make resource decisions themselves.

This list is not really a scale, and we asked respondents to tell us how much they agreed with each of these potential roles. The roles are thus not mutually exclusive, although it is unlikely that any one who reports favoring a minimal role for scientists will also prefer the technocratic role of putting them in charge of resource decisions. We asked respondents to report how much they agreed with each of the roles on a five-point scale from "highly disagree" to "highly agree." For the purposes of this presentation, we collapsed the "highly agree" and "agree" into a single "agree" category. Figure 1 describes the responses from the scientist and manager respondents.

	Scientists		**Managers**	
	Agree	Disagree	Agree	Disagree
Report	39%	48%*	42%	34%
Interpret	88%	5%	78%	7%
Integrate	76%	7%	90%*	3%
Advocate	16%*	63%	9%	60%
Make Decisions	4%	81%	7%	79%

***** Significant at $p < .05$

Figure 1: Proper Role of Scientists in Natural Resource Decision Making

Both scientists and managers are split in their preference for the "report only" role for research scientists. Approximately the same number of scientists and managers agree that scientists should only report results and let others make decisions. But, almost half of the scientists disagreed with this role while only one-third of the managers did. This difference is significant. Both scientists and managers agree that interpreting results for others is an appropriate role for research scientists. More scientists and managers see this as an appropriate role than just reporting results, the traditional role for such scientists. While most scientists and managers agree that an integrative role for research scientists is appropriate, managers were significantly more likely than scientists to agree that scientists should work closely with others to integrate the results of science into decision-making. Many scientists and managers reported that they disagreed with an advocacy role for research scientists. But, interestingly, significantly more scientists than managers identified this as an appropriate role. Almost no scientists or managers agreed that it was an appropriate role for research scientists to make resource decisions on their own.

In sum, managers and scientists have very similar preferences for the potential roles of research scientists in natural resource decision-making. Both scientists and managers are more likely to agree that integrative roles are more preferable than any of the other roles, including the minimal traditional role.

1.5 Scientist Credibility

While many scientists report that appropriate roles for scientists might include more integrative roles, many also told us that they feared the credibility of scientists would suffer if they became more involved in natural resource decision making. So, based on our initial interviews, we investigated a large number of factors that might influence their credibility – including advocacy. We also asked respondents to tell us how important each of the factors is in contributing to a scientist's credibility. Figure 2 describes the top seven factors identified by scientists as most important to a scientist's credibility. It also includes responses of managers to the same factors. Again, for the purposes of this presentation, the categories of "very important" and "important" are collapsed into a single category as are the “not very” and “not important” categories.

Scientists’ Top Credibility Factors	Scientists	Managers
Quality of methods*	96%	81%
Data generated*	96%	64%
Hypotheses and theories*	90%	57%
Reputation*	84%	64%
Ability to communicate with peers	78%	not asked
Quality of journals*	73%	35%
Ability to communicate with resource managers*	71%	90%

*Significant at $p < .05$.

Figure 2: What Makes a Scientist Credible? Scientists’ View

Responses to all of the most important factors contributing to a scientist’s credibility are significantly different between scientists and managers.[5] Not surprisingly, the quality of methods, data generated, and the hypotheses and theories used were rated by almost all scientists as important to a scientist’s credibility. These are the tools of “the scientific method” and are the foundation of science. On the other hand, while many managers valued the quality of scientific methods in determining a scientist’s credibility, significantly fewer valued the importance of data generated or the hypotheses/theories used by scientists. The traditional tools for judging credibility in the scientific arena – conceptual models, quality of journals, and even the data generated – were not strong factors for managers in determining a scientist’s credibility.

Figure 3 describes the top seven factors identified by managers as important to a scientist’s credibility, and compares their responses with scientists.

[5] Unfortunately, we did not ask managers about a scientist’s ability to communicate with peers as a factor of credibility.

Managers' Top Credibility Factors	Managers	Scientists
Ability to translate results into usable information	90%	not asked
Ability to communicate with resource managers*	90%	71%
Practical results*	87%	54%
Experience and/or knowledge of managing public lands*	83%	57%
Quality of methods*	81%	96%
Reputation*	76%	84%
Interdisciplinary focus	76%	69%

*Significant at p< .05.

Figure 3: What Makes a Scientist Credible? Managers' View

One thing to notice when looking at managers' top choices for scientist credibility is that there is some overlap on the list; three factors that show up on both lists are highlighted in the Figure 3. The ability to communicate with resource managers is at the top of the managers' list, but at the bottom of the scientists'. ("Quality of methods" was at the top of the scientists' list with "reputation" not far behind.) Managers, on the other hand, judge the credibility of scientists by their ability to deliver research results that managers can use. Scientific results must be understandable and scientists must be able to communicate with managers about results that the manager can use. If the scientist has experience or knowledge about managing public lands, all the better for their credibility with resource managers. At the same time these factors are not as highly valued by scientists.

Because communication seems to be such an important factor for managers when they are assessing the credibility of scientists, we took another look at how much communication with specific non-scientific audiences contributes to the credibility of scientist. Figure 4 describes how important this ability to communicate is to a scientist's credibility, for both scientists and managers.

Audience	Scientists	Managers
Resource managers and agency staff*	71%	90%
Legislators and other elected officials*	40%	55%
Media representatives*	28%	44%
The general public*	36%	62%
Interest groups*	33%	64%

*Significant at p < .05.

Figure 4: Importance of Ability to Communicate for Scientists' Credibility

There is clearly a significant difference between scientists and managers with regard to communicating with non-scientific audiences. While managers, in general, see good communication as fairly important to a scientist's credibility, scientist respondents view that factor as far less important.

Our results suggest that both scientists and resource managers support the "emerging model" of integrated scientist involvement in resource decision-making. While neither group prefers "advocacy" of policy choices by scientists, both groups strongly support scientists becoming more involved in resource management. And, if scientists wish to have the credibility to act in this role, especially with managers, they will need to add the ability to communicate well with non-scientific audiences to their repertoire of credibility-making skills.

1.6 Summary and Conclusions

In *Compass and Gyroscope*, Kai Lee proposes a new form of planetary stewardship he calls "civic science," a blend of science and politics that uses "adaptive management" strategies to apply scientific information to environmental policy (Lee 1993). The science involved is large scale, experimental science in the field, conducted over time scales of biological significance. It tests hypotheses about ecosystems under particular management polices and practices. Civic science requires that research scientists come out of their labs and field stations to work closely with teams of collaborators in natural resource agencies, to design and monitor ecosystem experiments, and subsequently set new management directions using results from the experiments.

Previous social research in the Pacific Northwest indicates that the public is generally supportive of basic adaptive management concepts, although there is considerable public uncertainty about this, because early adaptive management experiments are still unfolding (Shindler, List, Steel 1996). Coupled with these data on advocacy roles and crediblity of scientists, Lee's efforts to promote a more activist, integrative role for research scientists in resource and environmental management would gain support among scientists and managers as well.

Of course there will be risks involved for the research scientists who work closely with managers and the public to do ecological science on this scale and to formulate new environmental policies. Not only will some of them have to leave the comfort of their own labs and field work and their traditional interactions with scientist colleagues, they will also have to learn to work more effectively with agency personnel and managers, public interest groups, and the public. Such factors as the large scale and costs of civic science, the very real possibility for experimental error and failure, the long time spans involved in this new form of research, and the polarized nature of interest groups and of debates about resource management alternatives all pose problems for integrative scientists, as Lee indicates. Their work will inevitably come under closer public and interest group scrutiny than that carried out in the traditional scientific contexts, and it may be that the more privileged and secure role that they currently experience as generators of "objective" knowledge will be questioned, even by some of their peers[6]. Research scientists will especially have to become more effective communicators with resource managers and non-scientist groups.

1.7 References

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[6] Our interviews revealed that some scientists are wary of other scientists who "cross the line" into the management and public arenas.

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