Forest Ecology and Management 153 (2001) 189–198

Forest Ecology and Management

www.elsevier.com/locate/foreco

Roles of research scientists in natural resource decision-making

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Abstract

The issues surrounding natural resource decision-making in the present day are complex, varied and debated frequently and contentiously by the public. The complexity of the issues poses new challenges for scientists who are being asked to actively engage in this debate. This raises questions about what is credible scientific information and how such information is used in often emotionally or politically laden natural resource management decisions. One result has been an uncomfortable partnership among scientists and natural resource managers. Scientists are being asked to frame their research in ways that maintains scientific independence yet is responsive to management questions, at scales that often challenge existing scientific knowledge and under severe time constraints. Resource decision-makers are challenged to clarify their management goals, to fully understand and use the science, and to explicitly identify the level of acceptable risk. Using the Interior Columbia Basin Ecosystem Management Project as an example, lessons learned from the interaction among scientists and natural resource decision-makers is discussed and propositions for appropriate roles are presented. When properly generated, presented, and accountably used, science facilitates discussion among competing interests by helping to define the range of available choice and focusing discussions on consequences of social choice. By expanding and revealing the range of possible outcomes, scientists increase the likelihood that management decisions are understood and that those decisions can endure.

Keywords: Decision analysis; Ecosystem management; Forest management; Interior Columbia River Basin; Science and policy

1. Introduction

Decision-making in natural resources is becoming increasingly difficult for land managers, scientists, politicians, and the public. The issues are complex and public dispute is increasingly common and contentious. Issues in the Interior Columbia River Basin exemplify this situation with often contentious debates about protection of endangered species, causes of and solutions for uncharacteristically severe wildfires, restoring forest health, providing clean water, and providing a diversity of public uses.

Forest management is dramatically different than it was once. A number of changes have increased the complexity of decision-making and are at the root of why research scientists are asked to play an increasingly prominent role in policy development and implementation, particularly at larger scales:

- Growing demands on and uses of a finite land base by an increasingly diverse public has intensified conflicts. The values people hold for different resource uses have changed both in their type and importance (Committee of Scientists, 1999; FEMAT, 1993).
- There is less management discretion and delegation of decisions to, and even trust of, professional

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0378-1127/01/$ – see front matter
PII: S0378-1127(01)00461-3

natural resource managers. This in part is because today's issues are often about different ends (e.g., preservation vs. utilization), rather than just means of land management (e.g., clearcutting vs. selective harvesting).

- We understand much more about natural systems today and they are more complex than we thought (FEMAT, 1993). We now know that some forms of past resource management were not as benign as resource professionals once thought and our definition of what we want to sustain has become broader, more complex, and controversial.
- Responding to these points as well as the evolving legal challenges to resource management actions on scientific grounds has put scientists in the middle. Some parties use any tools they can to pursue their cause and science is increasingly used as a weapon in these value conflicts.

Some authors argue that research scientists have an obligation to help resolve natural resource issues that are important to society (Lubchenco, 1998) and believe that scientific information can aid understanding and resolution of policy issues (Committee of Scientists, 1999). Others, however, submit that research scientists and science organizations are poorly suited to contribute meaningfully to policy formulation, especially when the issues are politically controversial (Collingridge and Reeve, 1986). We agree with both of these positions. Research scientists and the information they create can effectively contribute to resolution of natural resource management issues and can help to discover new opportunities. Research scientists, however, must be involved carefully because working within the science–policy interface is inherently an exercise in politics and is far different from the conduct of routine research. If not done thoughtfully, both research scientists and natural resource decision-makers, and the work they do, can be placed in jeopardy.

We also believe that while the debate of these opposing views of science involvement is interesting, it is largely moot in any practical sense. The fact is that research scientists are being asked, even demanded, to engage in resource decision-making (Committee of Scientists, 1999). In this paper, we discuss propositions related to how research scientists can be successful in bringing their skills and knowledge to bear on controversial natural resource management policies. The experience with the Interior Columbia Basin Ecosystem Management Project (ICBEMP) will be used to illustrate these propositions.

2. The scientist's role in intensive policy disputes such as the ICBEMP is much different than in routine research

Requests for scientific information to facilitate the creation and evaluation of management options run the gamut from simple daily requests to complex scientific undertakings covering large landscapes and extending over long periods of time. The latter take research scientists out of their normal research element in several significant ways often putting them at odds with land management policy-makers.

Routine research studies are generally driven by questions of importance to research scientists requiring basic and/or applied research. They are conducted primarily to fill basic gaps in scientific knowledge, providing spin-offs for management and policy-making. In contrast, natural resource management applications of science are often broad scale and conditions are far less controlled in the real world. These efforts are driven primarily by resource management issues, with spin-offs for research.

Routine studies are usually completed in a relatively calm atmosphere. There are critics, but they generally are constructive allies in the scientific process and understand the "language of science" (Ravetz, 1987). Results of routine studies generally are not circulated or published until they have been subjected to quality control checks usually accomplished through rigorous peer review, which is a hallmark of the scientific process. Time delays are of little consequence relative to assurances of the quality of the scientific findings.

Policy applications such as the ICBEMP, on the other hand, are often rushed with little time to do new formal studies. Scientific work during resource management decision-making is often restricted to the synthesis of available information. Review is often hurried and frequently includes people with non-technical backgrounds, a situation that troubles some research scientists (Clark et al., 1998; Jasanoff, 1990).

When science becomes a means for creating and evaluating resource management options, and those options have public value implications such as in the ICBEMP, everyone seems to take note and the rules of engagement change. Science applications to natural resource issues are usually done in the glare of public conflict and controversy. Discrediting the science and even the scientist is a strategy sometimes used by antagonists on both sides of the issue.

3. Propositions for considering science during high profile resource management decision-making

Because what we conclude about the role of research scientists in policy disputes such as the ICBEMP is based on relatively few well-documented case studies and little long-term in-depth formal evaluation, our discussion is presented as propositions — a supposition or tentative conclusion derived from existing knowledge (Clark et al., 1998). These propositions (shown in italics) suggest ways to help focus science into areas that enhance decision-making while avoiding the pitfalls that can lead to misuse of science or erosion of research scientists' credibility. These propositions reflect the authors' judgments, but they are grounded in the literature, numerous cases, and our recent experience in major policy issues where research scientists were actively engaged as part of the policy-making process. Some of these propositions clearly apply to both research scientists and policy-makers; other propositions focus primarily on either scientists or policy-makers.

3.1. Propositions for both research scientists and policy-makers

Research scientists and policy-makers must become comfortable with one another and co-labor to develop appropriate goals, expectations, and rules of engagement. An important first step at the beginning of the project is collaborative problem framing (Clark et al., 1999; USDA, 1995, 1997), a step that is often not done well (Clark et al., 1998). Problem framing must clearly document what is to be done, by whom, and for what purpose (Ozawa, 1996; Rayner, 1996). Neither the scientist nor policy-maker can effectively define the problems in absence of the other. Co-laboring is often done in a team setting, where there are clear objectives for the team. But the team accomplishes agreed upon objectives by taking on distinct and separable roles. Both parties must avoid the common trap of initiating activities (such as data collection) prior to reaching consensus on what the problem is that needs resolving and what information is needed to do so. Working together to "get it right" upfront will save time, money, and frayed relationships. Formal, written agreements such as the ICBEMP charter and working plans are often needed to gain understanding and support (USDA, 1997). In the end, the public evaluates whether they agree with the issue and problem focus of the effort, so the public view needs consideration throughout the process.

Tension is both expected and necessary for success. Tension between research scientists and decision-makers is the manifestation of two different perspectives, both of which are needed (USDA, 1997). These tensions have many sources including different world-views, cultures, reward systems and roles (Clark et al., 1998). The strength of the interaction comes from acknowledging and embracing the diverse perspectives that both the scientist and decision-maker bring.

Disputes about control and power relationships are inevitable and should be dealt with directly. It is important to determine what activities fall within the domains of science and decision-making because there are different rules for behavior and legitimacy in each. Determining who writes and approves documents created is especially important. Science findings, for example, should be published in outlets that are subjected to the same review and approval as any other research paper; they should not be subject to the "approval" of the policy officials. Funding is often a tool through which control is exercised and there is a need for clarity about funding responsibilities up front. In sum, boundaries between science and policy must be clear (but permeable as well) for successful interaction between policy-makers and research scientists.

Ongoing, joint monitoring of progress will ensure that objectives are being met. The concept of adaptive management applies to the planning and implementation of these efforts as much as it does to the management of the land itself (Lee, 1993). Reviews of the decision process should be an ongoing enterprise by both research scientists and decision-makers and should be open to interested parties (Jasanoff, 1990). This joint review will aid mutual understanding and help to isolate situations where a mid-course correction is needed to achieve agreed upon goals. In the ICBEMP project these were done through annual work plans.

3.2. Propositions for research scientists

There are some special considerations for research scientists who find themselves immersed in intensive natural resource policy disputes.

Research scientists have critical responsibilities that will require new ways of thinking and acting. Among these are: understanding the political environment (Letey, 1999); transforming land management questions into science questions; synthesis and interpretation of existing knowledge into a management-relevant form; critical thinking and analysis in a broader context than is the norm for research scientists; isolating and evaluating the scientific and resource management implications of assumptions and caveats; documenting conclusions and logic trails that lead to them; seeking and responding to critical review from peers and other parties; communicating the science findings to diverse audiences; and responding in a professional way to attacks from hostile critics.

Research scientists must operate "outside the box" of routine research to be successful (Letey, 1999). As a social choice process, natural resource decision-making is inherently dangerous territory for the scientist. Success requires doing business in new and often uncomfortable ways. The world of integrating science and resource decision-making will mean: working on new types of problems; intense public scrutiny, criticism and attacks; cross-disciplinary science that often bring conflicting scientific ideologies, theories, and methodologies together; short time frames; different types of processes and products; and often changing questions and direction as the process unfolds. The recognition that different disciplinary perspectives generate sometimes dramatically different world-views should not be underestimated. Successfully harnessed, diversity of perspectives contributes to problem resolution in often unexpected ways; but if unsuccessfully managed, conflicts may occur limiting integration.

Research scientists must become comfortable working in a crisis-driven atmosphere. Urgency and shifting direction often characterize natural resource decision-making today. There is a substantial time-shift in policy-oriented science compared to routine research studies (Nelkin, 1977; Underdal, 1989). The scientist must adjust to the need to move from an orientation of "tomorrow" to one focused on "today". And science must be accomplished in a way that protects the integrity of the scientist as well as the policy-maker. Clarification of the degree of confidence in the science findings and a tight focus on the problem will help, but the challenges cannot be ignored.

Clarification of uncertainty and risk is essential to understand the degree of confidence in scientific conclusions. In complex natural and human systems, all of the relationships have yet to be identified, let alone understood with certainty (Thompson, 1986). Most research leads to incomplete understanding with many caveats and assumptions that make conclusions less than certain (Lertzman et al., 1996). Research scientists should clearly state the confidence that can be placed in their scientific conclusions (Mills et al., 1998). The variability around the estimated consequence of an action should be displayed in the most complete terms possible, and hopefully quantitatively. Scientist should not internalize their own risk preference within their analysis. It is the responsibility of the scientist to state the likely variability in the outcomes; it is the role of the decision-maker to judge the degree of risk that is acceptable. This is particularly relevant in land management applications where the scientific information often is being generated at the frontier of knowledge and under time constraints where standard analytical and statistical methods to measure confidence are lacking.

Quality control of the scientific information is the scientist's responsibility. Tight time lines and pressure to produce scientific results faster than the norm do not remove the responsibility or the necessity for quality assurance processes. Good planning (with ample written documentation), and intensive peer review is usually possible even in the tightest time frames and should be a minimum requirement (Clark et al., 1998; Jasanoff, 1985). Results of reviews should be formally reconciled to convey the logic and limitations of what was done and why. This will be an invaluable resource when decision processes and decisions are appealed, as they most certainly will be.

To protect credibility, science findings should be published and available for public review. Withholding (or even appearing to withhold) information is dangerous to the scientist's credibility and the decision process. An open science process assures independence and reinforces the objectivity of the science input (Clark et al., 1999; McCool and Burchfield, 1999). Public scrutiny is a key to insuring that the science information is objective and considered in decision-making (Jasanoff, 1990).

Research scientists must be prepared to respond to harsh critiques and attacks meant to undermine their credibility or to challenge their work. In cases with which we are familiar, research scientists have been attacked both professionally and personally, evidently in an attempt to undermine the credibility of their work because of its implications for the policy outcome. One of the best ways to cope with this scrutiny is to stay in the science role using time-tested strategies. If someone wants to debate the science, they must play by the rules of science, using peer reviewed information, clearly stated assumptions, and rationale. This often reveals that the debate is not about science information at all but about different value positions.

Research scientists must remain independent from the final decision to maintain their credibility. Our experience with a variety of alternatives suggests that ''separate but together'' is best for both scientists and policy-makers. In the ICBEMP project, for example, research scientists worked closely with decision-makers but maintained scientific independence through a separate organization. Research scientists were accountable to a science administrator, rather than to those making resource management decisions. Whether such efforts should be organized in rigid hierarchies or in more loosely coupled organizations is a separable issue discussed elsewhere (Meidinger, 1997).

When research scientists advocate a particular outcome or position, they place their credibility as an impartial scientist at risk. Whether research scientists should advocate a position and/or whether they can do so without compromising their role as an impartial provider of science information is hotly debated (Hammond and Adelman, 1976; Weiss, 1991). Some believe that research scientists cannot avoid being advocates (O'Brien, 1993; Shannon et al., 1996). Others feel that the scientists should function as advocates because of their special expertise (Meffe and Viederman, 1995) and to fulfill their ethical responsibilities (McCoy, 1992), and to successfully test their hypotheses (Latour, 1987). Others insist that research scientists not advocate policy positions (Lackey, 1999; Mills, 2000). In spite of these divergent perspectives, most of the authors explicitly recognize the importance of the scientist's credibility and the need to protect it. Research scientists often suggest that they are value-neutral and impartial. This is easy to say and hard to do. Human nature leads us all to form judgments about the relative merits of one position or another (Clark et al., 1998; Meffe and Viederman, 1995; Shannon et al., 1996). The issue, however, is not whether research scientists have personal values. It is whether they should espouse a personal opinion as a scientist about what they think is a good and bad resource management solution (Meine and Meffe, 1996). While the views expressed by Mills (2000) are what led us to this proposition, whatever role the research scientists takes in position advocacy should be very carefully developed so as to protect the credibility of the science information that they and others offer to the outcome.

Evaluating the consistency of the final decision with available scientific information is necessary for success (Committee of Scientists, 1999; Everest et al., 1997; Mills and Solberg, 1998). The task is to evaluate whether the relevant science information was fully and completely considered; whether it was interpreted correctly, including uncertainty; whether projections of effects are consistent with the science information, including the risks. Each of these should be revealed in the decision documentation. In concept, the science consistency evaluation is similar to an evaluation of legal sufficiency, political feasibility, or economic viability. The formal science consistency evaluation puts appraisal of decisions with regard to their scientific bases on equal footing to other evaluations of the soundness of decisions. The science consistency evaluation also aids in transferring often complex and voluminous scientific information to busy decision-makers by focusing on science information that has been ignored or misused.

If done iteratively during evolution of the decision, this can lead to a final decision that is more consistent with science. The science consistency evaluation is also a powerful tool to hold the scientist, decision-maker, and others accountable for complete and proper use of the science information.

Research scientists must recognize that scientific findings and perspectives are only one set of factors that decision-makers must consider (Franklin, 1995; Sweeney and Stangel, 1995). Research scientists can certainly help focus the debate, but science cannot, should not, and does not ''make'' the decision. Science informs the decision rather than directing any particular outcome. To assert otherwise moves the scientist from information provider to advocate, a position we believe to be inappropriate.

3.3. Propositions for the decision-maker

Resource management was not easy in the absence of research scientists; it will not necessarily be easier with their involvement. Using science and involving research scientists in resource decision-making will challenge tradition and introduce new expectations for decision-makers (Clark et al., 1998). Science is not a panacea and will not provide the silver bullet to resolve complex and contentious issues. In situations where scientific information is properly used, however, the resulting decisions should be more defensible. To this end, several expectations are necessary to achieve this benefit while simultaneously protecting the decision process.

Management goals must be clarified prior to initiating the work of research scientists. Establishing goals is one of the most important value judgments made in decision-making and they must originate with the policy-maker. Critical review of the goal setting process is as important as is review of the science that follows. After the goals and issues are clear, it is the role of research scientists to transform resource management issues and questions into appropriate science questions.

The level of risk tolerance that is biologically, politically, legally, and socially acceptable should be explicit. There will always be uncertainty because of lack of complete understanding, an inevitable outcome even after extensive scientific study. Unless uncertainty and risk are dealt with explicitly, they may be ignored or internalized within the science process, either of which impedes full disclosure of decision consequences.

Decision-makers are responsible for evaluating whether research scientists fully responded to policy needs. Important questions include: Were the policy questions appropriately transformed into science questions? Were all the appropriate scientific disciplines, theories, and perspectives involved or considered in the process? Was the information generated relevant to the decision? Have critics had access to the science findings? Were their criticisms appropriately responded to and documented? Were appropriate steps taken to ensure that uncertainty and risk were clearly described in the findings?

When confronted with differing scientific viewpoints or findings, policy-makers should request written clarification from the research scientists involved. Often, apparent differences can be explained by inconsistent assumptions, methodologies, samples, etc. But differences may also arise from ideological perspectives embedded in certain disciplines (Mazur, 1981). A clear understanding of what explains the differences is critical before deciding what may be the implications for policy.

Challenging the logic of science findings if they seem faulty is necessary for accountability. Decision-makers must master the science information to constructively use and consider it in decisions. This can be done by working with research scientists to understand findings and underlying assumptions and caveats. Challenging research scientists is appropriate if their evidence does not support their conclusions. But avoid challenging the science because the results are not consistent with personal or agency values or positions. Challenging research scientists because the ''answers'' are uncomfortable will shut the decision-maker off from information and/or take on the appearance of censorship.

Clarifying how scientific information was considered in the decision demonstrates the relative importance of science versus other decision factors. The contribution of scientific information to the credibility of the decision process cannot be realized unless it is clear to all how the science information was used (Waddell, 1989). An explicit accounting of what influenced the decision (and why) will provide supporters and critics alike fair opportunities to determine if the resulting decisions appropriately considered the scientific information made available.

4. Science and the Interior Columbia River Basin Ecosystem Management Project

The science work for the ICBEMP was a comprehensive ecological and social-economic assessment developed to provide a technical foundation for ecosystem management decisions. Science was recognized as a key part of the project from the beginning. The complexity and scope of the issues on which a decision were sought required a through understanding of resource trends and the consequences of land management alternatives, an understanding that could only be gained by a thorough science analysis. The desire for science-based decisions was also founded on the presumption that several interests would challenge any decision. While it was recognized that the science foundation alone was not sufficient, it was believed that it was an essential component of any successful decision.

In contrast to the Forest Ecosystem Management Assessment Team (FEMAT) in the Pacific Northwest, scientists in the ICBEMP stayed more in the role of information providers and land managers were more clearly in the role of decision-makers. Science in the ICBEMP was more clearly recognized as the foundation of sound decision, rather than the reason for decision.

Major policy issues related to endangered fish, forest and rangeland health, and potential consequences of policy options on human populations in the area. The project was originally envisioned as 9–12 months task but expanded to more than 5 years, as complexity of the issues became clearer. Some characteristics of how the process engaged research scientists in the assessment are briefly described below.

A charter was written for the science portions of the ICBEMP project that clarified land management questions and the management structure. Annual lists of tasks that the science team would complete augmented the charter. Periodic updates of the agreed upon tasks and periodic reassessment of the appropriate science role proved to be essential to focus efforts of research scientists.

The ICBEMP was initially an open process that provided frequent opportunities for public briefings, including interaction with research scientists. This situation created unusual pressures on research scientists who were working in an intense environment under difficult time constraints (McCool and Burchfield, 1999). The process became less open later, partly due to the controversy and desire to more efficiently complete the project. Drafts of science documents were made available to the public on a routine basis.

Supervision of the science team was retained by Research Station Directors to maintain independence from decision-makers. When technical staff from the management agencies worked on science tasks, they fell under the supervision of science leaders and played by the same science rules as the research scientists.

Science information came from both a syntheses of available science information and new studies. While completion of the new studies extended the time frame, they brought invaluable knowledge about major policy issues such as the viability of wildlife and fish and the extent of the fire risks. The lack of clarity of the land management issues in the beginning of the project extended the time frame of the science effort. In the early years that lack of clarity led to the collection and analysis of more data than was central to the issues that were being decided.

Science findings were peer reviewed through a double blind peer review process. The science findings were first published in USDA Forest Service publications because they would be available more quickly and in greater detail. Subsequent articles in refereed journals followed to make the information more widely available and to ensure greater review in the science community.

The science findings were aggressively communicated to decision-makers and other interested parties so that they could not be ignored during the public debate and decision-making process. Summary reports of the science findings were published. Briefings for the press, interest groups, local elected officials, and congressional staff were also conducted to communicate the most central conclusions. A major workshop was held with approximately 600 participants to present and discuss the science findings.

The science team projected the consequences of the decision alternatives and prepared a draft science consistency evaluation on the preferred alternative in the draft environmental impact statement. This evaluation pointed out inconsistencies in the draft decision with available scientific knowledge, what caused the inconsistency, and possible solutions that would bring the decision into consistency with the science. The evaluation also identified inconsistencies within the science information itself. Whether the decision-maker decided to achieve consistency was their choice given other factors they had to consider. The science consistency evaluation was revised as the decision evolved to provide the decision-maker updates on the progress of their decision with regard to its consistency with science. The science consistency evaluation proved to be an effective technology transfer device because it focused the attention of the decision-maker precisely on the point where their tentative decision was not consistent with science rather than spreading attention broadly.

The science consistency evaluation was a valuable tool to focus energy productively whenever research scientists felt that their information was being misused or ignored. Throughout, the science team worked to refrain from advocating any particular outcome or decision. Although there were occasional slips into advocacy, partly due to frustration with the lack of complete consideration of the science information, discussions within the science team minimized their occurrence.

In the end, benefits of the science component of the ICBEMP were many. The science assessments and evaluations of the effects of alternatives lead to a more thorough understanding of the complex system being managed, such as its dynamics and variability over space, than would ever have been gained without the science component. Science helped to focus information on issues that were most amenable to decisions at the basin-scale; scientists carefully described the scope and character of those issues, for example, the risk of fire and aquatic habitat issues and their interrelation across time and space. The projection of effects of the alternatives by the science team lead to higher quality estimates than might otherwise have been developed, avoided unproductive debate about the likely outcomes, and helped focus public dialogue on the values being traded off among the alternatives. The science consistency evaluation, although at times a point of contention between the science team and the management team, is leading to a more full and complete consideration of the available and relevant science than would have occurred without the science team's efforts.

5. Conclusions

Today's choices about the management of natural resources are conflict-laden and increasingly polarized. In an environment of extreme positions and a public increasing cynical about the ability of managers to solve problems, research scientists are being asked to take on a significant role in decisions about management of natural resources.

Although scientific information alone does not make decisions, it is our contention that science can help better inform difficult natural resource decisions in several ways.

- *Scientific information, when properly generated and presented, is neutral to differing values and can help facilitate productive discussion among different and competing interests*. Discussion of the science underlying decisions can help create a forum within which otherwise polarized interests may engage in productive dialogue and analysis of options. A two-day conference that drew approximately 600 people interested in a discussion of results of the ICBEMP scientific assessments is an example of research scientists' ability to engage a diverse audience in a neutral forum.
- *Scientific information can help focus the discussion on choices and their consequences rather than on dogmatic and polarized positions*. Ideologies (even in scientific positions) exist but science can improve information about effects of decision options, including evaluating merits of positions stated by antagonists and research scientists with opposing perspectives and theories. The science team's presentation of options and their consequences helped focus the public dialogue on choices.
- *Scientific information will enlighten decision-makers about the range of available choices, and may even lead to new options that embody greater compatibility among competing interests*. A clear range of choices provides hope that more of the competing needs of the different stakeholders will

be met. Whether or not such analysis reveals more or fewer choices depends upon the decision-making context and constraints. Evaluation of management scenarios by the science team is an example of informing the debate by presenting multiple management options and projections of the consequences of each option.

- *Use of scientific information increases the likelihood that consequences of management decisions will be more fully understood and those decisions will actually lead to the expected outcomes*. The systems in the Interior Columbia River Basin (biophysical and social) are complex. Analytical approaches used by research scientists can help reveal relations, especially about increasingly complex issues being addressed in natural resource management. Projecting the long-term effects of management options is difficult even when aided by available science. Without that science, the likely outcomes of options would be even more uncertain.

There are many points of view regarding the value and as well as the problems associated with integrating science information into the policy process. We believe that an open and critical dialogue must occur to ensure that the promises are achieved and the pitfalls are understood and hopefully avoided. Unless the concerns we describe are addressed, the credibility of research scientists, the science institution, and even the science process itself may be compromised. The natural resource decision-making process may also suffer in the long run as well. There is too much to gain by the careful development and use of scientific information do not take these concerns seriously. Credibility of science and policy is hard to gain, once lost is even harder to regain.

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