Combining science and policy in conservation biology

Gary K. Meffe and Stephen Viederman

As conservation biologists and wildlife biologists continue to assess their commonality and divergence, here is a view of how we meld our needs to influence policy decisions.

Conservation biology is a new and developing science, a product of the late 1970's and early 1980's when ecologists first gathered in mutual recognition of an impending biological diversity (biodiversity) crisis. The leading journal in the field, *Conservation Biology*, only began in 1987, and the first 2 textbooks on the topic appeared in the fall of 1993 (Primack 1993) and the spring of 1994 (Meffe and Carroll 1994). Thus, the field is in a rudimentary stage, we are still learning some very basic things, and conservation science is rapidly evolving. Conservation biology began with a major emphasis on genetics, biogeography, and other ecological and evolutionary issues, but the field is now maturing to encompass other concerns beyond ecology, including economic, legal, and political issues. Because it is so young, the proper balance between basic and applied science, between curiosity-driven and issue-driven research, is still being sought.

Many scientists in the field of conservation biology are only now beginning to understand how policy decisions are an important influence on natural systems. We can no longer simply do the science and hope that someone else uses the information to make good laws that protect species and their ecosystems. We now understand that much of what we do in conservation biology is essentially worthless if it is not translated into effective policy. All the theories, all the ecological and genetic models, and all the data amassed will have little effect if we do not influence policy and human behavior toward protection of biological diversity. We believe that the major advances in conservation *action* will take place not in scientific laboratories or field research sites, but in the political and economic arenas, because present limitations in conserving biodiversity do not typically occur through lack of knowledge, but rather poor implementation—the policy arena. Thus, the science of conservation biology is necessary, but not in itself sufficient, to stem species extinction and ecosystem degradation. The challenge is for science to inform policy to change individual and institutional behavior.

Influencing policy

The key question is: How can biologists influence local, national, and international policies to positively affect biological diversity? The answer, we feel, is a 2-step approach. First, scientists, especially conservation biologists, must decide that they *should* and *can* influence policy. While most scientists recognize that quick action is needed to change what is wrong with humanity's approach to the earth and its resources, we cannot continue to believe that merely doing good science is sufficient progress toward that end. Scientists and the world at large cannot continue indefinitely along the same trajectories of continued resource destruction. In an ideal world, biologists would experiment, observe, tell policy makers what to do, and it would be done. But our world is far from ideal, and policy-making does not work that way. The policy process responds to many forces

Address for Gary K. Meffe: University of Georgia's Savannah River Ecology Lab, Drawer E, Aiken, SC 29802, USA. Stephen Viederman: Jesse Smith Noyes Foundation, 16 East 34th Street, New York, NY 10016, USA.

Key words: biopolitics, conservation biology, policy, science

and does not adapt quickly to change or new information. It is instead a balancing act of many different players, and we are unlikely to change the process significantly—at least in any reasonable time frame that would reverse biodiversity losses—if we see our role as passive transmitters of the results of our science. Thus, scientists must instead change how they influence the policy process. Scientists need to adapt their behavior to the existing policy process rather than complain about the process but never change the system. To do that, scientists must learn about the policy process and conduct their business to influence that process.

But first, a psychological barrier must be overcome. Scientists are often wary of getting involved in policy because they see it as advocacy and a violation of their scientific objectivity and public trust. Scientists are traditionally supposed to be objective and largely emotionless on the job, with no value judgments. We believe this is an incorrect description of how things are and how they should be. Values are always present, whether admitted or formally expressed, and the policy process merely focuses values more clearly and forces individuals to confront their values and biases. For example, most if not all conservation scientists clearly believe that biological diversity is good and that it should be conserved (2 clear values). Furthermore, biological knowledge will always be incomplete, given the magnitude of our concerns. This forces us to focus attention on the values we bring to our research and to the interpretation of our results.

As Soulé (1985) told us a decade ago, conservation biology is a crisis-oriented discipline with a clear, value-laden purpose: protect and restore biological diversity on the planet. Scientists can take a clear stand that biodiversity is good, that functioning and intact ecosystems are good, that continued evolutionary change and adaptation are good, and that diversity and variation in general is good. Scientists cannot and should not remove themselves from these usually unstated value judgments. It is quite acceptable (in fact, unavoidable), in our opinion, to hold values as a scientist and try to influence the policy process, as long as the scientific process of objective hypothesis testing is not compromised. Thus, the first answer to how scientists can affect the policy process is to agree that they should, and must, fulfill their obligations to influence policy, recognizing that they are both scientists and citizens.

The second answer is that scientists need to better understand how the policy process works and thus more effectively exercise their influence that way. Effective policy is often a crisis in timing: a decision must be made now, but useful information is nonexistent, insufficient, contradictory, or of poor quality. Regardless, policy decisions await nobody. There is often no time for proper, controlled studies to be done, so scientists must anticipate, to some degree, the needs of policy makers, be willing to listen and learn and deal with uncertainty, and have the relevant information available before policy makers know it is needed. Not an easy task by any means! But the reality is that policy will continue to be made, with or without input from scientists. The burden, unfortunately, is on scientists to provide relevant, timely, and meaningful information to policy makers. This means the science-policy relationship is not symmetrical: policy makers will continue to make policy quite independent of scientific input. It may not be fair, but that is the way it is. Consequently, to effectively influence the process, scientists must do 3 things:

Develop issue-driven rather than discipline-driven science. This means beginning with the problem at hand and not with a particular discipline, breaking down disciplinary barriers, and working across disciplines to address larger issues. Single-investigator, curiosity-driven science is less likely to address policy issues than is multiple-investigator, issue-driven science, especially in this era of holistic, ecosystem-level protection. Conservation issues are complex and demand input from many disciplines, especially those beyond the realm of biology, such as economics, the social sciences, ethics, and philosophy.

Incorporate broader sources of information, including information from non-scientists. In particular, include information and perspectives from: (a) people most affected by the environmental assaults in question—the folks who have a real stake in the issue; (b) people who have historically maintained sustainable societies, for they may have important information and appropriate technologies to share; (c) people who are charged by virtue of election or appointment to make and implement policy, for they are the most powerful entities in the process and will not be bullied or easily fooled; and (d) people who may produce the knowledge to assist and inform policy makers, such as other scientists (even competitors), educated laypersons, and so forth. The point is, scientists cannot remain narrowly focused and rely only on information that they produce; all information from all relevant sources can and should be used to influence conservation policy.

Understand and work within the policy process. Good science does not automatically or necessarily translate into good policy. Because science is only 1 of many inputs for the policy process, it had better be

good and appropriate if it is to count. Scientists must listen to policy makers, just as they want policy makers to listen to them. The old adage "whoever likes sausages or laws should not watch either one being made" applies to policy. Some aspects of the policy process include the following (Meffe and Carroll 1994):

- There are usually no institutional structures for effectively integrating economic, environmental, and political concerns. Thus, everyone is doing their own thing, with little overall coordination.
- Nobody is in charge, but many people deal with pieces of the problem. Reductionism reigns.
- Policy makers have plenty of information, often conflicting, and plenty of demands for action, also often conflicting. They are scattered.
- Policy makers do not want more problems—they want silver bullets or quick answers for existing problems. Equally, they do not like surprises.
- Information for policy makers is usually imperfect, and there is often little or no organizational demand for specific information by policy makers. Consequently, they are usually flying by the seat of their pants.
- Information often is not available in the time frame needed or in a form that is useful. Timing is everything.
- Scientists distribute their work through publications and conferences but rarely emphasize their findings to policy makers, who do not read the journals or go to the conferences. As a result, useful scientific information is not used in the policy process, and scientists are usually preaching to the choir.
- Scientists often want to provide information on what interests them rather than what may be needed by policy makers. Scientists need to be more flexible in their interests if they are to influence policy.
- Requests for information are often excuses for postponing action—the "more study is needed" syndrome of bureaucracies.
- Policy makers first deal with pressing problems with short-term solutions, putting off long-term problems and their solutions. They are good crisis managers but poor long-term thinkers.
- Policy makers in any institution typically react to the incentive systems of the institution rather than to larger value systems external to the organization. So they do what is best for their careers and institutions, but not necessarily what is best for long-term, common interests.

In sum, the policy process is not linear and certainly not pretty. But if scientists are to affect this process, it will require major changes in how they actually do their science and approach their problems. We are literally facing a major paradigm shift in how scientists conduct their work and relate to policy makers. It may be painful, as paradigm shifts usually are, but we believe it is necessary if we wish to create sensible policy that reflects a value system of long-term concern for biodiversity protection. This new paradigm has been called "postnormal science" (Funtowicz and Ravetz 1991). The postnormal paradigm has the following characteristics (summarized from Meffe and Carroll 1994; see also Funtowicz and Ravetz 1991):

Adopt pragmatism and plurality. Scientists must work with flexibility on complicated problems using many tools, with inputs from many sources, and not just focus on their existing toolboxes and try to fit problems to their abilities.

Accept uncertainty as a given. Nature is complex and will always surprise us eventually. Uncertainty must be included in the planning and policy process, as it can not be excluded and controlled.

Focus on data quality rather than data completeness. We will never have a complete picture of complex natural systems. So rather than work feverishly to produce the most complete data picture possible, be sure that existing data are of the best quality possible.

Use a systems approach that is comprehensive, holistic, global, long-term, and contextual. Move away from reductionism and a discipline-bounded approach.

Be concerned with dynamics, process, nonequilibrium, heterogeneity, and discontinuity. Again, ecological systems change and are largely unpredictable. This must be included in scientific approaches and related to policy.

Include social points of view. It's not all biology because humans are interacting with virtually all ecological systems and we cannot study ecosystems in isolation from people. Thus, the ivory tower days of studying pristine systems isolated from the affairs of humanity to satisfy personal curiosity are over. Also, scientists need to be concerned with the processes by which institutional and individual behaviors change. Understanding institutions and their quirks and limitations will help implement necessary changes based on scientific results.

Thus, the postnormal paradigm tells us that we need to develop issue-driven science to most effec-

tively address conservation problems and policy issues. It is not value-free or ethically neutral (although science must certainly continue to be conducted in a critical, unbiased, hypothetico-deductive manner, as always). The approach begins with a problem-orientation that is non-disciplinary (as opposed to curiosity-driven, disciplinary science), and is holistic, dynamic, and includes humanity.

Publishing policy-oriented science

Will scientific journals publish the kind of science and policy-oriented articles suggested above or is it too radical and too close to advocacy? We will specifically address the journal *Conservation Biology* as an example of recent trend in this regard. How does *Conservation Biology* address scientific studies that aim to influence policy?

Perhaps the best way to begin to answer that question is to assess the attitudes of the Editors, and ask whether they tolerate and even encourage policy papers. The answer is, very much so. David Ehrenfeld edited *Conservation Biology* for its first 7 years of publication (1987–1993). In his final editorial upon conveying editor duties to his successor he stated the following (Ehrenfeld 1993):

> Probably the best thing I could do for my very capable and experienced successor, Reed Noss, is not to give him advice. But I can't resist one short and very general comment. The strength of *Conservation Biology* and of the field that it has helped to develop is in its breadth and its associations. For me, this breadth is born of the conviction that science alone does not have and never will have solutions to the fundamental environmental problems of our time, which are religious in the largest sense of the word, dealing as they do with values and the human spirit. If we remember this at all times, our science will then be freed to play the part that is expected of it in the battle to save life on this planet.

Ehrenfeld thus established a broad philosophical base, admitting that true conservation advances will come from more than just straight science. In his opening essay as the new Editor, Reed Noss (1993), said:

> Science, as traditionally defined, is fundamental to conservation biology but does no good if isolated from "softer" issues such as ethics, sociology, and political strategy. Indeed, there is nothing more dangerous than science in an ethical vacuum. As vital as high-quality empirical work and hypothesis testing are in conservation biology, we get the job done only by translating scientific findings into policy and management prescriptions, and then by getting those prescriptions implemented on the ground... I believe that conservation biologists have a responsibility to enter the policy arena and advocate both general principles and specific actions needed to conserve biodiversity. To not do so is to advocate the status quo, meaning extinction. Scientists cannot simply hand over data to bureaucrats or politicians and expect them to make rational and prudent decisions about complex problems they know and care little about.

Thus, here we have a very clear mandate for scientists to affect conservation policy, at least through *Conservation Biology*. But is it in fact being done? To examine the degree to which *Conservation Biology* actually publishes policy-oriented articles, we examined all issues of the journal from 1987–1994 (n = 32) for articles specifically dealing with policy issues. We did not include articles that might offer a policy implication as a spin-off from technical content, but included only those articles with policy as a major thrust. We examined 6 classes of articles: editorials, essays, contributed papers (which are the traditional, scientific data papers), notes (shorter data papers), comments, and diversity.

First, we found a striking trend in growth of the journal (Fig. 1), with a current doubling time of about 3 years. Thus, conservation is a healthy, and vigorously growing field; as of 1995 the journal is moving from 4 to 6 issues/year. Second, 9.3% of the articles (about 1 of 11) were on policy. Most of these were concentrated in the editorial, essay, comments, and diversity sections (39 policy articles of 203 total articles in those sections, versus 14 of 366 contributed papers and notes), as might be expected. Increasing trend was not apparent in the percent of policy articles through time. Overall, the journal appears to do a reasonable job of encouraging and publishing policy-oriented articles. However, if policy changes are truly where major advances will be made, the journal (and other journals as well) should actively encourage more policy content and policy research with direct relevance to conservation.

But how does one effectively participate in scientific writing with a strong policy emphasis? And

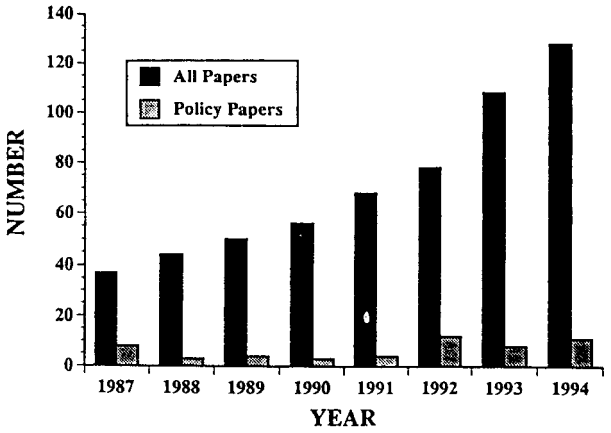

Fig. 1. Articles dealing primarily with policy issues relative to total number of articles in 6 categories (editorials, essays, contributed papers, notes, comments, and diversity) published in *Conservation Biology* during 1987–1994.

what are the potential pitfalls? Two articles from *Conservation Biology* offer guidance to scientists. The first is by Salzman (1989), regarding animal mortality related to gill netting in Central California. The Point Reyes Bird Observatory (PRBO) documented deaths of large numbers of marine birds and mammals in fish gill nets off the California coast. Representatives of the PRBO eventually helped effectively regulate gill netting through strong advocacy based on scientific data. They did not carry signs, protest, or boycott products; that was not the type of advocacy they saw as appropriate for a scientific organization. Instead, PRBO amassed solid and irrefutable data on the problem. They did not enter into lawsuits (although lawsuits were based on their data) and consequently were seen by all sides as unbiased, critical observers. Yet they clearly were advocates for regulation of gill netting to reduce or eliminate deaths of sea birds and mammals. The approach PRBO recommends for such policy-influencing activities they call *focused advocacy*: "reporting data and pressing to ensure that the information is interpreted correctly and acted upon" (Salzman 1989:179).

In the second example, Rohlf (1991), a lawyer, offered 3 specific suggestions for scientists to facilitate policy efforts:

- Scientists should develop a degree of legal sophistication. They should understand the legal process as much as possible, so as not to be blindsided when their data are used and ultimately attacked in the courts.
- Scientists should perform directed research. This reiterates the postnormal approach discussed earlier, where research is chosen that directly relates to the policy process, rather than curiosity-driven research that may or may not bear on policy questions.
- Scientists should fully participate in the policy process. They should find out where the hot issues are and not shy away from them. Scientists should produce data that will enable participation in the process. And, we add to Rohlf's suggestion, scientists should create opportunities for participation, such as going to newspapers or other media with scientific information relevant to a policy issue.

Scientists influencing policy: a summation

We conclude that, for effective influence on policy development, scientists must adopt a postnormal approach, which includes:

- exercising pragmatism and plurality (coming down from the ivory tower and working on issue-oriented problems in an interdisciplinary way);
- accepting and embracing uncertainty in ecological systems and working with it, rather than trying to exclude it; focusing on data quality rather than data completeness, because we'll never know everything about a system;
- using an approach that is comprehensive, holistic, global, long-term, and contextual, and moving away from reductionism;
- focusing on dynamics, process, nonequilibrium, heterogeneity, and discontinuity, because nature is in flux;
- including broad social perspectives, because we cannot separate nature from humanity; and
- understanding processes by which institutional and individual behaviors change, and how we can effect those changes.

It will not be easy for scientists to influence the policy process for the benefit of biological diversity, but we have little choice if we truly want to conserve that diversity for its inherent good and its value to present and future generations. This entire perspective was summed up nicely by Funtowicz and Ravetz (1991) when they stated that "facts are uncertain, values in dispute, stakes high, and decisions urgent." Scientists should remember this as the background within which their work must fit if they are to influence policy consistent with values that embrace a

long-term perspective with concerns for future generations and the biological diversity upon which they will depend.

Acknowledgments. G. K. Meffe was supported by contract DE-AC09-76SROO-819 between the U.S. Department of Energy and the University of Georgia, as well as a sabbatical leave hosted by the National Biological Service Laboratory, Gainesville, Florida.

Literature cited

EHRENFELD, D. 1993. The making of *Conservation Biology*. Conserv. Biol. 7:743–745.

FUNTOWICZ, S. O., AND J. R. RAVETZ. 1991. A new scientific methodology for global environmental issues. Pages 137–152 *in* R. Costanza, ed. Ecological economics: the science and management of sustainability. Columbia University Press, New York, N.Y.

MEFFE, G. K., AND C. R. CARROLL. 1994. Principles of conservation biology. Sinauer Associates, Sunderland, Mass. 600pp.

NOSS, R. F. 1993. Whither conservation biology? Conserv. Biol. 7:215–217.

PRIMACK, R. 1993. Essentials of conservation biology. Sinauer Associates, Sunderland, Mass. 564pp.

ROHLF, D. J. 1991. Six biological reasons why the Endangered Species Act doesn't work—and what to do about it. Conserv. Biol. 5:273–282.

SALZMAN, J. 1989. Scientists as advocates: The Point Reyes Bird Observatory and gill netting in central California. Conserv. Biol. 3:170–180.

SOULÉ, M. E. 1985. What is conservation biology? BioScience 35:727–734.

Gary K. Meffe is an Associate Professor at the University of Georgia's Savannah River Ecology Laboratory; his major interests are aquatic ecology, evolutionary and community ecology, and conservation biology. He is senior author of *Principles of Conservation Biology* (a college textbook), is on the editorial board of *Conservation Biology*, and is Deputy Editor of *Oryx*.

Stephen Viederman is President of the Jessie Smith Noyes Foundation, a philanthropic organization devoted to sustainable development and issues of environmental justice. He is Vice President of the International Society for Ecological Economics and is on the Board of the Rainforest Foundation.