Making Sense of the Policy Process for Carnivore Conservation

STEVEN A. PRIMM*‡ AND TIM W. CLARK*†

*Northern Rockies Conservation Cooperative, P.O. Box 2705, Jackson, WY 83001, U.S.A.
†Yale University, School of Forestry and Environmental Studies, 301 Prospect, New Haven, CT 06511, U.S.A.

Abstract: *Grizzly bears (*Ursus arctos horribilis*), mountain lions (*Puma concolor*), wolverines (*Gulo gulo*), wolves (*Canis lupus*), and lynx (*Felis lynx*) are all top-level carnivores in the Rocky Mountains of the northern U.S. and southern Canada. Because of their body size and high trophic position, these species require abundant prey species and large habitat areas—requirements that make their conservation a controversial public policy problem. Because the challenge of conserving these species extends beyond biological issues, it is necessary to involve other relevant disciplines and perspectives in understanding and solving the problem. Our examination of the context, content, and process of large carnivore conservation policies suggests more effective and active roles for scientists in designing solutions to the problem of landscape-level carnivore conservation. Scientists must develop an understanding of the range of participants in the policy process and the ways in which these participants receive and utilize information. This knowledge of the policy process could help scientists to better understand their roles in framing and clarifying policy questions, projecting the consequences of various alternatives, and presenting policy information in appropriate fora.*

Conservación de Carnívoros en las Montañas Rocallosas: Comprensión del Proceso Político

Resumen: *Los osos pardos (*Ursus arctos horribilis*), pumas (*Puma concolor*), carcayús (*Gulo gulo*), lobos (*Canis lupus*) y linces (*Felis lynx*) son carnívoros de alto nivel en las Montañas Rocallosas del norte de los Estados Unidos y el sur de Canadá. Estas especies, debido a su talla y alta posición trófica, requieren de abundantes especies presa y hábitats extensos—requerimientos que hacen de su conservación un controvertido problema político. Debido a que el reto de conservar a estas especies rebasa los aspectos biológicos, es necesario involucrar otras disciplinas y perspectivas relevantes en el entendimiento y solución del problema. Nuestro análisis del contexto, contenido y desarrollo de las políticas de conservación de carnívoros sugiere que los científicos jueguen un papel más efectivo y activo en el diseño de soluciones al problema de la conservación de carnívoros a nivel de paisaje. Los científicos deben comprender el rango de participantes en el proceso político, así como de las formas en que reciben y utilizan la información. El conocimiento del proceso permitiría que los científicos entiendan mejor su papel en la estructuración y clarificación de preguntas sobre políticas; en la proyección de las consecuencias de varias alternativas y en la presentación de políticas de información en foros adecuados.*

Introduction

Grizzly bears (*Ursus arctos horribilis*), mountain lions (*Puma concolor*), wolverines (*Gulo gulo*), wolves (*Canis lupis*), and lynx (*Felis lynx*) are important, high-profile species in the Rocky Mountains of the northern U.S. and southern Canada. Ecologically, they are vital indicators of the health of the bioregion (Schonewald-Cox et al. 1991; Noss et al., this issue). Culturally, these animals are a major part of the allure and romance of wild places such as Greater Yellowstone and Banff National Park (Kellert et al., Rasker & Hackman, this issue), but their future survival is tenuous. Harting and Glick (1994:181)

‡*Current address: World Wildlife Fund-US, 1250 24th St., NW, Washington, DC 20037.*
Paper submitted January 15, 1995; revised manuscript accepted August 3, 1995.

note that "carnivorous mammals represent more than half of those listed as threatened, endangered, or rare" in the Greater Yellowstone Ecosystem. Grizzly bears are threatened and wolves are endangered throughout the U.S. portion of the Rocky Mountains. Similar long-term declines may be occurring in the Canadian Rockies as well in the absence of proactive conservation efforts (Herrero 1994; Paquet & Hackman 1995).

Carnivore conservation in the Rocky Mountains is more than a biological problem; it is a public policy problem with multiple dimensions (Clark et al., this issue). If carnivores are to survive in the wild, scientists, conservationists, land managers, and citizens must develop a broader understanding of the social, cultural, economic, and administrative dimensions of carnivore conservation. Inquiry into carnivore policy must be guided "by the requirements of the issue at hand rather than the researcher's tool kit" (deLeon 1994:84). In other words, we must use analytical frameworks and conceptual tools appropriate for understanding and addressing policy problems rather than relying solely on biological and ecological science. We introduce an analytic framework and basic conceptual tools with the explicit aim of integrating scientific knowledge with a policy orientation. A policy orientation consists of "knowledge (or intelligence) that is directly useful in the policy process [coupled with] knowledge of the process itself" (Clark 1992:424).

To clarify, scientists have knowledge that should be used in designing and implementing policy. It is necessary knowledge, but it is not sufficient for good policy. Participants also need a policy orientation that includes a working knowledge of the policy-making process itself (Lasswell 1971). Policy consists of much more than legislation and broad initiatives far removed from the on-the-ground reality of large carnivore conservation, and it pervades all conservation efforts. Developing better knowledge of these processes can lead to more effective participation both in policy design and in implementation. A policy orientation can also augment scientific research by directing attention to policy-relevant subjects and aiding development of persuasive presentation and communication techniques, both of which can give scientists a much more active role in designing and implementing policies for conservation (Lubchenco 1995).

We probe key questions about the process of conserving Rocky Mountain carnivores. We first provide a brief overview of the carnivore conservation challenge and then examine what constitutes effective carnivore conservation. Third, we investigate where conservation problems occur, in a contextual rather than geographic sense, and introduce analytic models for understanding context. Fourth, we discuss how policy-relevant, biologically-sound conservation knowledge can lead to successful conservation action. We conclude with some specific but strategic recommendations for making progress in carnivore conservation. By bringing the what (policy content and substance), where (context), and how (skillful participation in the policy process) together, we can form a solid policy orientation that greatly increases the chances of effective conservation (Clark et al. 1992).

Overview

The biggest constraint on conservation of large carnivores is that their habitat requirements are so extensive that provision of adequate space carries large costs (Bixby 1992). The space and isolation required by each of these species means that their needs will conflict with some human activities. Carnivores are further burdened by the stigma of interspecific competition with humans (Noss et al., Weaver et al., Rasker & Hackman, Mattson et al., this issue). Carnivores not only occupy habitat where people could be ranching, recreating, building homes, logging, or drilling for oil; they also compete for game animals, some prey on livestock, and a few occasionally harm people.

Another major constraint is the lack of available resources and means for effective carnivore conservation. The state, provincial, and federal agencies with authority over carnivore conservation often must meet multiple demands on limited budgets. Moreover, these agencies often emphasize production of tangible products for the public: commodities such as livestock forage, lumber, oil and gas, or minerals; huntable or watchable wildlife; and recreational experiences that demand facilities such as parking lots, picnic areas, and campgrounds, (U.S. General Accounting Office 1991). These priorities reflect the preferences of the historic or extant political coalitions that set the dominant direction for the management agencies (Wood & Waterman 1994).

Conservation of large carnivores is also linked inextricably to several broader issues. The U.S. Endangered Species Act (ESA), ecosystem management, use of western public lands, and other contentious issues all manifest themselves in the issue of carnivore conservation. Wrangling over carnivore conservation is also often a "surrogate" for broader cultural conflicts: preservation versus use of resources, recreation-based economies versus extraction-dependent economies, urban versus rural values, and states'-rights versus federalism (Egan 1994; Kellert et al., Rasker & Hackman, this issue).

These conflicts came to a head during wolf reintroduction efforts in the United States. Wyoming's state legislature attempted to place a $500 bounty on wolves, in conflict with federal law protecting the animals (Kenworthy 1995). Montana's state legislature passed a resolution calling for stocking New York City, San Francisco, and Washington, D.C., with wolves (Kenworthy 1995). Such opposition to wolf reintroduction seems to be closely related to hostility toward the federal government, among other things (Egan 1994). Threats and acts of vio-

lence against federal employees in the West seemed to reach a crescendo during the time that reintroduced wolves were beginning to roam Yellowstone National Park (Egan 1995). Meanwhile, newspapers such as the Chicago Tribune and other media outside the West hailed the reintroduction program as "atonement, . . . corrective repentance, [and a] declaration of the redemptive decency of human spirit" (Anonymous 1995: 10). Clearly, wolves generate strong feelings that vary widely among cultural groups (Kellert et al., this issue).

Some other carnivores do not receive nearly the attention that wolves do. They often lack both supporters and enemies, and thus receive neither negative nor positive attention. In the case of the wolverine, for example, there is no "wolverine policy" to be analyzed or debated. Nonetheless, a wide range of other policies combine to form an overall de facto "policy" for wolverine conservation. Majone (1989:160) states that "actions and decisions may add up to agency policy—but policy that no one has deliberately planned." Trapping, timber harvest, oil and gas exploration, and recreational activities all affect the survival prospects of wolverines and thus must be examined. But even species that are the focus of formal policies—grizzly bears, for example—are heavily influenced by a wide range of other policies (Keiter & Locke, this issue). County zoning regulations, public lands grazing, and federal budgetary politics all have effects on grizzly bear conservation, even though they are not formally part of grizzly bear conservation policy. The policy process for carnivore conservation is exceedingly complicated, in addition to being polarized and conflictual. Agency resources, political conflicts at different scales, and basic questions about the substance of good carnivore conservation are all important issues to explore. A working understanding of these policy linkages is essential for effective conservation problem solving. We begin outlining this understanding by considering the potential for scientists and science to be useful to the policy-making process through existing knowledge of large carnivores.

Policy Content

Finding ways to ensure the continued survival of Rocky Mountain grizzly bears, mountain lions, wolverines, wolves, and lynx can be difficult within the policy context we have outlined. Extensive home ranges and diverse habitat selection by large carnivores mean that recreational use, grazing, logging, and development all affect these species (Noss & Cooperrider 1994). The decision-making processes for these diverse activities are as diffuse as the activities themselves, involving a wide range of people with diverse interests, beliefs, and perspectives.

Basic knowledge about the life needs of Rocky Mountain carnivores is a prerequisite for conserving them (Weaver et al., Noss et al., this issue). Ruggiero et al. (1994) note that sound scientific information about sensitive species is necessary for avoiding or resolving conflicts over land use. Scientists and land managers can use existing descriptive information and a number of theoretical constructs to assess the current conditions of these species and to design appropriate conservation policies.

For some species of large carnivores, information about current conditions and survival requirements is thoroughly lacking. In addition, the applicability of theoretical statements is suspect because of a lack of knowledge about mitigating or exacerbating circumstances facing each species. Although potentially useful after some refinement, habitat suitability indices for carnivores raise several difficulties that point to the need for adaptive research and management approaches to habitat conservation (Mattson et al., this issue).

Among these difficulties is the fact that information on habitat suitability is lacking for species like the wolverine, and the dynamics of habitat selection for other species are poorly understood (Banci 1994). Also, habitat judged suitable on the basis of foraging or denning opportunities may lack other key attributes such as adequate habitat security and connectivity to source populations of the species in question (Butterfield et al. 1994). Furthermore, habitat selection may be highly variable within a species such as the grizzly bear, and thus important habitat may go unrecognized because it lacks high-quality attributes (Weilgus & Bunnell 1994). Also, habitat models would almost certainly lack the flexibility to reflect temporal and macrospatial habitat-use variations within species. Observed habitat selection may be an artifact of some other factor such as extirpation or displacement from a wide range of other habitat types (Hollander et al. 1994). Pulliam (1988) and Turner et al. (1995) point out that use of a discrete parcel of habitat may be the result of larger landscape-level or environmental conditions and not necessarily related to the attributes of the site itself.

There are significant gaps in the scientific knowledge about these species, indicating the need for further research (Ruggiero et al. 1994; Noss et al., Weaver et al., Mattson et al., this issue). Even for the most intensively studied species—grizzly bears—essential population viability information is lacking (Mattson & Reid 1991). At the other end of the spectrum, "knowledge of wolverine habitat needs at the landscape scale is virtually nonexistent" (Lyon et al. 1994:133). It is beyond the scope of this paper to review the status of scientific knowledge and identify gaps by species and region (see Weaver et al., Noss et al., this issue). Ruggiero et al. (1994) argue for a realistic approach to filling these research gaps by balancing the need for rigorous research with an appreciation of the practicality of acquiring information about secretive, low-density species such as the wolverine. Lacking information, a conservative approach to habitat

management with meaningful efforts to limit human-caused mortality (e.g., trapping, shooting, vehicle collisions) is the most plausible interim strategy (Banci 1994; Mattson et al., this issue).

Another strategy would be to identify "adaptive management areas" that, from a landscape perspective, are clearly important to large carnivore conservation (Turner et al. 1995). Then a coordinated research and management program could be put in place that would conserve habitat options while gathering important information about carnivores in the area. Holling (1995:18) promotes this approach as "the foundation for regional experiments in adaptive policy design and management that are as much examples of institutional learning as they are of using science for public policy." Such a strategy recognizes an important aspect of the carnivore conservation problem: we do not have a universe of opportunities to which we can apply elegant habitat models and other tools that may be years in development. We are down to a few key land areas that would support large carnivores in the Rocky Mountains. Conservative management that preserves conservation options, coupled with a concerted effort to fill research gaps within these areas, is a viable and reasonable approach. To point out this strategy, however, is only to specify policy content. Finding ways to enact such strategies requires explicit knowledge of the policy process and a realistic appreciation of the context in which policy is made.

The Policy Context

Making sense of the broader context of conservation policy can be difficult. A framework or method of inquiry to map and understand this context is vital (Clark 1993), but a lack of inquiry methods, inappropriate simplifying assumptions about the policy process, and limited understanding of self-in-process impede development of this type of knowledge. For example, there is a marked tendency among scientists and other people to dismiss major aspects of the policy process as mere "politics" (Clark & Harvey 1991). Conservation issues are often described as cases of "science versus politics." This characterization implies that there are two separate, parallel arenas for authoritative decision making, one rational (science) and one irrational (politics). Without a "scientific branch" to complement the executive, judicial, and legislative branches in the U.S. and Canadian governments, however, all public decisions are made in the relatively irrational arena of politics (Lasswell 1971).

The political arena weighs beliefs, values, and cultural preferences against one another, resulting in decisions that are virtually never based solely on scientific or economic criteria (Brewer & deLeon 1983). Lasswell (1930: 185) asserts that politics does not produce the "'rationally best' solution, but the emotionally satisfactory one. The rational and dialectical phases of politics are subsidiary to the process of redefining an emotional consensus." This "irrational" process for decision making is a fact in biodiversity conservation in North America. Perhaps a more palatable way for scientists to think about the policy process would be to approach it as an inquiry into the community behavioral ecology of human beings. Such an inquiry requires new frameworks and conceptual tools.

Participants in the Policy Process

To dismiss the complexity of the nonscientific aspects of large carnivore conservation as "politics" undermines the development of a useful understanding of the conservation process. As Simon (1983:99,100) points out, "the activities we call 'political' are simply another manifestation of the propensity of human beings to identify with personal goals and to attempt to realize these goals in a lawful manner." In a democratic political system these activities are carried out by competing groups of people organized around common causes (Brewer & deLeon 1983). But traditional theories about interest groups obscure much of the detail of such competition by focusing almost exclusively on lobbying organizations, an emphasis that overlooks the role of many participants within government and other institutions who are strong de facto advocates of one cause or another (Sabatier 1993).

To provide a more inclusive and effective theory for understanding policy development, Sabatier and Jenkins-Smith (1993:16) advance the notion of "policy subsystems," or the "interaction of actors from different institutions who follow and seek to influence governmental decisions in a policy area." Members of subsystems share a special, long-term interest in a particular issue, such as wilderness designation or carnivore conservation. The subsystem is a broad group that includes all sides of the issue, not just allies. It includes participants "at various levels of government active in policy formulation and implementation as well as journalists, researchers, and policy analysts who play important roles in the generation, dissemination, and evaluation of policy ideas" (p. 17). The subsystem concept allows inclusion of a range of players who are often overlooked by analyses that focus solely on interest groups or on certain institutions such as Congress or Parliament or agencies.

Within a subsystem, the various participants loosely organize into competing "advocacy coalitions" (Sabatier & Jenkins-Smith 1993). Policy struggles are competitions between different belief systems of opposing advocacy coalitions. The competing coalitions in a particular policy arena strive to apply their beliefs and values to policy problems, with the goal of shaping outcomes in accordance with their belief systems. Advocacy coalitions are

best described by the views they emphasize the most. Most advocacy coalitions, however, represent a continuum of beliefs and values. The composition of individual advocacy coalitions changes across time and with different issues as underlying values and beliefs align differently.

In carnivore conservation, the concept of advocacy coalition squares readily with experience: certain agency members can be counted on to be strong supporters of carnivore conservation, whereas others of the same agency consistently favor other goals (McCarthy 1994; Mattson et al., this issue). Some politicians are reliable supporters of carnivore habitat protection, whereas others are lukewarm, and others are perennial crusaders against protection of wilderness and endangered species. Without being formally or even consciously allied with actual interest groups, these participants are still members of advocacy coalitions. Although the carnivore conservation subsystem may appear to be dominated by elected officials, environmental groups, and Wise Use organizations, closer observation shows that bureaucrats and scientists also play prominent roles in the policy process (Mattson & Craighead 1994; Mattson et al., this issue).

Bureaucrats in the Policy Process

Theoretically, government agencies would transcend subsystem dynamics and instead serve as neutral administrators who carry out the will of the legislative branches of government. This is not the case, however, nor should we expect it to be. To state it generically, the purpose of government agencies is to respond to vague mandates and develop responses to very generally defined problems. Exactly how to follow such mandates and how to develop more detailed problem definitions are left up to the agencies. For example, the Endangered Species Act directs agencies to conserve species but provides little in the way of guidance for implementation. The act certainly does not provide specific directives about particular species, and it thus delegates responsibility for designing recovery plans to the U.S. Fish and Wildlife Service (USFWS) (16 U.S.C. §D1533 [f]; Keiter & Locke, this issue). Such delegations make sense because the USFWS has expertise that Congress lacks for designing conservation programs, and Congress simply does not have the time for activities such as recovery planning. Thus, in some ways, an agency serves as a standing body of experts who are intimately familiar with a certain problem and skilled in the relevant techniques for dealing with the problem. In this respect bureaucrats should favor certain types of policies simply because they know more about the target problem than the average person does (Wood & Waterman 1994).

It is also true, however, that certain policies and programs bring agencies more rewards than others (Mattson et al., this issue). A particular agency program may garner public approval, please key constituencies, increase agency power and prestige, or shore up budgets (Wilson 1989). McCarthy (1994:323) studied a sample of U.S. Forest Service personnel and found that "those educated or specialized in a particular field favor activities that will allow them to manage actively in their discipline." Foresters favored timber management projects, mining engineers and geologists favored mineral development, and wildlife and fisheries biologists favored habitat improvement activities. Thus, it makes sense that bureaucrats would favor certain policies and would participate at some level in coalitions to support those policies.

Furthermore, bureaucrats are people: they have been socialized in particular ways and hold certain beliefs and values. McCarthy (1994) found that early, formative socialization was the most influential factor in the policy preferences of U.S. Forest Service personnel. These individual attributes inevitably affect interpretation of mandates and the vigor with which bureaucrats pursue them. Such attributes also affect the types of policies and mandates that individual bureaucrats will prefer and how bureaucrats will help to shape new mandates emerging from the policy process (Brown & Harris 1992).

This amalgam of professional, organizational, parochial, and personal influences inevitably leads bureaucrats to favor certain policies actively and to seek to influence the policy process through problem definition, program design, and implementation (Wilson 1989). Whether this behavior is pursued independently of other like-minded participants in the policy process or not, such behavior increases the cumulative advocacy for one policy or another, thus promoting the cause of one advocacy coalition or another (Sabatier & Jenkins-Smith 1993). In particular, bureaucrats may act out their policy and ideological preferences through the implementation process, either vigorously pursuing a favored mandate or ignoring or weakening a disfavored directive (Wilson 1989). Directives may be vague or conflicting, funding may be inadequate, or the agency may simply choose to delay implementation or ignore directives. Poor enforcement or implementation can lead to effective policies that are the opposite of stated policies, even if the offending actions are not committed by the agency. For example, if a wildlife agency inadequately monitors trapping in the field or sale of pelts at markets, then the actual policy outcome for species like wolverines or lynx may be local or regional extirpation, regardless of what the formal regulations state.

Scientists in the Policy Process

Science in policy is yet another complex dimension of the overall context. Scientists, according to the tradition of technical rationality, "translate scientific research into social progress" (Schön 1983:338–339). In this view scientists play a key role in policy making because their research is presumed to be uninfluenced by values and

their knowledge and advice unbiased. The role, identity, and status of experts in society has clearly been enhanced by promotion of this view by scientists themselves. Bahm (1971:396) notes that the notion of value-free science—based on the very real value of "permitting the facts rather than one's preferences to determine conclusions"—has been elevated to dogma through repetition and education.

But this view does not portray reality. Scientists show the same characteristics as bureaucrats in on-the-job situations (Schön 1983), favoring some policies over others and seeking to influence them one way or another. Scientists are skilled at solving only certain kinds of problems and have a tendency to convert or redefine problems into those they are expert at solving. Bahm (1971:396) points out that rather than being value-free, "science is saturated with values. There is no aspect of science which is totally value-free and from which duties and obligations are completely absent." Science continues to depend on a foundation of values even though it has largely been forgotten, even repudiated. Value judgments appear in scientists' choice of which problems are important, serious, and worthwhile over ones that are trivial, seem to be unsolvable, have evil results, or have costs associated with solving them that exceed anticipated benefits. Scientists also make value judgments in their myriad decisions about methods, problem definitions, hypotheses, testing, experimentation, measurement, observation, personnel, and the dissemination and use of results (Mattson et al. this issue).

Bahm (1971) further argues that even the scientific attitude—which comprises curiosity, willingness to be objective, and willingness to speculate—is not value-free. Many believe that to be objective means to avoid being subjective. But Bahm claims that "strictly speaking, there can be no object without a subject, and no subject without an object. That is, no knowledge exists apart from knowers. . . . Therefore ought not one who claims to be scientific keep in mind the necessarily subjective conditions of his efforts to be objective? Can one be objective in his understanding of science if he fails to recognize both subjective and objective factors as necessary?" (p. 393). He notes that the common claims that "the scientific method is better than other methods" or that "science is, or ought to be, completely value-free" are themselves examples of prejudice and concludes that "success in science depends not upon complete absence of prejudice, but upon the presence of beneficial prejudices" (p. 394).

In addition, science is part of a larger, more inclusive social system, the system of public order, which, according to Lasswell and McDougal (1992:17), includes "a preferred pattern for the distribution of values and a preferred pattern of basic institutions." Scientists must recognize that "the scholarly observer is, further, inextricably a part of community process; he, like other community members, is incurably infected by preferences about value distribution, and enlightenment (or obscurantism) which he achieves in inquiry must have inescapable effects upon community process" (Lasswell & McDougal 1992: 19). There can be no neutral position in policy. Thus the roles of scientists and science in policy processes, like those of bureaucrats and bureaucracies, are complex.

Although many scientists still consider science to be free of values, the most obvious fact about the policy process is that it is value-oriented, whether it is focused on large carnivore conservation or any other issue. In fact, policy is understandable only when it is seen as a deliberate search for the maximization of valued goals. The connection between clarification of valued policy goals and scientific results is often intimate. That is, the benefits of science (improvements in the quality of human life) often figure prominently in people's explicit desires and choices about the future (Brunner & Ascher 1992). Indeed, science is cherished by society not for its own sake, but because of its potential contributions to policy (Ascher 1986). In policy the concern is "to foster understanding of the relevance to choice and decision of scientific standpoints and procedures"—in other words, to understand the "distinctive techniques of science and their relevance to the examination of decision and its environment, including the self" (Lasswell & McDougal 1992:866). The relationship between science and policy is clearly complex; relevant theories about policy processes must attempt "to emphasize and assess these relationships rather than to overlook and evade rational assessment of their significance" (Lasswell & McDougal 1992:16).

The key point concerning participants in the policy process is that the policy process as a whole is important to achieving real results in carnivore conservation. To focus only on Congress or agencies or scientists or interest groups is a serious but avoidable error. The concept of subsystems or advocacy coalitions is a valuable tool for describing and understanding these complex interactions, and it indicates the vast complexity of analyzing the important variables in large carnivore conservation. Conservation may appear to present an overwhelming task, creating strong pressures to circumscribe the definition of policy or to focus only on those narrow segments of the policy problem that are susceptible to quantification. For scientists this complexity may encourage narrow specialization and communication only with members of one's own discipline or organization. Such responses are mistaken and they consign otherwise effective participants to irrelevancy in the policy-making process.

Making Progress in Large Carnivore Policy

More scientific research is needed to guide the long-term conservation of certain species. But the scientific dimen-

sions of the carnivore conservation problem have received far more attention, scrutiny, and research than the larger aspects of the policy process (Clark & Minta 1994). Understanding the policy process is an undertaking that frustrates positivistic conceptions and expectations (Mattson et al., this issue). Fortunately, as we intimated earlier, conceptual tools exist that provide conservationists with "an orderly way of revealing the significant contours of reality" (Lasswell 1971:67). The concept of subsystems of advocacy coalitions is a productive way to evaluate these interactions because it takes into account all the diverse participants relevant to a particular policy issue. Building on this conceptual framework, we turn to a discussion of ways to improve carnivore conservation given the myriad contextual constraints we outlined earlier. Using the framework of subsystems or advocacy coalitions, we examine how science, information, and learning are treated in the context of the policy process.

Policy-Oriented Learning

Knowledge of how advocacy coalitions operate and use science can provide scientists with a better understanding of the process and allow them to make greater use of their knowledge resources. Sabatier and Jenkins-Smith (1993) refer to advocacy coalitions' use of information and science to refine their activities as "policy-oriented learning."

The role of knowledge in the policy process is limited in large part by the belief systems of the competing advocacy coalitions. According to Sabatier (1993:31), belief systems in an advocacy coalition are organized somewhat hierarchically. At the belief system's "normative core" are deeply held convictions about how the world works and how it ought to work. These beliefs are often religious in nature and are extremely resistant to change. Opponents of wolf reintroduction in Yellowstone National Park and central Idaho have demonstrated the durability of their normative core beliefs on several occasions, including outright refusals to believe the results of an economic study predicting increases in tourism worth $118 million resulting from the presence of wolves (Loomis 1992; Kellert et al., this issue).

The belief system's "policy core" contains beliefs about the policy process and how one ought to go about realizing normative core beliefs. These beliefs are difficult to change but can be altered on the basis of trial and error. For example, a group might believe that its cause represents a moral imperative that leaves no room for compromise and that anyone who is not fully committed to the cause lacks integrity. Thus, their core policy beliefs would likely tend toward adversarial litigation or one-sided legislative initiatives that, if successful, would vanquish their unjust opponents. Compromise, mediation, or piecemeal strategies would threaten the sanctity of the core normative beliefs and thus would not be considered core policy beliefs. Surrounding these cores is a layer of "secondary aspects" that consists of policy tools and advocacy strategies aimed at implementing the policy core. Secondary aspects are governed to some degree by the cores: some strategies would be inconsistent with the policy core and normative core and thus would be out of the question. But marginal adjustments of secondary aspects do provide feedback that could lead to modifications of the cores.

Policy-oriented learning occurs as participants in the policy process pay attention to feedback from their own actions so that they will eventually be successful in reaching their goals. Human values and subjective perceptions are inevitably part of this learning process. In this context science and knowledge are used largely in a strategic manner and not as a means to reevaluate one's normative beliefs and values or to uncover objective "truth" (Jenkins-Smith & Sabatier 1993). More accurately, people search for evidence to support their own goals and for techniques to help them achieve them (Kellert et al., this issue). Michael (1995:473) states that "'objectivity' unavoidably reflects the interests of the perceivers, shaped by their sociocultural, emotional, and cognitive constraints."

This is not to suggest that science is irrelevant to the policy process (though it may appear at times that the process makes little use of science). It is critical, however, that those who possess scientific knowledge understand the nature of advocacy coalitions and their goal-seeking behavior. The key to effective participation and conservation progress is to understand when and how scientific information can be used most effectively in the policy process.

Effective Use of Scientific Knowledge

Scientists can make the best use of their knowledge and skills by paying careful attention to several variables in the relevant subsystem. Jenkins-Smith and Sabatier (1993) outline broad conditions under which scientific information and analysis can contribute to policy-oriented learning. "The task," state Jenkins-Smith and Sabatier (1993:49), "is to identify the conditions under which a productive analytical debate between members of *different* advocacy coalitions is likely to occur." Four variables affect the likelihood of such learning and policy change.

The first variable is the level of conflict in the policy debate, which is inextricably related to the structure of belief systems. Explicit attacks on an advocacy coalition's core normative beliefs will inevitably raise conflict to a crisis level. Analysis and scientific research will make no difference in such a debate because the central beliefs of one coalition or another are at stake. Thus, analysis and scientific information will only be employed as a post hoc defense of core beliefs.

To a certain extent this situation may already prevail in the case of large carnivore conservation. Conflicts have escalated because carnivore conservation is linked to so many other policy issues, particularly grazing, mining, and logging on public lands (Kellert et al., Rasker & Hackman, this issue). Carnivore proponents have made wholesale denunciations of these industries (e.g., "Cattle Free by '93!"), leaving no doubt about the level of conflict involved. Demagogues in the Wise Use movement have capitalized on this view (e.g., "War on the West") to generate support and funding for their own causes. In some issues, conflict over these core beliefs will be inevitable; in others, it is avoidable to a certain extent. Careful research into the beliefs of an advocacy coalition can provide the information necessary to avoid or minimize unnecessary "core-to-core" conflict (Jenkins-Smith & Sabatier 1993). In other debates the stakes are not nearly so high for any coalition, and thus science can play a much larger role in the debate.

The second variable is the degree of analytical tractability of the policy problem. This variable is an obvious consideration in determining the usefulness of scientific knowledge in resolving a debate. Jenkins-Smith and Sabatier (1993:52) correctly point out that issues amenable to quantification and scientific method (e.g., fuel economy for automobiles) are easier to understand analytically than issues that are hard to study or quantify (e.g., federal funding of art). Although large carnivores are amenable to quantification and scientific research, they can be incredibly difficult subjects (Noss & Cooperrider 1994; Mattson et al., this issue). Appropriate levels of risk of extinction and relevant time frames also add to the analytic difficulty of this policy problem. Moreover, the high level of conflict over most carnivore conservation issues causes the opposing sides to be highly suspicious of "objective" information offered by the other side.

The third variable is the presence or absence of an analytical forum for debate of the policy problem. This variable is also important in assessing the role of science. Accepted and professionalized fora in large carnivore conservation may appear to exist. University departments deal with the issue extensively. Peer-reviewed journals such as *Conservation Biology* and the *Journal of Wildlife Management* provide opportunities to exchange information, test hypotheses, and seek management advice. But a larger and much more influential policy process actually determines whether and how we conserve large carnivores. In this context there is no professionalized analytical forum with accepted standards and protocols of debate. Members of the Wyoming Woolgrowers Association probably do not read the professional wildlife conservation journals and critically assess their own positions as a result. The actual policy debates are much more likely to be carried out in the editorial pages of the *Casper Star-Tribune.*

The fourth variable is the potential persuasiveness of policy-relevant knowledge, which is closely intertwined with the lack of rational fora for debate. Lacking a rational forum with agreed-upon rules of evidence, it is crucial to be able to design persuasive messages for different audiences. Too often, scientists see themselves as disinterested purveyors of "truth," rather than acknowledging their role in the policy process. Every piece of information has a persuasive role in the policy process, whether it was intended to or not (Majone 1989). It is critical, especially in the absence of agreed-upon fora and protocols of debate, to explain the conservation problem in terms that will make sense to the relevant audiences. Lasswell (1971:117) notes that the "most solvable problem is how to bring knowledge specialists into efficient collaboration with experts who are skilled in communication."

Simply exhorting scientists to communicate better and understand the policy process is unlikely by itself to solve the problem of large carnivore conservation. As Primm (this issue) notes, our societal decision-making processes are somewhat dysfunctional, and science alone cannot surmount these flaws. Lee (1993:88) states that "when societies are unable or unwilling to define new institutional arenas in a timely way, less formal means of conducting disputes are useful, to organize and facilitate negotiation among disputing parties." In that vein, Dewey (1927:167) advocates an "experimental politics" that would improve "the methods and conditions of debate, discussion, and persuasion". That is *the* problem of the public. In practical terms, improving public debate and moving toward a stable reduction in cultural conflict will require innovative processes to bring citizens and a diverse array of experts together to work toward common goals and to resolve policy disputes.

These processes, structures, and techniques are not yet well developed. Professional conferences could be one forum, but they still tend to be focused on a narrow range of disciplines, and they fail to engage the policy process actively. These conferences could be greatly improved with a few modifications and a restructuring of their goals. Lasswell's (1971) "continuing decision seminar" model provides useful guidelines for developing and maintaining strong interdisciplinary problem-solving teams. This seminar would consist of a dynamic group of committed professionals convening regularly over a fairly long period to analyze a particular problem and explore solutions. Dryzek (1990) and deLeon (1994) detail a number of different "discursive" processes and structures for "participatory policy analysis." A number of different methods ought to be explored simultaneously so that learning can be maximized (Brunner 1994).

Scientists can be most effective in ongoing policy debates by carefully understanding themselves and their own role in policy processes and the dynamics of the

policy subsystem relevant to the issues at hand. Scientists can take an active and useful role in "diagnosing emerging problems or in providing a foundation for the integrated understanding needed for policy design" (Holling 1995:5). Careful assessments of the advocacy coalitions, their beliefs, and the nature of the debate forum can reveal the appropriate role for scientists to play in the design of conservation policy. This knowledge is also vital in designing persuasive messages for key members of the policy subsystem.

Conclusions

Successful carnivore conservation policy in the Rocky Mountains of the U.S. and Canada must involve a wide range of disciplines and organizations using an explicit policy orientation. We have introduced basic conceptual frameworks for making sense of the social contexts and policy processes that affect carnivore survival. The broader context we have sketched is one in which "politics" dominates public problem solving, including the problem of large carnivore conservation. Developing a more detailed and useful understanding of "politics" is possible by means of the frameworks we introduced. These frameworks guide the use of existing scientific knowledge to improve carnivore conservation, and they suggest policy-oriented strategies for filling the knowledge gaps we identified.

It would be unrealistic, however, to suggest that this amount of knowledge is sufficient. Understanding context, science, and the use of science in the policy process forms the foundation of an effective policy orientation. But our collective decision-making processes have become largely dysfunctional, a situation evidenced by a profound lack of progress on pressing social issues (Brunner 1994). Thus, we see a need for improved methods for making collective decisions and solving public problems. Field testing such innovative strategies will require a critical mass of committed, policy-oriented individuals from a wide range of organizations and disciplines. These people should be willing to inquire into the nature of broad-scale social contexts and to seek problem-solving opportunities at smaller scales that "increase both understanding and the ability to develop and apply integrated and adaptive policies" (Holling 1995:17).

Integrating disciplinary and organizational perspectives for successful carnivore conservation must be guided by a method of inquiry to build an operational map of social process or context (Lasswell 1971). University-level courses and agency and interorganizational workshops are currently being used to apply interdisciplinary problem solving (e.g., Clark et al. 1992, 1993). To the extent that interdisciplinary knowledge and skill are lacking in existing efforts to conserve large carnivores, they should be addressed quickly. Holling (1995: 13) recommends a standpoint for scientists that is "fundamentally interdisciplinary and combines historical, comparative, and experimental approaches at scales appropriate to the issues."

Our fundamental point is that those of us committed to large carnivore conservation must be problem solvers in social contexts and in real-life situations. Problems such as large carnivore conservation are too complex at broad temporal and spatial scales to leave to one set of disciplines, knowledge specialists, or organizational participants. By building on past success and employing creative, cooperative approaches in the future, guided by an explicit policy orientation, we stand the best chance of maintaining viable populations of large carnivores and the ecosystems that support them long into the future.

Acknowledgments

W. Brewster, D. Casey, P. Curlee, L. Morrison, C. Rush, L. Ruggiero, M. Rutherford, and T. Wohlgenant provided critical advice in the development of this manuscript. The Northern Rockies Conservation Cooperative and its supporters facilitated the writing of this paper.

Literature Cited

Anonymous. 1995. The return of the wolves. Editorial. Chicago Tribune, 27 March:10.

Ascher, W. 1986. The evolution of the policy sciences. Journal of Policy Analysis **5:**367–373.

Bahm, A. J. 1971. Science is not value-free. Policy Sciences **2:**391–396.

Banci, V. 1994. Wolverine. Pages 99–127 in L. F. Ruggiero, K. B. Aubry, S. W. Buskirk, L. J. Lyon, and W. J. Zielinski, editors. The scientific basis for conserving forest carnivores: American marten, fisher, lynx, and wolverine in the western United States. U.S. Forest Service Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado.

Bixby, K. 1992. Predator conservation. Pages 199–213 in K. A. Kohm, editor. Balancing on the brink of extinction. Island Press, Washington, D.C.

Brewer, G. D., and P. deLeon. 1983. The foundations of policy analysis. Dorsey Press, Homewood, Illinois.

Brown, G., and C. C. Harris. 1992. The United States Forest Service: Changing of the guard. Natural Resources Journal **32:**449–466.

Brunner, R. D. 1994. Myth and American politics. Policy Sciences 27: 1–18.

Brunner, R. D., and W. Ascher. 1992. Science and social responsibility. Policy Sciences **25:**295–331.

Butterfield, B. R., B. Csuti, and J. M. Scott. 1994. Modeling vertebrate distributions for gap analysis. Pages 53–68 in R. I. Miller, editor. Mapping the diversity of nature. Chapman and Hall, London.

Clark, T. W. 1992. Practicing natural resource management with a policy orientation. Environmental Management **16:**423–433.

Clark, T. W. 1993. Creating and using knowledge for species and ecosystem conservation: science, organizations, and policy. Perspectives in Biology and Medicine **36:**497–525, appendices.

Clark, T. W., and A. H. Harvey. 1991. Implementing recovery policy:

learning as we go? Pages 147–163 in K. A. Kohm, editor. Balancing on the brink of extinction. Island Press, Covelo, California.

Clark, T. W., and S. C. Minta. 1994. Greater Yellowstone's future: prospects for ecosystem science, management, and policy. Homestead Publishing, Moose, Wyoming.

Clark, T. W., et al. 1992. Conserving biodiversity in the real world: professional practice using a policy orientation. Endangered Species UPDATE **9(5&6):**5–8.

Clark, T. W., A. P. Curlee, and R. P. Reading. 1993. Conserving threatened carnivores: developing interdisciplinary, problem-oriented strategies. Report on a meeting held on 26 August, 1993, Bozeman, Montana. Northern Rockies Conservation Cooperative, Jackson, Wyoming.

deLeon, P. 1994. Reinventing the policy sciences: three steps back to the future. Policy Sciences **27:**77–95.

Dewey, J. 1927. The problem of method. Reprinted pages 184–191 in D. Morris and I Shapiro, editors. John Dewey: the political writings. Hackett Publishing, Indianapolis, Indiana.

Dryzek, J. S. 1990. Discursive democracy: politics, policy, and political science. Cambridge University Press, New York.

Egan, T. 1994. Ranchers balk at U.S. plans to return wolf to the West. New York Times 11 December:A1.

Egan, T. 1995. Federal uniforms become target of wave of threats and violence. New York Times 25 April:A1.

Harting, A., and D. Glick. 1994. Sustaining greater Yellowstone: a blueprint for the future. Greater Yellowstone Coalition, Bozeman, Montana.

Herrero, S. 1994. The Canadian National Parks and Grizzly Bear Ecosystems: the need for interagency management. International Conference on Bear Research and Management **9(1):** 7–21.

Hollander, A. D., F. W. Davis, and D. M. Stoms. 1994. Hierarchical representations of species distributions using maps, images and sighting data. Pages 71–88 in R. I. Miller, editor. Mapping the diversity of nature. Chapman and Hall, London.

Holling, C. S. 1995. What barriers? What bridges? Pages 3–34 in L. H. Gunderson, C. S. Holling, and S. S. Light, editors. Barriers and bridges to the renewal of ecosystems and institutions. Columbia University Press, New York.

Jenkins-Smith, H. C., and P. A. Sabatier. 1993. The dynamics of policy-oriented learning. Pages 41–56 in P. A. Sabatier and H. C. Jenkins-Smith, editors. Policy change and learning: an advocacy coalition approach. Westview Press, Boulder, Colorado.

Kenworthy, T. 1995. Babbitt finds relocation program has Hill's wolves growling at him. Washington Post 27 January:A23.

Lasswell, H. D. 1930. Psychopathology and politics. University of Chicago, Chicago.

Lasswell, H. D. 1971. A pre-view of the policy sciences. Elsevier, New York.

Lasswell, H. D., and M. S. McDougal. 1992. Jurisprudence for a free society: studies in law, science, and policy. New Haven Press, New Haven, Connecticut and Martinus Nijhoff Publishers, Boston.

Lee, K. N. 1993. Compass and gyroscope: integrating science and politics for the environment. Island Press, Washington, DC.

Loomis, B. 1992. Opponents call wolf report 'hogwash'. Jackson Hole (Wyoming) Guide 29 July:A3.

Lubchenco, J. 1995. The role of science in formulating a biodiversity strategy. BioScience **45:**S-7–S-9.

Lyon, L. J., K. B. Aubry, W. J. Zielinski, S. W. Buskirk, and L. F. Ruggiero. 1994. The scientific basis for conserving forest carnivores: considerations for management. Pages 128–137 in L. F. Ruggiero, K. B. Aubry, S. W. Buskirk, L. J. Lyon, and W. J. Zielinski, editors. The scientific basis for conserving forest carnivores: American marten, fisher, lynx, and wolverine in the western United States. U.S. Forest Service Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado.

Majone, G. 1989. Evidence, argument, and persuasion in the policy process. Yale University Press, New Haven, Connecticut.

Mattson, D. J., and M. M. Reid. 1991. Conservation of the Yellowstone grizzly bear. Conservation Biology **5:**364–372.

Mattson, D. J., and J. J. Craighead. 1994. The Yellowstone grizzly bear recovery program: uncertain information, uncertain policy. Pages 101–129 in T. W. Clark, R. P. Reading, and A. L. Clarke, editors. Endangered species recovery: finding the lessons, improving the process. Island Press, Washington, DC.

McCarthy, C. 1994. Socialization and the policy views of USDA Forest Service planning personnel. Environmental Professional **16:**314–326.

Michael, D. N. 1995. Barriers and bridges to learning in a turbulent human ecology. Pages 461–485 in L. H. Gunderson, C. S. Holling, and S. S. Light, editors. Barriers and bridges to the renewal of ecosystems and institutions. Columbia University Press, New York.

Noss, R. F., and A. Y. Cooperrider. 1994. Saving nature's legacy: protecting and restoring biodiversity. Island Press, Washington, D.C.

Paquet, P., and A. Hackman. 1995. Large carnivore conservation in the Rocky Mountains. World Wildlife Fund Canada, Toronto.

Pulliam, H. R. 1988. Sources, sinks, and population regulation. American Naturalist **132:**652–661.

Ruggiero, L. F., W. J. Zielinski, K. B. Aubry, S. W. Buskirk, L. J. Lyon. 1994. A conservation assessment framework for forest carnivores. Pages 1–6 in L. F. Ruggiero, K. B. Aubry, S. W. Buskirk, L. J. Lyon, and W. J. Zielinski, editors. The scientific basis for conserving forest carnivores: American marten, fisher, lynx, and wolverine in the western United States. U.S. Forest Service Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado.

Sabatier, P. A. 1993. Policy change over a decade or more. Pages 13–39 in P. A. Sabatier and H. C. Jenkins-Smith, editors. Policy change and learning: an advocacy coalition approach. Westview Press, Boulder, Colorado.

Sabatier, P. A., and H. C. Jenkins-Smith, editors. 1993. Policy change and learning: an advocacy coalition approach. Westview Press, Boulder, Colorado.

Schön, D. A. 1983. The reflective practitioner: how professionals think in action. Basic Books, New York.

Schonewald-Cox, C., R. Azari, and S. Blume. 1991. Scale, variable density, and conservation planning for mammalian carnivores. Conservation Biology **5:**491–495.

Simon, H. A. 1983. Reason in human affairs. Stanford University Press, Stanford, California.

Turner, M. G., R. H. Gardner, and R. V. O'Neill. 1995. Ecological dynamics at broad scales. BioScience **45:**S-29–S-35.

U.S. General Accounting Office. 1991. Public land management: attention to wildlife is limited. Washington, D.C.

Weilgus, R. B., and F. L. Bunnell. 1994. Sexual segregation and female grizzly bear avoidance of males. Journal of Wildlife Management **58:**405–413.

Wilson, J. Q. 1989. Bureaucracy: what government agencies do and why they do it. Basic Books, New York.

Wood, B. D., and R. W. Waterman. 1994. Bureaucratic dynamics: the role of bureaucracy in a democracy. Westview Press, Boulder, Colorado.