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Interdisciplinary problem solving in carnivore conservation: an introduction

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INTRODUCTION

The goal of carnivore conservation is to reverse declines in populations and to secure remaining populations in ways that gain enduring public support. As noted by Minta *et al.* (1999: 374), 'Clearly, carnivore conservation rests both on reliable scientific information and informed public consent.' Inasmuch as these species play keystone roles in ecosystems, indicate the health of ecosystems, function as umbrella species, focus public attention on conservation, and garner support for broader conservation efforts, conserving carnivores pertains to more than just saving the animals (Terborgh *et al.*, 1999). But despite some progress, such as the wolf reintroduction into Yellowstone National Park, there are very few places where long-term conservation is assured. Although it is generally recognized that there are significant 'human dimensions' involved, little attention has been devoted to these factors (T. Clark *et al.*, 1996a; Weber & Rabinowitz, 1996; M. Miller, 1999). Ignoring or overlooking key variables can lead to inaccurate definitions of the problem, inadequate solutions, and continuing losses.

A more comprehensive, contextual, and rational approach to carnivore conservation is urgently needed. Concerned people must conceive of conservation as a process of human decision-making, upgrade this process to achieve better outcomes, and by this means change the human practices that threaten carnivores. The decision process is the whole sequence of actions and events by which human communities identify and solve problems that hinder achievement of their goals. Functionally speaking, they first recognize a problem, study it, debate and promote various alternatives, and prescribe new rules. Then there is a process of invoking the new prescriptions in specific contexts, enforcing sanctions, applying new standards, administering them, and resolving disputes. The decision process also encompasses monitoring or appraising the new rules, and finally

terminating these rules and moving on to new ones. We review and analyze problems of carnivore conservation by looking at case studies, and we synthesize a view of some basic problems that must be overcome to achieve better outcomes. We introduce an interdisciplinary approach that, by focusing on the decision-process problem at hand, encourages users explicitly, empirically, and systematically to address the full set of variables at play in any context within the limits of time and resources. The approach is practical, effective, and widely applicable (see T. Clark *et al.*, 2000a).

CASE STUDIES IN CARNIVORE CONSERVATION: SURVEYING SOME CHALLENGES

Three cases, briefly discussed here, suggest the range of factors at play in actual conservation, most of which are human factors that are not formally addressed by biology-based, scientific approaches, but which nonetheless have real and profound consequences.

Grizzly bears

Ursus arctos horribilis exist in the contiguous United States as two large and three small populations totaling fewer than 1000 individuals. Grizzlies were listed as threatened under the US Endangered Species Act in 1975 because of threats posed by human-caused mortality and loss of secure habitat. Key management documents produced by the decision process include the Grizzly Bear Recovery Plan (US Fish and Wildlife Service, 1993), standards and guidelines specified in national forest management plans (most current grizzly bear range occurs within US national forests), guidelines for the management of 'problem bears,' and a recent conservation strategy. The ability of these prescriptions to achieve bear conservation is debatable, as is the adequacy of the decision process (Wilkinson, 1998).

Stark differences in perspective exist about the quality of the decision process. This takes the form of intense and public debate about the adequacy of the science, the goals of recovery, the openness of the debate, the adequacy of implementation, and the ability of appraisals to provide realistic feedback. There is excessive, unproductive conflict and growing litigation as evinced in news articles, scientific journals, and court proceedings. The grizzly bear recovery process falls short of meeting recognized decision standards, such as being factual, comprehensive, rational, integrative, inclusive, timely, contextual, and ameliorative (see Lasswell, 1971). Critics charge that government researchers and managers chronically overlook and underestimate human dimension issues and that no mechanism exists

to integrate such information (Primm, 1993, 1996; Mattson & Craighead, 1994; Mattson 1995, 1996, 1997; Mattson *et al.*, 1996a,b).

Many value-based decisions are miscast as science-based issues, such as the number of bears and the quality of habitat conditions that are sufficient for recovery and related specification of time frames and appropriate levels of risk (see Shaffer, 1992). Even where scientific information has had a legitimate role to play, its influence has sometimes been overridden by other values, such as power interests, agency loyalty, or responsiveness to elected officials (see Mattson & Craighead, 1994; Mattson, 1996, 1997; Mattson *et al.*, 1996a). Recovery is defined in terms of certain demographic goals and habitat conditions, and thus couched in the language and outlook of science. The debates reveal little appreciation that all scientific models and projections are based on human value judgments about acceptable risks, probabilities, and thresholds, and that management activities are based on multiple and often competing values at different scales of society. Specific demographic and habitat-related objectives vary, sometimes substantially, from one bear population to another. Even when the goals are agreed upon, goals are only descriptions of what needs to be done, and the means of achieving them may remain in dispute. Habitat goals are expressed in terms of security from humans and specified in terms of maximum acceptable road densities and minimum percentages of bear range that are free of roads. Research is underway to justify demographic goals in terms of population viability analysis.

Grizzly conservation draws diverse participants, holding differing perspectives and values, interacting in complex and shifting situations, using diverse strategies, and seeking different outcomes. The Grizzly Bear Recovery Plan (US Fish and Wildlife Service, 1993: p. 29) acknowledges the influence of human contextual factors in a diagram taken from Kellert & Clark (1991), but study of these factors has been consistently *ad hoc* and incomplete.

Without exception, state and federal agency officials whose primary job is grizzly bear management were trained in traditional wildlife biology. Many were also involved in wildlife research at some point in their careers. Although top-level managers with more diverse backgrounds substantially set and influence the implementation of grizzly bear policies, biologists-turned-managers hold primary responsibility for developing programs, writing documents, and guiding their implementation. According to Mattson *et al.*, (1996a), most agency officials seem to be highly responsive to power incentives, particularly individuals both inside and outside the agencies who control resources and opportunities for them. As a consequence, a

complex human social dynamic holds sway over the decision process. Grizzly bears are at additional risk because of antagonism among participants and because all parties are held hostage to larger political agendas such as states' rights and national political issues (Primm, 1993, 1996; Mattson *et al.*, 1996a; Primm & Clark, 1996). No study to date has provided an adequate basis for anticipating and minimizing conflict or systematically improving the decision process in this case.

Jaguars

Panthera onca once ranged from the southwestern United States throughout the Americas to northern Argentina (Seymour, 1989). The species is threatened by the fur trade (now largely curbed via CITES), habitat destruction, direct persecution, and declining prey (Weber & Rabinowitz, 1996).

The decision process surrounding jaguar conservation is complex and less than effective. It is highly fragmented and, in many ways, under-organized. There is a general lack of biological knowledge to use in decision-making, and the level of uncertainty sometimes heightens the conflict that arises when people try to clarify and resolve issues. It is very costly to undertake the long-term studies needed because of the animals' low population densities and extensive ranges, and there are relatively few trained biologists to undertake the work (Mares, 1991). Most planning is therefore local and may be driven more by opinion than systematically gathered, reliable knowledge.

There is presently no unified strategy across the species' range, although efforts are underway to address this problem. Some nations, such as the United States and Mexico, list the jaguar as endangered, while others, such as Bolivia, permit hunting. Different groups and nations operate from different goals and problem definitions; indeed, one may see a problem where another sees a desired situation. In addition, administrative boundaries may not reflect informal levels of authority and control within a region. For example, large areas may be controlled by groups that have little to do with official government wildlife policy (e.g., drug cartels or political rebellions). The major threats to jaguars are rooted in human activities, which derive from the values that people place on resources. First, deforestation rates in Latin America vary by country, but are generally regarded as among the highest in the world. Second, human population growth, poverty, devaluing economies, and social conflicts have pushed people further into the tropical forests, and their main activity there is subsistence agriculture. Third, many tropical countries have huge international debts, and 45% of the economies in all developing countries relies on resource extrac-

tion, a situation that leaves little alternative but to destroy the environment for short-term survival. Fourth, economic globalization (e.g., treaties like NAFTA) encourages conversion of habitat to fulfill growing export markets for fruit and produce (Soulé & Noss, 1998). Fifth, persecution of jaguars is usually not penalized, even in countries that protect them. There are typically few individuals assigned to enforcement, salaries for such jobs are barely livable, and the legal system in rural areas does not yet play a strong role in society (Shaw, 1993). Sixth, jaguars are largely viewed as a threat to livestock. When humans expand their activities deeper into the forest, they kill the natural prey of jaguars and introduce domestic animals so that jaguars must either leave or switch to eating livestock. Relocating problem animals does little to address the conditions that created 'stockkillers.'

Finally, the perspectives of participants are problematic. Latin American wildlife agencies are often understaffed, causing delays in information gathering and planning. Because political appointees staff these agencies, important wildlife positions may go to people who are not necessarily well trained in biology, much less management of decision processes (Mares, 1991). In general, Latin American agencies are organized as top–down bureaucracies with complicated rules and slow processes that may impede conservation. In addition, if there is a national political change, entire institutions may be replaced. Economic devaluation is a constant threat, and unstable economies make it difficult to commit long-term funding to conservation.

Mongolian gray wolves

Canis lupus management follows a classic pattern of controlling large carnivores for the sake of game management (National Research Council, 1997). The postulate is that killing predators will result in larger numbers of prey species, a theory that prevails among game biologists everywhere. The literature refers to wolves as 'enemies' of wild ungulates (e.g., Dulamtseren, 1970) and the 1997 Red Book lists wolves as a threat to several species. Although wolves remain distributed throughout most of Mongolia, they have declined in recent decades and are actively hunted by herders and biologists alike (Reading *et al.*, 1998).

Wolf management is ostensibly based on biology, but since little is known about Mongolian wolf biology or the impacts of wolves on livestock or wild ungulates, non-biological considerations drive management. Biologists and wildlife managers do know that wolves occasionally kill both livestock and wild ungulates. Nomadic herders, who kill wolves to reduce livestock depredation, hold significant political power based on tradition.

The vast majority of decision makers and biologists in Mongolia also advocate killing wolves (Reading *et al.*, 1998). As result, wolves are persecuted through bounties in the name of livestock and game protection. For example, the recently formed Association for Protecting Livestock from Wolves holds periodic wolf hunts that are encouraged by the local press. Moreover, a traditional Mongolian myth holds that the person who kills a wolf gains that animal's strength and prowess.

The single most important factor influencing wolf management is the values and perspectives of Mongolians, from nomadic herders to managers to biologists. Wolf control is not a contentious issue – current practices are not questioned and little, if any, study of wolf management or alternatives occurs. The widely accepted goal of reducing wolf numbers appears to be succeeding (Reading *et al.*, 1998). Changing wolf management from active, widespread control activities to conservation will therefore require changing perspectives and underlying values – an extremely important, non-biological challenge. Furthermore, wolves are little studied, and non-biological considerations receive almost no attention.

Finally, wildlife biologists and managers in Mongolia receive traditional wildlife management training, several traveling to Russia (or the former Soviet Union) for higher university degrees. Until the last few years, coursework was strongly disciplinary, usually restricted to zoology, with little to no broader training in other fields, not even ecology. As a result, wolf management remains strongly traditional, with little to no questioning of management goals, underlying assumptions and theories, or methods. This traditional biological approach dominates despite a paradigm shift underway among biologists elsewhere in the world toward a more ecosystem-scale view of wolves and large carnivores in general (Clark *et al.*, 1999).

Other cases

Overall, carnivore conservation worldwide has been characterized, at least until recently, by insufficient attention to human dimensions, with disastrous consequences in some carnivore conservation programs (e.g., Lopez, 1978; Reading & Clark, 1996). For example, wolves reintroduced into the Upper Peninsula of Michigan (USA) during the mid-1970s were all killed within eight months of release. Hook & Robinson (1982: p. 382) examined local attitudes following the release and concluded that 'the wolf's future in Michigan depends upon the attitudes of Michigan residents.' Similar problems were encountered in the Florida panther (*Puma concolor*) recovery program following an experimental release of five panthers into Osceola National Forest in 1988 (Beldon *et al.*, 1990) and in the recent reintroduc-

tion of Mexican wolves (*C. l. baileyi*) in Arizona, where some released animals were shot. Other cases did attend to contextual factors. For example, a proposed red wolf (*Canis rufus*) reintroduction was moved from a site with an antagonistic public to a site with a more supportive public (Moore & Smith, 1991). The reintroduction of gray wolves into Yellowstone National Park was proceeded by massive attention to local values and attitudes. Both of those programs appear to be succeeding (D. Smith & Phillips, 2000; Kelly & Phillips, 2000).

SYNTHESIS AND ANALYSIS: THE NATURE OF CARNIVORE CONSERVATION

The cases show many of the 'real-life' factors at play in carnivore conservation. In addition to the obvious biological problems of carnivores, including small populations at low densities in fragmented, declining habitats, there are weaknesses in the decision process – the process by which people conceive of problems and carry out solutions – that greatly influence whether conservation programs will be effective. We briefly examine three of these.

Bounded professional perspectives

Most threatened carnivores live in human-influenced environments, and no amount of fixing of the biological problems will help unless the human-caused conditions of carnivore endangerment are also remedied. Professional attitudes too often dismiss the decision process and its effect on carnivores simply as 'politics' – an impediment to scientific or rational progress – and then discount it as a subject for scientific study or management by someone else. But, as Weiss (1989: p. 117) points out, 'Difficult to measure and understand is not the same as unimportant.'

Narrow, discipline-based, technical perspectives of those who figure most prominently in carnivore management and conservation – managers, researchers, government agency leaders, non-governmental advocates – may lead to defining problems and crafting solutions largely in technical terms of animal behavior, population dynamics, or habitat relations or in terms of data collection and modeling. To compound matters, most carnivore work is done through bureaucracies, which, according to Finlayson & McMahon (1994), exacerbate conservation crises with their cumbersome structures and operating procedures. When professionals act on narrow disciplinary and bureaucratic definitions and constructions, there is a mismatch or incongruence between their actions and the actual conservation challenge.

The predominance and persistence of less-than-comprehensive

methods for solving complex societal problems, we suggest, is the result of the 'bounded rationality' of all participants. Herbert Simon (1983), who coined this phrase, noted that because the world is more complex than we can comprehend, we filter out important stimuli and operate on simple representations of reality. These filters, largely subconscious, consist of each individual's values, disciplinary training, epistemology, parochial interests, organizational allegiances, and other factors. People bounded by biology tend to define conservation problems as biological constructs. Bounded rationality can impede creative thinking and effective problem solving (A. Miller, 1999). This is most clear in the Mongolian wolf case, where the extremely narrow training of wildlife researchers, the fact that many managers have no biological background at all, and the strength of the bureaucracy mean that there is no consideration of alternatives to the widespread, very traditional (even folklore-based) belief that wolves should be killed. Jaguar conservation, on the other hand, will likely be impeded by the large number of varied perspectives, many of which are likely to be bounded by geopolitical focus, biological training, organizational allegiances, and other parochializing factors.

Neglect of decision process

Decision-making is always much more about values than it is about 'facts' as scientifically understood. It is in this arena that science, analysis, and politics merge. Through this process people must mesh their different perspectives, values, and interests to find solutions to shared problems (T. Clark & Brunner, 1996). Whether acknowledged or not, all knowledge and all choices have social, political, and value content and consequences. Decisions cannot be made by neutral decision makers because neutral human beings do not exist (Primm & Clark, 1996).

Every carnivore conservation effort entails decision-making processes through which people attempt to solve a problem and choose a course of action. By knowing how the decision process is set up and how to judge whether it is working well, participants can insist on good practices and fix poorly performing processes. Decision processes can be empirically studied and managed for the benefit of carnivores as well as humans. Good problem solving entails asking, for instance, why certain prescriptions for carnivore conservation are developed and maintained, what information exists, what alternatives should be considered, and what their consequences might be, not only for the animals but also for people and institutions, how the process will be evaluated, corrected, and ended. Answering

such questions requires an explicit conception of the decision-making process, adherence to recognized standards of decision making, and skill in managing decision processes.

Although the decision process for jaguar conservation on an international scale is just beginning to coalesce, grizzly bears are the subjects of a highly organized decision process, in which certain weaknesses have been institutionalized. Few participants 'see' the full decision process they are caught up in, acknowledge standards against which their activities could be measured, or envision any way to intervene to reduce the conflict, build trust, and clarify and secure common interests. Instead, they see only that one agency or group is deliberately thwarting the aims of another, or that that there are dueling data sets with participants siding with one or the other, or in more personal terms, that one side is 'right' and the other 'wrong.' These myopic views lead to interactions and debates focused on technical matters and protection of personal, professional, or organizational 'territory' (Mattson & Craighead, 1994).

Improving the decision process is not merely a matter of getting the biological science right and having decision makers act on it. Many scientifically-trained professionals dismiss value-related considerations as beyond their scientific and professional responsibility and fail to recognize the values that underlie their ostensibly 'neutral' science or policy perspective. Assuming their work to be value free, many simply expect that their recommendations will be heeded by the public and decision makers (see Brewer & Clark, 1994). But this presumes a relationship between science and society that is little supported by abundant case material and hard-won experience. This presumed relationship – an uncritical and trusting client (society) depending on the authoritative input of expert, value-free, objective science – is deeply institutionalized in the professional norms, social institutions, and organizations that select professionals to do conservation work. Copeland & Lewis (1997: p. 304) call these assumptions into question by asking whether scientists are adequately trained with the necessary skills to ensure the effective use of their information. Failure to recognize, disclose, and compensate the value positions of all participants can heighten and personalize conflict by shifting the focus of debate to the competence or integrity of those people or organizations at odds. It is rare to find programs that explicitly and systematically address the perspectives and values of participants, rarer still for professionals in carnivore conservation to examine their own standpoints relative to the decision processes in which they participate.

Underappreciation of the human context

Human perspectives and practices are the ultimate cause of the problems that grizzly bears, jaguars, wolves, and many other carnivores face – perspectives that value other things more highly than carnivores and practices that are directly and indirectly destructive. Human-caused mortality is often driven by markets for pelts and other body parts, fear, livestock conflicts, usurpation and destruction of habitats, and human depredation on their prey. Even the severity of diseases, such as canine distemper or rabies, has been worsened by reductions in carnivore populations and interactions with domesticated animals. At the same time, conservation-oriented perspectives and practices are the source of solutions to these problems. Saving these species comes down to changing what, how, when, and where humans do the things they do. The numbers and distributions of people and livestock, the presence, size, and extent of human disturbances, and the outlooks and activities of people living near carnivores become very important. The task of an interdisciplinary professional is to be realistic about the context.

Local contexts are always nested within larger contexts. Programs to reduce human disturbances must be based on information and a humane concern for all those affected by the program. Such programs are contingent on the actions of many people and organizations, such as game or conservation departments or non-governmental environmental groups, which in turn are affected by factors such as the culture, structure, and resources of organizations, relations among subcultures, and external relations with powerful elites. The policies that guide organizations that manage wildlife (and human action with regard to wildlife) are the outcomes of larger political and economic processes devoted to determining who gets what resources, how, when, and where (Lasswell, 1971; Kellert *et al.*, 1996). At the largest scale, carnivore conservation problems are enmeshed within global social phenomena, such as the growing interdependence of human communities and economies and the global movement of people, goods, and services.

Based on the consensus that prevails with regard to exterminating Mongolia's wolves, it is legitimate to ask why conservation efforts should be initiated there or how they could possibly succeed. Yet, the overriding contextual factor is the global losses of this species and large carnivores in general that compel conservationists both within and outside the country to persuade Mongolia to change. The jaguar case is a prime illustration of the large number of contextual factors, from regional rebellions to international debt structures, that influence people's perspectives and practices as they pertain to large carnivore populations.

CONCLUSIONS AND RECOMMENDATIONS FOR CONSERVATION: A PRACTICAL INTERDISCIPLINARY APPROACH

Carnivore conservation poses a complex, interdisciplinary challenge because diverse human factors threaten many species and their habitats worldwide. We maintain that the overall goal is to conserve carnivore communities, while gaining lasting public support. Many problems prevent achievement of this goal, among them traditional professional perspectives, underappreciation of the human context, and disregard for the central role of the decision process. While the biological sciences are necessary for conservation, they are not sufficient. The best way to address these three problems is with an interdisciplinary approach (although we agree that 'decades of lip service to the idea of interdisciplinary research have so far not succeeded in generating much activity,' Finlayson & McMahon, 1994: p. 48).

The interdisciplinary approach we recommend offers a way to move forward practically. It is a means of organizing knowledge for thought and research and of integrating it to solve problems. Its categories serve as a 'checklist' of variables to address in any conservation project, thus enabling users to construct a realistic map of the social context and decision process and to use it to define and solve problems. It is rational, integrated, and comprehensive. As Brewer & deLeon (1983: p. 22) noted, 'other approaches may appear to offer simpler or easier solutions, but each usually turns up lacking in important ways – not the least of these being their relative inability to help one think and understand, and hence to become a more humane, creative, and effective problem solver.'

Recommendations

We recommend viewing conservation as a 'systems' challenge – a system of decision making. The four tasks demanded of professionals by this system are to: (1) establish a standpoint for yourself; (2) carry out problem solving; (3) ensure an adequate decision process; and (4) understand (map) the context of the problem at hand. These systems components are briefly described and interrelated below and in Figure 16.1. A fuller description and examples are in Lasswell (1971) and T. Clark (1997).

1. **Establish a standpoint for yourself.** All problem solvers have a perspective (or standpoint) in relation to the problem – a product of their training, personal values, and other factors. The purpose of clarifying one's own and others' standpoints is to recognize and avoid

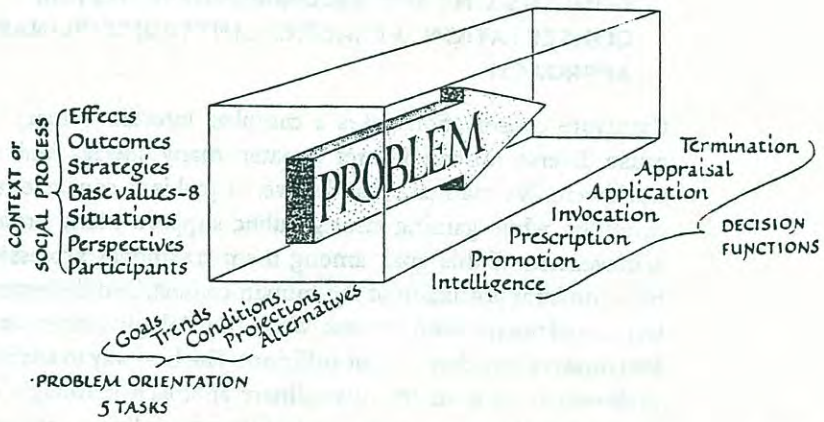

Figure 11.1. A systems view of carnivore conservation. The three axes show the key dimensions of interdisciplinary problem solving: (1) carrying out the five tasks of problem solving; (2) appraising the adequacy of the decision process; and (3) understanding (mapping) the context of your work and the conservation problem at hand. Also, but not illustrated here, is the task of clarifying your own standpoint (see text for explanation).

unconscious bias and to position oneself to solve problems in the common interest (see T. Clark & Wallace, 1999). Narrow, partisan standpoints will be less effective in resolving complex problems than those that are as free as possible from parochial interests, cultural bias, ideology, disciplinary rigidity, and fixed bureaucratic loyalties. In the broadest terms, we recommend that carnivore conservationists identify themselves as citizens of the global community who strive to maintain environments for a healthy, sustainable future for humanity and all life forms, and that they commit themselves to improving decision processes toward this end.

2. **Carry out problem solving.** How we characterize problems largely determines how we respond to them. Too frequently, conservationists commence 'biological' solutions before they define conservation problems and their context fully. If we miscast or under-represent what is involved in a problem, we virtually guarantee the misallocation of resources and increase chances of failure.

   Problem solving requires five interrelated tasks. Wallace & Clark (1999) offer explanations of the tasks and a worksheet. First, conservation goals, both biological and social, must be specified. Without biological sideboards, socio-economic forces may compromise the ecological health of the ecosystem under study. Although goals may

be somewhat general at first, over the course of a conservation program clarification of the social and biophysical context will demand greater specificity in the goals. Second, the history of the situation must be examined to determine if trends in events and processes are moving toward or away from the specified goals. Third, factors, relationships, and conditions behind the trends must be understood, including the complex interplay of factors that affected prior decisions. Models, both qualitative and quantitative, are often useful at this stage. Fourth, trends must be projected into the future, based on trends and conditions. Problem solvers should attempt to project a wide variety of possible future trajectories and outcomes, rather than accurately predict the 'correct' future. Finally, developing management and policy alternatives is the last task. Interdisciplinary approaches cultivate creativity in inventing new alternatives in policies, rules, norms, institutional structures, and procedures. Alternatives must be evaluated relative to the specified goals.

3. **Ensure an adequate decision process.** Carnivore conservation is concerned with establishing *who* will make decisions about *how* we use resources. Conservationists must successfully influence this process if they expect to save species and their habitats.

   Seven activities characterize the decision-making process: data gathering; recommending; setting rules; enforcing rules; administration; monitoring; and ending the rules (Table 11.1). Clark & Brunner (1996) describe these steps, give examples, offer questions to ask about each activity, and list standards for each of the seven functions. There are standards to judge the adequacy of each decision-making function, and applying these can raise the quality of conservation by identifying poorly performing processes and providing a basis for appraisal and upgrading (see Lasswell, 1971). The decision-making process should be, first of all, rational, comprehensive, and integrated. The biophysical and social information included in decision-making should be dependable; if not, some measure or description of uncertainty (or risk) is needed. The decision process should be open and accessible to those with something to contribute or something at stake in the program. Openness also refers to the extent to which the process is available to scrutiny. It should also be inclusive – 'selective omission' may serve personal or special interests and cause unproductive conflict. Timeliness is essential – the lag between perceiving a problem and taking effective action should be as short as possible, and obsolete or ineffectual management practices and policies should be

Table 11.1. *Decision process in carnivore conservation is made up of seven interrelated activities or functions*

- *Planning (Intelligence Function)* is the gathering, processing, and disseminating of information key to decision making. Is intelligence being collected on all relevant components of the problem and its context from all affected people? To whom is intelligence communicated? How would you like to see the planning function carried out?
- *Recommending (Promotion Function)* is the advocacy of specific policies and proposals. Which groups (official or unofficial) urge which courses of action? What values are promoted or dismissed by each alternative and whatgroups are served by each? How would you like to see the recommendation function carried out?
- *Setting Rules (Prescription Function)* is the authoritative statement of policies. Will the new prescriptions harmonize with rules by which the key organizations already operate, or will they conflict? What rules does the conservation partnership set for itself? What prescriptions are binding (these are easier to determine if they are written down)? How would you like to see the prescription function carried out?
- *Enforcing Rules (Invocation Function)* is the process by which participants determine what needs to be done according to their interpretation of the rules. Is initial implementation consistent with prescription? Who should be held accountable for following the rules? Who will enforce the rules? How would you like to see the enforcement function carried out?
- *Administration (Application Function)* is implementing the final prescription. Will disputes be resolved by people with authority and control? How do participants interact and affect one another as they resolve disputes? How will final implementation be carried out? How would you like to see the application function carried out?
- *Monitoring (Appraisal Function)* is evaluating performance in terms of goals. Who is served by the program and who is not? Is the program evaluated fully and regularly? Who is responsible and accountable for success or failure? By whom are one's own activities appraised? How would you like to see the monitoring function carried out?
- *Ending Management (Termination Function)* is ending or changing a policy, usually according to conditions set forth earlier. Who should stop or change the rules? Who is served and who is harmed by ending a program? How would you like to see the termination function carried out?

dealt with promptly. Decision processes should also be honest, flexible, and efficient.

4. **Understand the context of the conservation problem.** The human factor is too easily overlooked, ignored, or viewed as a constraint to the central biological task of carnivore conservation. The context, or the social process surrounding the conservation task, is central to understanding the problem and finding a permanent solution. This social process must be 'mapped' realistically, and the rich and pervasive patterns of people influencing or affecting each other must be detailed.

Table 11.2. *Some questions to ask in mapping the social process or context of carnivore conservation problems*

- *Participants.* Who is participating? Identify both individuals, groups, and organizations. Who would you like to see participate? Who is demanding to participate but not currently a participant?
- *Perspectives.* What are the perspectives of those who are participating, of those you would like to see participate, and of those making demands to participate? What would you like their perspectives to be? Perspectives include:
  - *Demands*, or what participants or potential participants want, in terms of values and organization.
  - *Expectations*, or the assumptions of participants about past and future.
  - *Identifications*, or on whose behalf demands are made.
- *Situations.* In what situation do participants interact? In what situations would like to see them participate?
- *Base Values.* What assets or resources do participants use in their efforts to achieve their goals? All values can be used as bases of power. What assets or resources would you like to see participants use to achieve their goals?
  - *Power* is having the ability to make, influence, and carry out decisions.
  - *Enlightenment* is the gathering, processing, and disseminating of information and knowledge.
  - *Wealth* is to have money or its equivalent (e.g., the production, distribution, and consumption of goods and services).
  - *Well-being* is to have safety, health (physical and psychic), and comfort.
  - *Skill* is the acquisition and exercise of capabilities in vocations, professions, and the arts.
  - *Affection* is to have intimacy, friendship, loyalty, other warm relationships.
  - *Respect* is to show and receive deference.
  - *Rectitude* is participation in forming and applying norms of responsible conduct (i.e., to have ethical standards).
- *Strategies.* What strategies do participants employ in their efforts to achieve their goals? Strategies can be considered in terms of diplomatic, ideological, economic, and military instruments. What strategies would you like to see used by participants in pursuit of their goals?
- *Outcomes.* What outcomes are achieved in the continuous flow of interaction among participants? Outcomes can be considered in terms of changes in the distribution of values. Who is indulged in which values? Who is deprived of which values? Outcomes also refer to the ways in which values are shaped and shared. The ways in which values are shaped and shared are called practices or institutions. How are practices changing? How would you like to see practices change? What is your preferred distribution of values?

Clark & Wallace (1998) describe the human social process and how to map it (Table 11.2).

One practical concern for problem solvers is to decide just how focused or broad their inquiry should be. The interdisciplinary

framework described here encourages problem solvers to be both comprehensive and selective simultaneously by focusing on the decision-making process in real-life contexts – the appropriate focus of inquiry should be the decision process, large or small, and how well it is working. Jaguar conservation, for instance, will necessarily involve international components, while the grizzly bear case is clearly more regional in scope.

Applying the interdisciplinary approach

There are several ways to apply this interdisciplinary, analytical approach to actual conservation situations (Clark, 1997, 1999). First, 'cooperative problem solving' through an adequate decision process is a way of getting participants or communities to seek their common interests. Many conservation programs attempt this approach with varying success, but few explicitly use an interdisciplinary approach. Problem-solving efforts can be set up by participants, coordinators, or decision makers to help groups integrate their knowledge to solve complex problems of all kinds (Willard & Norchi, 1993). This design seeks to explore the problem at hand, its context, and find enduring solutions in an integrative manner.

Second is 'prototyping,' which is a small-scale, trial change in a social or policy system. It has been used successfully in Australia in an endangered species case (T. Clark *et al.*, 1995a,b) and elsewhere. The primary goal of 'experimenting' with problems and solutions is to get information on relevant factors and to learn how to solve problems. Thus, the effort should include an explicit protocol for learning and integrating lessons across experiences and later scaling up through pilot studies and eventually full-scale applications.

Third, 'workshops for capacity building' improve basic problem-solving knowledge and skills. This approach is being actively used in the Greater Yellowstone Ecosystem; five two-day workshops focused on grizzly bear conservation, wolf recovery, and general problem-solving skills were carried out in 1999. Diverse people can be involved in workshops, even those at odds with one another. Team efforts are particularly rewarding. Workshops can help participants avoid approaches that are overly technical, parochial, or ones that tend to promote special interests. The challenge is to learn how to orient to complex problems using knowledge and methods from many disciplines and to integrate that knowledge for practical purposes. Of utmost importance are workshops to build a shared problem definition of conservation, improve cooperation among participants,

problems

enhance the capacity of participants to be effective through group action and discussion, establish priority areas for conservation, and open up opportunities to experiment and learn.

FUTURE RESEARCH AND NEEDS

First, not only must biological and ecological research on carnivores continue, but it should be directed toward conservation needs.

Second, social science research is also needed to conserve carnivores. In general terms, such work would examine the social and decision processes at play in any given case. Specifically, this would entail detailing via sociological, anthropological, psychological, or political science methods the practices, culturally and technologically complex though they may be, that hinder (or support) carnivore conservation. The perspectives behind the practices must also be determined, including the identities, the expectations, and demands of people involved. The play of values and institutions in society must be examined. T. Clark *et al.* (2000) reviews the range of biological and social science methods frequently used or available to conservation efforts.

Third, an interdisciplinary approach that synthesizes reliable information is needed to systematically integrate biological and social knowledge into a unified conservation program.

Fourth, applications of the interdisciplinary method described above (cooperative problem solving, prototyping, and workshops for capacity building), as well as more traditional conservation programs, should be systematically documented and studied for the purpose of learning what has worked and what has not. This kind of comparative learning approach is the only basis for genuine adaptive management. Comparisons should be carried out at regular intervals at professional meetings or by an oversight body. The lessons should be published and distributed widely. Participants in other programs can evaluate their utility, incorporate them as appropriate, and report results back to professional colleagues and societies. An endless repetition of this approach – field work using interdisciplinary and disciplinary approaches, comparison of results, lesson finding, distribution of lessons, refining methods, and new field work – offers a way to learn continuously and to improve carnivore conservation across the worldwide community.

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