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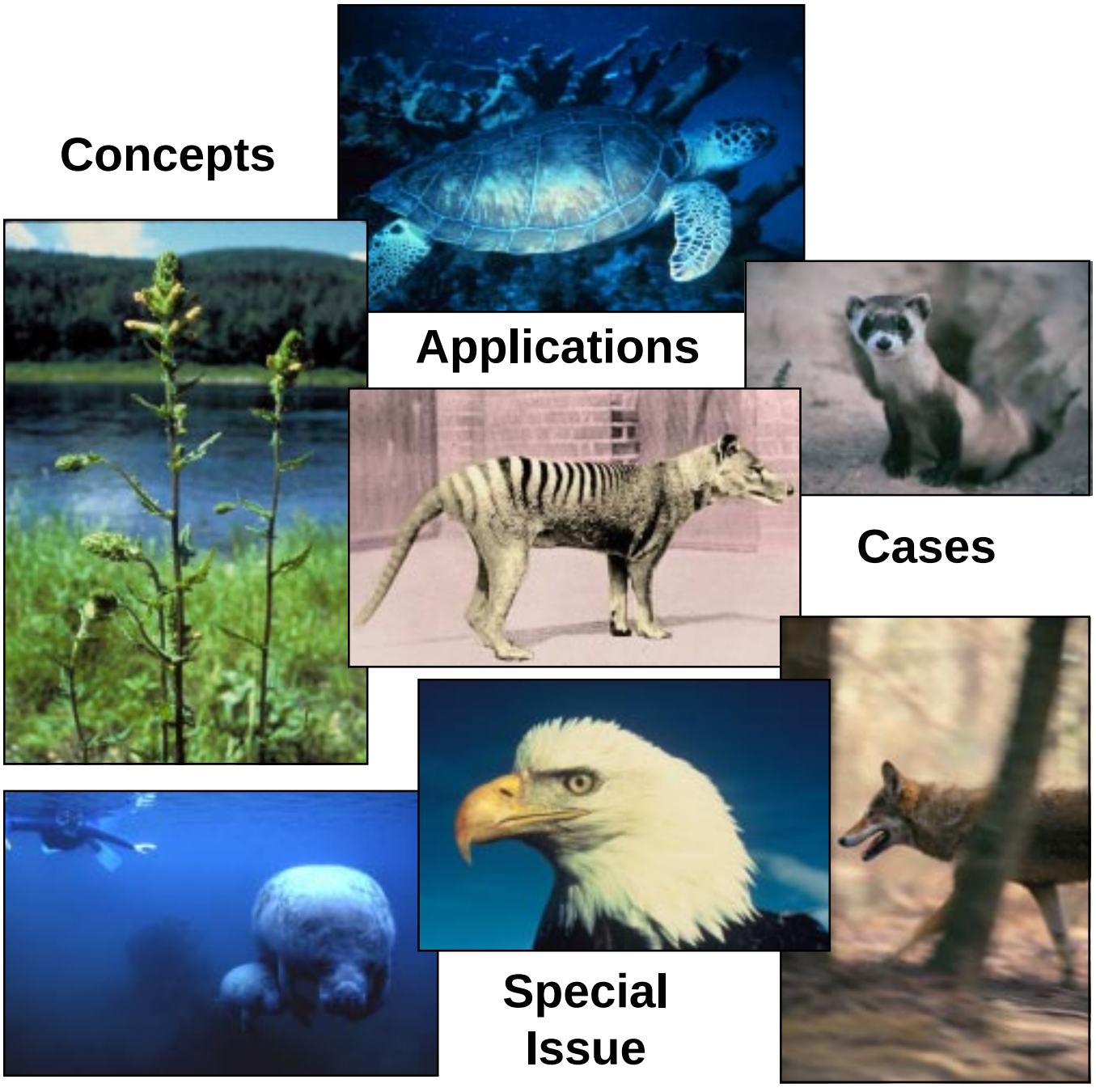
An Interdisciplinary Approach to Endangered Species Recovery:



Wild bactrian camels (*Camelus bactrianus ferus*) by Richard P. Reading

Cover photos. (Clockwise from top): green sea turtle (*Chelonia mydas*) by G. McFall, OAR/National Undersea Research Program, University of North Carolina at Wilmington; black-footed ferret (*Mustela nigripes*) by Charlene Bessken, BLM; red wolf (*Canis rufus*) by John and Karen Hollingsworth, USFWS; bald eagle (*Haliaeetus leucocephalus*) courtesy of USFWS; Florida manatee (*Trichechus manatus*) by Paul Dayton; furbish lousewort (*Pedicularis furbishiae*) by Irene Storks, USFWS. (Center): thylacine (*Thylacinus cynocephalus*) courtesy of the South Australian Museum, Adelaide.

Endangered Species *UPDATE*
Volume 19, Issue 4

Special Issue:
An Interdisciplinary Approach to Endangered Species Recovery: Concepts, Applications, Cases

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Introduction

Interdisciplinary Endangered Species Conservation: A New Approach For A New Century

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Endangered species conservation — encompassing research, policy, management, and all its many facets — is a management process that requires integrative and interdisciplinary methods to be most successful. This process is sometimes also called the "decision or policy process," but the labels can be used interchangeably. In the three decades since passage of the Endangered Species Act of 1973 (ESA), endangered species programs have faced serious challenges that have often impeded the ability of people involved to succeed. These include a preponderance of programs strong in natural sciences research and methods, but weak in the social science knowledge and individual skills necessary to effectively participate in and influence the management process (i.e. the series of decisions and actions that occur within a program from its inception through its design, implementation, evaluation and, if called for, termination). While the level of knowledge *about* the management process has increased markedly in the past decade, the level of skill necessary for managing and operating within it has lagged far behind the ecological scientific abilities of endangered species program participants. Consequently, endangered species conservation efforts suffer from a disconnect and imbalance in knowledge and skills concerning natural science research (on the one hand) and social, organizational, and values-related concerns (on the other). This leads directly to many complex and sometimes glaring problems in recovery efforts. It is generally accepted now that social factors — such as leadership, organization, communication/cooperation, and many others — play a critical role in the success or failure of endangered species conservation efforts (Clark et al. 1994, 2000, 2001; Reading and Miller 2000). Nonetheless, omissions and oversights in the management process continue to plague many ongoing efforts. As a result, perhaps the greatest problem facing these efforts is the inability or unwillingness of some government and non-governmental participants to adopt new knowledge and skills, use them effectively, and address the clear conservation challenges in a smooth and ultimately successful manner. Despite this lingering problem, there are a growing number of examples wherein people are picking up the new tools and applying them in the field with good effect. These innovative practice-based programs are paying off.

This special issue of Endangered Species *UPDATE* is the culmination of an extended program of research, education, and practice in interdisciplinary endangered species conservation. In addition to authoring a number of the following articles, we are practitioners of interdisciplinary problem solving methods in endangered species conservation. We have studied, taught, and practiced these methods in endangered species recovery programs in the United States and abroad for more than 25 years. We present this special issue for practitioners, teachers, and students of endangered species conservation in the hopes that it will help inspire more innovative, practical, and effective conservation. In this light, the articles presented herein reflect the efforts of their authors to clarify, promote, and practice endangered species conservation by scrupulously integrating the many variables falling under the aegis of endangered species "research," "management," and "policy."

This special issue is the latest in a series of publications in Endangered Species *UPDATE* that we began in 1988. The purpose of this series is to introduce practitioners and students of endangered species conservation to ideas and professional tools useful for increasing their effectiveness and efficiency. This issue is divided into three

sections, entitled "Concepts," "Applications," and "Cases," totaling 19 articles. We have reprinted all previously published papers in this series and added eight new ones featuring additional work on conceptual approaches, ways to apply innovative methods in practice, and case applications illustrating the use of these methods.

The first section, Concepts, introduces the reader to the theories that underlie interdisciplinary conservation. These theories are based in a discipline known as the policy sciences (Lasswell 1971; Lasswell and McDougal 1992). The policy sciences are "simultaneously a theory about society and a method of inquiry into problems and associated social and decision processes" (Clark 2002:ix). They are immediately practical when applied to improving endangered species recovery efforts. The Concepts section contains six papers that describe specific theories and their utility to endangered species conservation. These include:

- improving partnerships by better understanding the interests and activities of participants in decision making in endangered species programs;
- clarifying what constitutes a problem in endangered species conservation and how to address problems practically while bringing in all relevant areas of expertise and perspective;
- emphasizing the importance of social variables in endangered species programs;
- elucidating the role of human values in the recovery process, including programmatic decision making and outcomes;
- promoting the importance of clarifying and sharing personal perspectives on problem solving; and
- integrating methods from the natural and social sciences in the context of endangered species conservation.

Taken together, these concepts provide a foundation for understanding the policy sciences and showing how they can promote greater efficiency, equitability, and effectiveness in conserving species and improving the outcomes of species protection programs.

Wild Bactrian camels (*Camelus bactrianus ferus*) by Richard P. Reading.

Papers in the Concepts section that appeared previously in Endangered Species *UPDATE* include those on decision processes (1996), the human social process (1998), problem orientation (1999), standpoint clarification (1999), and integrating multiple methods (1999).

The Applications section of this issue features eight papers illustrating ways of applying the policy sciences' concepts in practice. The policy sciences are a branch of knowledge separate from either the physical/natural or the social sciences, and are sometimes referred as the "science of integration." The purpose of these papers is to create a bridge between the concepts and cases and to provide insight into how practitioners may use the policy sciences' integrative tools to improve decision-making and program implementation processes. These papers include practical examples of policy sciences concepts being used by professionals in governmental natural resource agencies, non-governmental organizations, and academia. Among the topics covered are:

- improving the organization and management of endangered species programs;
- promoting on-the-job learning as a means of improving recovery programs;
- designing and undertaking "prototype" program designs to explore different strategies for species recovery;
- experimenting with innovative team-building strategies;
- promoting the use of population viability analysis (PVA);
- pursuing inventive designs for species and population reintroduction programs;
- reviewing experience implementing recovery policy under the Endangered Species Act; and
- seeking a general understanding of the benefits of professional practice using a policy sciences, or policy orientation, approach.

Papers in the Applications section that have appeared previously in Endangered Species *UPDATE* include the chapters on implementing recovery policy (1988), PVA (1990), organization and management (1991), reintroduction (1991), professional practice using a policy orientation (1992), prototyping (1995), and learning (1996).

The third section, Cases, features

five new analyses of efforts to protect species or ecosystems of special concern. These case studies illustrate ways in which the policy sciences may be used by analysts and practitioners to evaluate and improve complex programs. Each case features one or more of the policy sciences concepts introduced in the first section of this issue. They are also intended to complement the policy sciences applications presented in the issue's second section. In the Applications section, the respective authors demonstrate how to use policy sciences concepts in practice. In the cases that follow, the authors use the analytical tools of the policy sciences to evaluate various programs and make recommendations for improvement. The cases address far-ranging conservation topics, including:

- black-tailed prairie dogs in the American west;
- great apes and the bush meat crisis in Central Africa;
- the Atlantic forest in eastern Brazil;
- biological corridors in Costa Rica; and
- the thylacine, or Tasmanian tiger, in Australia.

This special issue of Endangered Species *UPDATE* was created to provide guidance, where possible, for endangered species and ecosystem conservation efforts by providing ideas and direction for practitioners and analysts. Each article represents efforts by its author(s) to share their experiences using the policy sciences. Accepting new and in some cases radically different approaches to endangered species program design, implementation, and evaluation is a daunting challenge. We hope that the information in this issue will help reveal the utility in the approaches we espouse. In the concluding paper we describe how you might begin to apply these approaches and invite you to share with us your experiences using them. Finally, the literature cited throughout this issue can guide you to more complete descriptions and many other case applications.

This special issue would not have been possible without the guidance, assistance, and support of the staff of Endangered Species *UPDATE*: Beth Hahn, Jennifer Jacobus MacKay, and Misty McPhee. Other people assisted us with various aspects of this endeavor, including Denise Casey and Brian Miller. Funding was provided by the Denver Zoological Foundation, Northern Rockies Conservation Cooperative, Ursinus College, and Yale University's School of Forestry and Environmental Studies. Many individuals and charitable organizations aided publication of this special issue, including those that provided support to the Denver Zoological Foundation and Northern Rockies Conservation Cooperative, including Catherine Patrick, Gilman Ordway, Hope and Bob Stevens and the Fanwood Foundation, the Wiancko Charitable Foundation, Kathe Henry and the Scott Opler Foundation, and Stephen and Amy Unfried. We also want to recognize the many people we have worked with us as co-workers in the field and in the classroom.

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concepts

Red-legged frog (*Rana aurora*) by Ryan Haggerty, USFWS.

Making Partnerships Work in Endangered Species Conservation: An Introduction to the Decision Process

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Abstract
Partnerships are being used in endangered species conservation to improve effectiveness. The partnership goal is to increase cooperation, maximize resources available, and improve chances of species' recovery. Ideally, partnerships are unified by a common interest — recovery. However, in practice this is not necessarily the case as participants are differentially motivated and some carry out narrow self-serving actions within partnerships. As a result, "goal-substitution" weakens partnerships and increases the likelihood of failure. Endangered species case examples highlight that dysfunctionality is common to recovery programs and support our view that a better understanding of the decision process involved can improve recovery. Effectiveness of partnerships can be improved by teaching participants how to recognize and avert common problems, and how to build, lead, and participate in a better decision making process. The decision process is a means of reconciling or at least managing conflicts (i.e. rational, political, and moral conflicts) among policies through politics, and is comprised of seven functions: intelligence, promotion, prescription, invocation, application, appraisal, and termination. These activities are described, examples given, standards recommended, and questions to ask about each are given. The existence of a recovery program does not necessarily mean that partners are using a good decision process. However, a high quality decision process will make endangered species conservation most effective and efficient, and minimize failure.

Introduction
Those committed to restoring endangered species can recognize years of heroic effort (e.g., Yaffee 1982, 1994; Alvarez 1993; Clark et al. 1994; Bennett et al. 1995; Miller et al. 1996; Clark 1997). At the same time, they can acknowledge significant shortfalls in the overall effort. The tendency to subordinate the goal of recovery to other interests represented in a recovery program is one reason, among many, for these shortfalls. "Cooperation among scientists is not always a simple matter" (Mares 1991:59). The scientists, however, are not alone; bureaucrats, advocates, and others involved in a recovery program also have interests in addition to species recovery. A recovery program, in other words, is a human endeavor. It represents a noble human concern for other species, but it is vulnerable to goal substitutions and other human traits, including aggressiveness, dogmatism, and worse.

The increasing number and scale of partnerships augments both the possibilities for successful recovery and the vulnerabilities. Many types of partnerships exist, focusing on different species in different locations facing different biological challenges with different people involved. Some partnerships work better than others for species recovery (e.g., National Fish and Wildlife Foundation 1993; Beatley 1994; Clark and Cragun 1994; Jentoft and McCay 1995; Hutcheson et al. 1995; Roy and Fischer 1995). Despite differences, every partnerships entails a decision process through which the partnerships attempt to clarify and secure their common interest. Every decision process must perform certain functions well in order to succeed, whatever the common interest may be. An improved understanding of the decision process — and how to evaluate and improve its critical functions — can maximize the possibilities for successful recovery and minimize the vulnerabilities.

This article discusses the problems and possibilities in the decision processes of partnerships formed to recover listed species. It illustrates these using the Australian eastern barred bandicoot (*Perameles gunnii*)

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and the American black-footed ferret (*Mustela nigripes*) recovery programs. Components of the decision process itself are then identified.

Partnerships

The trend in endangered species programs is toward more and larger partnerships. Habitat Conservation Plans (HCPs), called for under the Endangered Species Act (ESA), are just one form of partnership. About 50 HCPs are underway and hundreds more are under discussion (Bob Baum 1996, personal communication). Moreover, partnerships are no longer limited to government agencies as conservation groups, universities, and businesses are becoming more prominent and, under some circumstances, even taking the lead in new partnerships. Ideally, a partnership is motivated by the partners' common interest in recovery of an endangered species. The expectation is that the goal of recovery is beyond the reach of any one agency or organization; none of them, working alone, has the resources, such as expertise, funds, and authority, necessary or sufficient to get the job done. By cooperatively using pooled resources, partnerships can maximize possibilities for species recovery.

In practice, however, recovery is not always the primary (or even a priority) goal for everyone in the partnership. For some participants, the partnership may be a chance to maintain funding for an existing agency or organization that has priorities other than recovery. For others, the partnership may be an opportunity to perform basic scientific research that may or may not contribute to recovery. These types of "goal substitutions" make the partnerships more vulnerable to failure and the species more vulnerable to extinction. The style or approach that participants use to pursue their own goals can further jeopardize the partnership. Participants who are aggressive, dogmatic, secretive, suspicious, and vindictive can easily dominate the partnership. Participants who are excessively timid, compromising, open, trusting, and forgiving may unwittingly collude in the destruction of cooperation; they reinforce dominating and destructive behavior by letting the others get away with it. Without partners of good will and good sense, there is little that can be done to cope with such patterns of behavior. A better understanding of decision process can go a long way toward minimizing these potentially damaging patterns and maximizing the possibilities for successful recovery.

Two cases illustrate the importance of the decision process for successful partnerships and recovery programs.

Eastern barred bandicoot program

The Australian eastern barred bandicoot program, composed of a single governmental agency for over ten years and later joined by non-governmental organizations (NGOs) and universities, was unable to obtain key information needed to plan and carry out recovery. Intelligence gathering, planning, and open debate about what to do and when to do it were limited. The partnership never clarified rules or guidelines for its own operation or for species recovery. After a few years, individual and organizational partners pursued separate goals and actions without adequate consideration of the consequences to overall species recovery or to the developing partnerships. As a result, the implementation — both technically and organizationally — was inadequate, and the species continued to decline. Essential data were lacking, especially feedback about the efficacy of management actions as well as the quality of the program itself. No comprehensive program appraisal was conducted, thus, there was little learning, and improvements were not possible. In short, despite activity in

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meeting rooms and in the field, the wild population continued to decline and the captive population grew little.

A "crisis intervention" appraisal of the entire program was eventually undertaken by several participants. The appraisal — systematic, comprehensive, and professional — resulted in a reorganization to streamline and upgrade all decision functions. Intelligence was improved by setting up working groups to gather scientific and social information, including a computerized captive breeding management plan. Open debate about the program and its future were encouraged. Implementation was improved by giving the working groups "the authority, guidance, and resources to develop and meet their own targets using their professional expertise," by appointing a strategic planner, and by developing the first true recovery plan for the species (Backhouse et al. 1994:263). Appraisal systems were improved by having the working groups meet with and report to core decisions makers at frequent, regular intervals, by giving working group members better access to decision makers, and by having the partnership conduct regular assessments of the program. Ongoing evaluation has led to several refinements in the structure and operations of the program. All in all, these efforts resulted in significant improvements in partnerships interactions and the species' status in a very short time (Backhouse et al. 1994; Clark et al. 1995), although it is premature to declare the species recovered.

Black-footed ferret program

Over the past fifteen years, the American black-footed ferret program has shown similar dysfunctional features: limited debate among partners about how to proceed, inability to obtain consensus on rules for progress; unproductive conflict; individual behavior contrary to the best interests of ferret recovery or the partnership; and a lack of appraisal, to mention a few problems (Reading and Miller 1994; Clark and Harvey 1998). According to Miller et al. (1996) the decision process functioned poorly relative to the overall goal because of goal substitution, narrow ideologies about power, and the use of coercive strategies on the part of the lead government bureaucracy. Decision functions were concentrated in the hands of a few and activities were channeled in ways that were congenial to the most powerful individuals and agency. Although the powerful role of government bureaucracies in decision functions is widely recognized, concentrating power over these functions seemed to be an end in itself in the ferret case, and the goals of species recovery and a successful partnership faded into the background.

These problems have not been addressed by federal or state authorities, despite widespread publicity. Due to a lack of progress and funding difficulties, however, the U.S. Fish and Wildlife Service (FWS) asked the American Zoo and Aquarium Association (AZA) to conduct a program analysis and action planning process. While the appraisal focused primarily on technical issues and fell short of looking comprehensively or systematically at the decision process, it did address parts of the decision functions and found them lacking. The appraisal's final report is forthcoming. Regardless of the AZA's recommendations, the FWS is ultimately responsible for making the partnership's decision process serve the overriding goal of ferret recovery.

Decision process

By knowing how the decision process works, or does not work, partners in endangered species recovery can maintain good practices or correct a poorly functioning process. The decision process is a means of reconciling or at least managing conflicts among policies through politics. Politics are inevitable because people develop and pursue different policies that reflect their own interests. Yet, in many instances, like endangered species restoration, people must reconcile policy differences to secure a common interest. In the decision process, a working specification of the common interest takes the form of rules, both substantive and procedural (e.g., what is to be achieved and how?). There are many kinds of rules for many kinds of partnerships and communities, including informal guidelines and social norms that are accepted in a group (e.g., norms of discussion in meetings), requirements established by experts (e.g., population viability analyses), laws by representatives of the people for a local, state, or national community (e.g., the ESA), and rules about rule making (e.g., the U.S. Constitution). Rules are necessary for any group of people to coordinate, albeit imperfectly, the expectations and actions of its members. An action by a member is appropriate to the extent that it complies with applicable rules already prescribed by the relevant community; it is inappropriate when it does not comply. Fortunately, there is a large body of experience and theory about decision processes that can be applied directly and practically to species conservation (Lasswell 1971).

The decision process of a species conservation partnership should be an open, flexible, and fair means to produce operational rules for all partners to follow in meeting the partners' common goal. Recovery plans, management plans, proposals, cooperative agreements, and the like are the basis for rules. Yet, the existence of a recovery plan does not necessarily indicate a good decision process or adequate rules for cooperation and recovery. Partnerships can not work if some members seek rules that ben-

efit their own special interests at the expense of common interest. Once rules are specified and agreed upon, the rules must be enforced against challengers. The rules can be evaluated by the partnership and changed if necessary — provided, of course, that the rules are clear enough to be evaluated.

Although many people think of decisions as a precise point in time when commitments are made, in fact, many related decisions proceed that moment and many follow. Decision making is better described as a process than an event. Seven functions can be distinguished in every complete decision process (Lasswell 1971). The best way to introduce them is to ask seven general questions: (1) How is information about a problematic situation gathered, processed, and brought to the attention of decision makers? (2) Based on this information, how are recommendations promoted and made? (3) How are general rules prescribed? (4) How are the rules invoked against challengers in specific cases? (5) How are disputes in specific cases decided or resolved? (6) How are the rules and the decision process appraised? (7) How are the rules and the process terminated or modified? Table 1 lists and describes these seven functions, gives some examples, as well as standards they should meet, and suggests some basic questions that decision makers, other participants, and observers need to ask. In any ongoing decision process it is usually quite easy to identify these seven functions and the groups that are carrying them out, and to judge how well they are working. Consequently, it is also possible to intervene and improve one or more decision functions so that species recovery is enhanced and the partnership runs more smoothly.

Although it is possible to point to agencies and organizations that specialize in a given function, all partners perform all functions to some extent. It is apparent, too, that most functions are performed outside the organizations involved in species conservation. For example, as directed by ESA, the FWS carries out all seven functions, but many other organizations are involved as well. The National Biological Service [now the Biological Resources Division] and university researchers are primarily involved in gathering intelligence, planning, and estimating the conservation threat (e.g., pollution, habitat loss) and what to do about it. Conservation groups and businesses are often highly visible in promoting one course of action over others, although it should be acknowledged that all groups (and often subgroups and individuals), despite claims of objectivity and neutrality, take positions and promote decisions that will serve their own interests. Rules are set not only by legislative bodies, but also by agencies which have enormous influence in the design and actual operation of recovery programs, including field team activities. The FWS is usually joined by other agencies and organizations in implementing programs. The agencies are again involved in dispute resolution, as are the courts, while the media are involved through reporting on conflicts. The agencies, NGOs (e.g., AZA in the ferret case), and the public are involved in review and evaluation of conservation efforts. The final decision to terminate is usually made by government, but many other organizations are involved or affected by decisions to stop or significantly alter programs (e.g., see the dynamics of grizzly bear delisting in the Yellowstone region; Mattson and Craighead 1994; Greater Yellowstone Coalition 1995; Interagency Grizzly Bear Committee 1996). In the decision process of any organized partnership we may expect to find several official and unofficial participants involved in one or all decision functions.

Whether part of the formal partnership or not, people committed to species recovery should demand excellence in each decision function and in the overall process. The decision functions described in Table 1 can be used to ask hard questions and to develop standards to be applied, continuously and independently, by all concerned. Partnerships in endangered species recovery would be much more effective and efficient when they develop high-quality decision processes, which will depend on members learning explicitly about how the decision process works, how they can monitor the process, and how to intervene to improve decisions. With a relatively complete picture of the decision process, based on good intelligence and appraisal, participants can realistically and functionally describe their interactions with other members and explain the actual process and outcomes in their specific cases. A detailed analysis of the decision-making behavior of partnerships can reveal which values are at stake for individual members and the overall partnership. There must be fair trading and mutual exchange among members for a partnership to work well. In some (perhaps many) programs, however, partners do not share similar values, and little group effort is spent in clarifying and developing common ground. For example, while power, wealth, or special knowledge are often necessary for effective partnerships, these resources can distort the decision process. Power can be used to centralize, concentrate, or legalize certain decision functions, to the detriment of other involved or concerned people. The consequences may be catastrophic; if the partnership becomes embroiled in destructive conflict and disintegrates, the species may go extinct.

Decision making must be grounded in real-world contexts. It must be comprehensive yet manageable. The decision model presented here is a tool for building a map of each

particular process. And the map can be used by partners to guide the recovery effort, ensuring, for example, adequate intelligence and appraisal functions. Decision making requires a successful pattern of thought and action, and it is this crafting and maintaining of a good decision process that is the central challenge to partnerships in endangered species conservation.

Conclusions

Partnerships are being used with growing frequency to tackle many natural resource problems. The combined assets of government, conservation groups, business, and public involvement are a powerful tool to address these challenges. For partnerships to be effective, considerable attention must be given to the decision making process. Modern conservation practice demands a working knowledge of the seven decision functions; this knowledge is necessary for learning how to recognize and avert problems and how to build and maintain rational, participatory and equitable decision making processes to achieve species recovery.

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Denise Casey, Northern Rockies Conservation Cooperative, Pam Lichtman, Jackson Hole Alliance for Responsible Planning, Peter Wilshusen and David Gaillard, Yale University's School of Forestry and Environmental Studies critically reviewed the manuscript.

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Table 1. The seven decision functions essential to all endangered species conservation efforts (after Lasswell 1971).

Function (1)	Activities	Examples	Standards	Questions to Ask
Intelligence Planning	Information relevant to decision making is gathered, processed, and distributed. Planning and prediction take place. Goals are clarified.	Field work, social surveys, models, pluralistic discussion	Reliable, comprehensive yet selective, creative, open	Is intelligence being collected on all relevant components of the problem and its context and from all affected people? To whom is intelligence communicated?
Promotion Open debate	Active advocacy debate about what to do takes place. Different alternatives are promoted. Resources, data, and opinion are mobilized to secure preferred outcomes. Expectations begin to crystallize and demands are clarified.	Forums, pluralistic discussion, recommendation	Rational, integrated, comprehensive, effective	Which groups (official or unofficial) urge which courses of action? What values are promoted or dismissed by each alternative and what groups are served by each?
Prescription Setting rules or guidelines	Policies or guidelines for action are formulated and enacted. Demands are crystallized. Facts and their contexts must be examined, rules clarified, and implications of the rules examined. Rules must be specified, communicated, and approved by the partnership, government officials, and others concerned, i.e. those with authority (full support of officials and people involved) and control (a means to encourage compliance with rules).	Recovery plans and other written and verbal agreements for species/ habitat conservation.	Comprehensive, rational, open	Will the new prescriptions harmonize with rules by which the agencies already operate, or will they conflict? What rules does the partnership set for itself? What prescriptions are binding (these are easier to determine if they are written down)?
Invocation Implementation	General rules are put into practice. They begin to be applied in actual cases.	Programs are organized, teams set up, and work (research, management, public relations, analysis, etc.) begins in field, lab, and office.	Timely (prompt), open, dependable in characterizing facts, rational, not open to abuse by individual members, effective	Is implementation consistent with prescription? Who should be held accountable to follow the rules? Who will enforce the rules?

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Function (1)	Activities	Examples	Standards	Questions to Ask
Application Dispute resolution	Differences or deviations from the rules — based on peer review, authority, or other mechanisms — are resolved and implementation proceeds. Participants must interpret rules (prescriptions), supplement them if needed, and integrate old and new prescriptions into a working program. There must be enforcement as well as continuous review and approval or disapproval of behavior.	Open, pluralistic forums, internal and external means. The courts may figure prominently, but many resolutions take place formally or informally inside the program.	Rational (conforming to common interest prescriptions), uniform (independent of special interests), effective (must work in practice), and constructive (mobilizing consensus and cooperation).	Will disputes be resolved by people with authority and control? How do participants interact and affect one another as they resolve disputes?
Appraisal Review	Efforts are evaluated and continuous assessment is made of success and failure, in terms of goal achievement and responsibility and accountability for what happened. This requires gathering information on how well past decision functions worked, assessing the quality of performance, and disseminating findings and recommendations to appropriate people and publics.	Formal and informal, internal and external evaluations	Dependably realistic, on-going, independent of special interests, fully contextual (taking many factors into account, including matters of rationality, politics, and morality)	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?
Termination Termination	This is the cancellation of past prescriptions and frameworks for their implementation and the compensation of people who are adversely affected by termination. This function is most often overlooked or underappreciated.	Stopping practices that are not working as well as those that have accomplished their goals, moving to a new beginning.	Prompt, respectful and consistent with human dignity, comprehensive, balanced, and ameliorative	Who should stop or change the rules? Who is served, and who is harmed by ending a program?

1. The terms intelligence, promotion, prescription, invocation, application, appraisal, and termination are described in detail by Lasswell (1971).

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Northern spotted owl (*Strix occidentalis caurina*) by James and Karen Hollingsworth, USFWS.

Solving Problems in Endangered Species Conservation: An Introduction to Problem Orientation

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Abstract
Addressing endangered species problems successfully is a complex task that involves knowledge of the problem itself and its context. Problem-solving decisions and on-the-ground management are complicated and affected by numerous considerations. We illustrate complexities of problem solving in endangered species programs, using the Florida manatee recovery program as an example, and describe a practical approach for orienting to conservation problems that can help decision makers, other professionals, and interested people to better understand and develop recovery alternatives that are in the best interests of endangered species conservation.

Introduction
Endangered species conservation is crisis-oriented. Often, a field season that is too short, an interagency conflict threatens to stall efforts, or a program is held back by a puzzling technical problem, an impending budgetary shortfall, or a public outcry. These and many other problems must be overcome in recovery efforts. Viewing recovery as a series of interrelated problems that must be successfully addressed requires professionals and other people involved to be "problem oriented" in their outlook and actions. Because of the crisis atmosphere that accompanies recovery efforts, a particular kind of decision making in both the field and office can occur that is often not problem oriented. Decision makers, for example, may choose the one "conservation" alternative that is most appealing or expedient at the moment. This may be the alternative that casts them in the best possible light, produces the least number of conflicts, or otherwise allows them to feel best about themselves or their work (Ascher and Healy 1990).

We call this sort of decision making "solution oriented." It occurs when an individual or group is confronted with a problem and first decides which outcome is preferable and then makes a decision that will best achieve their preferred outcome. Often this approach is based on a limited view of the problem at hand. Instead of being genuinely "problem oriented," the effort is focused and "solution oriented," and decisions are made for purposes other than efficient species recovery. In this paper, we examine the problem oriented approach in general terms, describe its features and benefits, and illustrate its practical utility to endangered species conservation.

What are "problems?"
There are many ways to define a problem — all related to who develops the definitions (Weiss 1989). Analysts, legislators, lobbyists, advocates, scientists, managers, and the general public all may have different views of an endangered species problem. In this article we focus mainly on the behavior of federal and state agency staff involved in species recovery, and especially those in positions of decision-making authority.

Decision makers in endangered species programs are no different than decision makers elsewhere — they commonly choose to pursue solutions to problems that benefit them personally or professionally. As Janis and Mann (1977:9) note, "self-approval is an essential requirement for being satisfied with a decision." However, this is not always the best way to address endangered species problems. By relying too strongly on personal fulfillment criteria, alternatives that better address the recovery problem are often overlooked or ignored. What is best for the decision maker is often not best for addressing the conservation problem. Some decision makers fail to recognize this point, and as a result decision making is less effective than it otherwise could be. When this kind of problem includes decisions critical to the conservation of endangered species, the difference can be substantial and have significant long-term, and perhaps even catastrophic, effects on the recovery of the species.

Generally speaking, what is a prob-

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lem? Problems result from the discrepancy between a desired outcome — what a decision maker wants to have happen — and what actually occurs (Merton 1961; Kilmann and Mitroff 1979; Dery 1984). For example, consider a federal or state agency that reintroduces an endangered species into currently unoccupied habitat to establish a new and eventually viable population. Once the species is reintroduced into the unoccupied habitat, however, it suffers nearly 100 percent mortality due to various factors. The discrepancy between the desired outcome (establishing a new viable population) and the actual outcome (near 100% mortality of the introduced species) is the problem. To address this problem, the agency's staff have a number of approaches they can take. If they are solution oriented, they may revert to their original goal to reintroduce the species and choose a solution that addresses it as quickly as possible, such as attempting another reintroduction. Using a solution oriented frame of reference to endangered species conservation tends to recycle a misconceived conservation problem over and over in ways that consistently fail. For example, this is what actually happened in the endangered black-footed ferret (*Mustela nigripes*) case in Wyoming (Miller et al. 1996; Clark 1997). If participants' desire to carry out reintroduction is strong enough and they wish to save face, to not be considered a failure, or to accomplish an important scientific success, they may collect selected data that indicates that the near 100 percent mortality rate was caused by factors that are not likely to be repeated again, and thus rationalize attempting another reintroduction. The focus is on a single alternative, not on understanding the actual problem at hand, including the possibility that their own solution-oriented approach may be a real problem as well. This is being solution oriented.

We believe that a better approach to conservation is to be problem oriented. We recommend adopting a strategy of understanding the problem, including its context, rather than focusing on the most desirable technical solution. This approach offers a range of practical alternatives for addressing conservation problems in clearer and more realistic terms, and can result in more effective decision making for endangered species conservation. It is also an approach in which action can take place despite underlying and potentially substantial scientific uncertainty.

In endangered species conservation, science, management, and policy decision making is often disconnected and in some cases even polarized. That is, different participants are often responsible for each of these three areas, and the strategies used to make decisions in each area are often different and in some cases may be in direct conflict with one another. For example, consider a hypothetical endangered species. For our purposes, the problem at hand is the species' decline. The species' needs include further research, management actions to protect it and its habitat, and policy decisions to promote the continuation of its recovery program. For this species at a given point in time, a research decision may be made on the basis of what data is needed for its recovery, whereas a management decision might be made on the basis of who will need to be consulted before an action can be taken, and a policy decision such as which aspects of the program to cut or continue might be made on the basis of how large a budget can realistically be hoped for in the next funding cycle. A specific outcome of each of these three decisions might be necessary to further the recovery of the species, but there is often no common basis to tie these decisions together — no unifying, integrative problem oriented approach to the species' recovery. In fact, the research decision might be made on the basis of the interests and skills of the lead researcher. The management decision might be made on the basis of a decision maker's desire to avoid consulting with a disliked person or agency, and the policy decision might be made on the basis of how hard a decision maker is willing to battle superiors for increased funding. In each case it is as likely, if not more likely, that a decision will be made on the basis of a desired outcome such as avoiding a consultation with a disliked individual or a confrontation with a superior. Decisions made on this basis are solution oriented and rarely benefit species conservation. Unfortunately, the opportunity to be genuinely problem oriented may not exist or be possible in such settings.

The five tasks of problem orientation

To carry out sound integrated research, management, and policy and to avoid a solution oriented approach, Harold Lasswell (1971) proposed a strategy for problem solving that consists of five tasks: clarifying goals, describing trends, analyzing conditions, projecting developments, and inventing, evaluating, and selecting alternatives (Table 1). We recommend that this approach be used in endangered species conservation, though it is applicable to any kind of problem, conservation or otherwise.

The five tasks direct individuals to ask questions and seek out information in a fashion conducive to learning as much as possible about a conservation problem before making a decision to address it. This approach has been described and used on large carnivore conservation in the northern Rocky Mountains of the United States and Canada (Clark et al. 1996), in appraising threatened species conservation in Australia (Clark 1996), and in selected endan-

gered species cases in the United States (e.g., Clark 1997). Most recovery efforts attend to several of these five tasks in varying degrees and with varying levels of success. We describe each of the tasks briefly.

Table 1. One of several different ways to use problem orientation to address problems (after Brunner, personal communication; Clark 1997).

Problem Oriented Exercise

1. *Goals*. What outcomes do we prefer (what are our goals)? What are the problems with respect to these goals?

2. *Alternatives*. What alternatives are available to the participants and others to solve the problems?

3. *Evaluation of alternatives*. Would each contribute toward solution of the problems?

    a. *Trends*: did it work or not work when tried in the past on relevant cases?
    b. *Conditions*: Why, or under what conditions, does it work or not work?
    c. *Projections*: would it work satisfactorily under these conditions?

Repeat the procedure to refine and supplement considerations of goals, alternatives, and evaluation so far.

Clarifying goals

"The goal-clarifying task is indicated by the blunt question, 'What ought I to prefer?'" (Lasswell 1971:40). Because the endangered species problem occurs in a context (e.g., the structure of a recovery program or the dynamics of interagency or interoffice relations), it is vital to always focus on both the problem and its context. This goal question is best answered for a given endangered species problem after considering the problem's context or social process (Clark and Wallace 1998). Considering the social process means analyzing a particular problem or situation using several indicators. These include: (1) the actual or desired participants involved, (2) their various perspectives on the issue, (3) in what situations they interact or might interact, (4) what values (or assets or resources) they use in their efforts to achieve their goals, (5) what actions or strategies they use to achieve their goals, (6) what outcomes they will or might achieve, and (7) what the real and potential effects of their actions are (Clark and Wallace 1998 after Lasswell 1971; Willard and Norchi 1993). Once these factors have been considered, it becomes much easier to determine the costs and benefits of desired goals while aiming to reduce uncertainty and the potential to introduce further problems into the decision making process. Social process mapping should continue over the life of the recovery effort.

Describing (historical) trends

Describing trends means finding out how the species and its habitat are doing and also which participants and perspectives in the species conservation effort have met or fallen short of goals in the actions they have taken (Lasswell and McDougal 1992). "The immediate aim is to suggest that much can be accomplished in a problem-solving strategy that gives full weight to asking and answering the questions, 'Where are we? How far have we come in achieving what we are aiming at? Where are the positive and negative instances of success or failure?'" (Lasswell 1971:48). Answering these questions further clarifies the reasons that actions are taken and that certain outcomes result. However, it is important to do so for each technical component as well as each participant in the recovery effort. It is also important to understand how the other facets of the social process outlined above pertain to how well the overall program is meeting goals.

Analyzing conditions

For each of the trends identified about the species and its habitat and its human context there is a set of conditions influencing it. In order to understand trends in the species' numbers or habitat quality or whether participants have met or fallen short of goals it is necessary to analyze the factors that account for those trends. This task focuses on scientific inquiry, not only of endangered species biology, but also of human and organizational behavior and policy preferences in the social process.

Making projections

The fourth task involves making projections about what will likely happen given past trends and conditions. In part, this task demands that we suspend our beliefs and conventional views of what actions participants might take in the future. Instead it asks that we take a current situation and project it, free of the effects of possible future actions, to its likely outcome. For example, if current legislation severely reduces an agency budget for species recovery, the projected outcome is likely to be bleak. This example illustrates simply that by projecting current circumstances into future outcomes, we gain better insight into how those circumstances will affect the conservation problems at hand. Such projections also indicate where interventions or other alternatives are needed to address the problem and produce acceptable future outcomes. In our budget example, given that the species will decline without adequate funds, two alternatives include increasing the budget of the hamstrung agency or transferring authority for

species recovery to an agency with better funding. The other part of making projections is to try to foresee the consequences of choosing certain alternatives.

Inventing, evaluating, and selecting alternatives

This task calls for creating, reviewing, and choosing objectives and strategies for achieving them. In other words, what approaches do we use to realize the goals we set for endangered species conservation? What are the alternatives we will undertake to change conditions so that future trends will be favorable for the species and the human system involved? On the basis of all that we have learned about a given problem in the four previous tasks, what decisions should we make to reach our preferred goal?

In endangered species conservation these five tasks must be carried out to some extent over and over again over the lifetime of the program. For example, a detailed look at historical trends might force some endangered species program participants to return to and reformulate their goals. At every point in carrying out the five problem orientation tasks, problem solvers may be required to return to earlier tasks. The following case illustrates the importance of problem orientation in endangered species decision making.

Mass mortality, contingency planning, and the Florida manatee

Early in 1982, 39 Florida manatees (*Trichechus manatus latirostris*) died due to what is believed to have been the effects of a toxin caused by a dinoflagellate commonly associated with red tide in Florida (O'Shea et al. 1991). Although it was not the first time red tide was suspected as a cause of manatee mortality (Layne 1965), it was the first such die-off to occur after the development of a formal Florida manatee recovery program under the Endangered Species Act.

The Florida manatee was listed as endangered under the Endangered Species Act upon its passage in 1973, and is also protected under the Marine Mammal Protection Act of 1972. The first recovery plan for the species was adopted in 1980 along with a comprehensive work plan to coordinate interagency implementation of the recovery plan (U.S. Fish and Wildlife Service 1980; Rose et al. 1981). The original plans did not specify measures to be taken in preparation for a die-off. Following the 1982 die-off, calls were made for the U.S. Fish and Wildlife Service (FWS) and the Florida Department of Natural Resources (FDNR, now the Florida Department of Environmental Protection [FDEP]) to develop a contingency plan to address preparations for and actions necessary to respond to another die off. At the time, FWS and FDNR represented the lead federal and state research and management authorities in the manatee recovery program.

In 1988 FWS convened a new Florida manatee recovery team and charged it with revising the recovery plan, which it did in 1989 (FWS 1989). By 1988, no contingency plan had been developed. As a result, the recovery team considered developing a contingency plan for responding to future die-offs to be among the highest priorities in manatee recovery. Subsequently, the revised recovery plan specified that FWS and FDNR should complete the contingency plan by January of 1990. When that date passed, researchers involved in the 1982 event reiterated the need for a contingency plan (O'Shea et al. 1991).

According to FWS staff, after the release of the revised recovery plan, FDNR staff were given initial responsibility for drafting the contingency plan. Not having prepared anything by 1992, they asked FWS to prepare it. FWS agreed, but got no farther than preparing an outline, which was subsequently shelved when other issues that FWS considered more pressing took precedence. As a result, when another red tide-related die-off occurred in 1996, there was no contingency plan, and the response, in terms of coordination and cooperation among key participants, was chaotic.

The 1996 die-off lasted approximately two months, from early March into May, and resulted in the deaths of 149 manatees (Florida Marine Research Institute 1996; Marine Mammal Commission 1998). Early in the die-off, multiple manatee carcasses were being recovered every day, creating an unprecedented workload for an extraordinarily experienced team of scientists schooled in manatee carcass salvage, pathology and epidemiology, contaminants, and other areas necessary to respond to a die-off. The response illustrated both the exceptional technical capabilities of participants in the manatee recovery program and the inability of those participants to address a die-off of such magnitude unprepared. Problems that may have been minor during times of low manatee mortality were substantially magnified by the frenzied atmosphere of the die-off response. Issues concerning personality conflicts, the chain of command, communication among participants (particularly between agencies) and with the media, coordination of response tasks, taking and handling of tissue samples, and distribution of data, among others, became major stumbling blocks to a smooth response.

Virtually all of the problems experienced by participants in the response were attributable either directly or indirectly to the lack of a contingency plan (Marine Mammal Commission 1997). This was noted by many participants in the response, as well as independent reviewers (Marine Mammal Commission 1996,

1997; Work 1996). By April 1997, FWS answered its critics by completing a contingency plan (FWS 1997). This plan, however, did not sufficiently address FDEP's involvement or the steps necessary to convene and coordinate an interagency team to respond to future die-offs. As a result, FDEP contracted to have its own contingency plan developed by the end of the year (Geraci and Lounsbery 1997). Soon after, FDEP suggested to FWS that it combine the two plans, and FWS agreed to do so (FDEP 1997; FWS 1998).

Problem orientation in the Florida manatee case

Mass mortality of manatees is a crisis which triggers the need to mobilize and organize in a very short period of time (ranging from hours to days) numerous experts located in different cities, responsible for different tasks, and answerable to different mandates, superiors, and budgetary constraints. The initial and overriding goal of a manatee die-off response is to efficiently and effectively coordinate and carry out the response, including determining the cause and doing whatever is possible to mitigate it. In 1996 the discrepancy between that goal and what actually occurred created the problem — the response was poorly coordinated and, as a result, aspects of it were poorly carried out. Therefore, participants and observers noted trends and conditions: a technically proficient but organizationally poor response to the 1996 die-off. In response to these trends and conditions, participants and observers projected possible scenarios based on whether the goal (an efficient and effectively implemented response) would be met in the future. That is, what would happen in the event of another die-off if there (1) still was no contingency plan, or (2) was a comprehensive contingency plan in place. Alternatives flow logically from these projections. In this case, the one obvious alternative to be pursued was to ensure that a contingency plan was produced. Everyone involved in the die-off response recognized this, and many pressured FWS to undertake the job in a timely fashion, which it did. FDEP, independent of FWS, then developed its own plan to address deficiencies in the FWS plan.

Obviously, neither FWS nor FDEP completed a contingency plan prior to the 1996 die-off. It took a crisis, and its associated wake-up call, to provoke them into action. After the 1982 manatee die-off, analysis of the trends and conditions surrounding the die-off and the response to it by recovery program participants and observers led to the formation of a goal. That goal was to develop a contingency plan, and it was even formalized in the Florida manatee recovery plan. The fact that it did not happen until after a second, more severe die-off occurred illustrates how difficult it can be to successfully perform the five tasks of problem orientation given real contexts, even when addressing a well-defined problem with potentially catastrophic results.

As in many other endangered species programs, in the manatee recovery program FWS and FDEP are constantly challenged to assess trends and conditions, set goals, make projections, and evaluate alternatives to address numerous problems. The Florida manatee recovery program is complex - there are more than 20 state and federal agencies and non-governmental organizations given formal responsibility for implementing recovery tasks in the most recent recovery plan revision (FWS 1996). Additionally, manatees' principal threats include collisions with motor boats (of which there are more than 750,000 registered in Florida) and loss or degradation of their habitat due to coastal development (of which there is a great deal in Florida). The recovery program's bureaucratic complexity combined with the exacting demands of mitigating manatee mortality and habitat loss leads to a "brush fire" mentality in which long-range planning in the regulatory agencies takes a back seat to a crisis-a-day atmosphere.

Excessive workload is not an excuse for the agencies' failure to develop a contingency plan prior to the 1996 die-off. Rather, it is an illustration of the difficulties encountered in problem orientation. For any given problem, it is necessary to undertake the five problem orientation tasks. When confronted with multiple problems every day in which trends, conditions, goals, projections, and alternatives must be weighed, it can be difficult to keep up with the intellectual and practical demands. It is in these instances when practitioners may become "solution oriented" and skip certain tasks, particularly making projections and considering alternatives, to make decisions based on personal interest.

In the case of the manatee die-off contingency plan, the decision not to prepare such a plan even after it was mandated in the 1989 recovery plan was not malicious. Rather, it was the result of a solution orientation in which it was easier to bypass the problem orientation tasks than to undertake them in a hypothetical situation (the possible occurrence of another manatee die-off). It can be very difficult to project potential consequences of a given decision. However, following the 1982 die-off, by considering the complexities of die-off response, the possibility of contending with a much larger die-off in the future, and the many people and actions that would need to be coordinated, the organizational shortcomings of the 1996 die-off could have been projected. Had FWS staff taken a little time to conduct the problem orientation tasks, they might

have recognized the benefits of developing a contingency plan and taken action sooner.

Conclusions

In endangered species conservation, it is critically important to address each of the five problem orientation tasks in every practicable situation. The benefit of problem orientation, regardless of who undertakes it, is to better understand the problem or decision and its context. This may sound like a call for a lot of time-consuming academic effort for a crisis-oriented field in which time is always at a premium. However, the problem orientation tasks can be conducted quickly; they do not have to be time-consuming, merely an honest attempt to place in context facts, options, and potential consequences of a decision. It makes sense to gain as broad an understanding as possible of the context of a problem before addressing it. Problem orientation helps this process, and in so doing improves the scope of knowledge available to the decision maker, and thus clarifies which alternatives will best achieve the goals of conservation. We have illustrated how problem orientation can be used to improve decision making and actions for endangered species conservation. Using the approach we propose will help anyone interested in practical endangered species conservation to gain a better understanding of the issues they wish to address.

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Understanding the Human Factor in Endangered Species Recovery: An Introduction to Human Social Process

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Abstract
*Biologists often take a technical biological view of species recovery, overlooking the necessity of attending to the human factor. The Hawaiian monk seal (*Monachus schauinslandi*) and Yellowstone grizzly bear (*Ursus arctos horribilis*) cases illustrate negative consequences to a recovery program when social process is overlooked, under-attended to, or ignored. Understanding human social process in practical terms is essential as species will be recovered only if human social process can be made to effectively support restoration. A practical model of social process (i.e. participants, their perspectives, situations, values, strategies, outcomes, and effects) is described and a method to realistically "map" the social process is introduced. Seven kinds of public participation in species recovery are described. It is recommended that greater attention be given to social process dimensions of species recovery at the same time that biological issues are addressed and the public be involved actively in support of species conservation.*

Introduction
Most biologists have been trained to understand the species loss problem and the recovery solution primarily in technical terms. The importance of the human factor can be overlooked, ignored, or viewed as a constraint to the central biological task of species recovery. From this standpoint human interactions are often labeled as "politics" and dismissed as outside of recovery professionals' immediate concerns (see Kellert 1985). We all know that people's interactions affect the environment; some interactions may lead to protection of biodiversity and some may lead to species endangerment, depending on the type and its outcomes. Understanding human social process in practical terms is important because endangered species will be saved only if social process can be made to effectively support that goal. Social process "mapping" describes the interaction among people in the context of a recovery challenge, for example, between managers and biologist, between non-governmental organizations and government agencies, or between conservationists and the public. Social process mapping also describes the interaction between people and the problem itself, for example, the effect that recovery actions such as habitat protection have on people's lives and values. These two types of social interactions are both the ultimate cause of the endangered species crisis and the site of its ultimate solution. Endangered species recovery professionals must understand social process in species recovery work and learn to participate in it productively if they want to be maximally effective. This article examines human social process in general terms, offers an approach to understanding it, and surveys the kinds of social participation possible in recovery.

Endangered species case examples
Two cases illustrate the importance of mapping, understanding, and participating in social process during the recovery process. Ignoring the social dimensions of management can result in overlooking allies and support for conservation, it can lead to intractable negative public perceptions, and it can draw down trust in government officials and professional biologists. In some cases, under-appreciating and not working with social process can lead to failure to conserve species!

Hawaiian monk seals in Hawaii
In 1994 National Marine Fisheries Service (NMFS) biologists attempted to solve a long-standing problem facing Hawaiian monk seals (*Monachus schauinslandi*) in the northwest Hawaiian Islands. The seals, numbering fewer than 1,500 and listed as endangered under the federal Endangered Species Act (ESA), suffered from an aberrant behavior displayed by selected mature males. This behavior, called "mobbing," occurs

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when a male monk seal attacks a female in an attempt to mate, injuring or even killing her. In the summer of 1994 NMFS biologists moved 21 male monk seals known to exhibit mobbing behavior from Laysan Island in the northwest Hawaiian Islands to areas throughout the main Hawaiian Islands, where there were no known resident monk seals and thus where threats to females would be minimized. NMFS's view of the relocation was specific: it was a monk seal protection measure, an action that needed to be taken in order to safeguard the health and well-being of female seals crucial to the breeding success of the population. The relocation was technically successful. The animals were moved and the integrity of the original populations was safeguarded.

NMFS perceived the relocation as a management action that had physical affects limited to the seals themselves. When NMFS decided to relocate the seals, it had a small window of opportunity to implement the decision because of the limited availability of ships and equipment needed to capture, relocation, and release of the seals. NMFS considered contacting the fishing industry, specifically the Western Pacific Fishery Management Council (WPFMC), before capturing and releasing the seals to explain the plan. However, doing so would have created the need for potentially lengthy discussions between the agencies concerning the possible impacts on fishermen of the seal relocation. Beginning such discussions so close to the time of the proposed seal relocation would likely have caused NMFS to miss its window of opportunity to move the seals. Therefore, NMFS chose not to alert the council or local fishermen on the main Hawaiian Islands about its intentions.

Once the seals were moved, NMFS issued a press release explaining what it had done and why. This upset local fishermen and particularly the WPFMC, NMFS's strongest and most influential constituent in Hawaii. Fishermen perceived the movement of seals to be a threat to their operations in the main Hawaiian Islands. NMFS began to field complaints from fishermen that monk seals were taking their catch. Some fishermen even accused NMFS of covertly attempting to establish a population of monk seals in the main Hawaiian island in order to justify regulatory limits on fishing in areas where there had previously been no seals and therefore no conflicts with fisheries. NMFS underestimated the level of frustration and the strength of public reaction. As a result, the agency had to undertake damage control, including pacifying angry fishermen and bringing in high level officials to address the issues before the WPFMC.

For an agency in charge of overseeing the nation's fisheries, this episode was unfortunate. While it protected monk seals, it reflected a lower priority for the agency's main constituency, the fishing industry, thus creating conflict for the agency's local and regional leadership. Although conflicts between marine mammals and fisheries occur frequently in the management of both, rarely are marine mammal interests put before those of fisheries when a management action affects both, especially when the fishing interests are considered before the action is taken.

Grizzly bears in the Yellowstone region

In 1996, grizzly bear #209 was intentionally trapped in Grand Teton National Park (GTNP), Wyoming, and later killed under the auspices of the U.S. Fish and Wildlife Service (USFWS, chief administrator of ESA) in cooperation with the National Park Service, the Forest Service (FS), and the Wyoming Game and Fish Department (WGFD)(Cromley 2000). The grizzly bear (*Ursus arctos horribilis*) is a threatened species under the ESA and afforded special protection. Grizzly bears, which number about 300 in the Yellowstone region, are large predators that can and do kill livestock. Because GTNP permits livestock grazing, this brings bears into direct conflict with rancher special interests in the Park. The agencies try to accommodate both bears and cattle, but there are situations where bears are trapped and relocated (or in this case killed) to protect private cattle on public lands. Bear #209 was previously implicated in killing cattle inside GTNP and outside the park on a nearby FS allotment. When #209 moved back into GTNP near cattle grazing under a special grazing arrangement and into a management zone which permitted killing the bear, agency officials decided to act. The decision was influenced by the agencies' aggregate view that bears are recovered in the Yellowstone region, or very nearly so, and that the loss of one or a few bears would not jeopardize the population's status and might diffuse rancher opposition to bears.

Many people were upset that a threatened species was killed in a national park set aside to conserve wildlife to aid ranchers who were grazing cattle under a special permit, the legality of which was openly being questioned at the time. One longtime area resident organized a petition — signed by over 800 people within a few days — and gave it to officials in GTNP, the FS, and the Secretary of Interior to protest the killing. Newspapers printed letters criticizing the killing and covered the issue prominently. Local, regional, and national conservation groups were taken aback by the incident and made their disapproval widely known. Among the concerns expressed were questions about the competence and trustworthiness of the agencies, government employees,

and their bear management policy.

This episode added to the growing public distrust of officials and the sense that public lands and wildlife are being chronically mismanaged. Other events in preceding years fueled this public view (e.g., Primm 1994), including a court ruling the year before that showed the USFWS grizzly bear recovery plan was flawed and needed to be revamped. The judge declared that the USFWS and others "have acted in a manner that is arbitrary and capricious and contrary to law by issuing a Recovery Plan that fails to establish objective, measurable criteria in a determination . . . that the grizzly bear be removed from the threatened species list" (Thuermer 1995a:13A, 1995b).

In response to the public outcry over the #209 incident, officials offered more complete explanations. Officials of the WGFD, which administered the lethal injection, said it was done because the bear "would not stop eating cows grazing in the Park" (Thuermer 1996a:14A). Other officials defended their actions by saying that #209 was a known cattle killer on an adjacent FS grazing lease (where bears were nonetheless protected) and that cattle grazing was legal in this national park. GTNP Superintendent noted he allowed grazing because ranching helps keep open space which supports the tourist-based economy of Jackson Hole (Thuermer 1996b). These explanations did not satisfy protesters, but after some weeks the issue seemed to die down in the press. However, it persists in many people's minds.

Like the monk seal case, this was another distressing episode for federal (and state) agencies in charge of overseeing endangered species restoration. While the agencies in the Yellowstone region generally protect grizzly bears and work for their recovery, this incident reflected a lower priority for bears than for the interests of cattle ranchers. This episode created a conflict that has yet to be satisfactorily resolved in some people's minds. These two cases show that social process is a key variable in endangered species recovery.

A practical model of social process

Social process is the interaction of people as they influence the actions, plans, or policies of other people, even if they are unaware of each other. It is the process by which we create and sustain the human community. In trying to understand social process in general or in endangered species cases, most people merely impose conventional classification systems extrapolated from everyday life. The terms used in these schemes and the scope permitted by them are often wanting in analytic strength and insight. For example, how many times have you heard someone use terms like "politics" or "personality" to "explain" away troublesome social dynamics and outcomes?

A much more useful model of social process has been devised based on functional anthropology and the policy sciences that enhance understanding of complex policy problems (Lasswell and Kaplan 1950). The model focuses on **participants** with **perspectives** interacting in particular **situations**. Drawing on whatever **base (power) values** they have, they adopt **strategies** to pursue particular value **outcomes**, which have **effects** on future interactions (Table 1). These terms are described in detail in theoretical and applied works by Lasswell and Kaplan (1950) and Lasswell (1971) and discussed in the context of conservation biology by Clark (1997a) and others. Another way to highlight these categories is to ask seven questions: Who participates in the recovery process? With what perspectives? In which situations? Using which power bases? Manipulating them in which strategies? With what outcomes? And with what longer effects?

This model is well documented in the social sciences literature and has been widely used internationally. It is applicable to any context in which people interact (Lasswell and McDougal 1992). Indeed, it functions as more than a model. Its integrated concepts constitute a "stable frame of reference" that allows users, both participants and analysts, to look not just at the particulars of recovery efforts, but, more importantly, at the functional relationships that propels them and all human activity. This model and mapping method is not simply a cookbook approach to adding social science data to biological data in analyzing endangered species problems or in finding solutions to them. The power of this analytical, highly flexible framework is its simultaneous comprehensiveness and selectivity in mapping human dynamics and their implications. It offers insights into social process simply not available from using conventional views and terms. By using this model and method, data, both hard and soft, that might otherwise be overlooked or misconstrued can be appreciated and incorporated more fully and accurately into a view of any endangered species conservation task.

In all interactions, people tend to act in ways they *perceive* will leave them better off than if they had completed them differently. Because of the subjective character of perceptions, people perceive themselves, their environments, other participants, and, in this case, endangered species recovery efforts differently. The differences among people — in identities, expectations, demands, values, strategies, and other variables — may be vast and irreconcilable. No amount of "cold, hard fact," collected by "objective, neutral" scientists and "equally accessible" to all participants, and no amount of "edu-

Table 1. Some questions to ask in order to map the social process of a specific endangered species recovery problem (modified from Lasswell 1971; Willard and Norchi 1993).

1. **Participants.** Who is participating? Identify both individuals and groups. Who would you like to see participate? Who is demanding to participate?

2. **Perspectives.** What are the perspectives of those who are participating? Of those you would like to see participate? Of those making demands to participate? What would you like their perspectives to be? Perspectives include:
   A. **Demands**, or what participants or potential participants want, in terms of values and organization.
   B. **Expectations**, or the matter-of-fact assumptions of participants about past and future.
   C. **Identifications**, or on whose behalf are demands made?

3. **Situations.** In what situation do participants interact? In what situations would like to see them participate?

4. **Base Values.** What assets or resources do participants use in their efforts to achieve their goals? All values, including authority, can be used as bases of power. What assets or resources would you like to see participants use to achieve their goals?

   A. **Power** is to make and carry out decisions.
   B. **Enlightenment** is to have knowledge.
   C. **Wealth** is to have money or its equivalent.
   D. **Well-being** is to have health, physical and psychic.
   E. **Skill** is to have special abilities.
   F. **Affection** is to have family, friends, and warm community relationships.
   G. **Respect** is to show and receive deference.
   H. **Rectitude** is to have ethical standards.

5. **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?

6. **Outcomes.** What outcomes are achieved in the ongoing, continuous flow of interaction among participants? Outcomes can be considered in terms of changes in the distribution of values. Who is indulged in terms of which values? Who is deprived in terms of which values? Outcomes also refer to the ways in which values are shaped and shared. The particular 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?

7. **Effects**. What are the new value/institutions, if any? Are new practices put into place? Are old practices maintained? What forces promote new practices? What forces restrict new practices?

cation" and "exchange of ideas" can completely eradicate the inherent differences among people. However, this fact does not disaffirm our common interests or obviate the need to strive for common goals. The social process model provides (1) a practical method of accounting for these myriad differences, (2) a vehicle for explaining their dynamics, and (3) insights for preventing or correcting weaknesses to clarify and secure common interests. This kind of social process knowledge and skill would greatly improve the effective practice of endangered species professionals.

One of the central concepts in the social process model is the interplay of human values. People's values underlie their perspectives on the world. They are the medium of exchange in all human interactions. Values constitute the goals that people strive for, an education, skill in performing their jobs, good health, good government, healthy environments, security, among many others. But values also constitute the assets or resources on which people draw to achieve these goals. Wealth is used, for instance, to buy the necessaries of life, although it may also be used to "buy" power. People use the respect of their peers or the power of their status to build support for a cause they believe is right. Or they draw on the well-being they feel from knowing that other life forms are secure and healthy to build strong communities or political alliances. Values are also manifest in the outcomes of social interactions, not only in the achievement of individual goals, but also in changes in institutional practices. For instance, a new law rolling back environmental protection may advance the power or wealth of a special interest group while diminishing public health. Similarly, the decisions to translocate monk seals or kill grizzly bears are value outcomes that reflect institutional practices.

Policy scientists have classed all human values — everything that people in all cultures in all times at all ages at all levels have strived for — into eight functional categories: power, wealth, enlightenment, well-being, affection, skill, respect, and rectitude (Lasswell and Kaplan 1950). These are functional categories in that these terms can be used to describe how people's actions actually function in society despite how they may be conventionally described, understood, or promoted by

participants or observers. For instance, the Hawaiian monk seal and Yellowstone grizzly bear cases could be analyzed functionally in terms of these values. All eight values were involved in the social transactions that took place. How were these values "traded," and how did they influence each other in the social transactions that took place? Who was indulged and who was deprived in value terms? In other words, how were values shaped and shared through these two recovery efforts? It is beyond the space here to answer these questions. But, both cases involved all eight values interacting in a complex manner. Clearly power figured into both cases, as did respect, wealth, and rectitude. A value analysis of these two cases based on empirical study can provide insight and improved understanding of the actual social dynamics at play. An ongoing mapping of the social process of any recovery program can reveal trends and why trends are taking place that may not be evident otherwise. In turn, future developments might be anticipated and any foreseeable problems averted. This knowledge about value trends, conditions, and projections can be used to manage social process and all the values, especially power, respect, wealth, skill, rectitude. In these two cases, this kind of knowledge was potentially available to mangers and could have been skillfully used to advance social process in favor of endangered species recovery.

In endangered species recovery, the American public has declared via the ESA that it is the goal of the United States to "provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, and to provide a program for the conservation of such endangered species and threatened species" (USFWS 1988:1). This means that we have set national rules or guidelines for ourselves about how we will deal with each other, with other species, and with ecosystems in certain contexts. In functional terms, all eight values are always involved in the ESA and species conservation. For instance, such a statement of national intent or policy is based on power and requires a commitment of collective national wealth to implement it. Enlightenment and skill are also required to implement it. Achieving the national goal of biodiversity conservation produces outcomes involving respect (both self-respect and the regard of the international community), affection, and well-being. The ESA is also a statement of our rectitude standards. It is clear that restoration efforts affect people's lives in many ways. Indeed, all eight values are always at play at some level in all human interactions. Understanding which values are predominantly at play and how they are exchanged *functionally* — figuring out who is indulged and who is deprived in specific recovery cases — is the key to understanding social process practically. The social process method, as an analytic and comparative approach, produces insight and reveals ways to learn, intervene, and improve recovery efforts far beyond conventional, ordinary, and particularized understanding.

Mapping social process

Professionals confronted with complex policy-relevant problems, such as biologists working on endangered species recovery, need a practical guide to map and understand the social process dimensions of their work (Table 1). The model described here and the categories and questions in Table 1 can guide professionals in building a map to orient to any social context. Because every detail of a problematic situation is affected by interaction with the entire context, problem solvers must use a method that places the problem within the social setting. With a contextually-relevant, functional map of social process, people involved in recovery programs can more easily see how their decisions and actions would be perceived by other participants and they could better understand others' actions.

To illustrate the value of social process analysis, in the monk seal and grizzly bear cases ask yourself who are the participants, what is their perspective in terms of identities, expectations, and demands. Also discern what the situation is in terms of geography/ecology, time, institutions, and whether a crises exists or not. Further determine what base values are involved, what strategies are being used, whether they are coercive or persuasive. Finally assay what outcomes are sought and what outcomes actually resulted in terms of values and institutional practices and what their effects are. To answer these questions in realistic detail you need to do research on the endangered species recovery effort in question. Remember the purpose of social process mapping is to understand a given case so that practical improvements might be made.

Both the monk seal and grizzly bear cases are complex and it is impossible to fully illustrate how the social process model can be used to practically map these cases for improved management in this paper. But, in part, for the monk seal case, for example, moving seals was perceived by agency officials as the responsible and ethical thing (rectitude value) to do to aid species recovery based on their knowledge (enlightenment value) of the situation. They had the power, wealth, and skill values to make and carry out decisions. But to the fishing industry, the situation and other aspects of social process looked quite different. These people perceived that they would be deprived of wealth (wealth value) by having seals moved into new areas.

They may also have feared a loss of power, respect, and well-being values. The remaining values were functionally involved as well. The issue is whether the agencies' knowledge was adequately contextual and their use of power, skill, and wealth were appropriate in this context. Moving seals was a functional value clash wherein participants were differentially indulged or deprived of values. Being fully cognizant of the direct values clash in moving the seals argues for having positive social relationships firmly in place in advance so that when rapid decisions and actions are necessary public or special interest backlash can be avoided or minimized. Thinking and acting contextually in terms of social process permits professionals to better appreciate and manage recovery efforts.

Again, in the grizzly bear incident, killing #209 was consistent with agency officials' values of rectitude, respect, well-being, affection, power, wealth, enlightenment, and skill. But many outsiders perceived that officials were misusing their power, knowledge, skill, and public funds, and they felt that the community's rectitude standards were violated in failing to protect the bear. Cromley (2000) analyzed this case in detail relying in large part on the social process model introduced in this paper. She focused on how differing expectations of participants making up the social process came into direct conflict. Numerous practical management recommendations were made as a result of her analysis to avoid this kind of problem in the future and to better manage the social process dimension of grizzly bear recovery.

Because social process is not static, it must be continuously mapped over the life of any conservation "decision process" (see Clark and Brunner 1996) and as the nature of the problem changes over time (i.e. as problems are defined, acted upon, and results evaluated). Remember that the social process model and mapping procedure is not a simple cookbook method (Clark 1977b). Mapping and understanding social process in practical terms requires study, skill, and judgment. Nevertheless, it is vital for professionals to integrate social process knowledge into problem solving for endangered species recovery. The framework devised by Lasswell (1971) is a means to meet this challenge integrative challenge. Like any method, this one can be learned through study and application, and skill in its use can develop through practice over time.

Effective public participation in recovery efforts

Recovery personnel can interact with each other, the public, or in social process in a variety of ways. They can make decisions and take actions based on acontextual professional assessments — thus largely ignoring the public and social process. Or they can involve the public directly and meaningfully in problem solving. The two cases above detail how the public was involved or not in recovery and what the consequences were.

Organizing effective public involvement is not always easy, and endangered species recovery has had a mixed history of public participation. Participation has too often been construed simply as "getting more citizen input." But there is growing recognition that conserving wildlife and restoring species require local involvement in more substantive ways. Contemporary recovery efforts are beginning to see more diverse people as important problem solvers and nature conservers (Pimbert and Pretty 1995). Regardless of how the public is viewed, local involvement can be very helpful, so social process must be part of a comprehensive and rigorous understanding of the conservation problem prior to exploration of solutions. Public participation must also be done in a deliberative and democratic way (Dryzek 1990). Local involvement for its own sake will not lead to species recovery or improved social process: what is needed is responsible, constructively critical, political participation (Forester 1980). Remember also that regional or national involvement is also vital and may even be more important in some cases than local involvement.

Pimbert and Pretty (1995) have identified a continuum of participation types in conservation, ranging from passive to active (Table 2). It is believed that lasting conservation measures will result from the more active "functional," "interactive," and "self-mobilized" participation modes. It only makes sense in a democracy that long-term success will come when people's ideas and knowledge are valued and power is given to them to make key decisions in close cooperation with experts and governments. In fact, without the real commitment of local people, conservation is probably impossible.

There are existing theories on how social process should be carried out in a democracy and these are directly relevant to setting up and running recovery and other conservation programs. Dryzek (1990) notes, for example, that "discursive democracy" can overcome many of the common weakness in public policy and decision making. And Barber (1984) describes a "strong democracy" dominated by "communicative rationality" (the reflective understanding of competent participants), which he feels is urgently needed today. Both Dryzek and Barber's ideas can lead to coordination of community actions through discussion (see Habermas 1984). In short, the quality of public or social participation is what counts. According to Dryzek (1990:23) "communicatively rational policy

Table 2. The seven types of public participation possible in endangered species recovery (modified from Pimbert and Pretty 1995).

Participation Type	Descriptions
1. Passive participation	People are told what is going to happen or what has happened. Communication is unidirectional. Information being transmitted belongs to outside experts.
2. Participation in information giving	People answer questions put them by experts in questionnaires or other surveys. People do not influence the process otherwise.
3. Participation by consultation	People are consulted and outside experts listen. Outside experts define problems and solutions. No concession to public.
4. Participation for material incentives	People provide resources such as labor for food, cash, or information.
5. Functional participation	People form groups and meet objectives. This may happen once a recovery effort has been set up by experts.
6. Interactive participation	People involved in joint analysis, production of action plans, and enhanced organized participation.
7. Self-mobilization	People take independent initiatives apart from experts and government. This may or may not challenge existing experts and government.

science of participatory democracy, oriented to the public sphere rather than the state, is well placed to reconcile the twin demands of effective social problem solving and democratic principles." There are many theories besides these two about how to reconcile rationality and democracy. Knowing about these theories and practically applying them in species conservation is indeed challenging.

There are several incipient designs in currency today that attempt to resolve conflictual social problems, that improve rationality and democracy — among them are mediation, alternative dispute resolution, regulatory negotiation, policy dialogue, principled negotiation, and problem-solving workshops. None of them fully acknowledges the need to understand and map social process. A rational problem-solving approach to conservation problems, including appreciation of social process involved, and practically finding consensus are ideals to strive for. Being knowledgeable of the social process dimension of recovery as well as being skilled in mapping it practically can significantly aid professionals achieve their goals.

Conclusions

As the two examples illustrate, recovering species involves human social process. Effective problem solving in conservation must account for the social dimension. This can best be done by employing a practical model to help you map the social process of the case you are interested in. The social process categories — participants, perspectives, situation, base values, strategies, outcomes, and effects — can guide conservationists in systematically examining whatever situation they are concerned about. A challenging task in social process is to involve the public in genuine problem solving that maximizes chances of successful species recovery. The social process model and mapping method offered in this paper can aid species recovery and conservation in practical and substantial ways.

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Grizzly bear (*Ursus arctos horribilis*) by LuRay Parker, USFWS.

The Dynamics of Value Interactions in Endangered Species Conservation

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Abstract
*Conserving endangered species is a technical task, but it is also highly value laden. Yet the value dimension of conservation is often overlooked or ignored by most participants. Values — the things and events in life that people desire, aim at, wish for, or demand — figure into all aspects of conservation, including the science component; in fact, values are the basic medium of exchange in all human interactions. Values may be functionally categorized as power, wealth, skill, enlightenment, affection, well-being, respect, and rectitude, all of which are needed for people to live with dignity in a healthy environment. A 2000 paper by Scott Johnson describing the Hawaiian crow (*Corvus hawaiiensis*) case is used as an example of the importance of values to endangered species recovery efforts. Participants in this recovery effort at first were unable to appreciate and manage the value-based dynamics to promote conservation, but later were able to make some improvements. Attending to value dynamics in a conscious, systematic way can enhance species conservation in all cases.*

Introduction
As professionals dedicated to protecting and restoring biological diversity, we focus our attention on the populations and habitats of imperiled species. Our ethical standards tell us that this work is important, and our views are justified by society through the Endangered Species Act and other mandates. We have been trained in the technical knowledge (e.g., ecology) and skills (e.g., field measurements) necessary to restore species or prevent their endangerment. Focusing strictly on the biological tasks, however, may mean the neglect of the "human dimensions" of conservation, which are often dismissed as "biopolitics" and avoided or left to others to deal with. In addition, most conservation professionals work for organizations — state or federal agencies, advocacy groups, universities, or businesses — that exhibit particular mandates, cultures, and ways of operating that affect how the organizations and their people deal with others and, as a result, how successful recovery programs are. This is well documented in the literature (e.g., Miller et al. 1996, Flores and Clark 2001).

Disciplinary biases and organizational cultures are just two of the many expressions of human values that are present not only in recovery programs but in every facet of life. People pursue values constantly. Values are the things and events in life that people desire, aim at, wish for, or demand (Lasswell 1971). According to Taylor and Douglas (1999:315), "values are cognitive representations of human needs." They "indicate preferences people share for certain types of outcomes in their lives and for certain types of conduct" (Ball-Rokeach and Loges 1992:222). In all our interactions, at all levels of society, we exchange or transfer values of one kind or another. The vast literature on values contains numerous lists of what people value, some abstract, some more conventional, some short, some long. But as Bell's (1997:179) survey of the literature shows, there are "some core human values about which there is wide agreement both over geographic space and time — from well before the birth of Christ up to the present."

We believe that it would be beneficial to those who work in endangered species recovery programs to become more aware of the value dynamics at play in their work and to develop a broader and more theoretical conception of values. This would help professionals to see similarities in the problems that plague different cases and to adapt the solutions, lessons, knowledge, and skills from successful cases to others. To that end, we examine value interactions in endangered species restoration, drawing initially on a paper by Johnson (2000) that describes the Hawaiian crow (*Corvus hawaiiensis*) conservation case.

An account of Hawaiian crow conservation

Scott Johnson's article, "Building a species recovery program on trust," which appeared in *Conservation Biology in Practice* in 2000, offered his perspective as a professional biologist and U.S. Fish and Wildlife Service (USFWS) employee on the Hawaiian crow ('alala) case. He recounted that the USFWS had originally been denied access to the crow population, which was largely on private land, and that the agency was sued by environmental groups for failing to recover the species. He described the persistent interpersonal tension, the preconceived negative views that each group seemed to hold about the others, the name calling (he was labeled a "bureaucratic biologist"), and the suspicion that kept the various groups apart. The program was not cooperative and lacked trust.

Believing that the problem was that the public lacked "information," he and his colleagues' initial response to this messy situation was to try to solve the problems by providing as much information as possible. They expected that sharing information with ranchers and The Peregrine Fund, both central players, would make the program run smoothly. This is a common assumption among biologists, managers, and other technically oriented professionals. Their education, training, and often their entire professional lives have inculcated the belief that scientific truth is the touchstone against which all things are measured. So they are convinced that if the participants in a recovery program all shared the same knowledge, they would all come to the same understanding of the problem, its solution, and the means of achieving the solution. For agency managers this knowledge often means the population dynamics, habitat relations, and management steps necessary to meet legal mandates. For conservation advocacy organizations, which also commonly play the we-need-to-educate-the-public game, knowledge refers to population viability, factors responsible for habitat loss, and effectiveness of government in solving conservation problems. Although we do not know what knowledge Johnson and his colleagues imparted about the crow situation or how the educational program was carried out, the people who opposed the government program, according to his own account, did not take kindly to this approach or its underlying assumption. The knowledge-sharing strategy did not improve the working relations or the status of the crow.

But then, as Johnson put it, "After a couple years of pounding our heads against the wall, the group finally concluded that our basic flaw was . . . a lack of trust" (p. 36). The USFWS team saw that "mutual trust must be developed by specific actions that have nothing to do with actual work being conducted" (p. 36). They concluded that trust would come about by interaction outside the 'alala arena — through social interaction not focused on crows. At the same time, Johnson admitted, recognition that they would now have to focus on "relationship-building" produced "rolled . . . eyes" and cringes from team members. Realizing that they were in a dysfunctional social relationship and that facilitated meetings, conflict resolution, surveys, emails, and faxes would not fix the situation (as is often thought), Johnson and his team decided to change patterns of interaction with the ranchers and other participants. They focused on "specific actions that fundamentally changed our behavior toward each other before we even sat at the meeting table or called each other on the phone" (p. 36). They acknowledged that they did not have the knowledge or skills to bring about such changes, so they consulted someone outside the program who did. This individual convened all parties. "The sessions were simply aimed at each individual's personal development and experiences and what each brought to the group" (p. 36). As a result, the group found many shared experiences, which led to a greater "sense of community" (p. 37). Good will was built where it had been absent.

Understanding human values

One of the most universal systems of value analysis is Harold D. Lasswell's (1971) "functional value categories," which stem from his belief that human dignity is the overriding goal of all people (Lasswell and McDougal 1992). In short, everyone wants to live with dignity, which means having adequate amounts of eight categories of values — power, enlightenment, wealth, well-being, skill, affection, respect, and rectitude (Table 1) — and being able to shape (give) and share (receive and use) all eight to the fullest extent possible. This list is general enough to encompass most other "lists" of values, including those spelled out in the Declaration of Independence, the Constitution of the United States, other national constitutions, the Universal Declaration of Human Rights of the United Nations, and similar conventions (see McDougal et al. 1980; Clark 2002).

In advancing his comprehensive, if not exhaustive, list of values, Lasswell recognized that the eight value categories are both diverse yet culturally specific. For example, sharing and shaping information, i.e., enlightenment, means something entirely different for a scholar in England than it does for an orphaned child living in poverty in India. We may not think that the child epitomizes "enlightenment," but he is savvy in his own way and knows about those things that are worth knowing in his life. In both cases, enlightenment is essential to their

Table 1. List of values or "bases of power" for participants to use to influence endangered species conservation outcomes. Participants in endangered species should ask the questions listed below. The end of a species conservation process leaves some participants better or worse off in terms of these values (ask: Who gains and who loses from a given conservation program in terms of the eight values?)(see Lasswell 1971; Clark 2002). These values are not ranked or ordered by importance. Seeing and understanding that endangered species conservation is at heart a task of bringing people's value dynamics into harmony with one another and with the Endangered Species Act is tantamount to overcoming a major part of the conservation challenge.

Power means to give and receive support in making decisions in specific contexts. For example, power is needed to access goods and services (e.g., enlightenment, well-being, wealth).
Ask: How is power given and received in interpersonal and decision process and what are the outcomes?
Enlightenment means to give and receive information. Enlightenment is the finding and spreading of knowledge. For example, researchers, teachers, and professors are specialists in enlightenment.
Ask: How is information given and received? What are the outcomes?
Wealth means to give or receive opportunity to control resources, such as money, natural resources, and other people. For example, financiers, business leaders, and economists manage wealth.
Ask: How is wealth affected (given and received) by the process? What are the outcomes?
Well-being means to give or receive opportunity for personal safety, health, and comfort. Well-being is a value that expresses a sense of bodily and mental integrity and vitality. For example, doctors, nurses, and social workers provide well-being to people.
Ask: How is well-being, both physical and mental, affected by the decision process?
Skill means to give or receive opportunity to develop inherent talent into operations of all kinds, including professional, vocational, and artistic skills. Skill is the acquisition and use of mental and physical abilities. For example, scientific and analytic associations, labor unions, and artistic cooperatives promote skills.
Ask: What kind of skills are used (or not) in problem orientation and in decision process, how, and with what outcomes?
Affection means to give and receive friendship, loyalty, love, and intimacy in interpersonal situations. Affection includes friendship and community relations. Rectitude is the value of morality. For example, professional, friendship, family, and community circles are representative.
Ask: How are professional, friendship, and loyalty values used in decision process and with what outcomes?
Respect means to give and receive recognition in a profession or community. Respect refers to what is often called "place in society"—it is a pattern of deference. Less experienced people defer to more experienced people in most professional situations, for example. For example, the Nobel Prize committee and many other types of awards are available to recognize accomplished people, friends, and colleagues.
Ask: How is respect or deference used (or not) in decision process and what are the outcomes?
Rectitude means to give and receive appraisal about responsible or ethical conduct. For example, ethical and religious systems exist in all communities and may be taught in homes, classrooms, and churches.
Ask: What are the ethics at play in interpersonal relations and embodied in decision process outcomes?

welfare. In our culture, shaking hands, nodding recognition, and tipping one's hat are all ways to express respect or deference. Although the same gestures are not universal, other societies have their own ways to convey respect in specific contexts. The same is true for all the other value categories: each exists in every kind and level of interaction, though its content and form vary from one context to another.

Thus, the eight values are *functional* categories that can be used to describe and understand any situation where people interact (Table 1). For example, we can accept that people in every society (and in every recovery program) want power, which is necessary to participate in decision making (Lasswell 1948). This does not mean that every person wants

power with equal intensity, or that the quest for power is innate or acquired, but, clearly, people's striving for power and use of power are elements that should be assessed in any social process. The value demands vary from person to person, group to group, and from time to time in the history of any one person, group, or culture.

Values are central to endangered species conservation as they are in every other kind of human activity, whether the people involved understand this fact or not. When professionals from the USFWS meet and talk with ranchers or environmentalists, for instance, they are participating in a process of shaping and sharing values. As staff members of a lead agency in carrying out federal ESA policy, they expect to wield a certain amount of power, and they expect to be paid adequately for the work they do (wealth). Through their work they exhibit their knowledge (enlightenment) and skill, and they hope thus to earn the respect of the people they do business with and maintain friendly relations with their coworkers (affection). They believe that the work they are doing is right and justified (rectitude). They trust that their well-being will not be threatened in any way as they carry out their duties. Similarly, the values sought by the ranchers with whom the USFWS deals could be described to explain their behavior in their specific circumstances, or those of the environmentalists or any other group with an interest or stake in the issue. Some recovery programs show a deeply rooted pattern of those in a superior value position — for example, those with more power, more money, or more knowledge — treating other participants in politicized and disrespectful ways that do not offer them dignity. Needless to say, those who are the objects of this kind of behavior stop cooperating.

Typically, species become imperiled because of the unintended consequences of people's value-based activities and complex value dynamics. As we seek to satisfy our individual needs — to establish families, build communities, participate in governance, work for money and access to material goods, express our beliefs, exercise our skills and knowledge, and so on — we create institutions and carry out operations that affect the environment and other plant and animal species. In some situations these effects (some of which are deliberate whereas others are unplanned or involuntary) are minimal, but in others they are more damaging. It is people (in ever increasing numbers) seeking values that cause species endangerment. Species conservation, then, is a job for those who fully understand not only the biological dimension, but also the value dimension. Although value-based practices are largely responsible for species losses, they are also the means to turn this pressing problem around.

As Dery (1984) notes, however, people's behavior cannot be changed merely by bringing "new information" to their attention. This runs counter to the tendency among endangered species professionals to assume a technical, biological standpoint in which collecting scientific information about the species and its habitat is the most important (and sometimes the only) job they need to perform. A *policy-oriented* professional, on the other hand, fully appreciates the value dimension of conservation and works for better value outcomes, that is, "win-win" solutions accomplished through a process that offers dignity to everyone involved (Clark and Wallace 1999). The policy-oriented approach permits professionals not only to understand the conservation task primarily in terms of value interactions, but also to carry out systematic inquiry into those dynamics. (The value that scientists place on "systematic inquiry" is an example of how highly they rank enlightenment.) This task requires skill in interdisciplinary, "procedural rationality" for analyzing problems and evaluating potential solutions (Clark et al. 2001).

The crow story in terms of values

It will be instructive to reexamine the experience of Johnson and his team in terms of a systematic understanding of values. After two years, they realized that the key to success was not dispensing more scientific and management information, but developing "trust" among the people involved. This was an acknowledgment that, even though he and his colleagues had put the highest value on enlightenment, it was not what was needed in that situation and it did not solve the problem. Johnson failed to appreciate that while he was focusing his efforts on educating others, he was simultaneously and perhaps unconsciously shaping and sharing other values in his exchanges with ranchers, environmentalists, and others in ways that were counterproductive to his own goals. His way of confronting the problem (combined, of course, with the ways in which other people confronted the problem) produced a poorly performing program.

In fact, it is likely that the education strategy inhibited participants from sharing power, respect, and rectitude. The relationships among participants were based on power without communication or cooperation. The landowners exerted power over the government agency staff, to the detriment of the latter's desires (to meet their needs for rectitude) for crow conservation. What the landowners sought was respect, recognition of their own rectitude standards, and formally shared power. The USFWS thrusting information on them did not satisfy their value demands, and so the program was unable to advance. When a program is

thus "politicized," it is transformed into a power relationship, often at the expense of other values that must be recognized and satisfied in order for the program to succeed. Thus, a well meaning USFWS crow conservation effort was likely undercut inadvertently by the very people who wanted its success.

Johnson deserves recognition for his willingness and ability to "rethink" the problem and change direction. Too many recovery programs never get to this point and persist in tinkering with technical/biological details, giving lip service to "human dimensions," or giving in to powerful anti-ESA forces. Few are able to conduct the genuine self-analysis that would lead them to reconceptualize the problems and the solutions.

It became clear to the crow recovery team that other values were at play. Johnson referred to several value categories in his article, although he did not use the terms we've introduced here. "We were wrong," he finally concluded, a statement about rectitude. He wrote about the need for more useful skills to save the crow. His team was denied access, a sign of landowners' power over crow biologists. He invoked the word *trust* as the key to his new solution; trust develops in the giving of respect and in the sharing of all the other values. He remarked on the ranching family and loyalty — the value of affection as shown in family, friendship, and community. His discussion of how all the participants used financial resources and sought to make a living was a reference to the wealth category. Although the value dynamics in the crow case were real and very much affected how the program unfolded, they were not visible to most participants. So the people involved were unable to understand and manage the problems they faced in a way that promoted conservation. Ignoring the full range of values in any species recovery effort can lead to mistrust, misguided professionalism, and a weak or failed program. The crow case is not unique, however. Many other case studies of endangered species conservation show little appreciation of the value dynamics involved (e.g., Clark et al. 1994; Reading and Miller 2000; Wallace 2000; Wallace in press)

Hawaiian crow by David Ledig, USFWS.

As of 2000, interactions in the crow case had not always been smooth nor had the 'alala fared well, according to Johnson. The wild population now consists of only a few individuals. Captive breeding and reintroduction plans are in place. As new members joined the new interactive group, they have not fully understood the need to give and receive values in a productive way. Some people tried to re-politicize interactions, and changes in agency personnel have both helped and hurt. Trust cannot be built easily among new people at each meeting; it takes time to establish dependable patterns of mutually respectful, honest interactions. Johnson (p. 37) notes that "the key lesson is that partnerships and mutual trust cannot be taken for granted; nor can they be expected to continue as members come and go." Hopefully, recent events in this case have brought about improved cooperation and prospects for eventual crow recovery.

Conclusion

Although endangered species conservation is clearly about restoring imperiled species and their habitats, it is also overwhelmingly about the value "transactions" among people who have an interest or a stake in the issue. Recognizing this fact is a major step toward meeting the conservation challenge. Lasswell's concept

of meeting human dignity through the adequate shaping and sharing of eight categories of values is a relatively simple, but highly useful, scheme for organizing and analyzing what would otherwise be a morass of individual and group perspectives in endangered species recovery. It provides a framework for professionals to use to seek information about each participant's demands, expectations, and strategies. "What do people want from this situation?" "What power, money, respect, skills, or information, for instance, do people have and how might they use these assets to get what they want?" Careful analysis should include comparing participants' actions against their words. If some people complain about their financial losses, yet continue to complain after they are offered compensation, then perhaps what they really seek is respect, or sharing in decision making, or perhaps recognition of the "rightness" of their point of view or a chance to exercise their skill. Understanding how all eight values — respect, skill, wealth, affection, power, rectitude, well-being, enlightenment — are shaped and shared in an endangered species program is essential to find ways to bring people together in a cooperative endeavor in which trust and dignity are available to all. Bringing USFWS personnel, ranchers, and other people with diverse value outlooks, interests, and demands, together in a cooperative program is challenging. Leading and managing the value-rich process of species conservation remains a challenge that requires knowledge and skills far beyond technical considerations. Fortunately, we have concepts, tools, and much experience to draw upon to improve our own awareness of what is at stake value-wise and what we can do to aid the value shaping and sharing process that is endangered species conservation.

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The Professional in Endangered Species Conservation: An Introduction to Standpoint Clarification

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Abstract
The work and role of professionals who carry out endangered species conservation is changing, as society itself changes. Knowing about the range of standpoints a professional can assume in conservation is one way to enhance effectiveness. Professionals may assume a variety of standpoints depending on how he or she sees the recovery process and their own role in it. Recovery may be viewed as a biological-technical task or a multifaceted task with both biological-technical and social dimensions. An endangered species case illustrates how one professional changed her standpoint from a "conventional" one to "policy-oriented" professionalism." These two forms of professionalism are compared.

Introduction
Most endangered species conservation work is carried out by professional biologists and managers. Professionals labor to meet goals as laid out in the Endangered Species Act and in other public policies. For our purposes, a professional is a person with specialized education who participates in a community with standards of practice and shows a commitment to public service (Clark 1997a). Both the work of a professional and his or her role in society have changed dramatically in recent years and both are expected to change even more in the foreseeable future. Today's work settings are as diverse as the species and habitat conservation challenges a professional faces. The days when professional biologists could go to the field and work in solitude at their own pace are long gone. Among recent changes are partnerships of various kinds which both aid the work of professionals and make it more difficult. As a result, professionals should always be on the lookout to improve their performance. Being explicitly aware of the standpoint a professional assumes in endangered species work or in other conservation efforts is one way to improve performance, and it can significantly aid in getting the species recovered. In this paper we (1) examine the notion of standpoint clarification for a professional, (2) look at two ways to conceptualize the recovery process and examine models of professionalism, (3) give an example of these issues, and (4) offer recommendations for improving professional standpoint clarification and performance.

Standpoint clarification and the professional
Regardless of the professional work to be done in endangered species conservation or any other conservation effort, managing oneself constructively is important. Two dramatically different professional standpoints are well illustrated in companion articles on the controversy over elk management in Yellowstone National Park (see Bugle 1998). Many endangered species cases show similar differences in standpoint amongst participants about what happened in the program, why it happened, its significance, and what should happen in the future. Knowing about one's own behavior and role in endangered species recovery requires knowing about the biological challenge (e.g., the species requirements), the organizational environment (e.g., what the boss wants and will permit), and it also requires knowing about oneself. All too often, professionals assume, perhaps unconsciously, that they know what they are doing and why, and that other people will see and appreciate their good works. Clarifying one's standpoint relative to both the endangered species recovery challenge and other participants is important to achieving conservation goals, just as knowing the population status of a threatened species is an important variable. Being clear about one's standpoint can aid successful teamwork and successful conservation. Being unclear can lead to conflict and disaster.

Professionals must clarify their standpoints so they can most effec-

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tively participate in recovery efforts. Professionals can be either participants or observers of the recovery process, depending on their level of involvement and how they perceive themselves in the process. Professionals can be more or less aware of both themselves and others, depending on how self-reflective and observant they are (Schön 1983). To be as effective as possible in endangered species recovery, professionals must be clear in their standpoint — how they fit into the process — and seek to avoid biases to the degree possible. This is possible only by being self aware and using that knowledge of self in professional judgment and interpersonal relations. Most individuals have at one time or another analyzed their actions and role in interpersonal relationships, whether with a spouse, partner, parent, sibling, or friend. We do this in order to know where we stand with someone concerning expectations, demands, trust, and many other aspects of relationships. This self-analysis is at the heart of clarifying one's standpoint, and the process is no different in a professional setting than in a personal relationship. All people have biases as a result of experience, personality, interest, education, among other things. Learning about one's own standpoint and the perspectives of others is not easy, but it is essential to effective professional practice. Over time as professionals gain experience they improve understanding of self and others. For professionals to reach their potential for effectiveness in either technical work or in leadership, they must be able to look at and understand themselves and others involved in or interested in the species and its conservation.

Two views of the recovery process

One aspect of professional standpoint is viewing or conceptualizing just what the recovery process is. There are many different ways to understand the endangered species recovery process. Depending on how the process is appreciated determines what a professional might do as well as how other people involved may respond. Clark (1996) describes two views that professionals may take of the recovery process.

The first view sees the recovery process largely as a technical task requiring that a professional be given a relatively free hand to formulate the challenge and address it. The professional is guided by the scientific method and adheres to the view of technical rationality (Schön 1983). The major constraint is perceived as the lack of scientific information about the species and its habitat, lack of funding, and political obstacles (e.g., public opinion, politicians, developers), all outside the program. Examples of this standpoint abound and it is perhaps the dominant view in endangered species recovery (e.g., Butler and Merton 1992; McFarlane 1992). In accordance with this view, species recovery is achieved by carrying out appropriate studies, filling in the missing biological knowledge, ascertaining its management implications, implementing the chosen management actions, and otherwise maximizing money flows into the program and minimizing external political interference. Professionals who subscribe to this view tend to see themselves as scientists carrying out "good science." They believe they are agents of objective, value-neutral science, and are often relatively unaware or inattentive of the social matrix within which they work. Despite their skills in scientific methods, these professionals are little skilled in social processes, decision process analysis, or team participation. This view is called a "science-based" approach to species recovery.

The second view sees recovery as a multifaceted task with both biological-technical and social dimensions. The professional is guided by a problem oriented, contextual outlook, and diverse methods, including traditional biological scientific approaches as well as diverse social science methods and qualitative and integrative methods. This view is partly described by Schön and called "reflective practice" and more fully described by Lasswell (1971), Clark et al. (1992), and Clark (1992) and labeled "policy-oriented" professionalism. This conceptualization requires a broader, genuinely interdisciplinary approach and professional skills that the technical rationalist does not know about or use. In this view, the major constraint is perceived to be lack of effective social processes that would integrate values and knowledge for successful conservation. Examples of this view are less evident in the literature (e.g., Kellert 1985; Clark 1989; Miller et al. 1996). From this view, the way to achieve recovery is to address, simultaneously and explicitly, socio-economic, organizational, and political as well as biological dimensions of recovery. This is both a methodological challenge and a challenge to the ability of professionals to integrate often disparate fields of knowledge. This approach explicitly requires that professionals develop awareness of their roles in the social process of endangered species recovery. This "practice-based" approach encourages people to observe what actually works, both technically and socially, and apply experience and lessons successfully.

We believe the second view is the more practical of the two. Professionals, other participants, and observers may use one or the other without being fully aware of the assumptions and approaches that they bring to the recovery process. In turn, these lead to differences in expectations, demands, and actions, which may lead to miscommunication, conflict, and possibly failure if these viewpoints are not clarified and differences addressed. These two views of endangered species conserva-

tion are based on two very different models of professionalism, as contrasted in Table 1. These show dramatically different assumptions, approaches, and consequences.

A case: an endangered species biologist "situates" herself

This case is about a professional who started off with the first view of species conservation and rapidly shifted to the second conceptualization as a result of her direct experiences (see Bentrupperbaumer 1998). This professional studied the endangered cassowary (*Casuarius casuarius*). This large forest-dwelling flightless bird inhabits wet tropical regions of northern Queensland, Australia. Bentrupperbaumer explains why she changed her standpoint in her Ph.D. thesis in a section called "situating the author." She revealed her current standpoint to herself, co-workers, and readers in this section and her story is an interesting one, but not atypical of endangered species professionals. At the heart of her standpoint was that she hoped to contribute to preventing the extinction of a species even in a modest way. And as a result of her experiences, she indicated that she left "normal" biology behind and came to have a broad interest in ecology, environmental psychology, and environmental management.

Over several years she collected data on the bird and its habitat. Even though her work began as a biological study it soon progressed into a conservation and management one when the bird's forest habitat began to be logged. She came to realize that conserving this magnificent bird would require overcoming the "ineffectual" way in which the recovery effort at the time was unfolding. Several incidents propelled her into a fuller appreciation of the second view described above. She soon found that "Despite the harsh and demanding physical and climatic conditions of the field, the actual biological component of the field work presented the least difficulties. Cassowary 'politics' inevitably came to the fore, on many occasions threatening to terminate the project" (p. 25). Denials of access by private landowners half way through her study and attempts by local community conservation organization to terminate the 'human population study' component of the research are two examples.

Among the many incidents were these two. The first incident that resulted in a significant change in her standpoint was a response by the major landowner who became concerned about the possible implications her results would have on his property's future. The State Government was at the time preparing nature conservation legislation. This private property completely landlocked the northern boundary of the study site, a 319 ha World Heritage area listed as a National Park. The other boundaries include the sea and a mangrove river. This property had been described as critical habitat for cassowaries previously. In addition to

Table 1. Two Models or Standpoints of Professional Problem Solving in Endangered Species (from Pimbert and Pretty 1995; Clark 1997a).

Conventional Professionalism	Policy Oriented Professionalism
Technological rationality	Reflective practice
Scientific method is singular, reductionistic, and positivistic (cause and effect, prediction)	Scientific method is holistic and post-positivistic (human freedom, empirical, systematic)
Strong natural science biases	Mix of natural and social sciences
Professional categories and perceptions are central	Local categories or contextuality is central to problem solving
Professionals know what they want and follow a pre-specified plan or project design	Professionals do not know where projects will lead so work is an open learning process
Information and results are extracted from controlled situations	Understanding and focus emerge from interaction with context
Problem solving is blueprint-like	Problem solving is process-like
Use problem-blind, acontextual outlook, and disciplinary methods	Use problem-oriented, contextual outlook, and integrative methods
Assumption of single, tangible reality	Assumption of multiple realities that are partially socially constructed
Professionals control problem solving and clients	Professionals enable and empower people in close dialogue about problem solving in context
Often works alone with single disciplinary focus	Work in groups with an interdisciplinary focus
Careers are inward and upward	Careers include outward and downward
High level professionals loose touch with changing local realities	Professional stay in touch with action at all levels

denying her access to the study site, the landowner cleared extensive areas of his property preempting the potential restrictive status of a formal critical cassowary habitat classification.

The second incident that resulted in a significant change in her standpoint was the response of the local conservation organization to her when she "disengaged" herself from them. She worked with this group at the request of the then State Minister of the Environment. She left the conservation organization to begin her Ph.D. work. Because of this and the preceding incident she decided to expand her thesis beyond cassowary biology to include the human dimension. Issues about who dominated the cassowary conservation issue arose, and there was a perceived loss of control by "locals" over a study being undertaken under the auspices of a distant university and a federal government management agency that was perceived as a threat to the expertise and credibility of the conservation organization. Other human issues were involved, such as conservation vs. development, polarization of the local community with respect to rapid change underway and development speculation, etc. One of the most important was that the local conservation organization's efforts to "undermine the credibility of myself and the value and relevance of the research project were both instructive and sobering, as well as personally very difficult to accept" (p. 26). This history, especially with the community conservation group, highlighted the complex and dynamic role of the professional in endangered species conservation and the need to clarify just what standpoint a professional like herself should take in such a situation. She concluded by noting that the "emotionally charged and politically volatile community environment underscores the difficulties of 'field work' with human communities" (p. 25).

These incidents and others motivated her to move on to other knowledge areas beyond biology and survey social science literature for guidance. As she noted, this "presented many challenges for an ordinary biologist like myself" (p. 25). The social sciences gave her important concepts and methods to understand the hard conservation experience she had gained and how to tackle future work practically. She reported that there were "continuous tensions between my proceeding being fully aware of the limitations and dangers of simplification, and not proceeding thereby giving in to this conflict and continuing on 'as normal' with a biological perspective only" (p. 24). She expanded her research and gathered social science data on the human community in the region and interrelated it with the biological data set. She said she sought to "heed the current call for multidisciplinary research ... and have taken courage from the knowledge that more biologists, ecologists, psychologists, and other environmental scientists seem willing to cross disciplinary boundaries and levels of organization in a endeavor to contribute to solving the extinction crises" (p. 25). Though all of this, she sought a "coherent, holistic picture relevant to endangered species recovery" (p. 25). But it was not without difficulties. Her work evolved into a professional approach that integrated a number of disciplines all focused on understanding and aiding endangered species conservation. Not only did she add to cassowary conservation, ultimately this effort significantly clarified her standpoint to herself.

This professional career is developing towards a fully-mature, policy-oriented standpoint. The evolution of a traditional professional career into a policy oriented one was first described by Lasswell (1971), and Bentrupperbaumer's account fits the profile. The conservation literature now contains similar descriptions of policy-oriented professionals and benefits (e.g., see "Conserving biodiversity in the real world: Professional practice using a policy orientation," (Clark et al. 1992) and "Practicing natural resource management with a policy orientation" (Clark 1992)). More recently, a policy-oriented approach to conservation biology was described by Clark (1977a). Bentrupperbaumer's professional transformation is one example of the kind of change needed broadly in conservation professionalism (see Schön 1983; Sullivan 1995).

Conventional professionalism and the policy-oriented professional

Bentrupperbaumer shifted her view of endangered species recovery from a conventional to a more holistic one (Table 1). As a result she changed from understanding her role and herself in a "conventional" sense towards a more comprehensive, policy oriented understanding. Clarifying standpoint means finding out which kind of professional you are, which kind you want to be and why. The conceptual tools a professional possesses include a way of seeing oneself, other people, the conservation challenge, and communication styles (see Clark and Reading 1994).

To clarify standpoint, we recommend that professionals start by asking themselves questions about their own professional roles, tasks, shaping factors, and orientation that they take or assume (Table 2). Table 2 offers questions that professionals should ask themselves continuously over a career about these variables. Asking and answering these questions leads to "reflective" practice and can lead to policy-oriented professionalism, when combined with skilled use of a genuine interdisciplinary problem solving method (see

Clark 1997b). Restructuring professionalism toward policy-oriented practice requires a substantial commitment to learning by professionals, universities, and other organizations (Clark 1997a). Training and updating training can take place in universities and professional schools, agency workshops, and at the individual level. If organized policy-oriented education is not available, then the individual is left to one's own devices to improve problem solving.

Table 2. Questions Professionals Should Ask Themselves to Clarify Their Standpoints (after Willard 1998, personal communication).

(1) What roles are you and other people engaged in while working in the recovery effort-scientist, technician, manager, student, teacher, advocate, advisor, reporter, decision maker, scholar, facilitator, concerned citizen, or others?

(2) What problem solving tasks do you carry out when performing your roles-clarifying goals, determining historical trends, analyzing conditions, projecting trends, and inventing and evaluating alternatives?

(3) What factors shape how you carry out your tasks and roles-culture, class, interest, personality, and previous experience?

(4) What conditioning factors shape your personal and professional "approach" in general and in reference to any particular conservation case? Which approaches or roles are you predisposed toward or against, and how are you predisposed to conduct your professional work from each?

(5) How does your approach shape how you carry out the intellectual tasks associated with your roles? For example, what is the impact of your "reflective approach" on the goals you clarify and how you specify them? the trends you identify and describe? the conditions you analyze and how you analyze them? the projections you make and how you make them? the alternatives you invent, evaluate, and select?

Conclusions

Clarifying one's standpoint is a necessary first step toward gaining a better understanding of the human social process associated with endangered species conservation (Clark and Wallace 1998). Understanding one's own values and interests in the context of a larger social and organizational whole, in this case endangered species recovery programs, only helps a professional to raise awareness and eventually master many of the problems inherent in complex programs that transcend social and technical-biological realms.

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Research in Endangered Species Conservation: An Introduction to Multiple Methods

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Abstract
Diverse methods may be required to understand and solve conservation problems in species recovery. These problems are usually multi-faceted. Endangered species recovery is a biological challenge, but it also requires that professionals and the public support an organized recovery effort in a timely, rational, and effective way. Biological, social, and interdisciplinary methods all lend themselves to aid the multi-dimensional task of species recovery, although social science and interdisciplinary methods are little used currently. These three kinds of methodological approaches are briefly examined. We end the paper with a call for increased interdisciplinary approaches, as we believe they promise greater effectiveness in species conservation.

Introduction
Endangered species conservation is usually a complex, multi-dimensional challenge. As such, endangered species recovery programs require the use of diverse methods to determine which processes threaten a species and what to do to achieve recovery. Interdisciplinary approaches that incorporate multiple methods in biology and the social sciences promise to improve species restoration efforts. Biological methods focus on the species and its ecosystem. Social science methods examine the decision and social processes, including how the values and perspectives of participants and the situation affect recovery efforts. Interdisciplinary methods systematically integrate biological and social research into a unified recovery program.

Many universities offer programs in biological and social methods, and a few even offer interdisciplinary programs that address the full challenge posed by endangered species conservation. The established, but separate, disciplines (e.g., wildlife biology, sociology, policy analysis) train professionals to be knowledgeable in different methods. Despite the obvious need for professionals skilled in integrative approaches, there are few jobs in endangered species recovery that explicitly utilize interdisciplinary problem solvers. Fortunately, the situation is changing. Conservation and related professions, university training programs, and the organizational contexts of practice are in flux today and prospects for using fully integrative methodologies in the future is improving. We expect that interdisciplinary approaches using multiple methods and inclusive participation will significantly improve success rates over more narrow approaches that rely on a limited set of methods, a single discipline, or domination by single (or just a few), self-interested people or organizations.

In this paper, we (1) offer a brief overview of multiple methods in endangered species recovery, (2) look briefly at available biological and social science methods, and (3) introduce an interdisciplinary approach we believe best uses and integrates knowledge obtained from the diverse biological and social methods currently employed to restore endangered species.

Multiple methods: a strategy in species recovery
Using multiple methods in endangered species recovery is like triangulation wherein a radio collared Florida panther's (*Felis concolor*) location is located, or 'fixed,' using three receiver readings from different angles. As conservationists, we can best get a 'fix' on a conservation problem by using different methods, ideally a combination of biological and social science methods. In our case, triangulation means using and integrating data from diverse sources about a problem and its context. It means using different investigators, ideally working in close collabora-

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tion. Different theories should guide work and interpret data. Multiple methods should be used to investigate a problem from different perspectives in order to develop the fullest possible picture of the conservation problem and alternatives to address it. Just as using multiple methods to address a specific research interest increases the reliability of results (e.g., independent measures of population size from an aerial survey, a ground survey, and capture-resighting data), so too do multiple methods increase the reliability of problem definitions. Using multiple methods to analyze a problem can improve the reliability, richness, and diversity of data available to researchers, decision makers, and managers (Clark 1993; Janesick 1994).

Increasingly, researchers are being called upon to address complexity (and risk) — a key theme of endangered species conservation. Perhaps it is not surprising therefore that some of the most interesting technical innovations in conservation were developed to cope with complexity and the long-term, exploratory, and creative dimensions of protecting and recovering endangered species (e.g., population viability analysis). The task is not to deny or try to minimize complexity in species conservation, but to instead emphasize the complexity, and search for ways to understand and address it. To this end, being knowledgeable and skilled in using and integrating multiple methods is key to successful recovery programs.

Studying endangered species using multiple methods is different from studying more abundant wildlife for several reasons. First, the species under study usually persists in low numbers (and density) and occurs in limited or shrinking habitat. As researchers, we must take great care to ensure that our work does not put the species or even individuals at risk. The species' status may limit the kinds of methods that can be used; therefore, methods should be developed to minimize harassment and, worse, mortality. Second, controlled experiments such as manipulating individuals, populations, or habitats, may be impossible for these same reasons. Third, the human context or social process that is often the root cause of endangerment may be unrelated to biological or other technical considerations and may require immediate attention. This means researching human values, perspectives, and practices and working to understand and perhaps alter those which adversely affect the species or habitat in question. Finally, there are few chances in species conservation. Usually, researchers get only a few chances (at most) to get it right.

Often the contexts of species endangerment and recovery efforts continually change in a highly complicated way. Researching conservation problems implies studying and interpreting the past to clarify current circumstances and needs of participants and to project future trends. If methods are not carefully considered, the very effort of studying a species, its habitat, and its context may adversely affect conservation efforts, especially if major variables (e.g., human social process [see Clark and Wallace 1998]) are overlooked, misconstrued, or misunderstood. Multiple methods help ensure a more complete and accurate understanding of a conservation problem's context.

Black-footed ferret (*Mustela nigripes*) recovery is a good example that illustrates how biological, social, and interdisciplinary research have been carried out in a conservation effort. The general characteristics of the program may be typical of how endangered species recovery is conducted. A ferret conservation program has been ongoing for almost two decades, and this species probably represents the endangered species case most covered in Endangered Species *UPDATE* (also see Clark 1989, 1997; Miller et al. 1996). In brief, biological methods have dominated ferret recovery efforts. There has been very limited utilization of social science, and especially interdisciplinary, methods, although there have been calls for greater use of both. This pattern of neglecting available methods directly reflects the biological, disciplinary training of most professionals in species recovery efforts.

Biological and social science methods

Relying on only a few methods from a biological discipline can result in a distorted picture of the conservation challenge, similar to the story of the three blind men trying to describe an elephant. Each blind man touched only one part of the animal — the trunk, leg, or tail — so each had a different notion of what it looked like, and all were wrong. Using a single discipline or limited methods can produce the same result: an incomplete and possibly distorted picture of the endangered species conservation challenge. This is why a skillfully used mix of biological and social science and interdisciplinary methods can yield the best, most realistic picture of the problem and possible solutions (see Barrett 1978).

Biological methods

Methods used in biological study of endangered species and other wildlife are detailed by Beveridge (1950), National Research Council (1986), Brookhout (1996), Scott et al. (1996), Baydack et al. (1999), and others. These methods set the standards for research and management, will always be essential to endangered species recovery, and require upgrading as needed.

Most readers of this article are probably better versed in biological research than either social or interdisciplinary methods. Because our so-

ciety is technologically driven, it is not necessary to detail the positivistic concept of the scientific method for constructing theories, designing and carrying out experiments, and determining cause and effect (see Beveridge 1950; McCain and Segal 1977; Ratti and Garton 1996). In short, biological researchers seek accurate predictions and strive to conduct experimental science using quantifiable methods (such as modeling). However, naturalistic studies, which are largely descriptive and qualitative, are also used in conservation. Overall, the positivistic approach is invaluable, but it can be misused when researchers or managers insist that all knowledge be obtained by this method. Positivism is coming under increasing criticism because of its inability to address highly complex, unique problems (e.g., Dryzek 1990).

Multiple methods were used, at least in part, in the black-footed ferret recovery effort. For example, researchers determined the free ranging ferret population's size from directly counting animals in spotlight surveys, snow tracking, litter counts, and mark-recapture methods (see Clark 1986 and Miller et al. 1996). These four methods were used to "triangulate" and support one another, increasing confidence in the estimates. The ferret recovery effort involved methods from many fields, including plant taxonomy, plant ecology, wildlife biology, conservation biology, ethology, population biology, genetics, physiology, community ecology, wildlife management, physiology, captive breeding, and zoo biology. Many good biological methods were used (Clark 1986, 1997; Miller et al. 1996; Reading et al. 1996; Lockhart et al. 1998), as well as some that were suspect (see Reading and Miller 1994; Miller et al. 1996).

Biological methods constitute only part of the full set of methods available to save species. Still, some biological researchers use a positivistic approach to species conservation that relies solely on biological methods to the exclusion of approaches that address the human dimensions of recovery (e.g., social, political, organizational, and policy issues). A more complete approach to conservation includes social and interdisciplinary methods.

Social methods

Methods in the social sciences used for endangered species conservation or other problems are discussed by Dominowski (1980), Barzun and Graff (1985), Miller (1991), Dey (1993), Rosaldo (1993), Denzin and Lincoln (1994), Strauss and Corbin (1994), Isaac and Michael (1995), and others. As the importance of social, economic, and organizational factors to endangered species recovery becomes clearer to wildlife and ecosystem managers, standards and approaches to modern social science research should grow in importance and use in endangered species recovery.

Social methods focus on the human element in endangered species conservation, range from positivistic approaches similar to those used in the biophysical sciences to descriptive approaches similar to naturalistic methods used in ecology. Positivistic studies were described above. Descriptive studies employ qualitative methods to "investigate human behavior in its natural and unique contexts and settings by avoiding the artificial constraints of control and manipulation" (Isaac and Michael 1995:218). This approach examines human behavior in real situations, relies on observational techniques, adapts itself to multiple circumstances, and recognizes both intuitive and explicit knowledge (Scott 1998). Because this kind of research studies human perception and multiple realities, often for applied purposes, it is little concerned with creating a final, unified system of knowledge or grand theory. It approaches research in a grounded, emergent way (i.e. induction), as opposed to approaching it with a preset explanatory theory (i.e. the scientific method). The study's boundaries emerge in the course of the research, rather than being preestablished prior to the investigation. This approach often uses a case study format because it better captures the multiple realities at play in complex human interactions (Yin 1989).

To analyze a human social situation means to break it down. Often questions in social methods include who is involved, what happened, why, when, and where (Marius 1995). Each question can be posed in several different ways. The question of 'who' forces us to find out who the individuals and groups involved in the social process affecting endangered species are. The question of 'what' forces us to shift through competing opinions, views, and misunderstandings to find out what really happened. Even if researchers determine what happened, why did it happen? This is a conditioning or cause and effect question. Things happen because of precipitating causes, but background causes may be important too. Causation is complex and usually there are multiple causes for, and outcomes that result from, human behavior. Therefore, factors must be considered in their context. Understanding the temporal and spatial context of events is essential to answer the other questions. In thinking contextually, researchers carefully try to sort through and evaluate the relative importance of various causes. Lastly, it is important to know when and where the situation under study came about or the event happened.

Qualitative methods are used to describe, classify, and analyze social phenomena and their interconnections. In carrying out data manipulations, information may "lose its origi-

nal shape, but we gain by organizing it in ways which are more useful" for generating insight about human behavior (Dey 1993:42). Making inferences from data is an important function of research. The aim of inference is coherence. Most people assume an ability to make correct inferences. In our daily, lives we make many inferences by recollecting past experiences and using them to interpret a present situation or event (Marius 1995). Without inference, we would have to reinvent life anew each day. Social scientists, as well as biological scientists, infer some answers to scientific questions. In doing so we strive to make sense of a behavior or situation, trying to decide what it is and whether our interpretation is reliable. Researchers use inference to fill in gaps to round out or complete a picture of a situation or event. Statistics can be a valuable quantitative method in this regard. But statistics require interpretation. By themselves, statistics tell us little, but what we infer from them can tell us a great deal. Inferring correctly is key.

The black-footed ferret case employed some social science methods. Initially these focused on socioeconomic and organizational dimensions (Clark 1989), and consisted of formal and informal interviews with many residents in ferret habitat and an economic trade-off analysis (Clark 1989). Increasingly, researchers recognized that many human factors were critical determinants of both short and long-term success in the ferret program and additional social science work was undertaken. Other social science methods included the use of decision analyses, interviews with local people and key stakeholders, a formal survey of values and attitudes, organizational and professional analyses, and policy assessments (see Clark and Harvey 1988; Clark and Westrum 1989; Clark et al. 1989; Maguire 1989; Clark and Cragun 1991; Reading 1993; Reading and Kellert 1993; Reading and Miller 1994). Efforts were made on the part of some researchers to integrate the diverse biological and social science data into a comprehensive picture of the whole conservation challenge and what to do about it practically (Clark 1989, 1997; Reading 1993; Miller et al. 1996). Overall though, there was little interest in social science or support for it in the ferret program, and the results of most social science analyses had little influence on program direction. This remains the case today.

The use of social science methods in endangered species recovery is increasing, but they have yet to be applied in ways that demonstrate their potential. The next major leap in research for endangered species recovery should be to apply multiple social science methods to the full context of recovery, including by researchers, decision-makers, and managers.

Interdisciplinary methods

The most comprehensive approach to problem solving utilizes interdisciplinary methods. Interdisciplinary problem solving draws on all methods typically used in the biological and social sciences. It differs from multi-disciplinary approaches in that diverse methods are integrated, rather than conducted in isolation. The first requirement of interdisciplinary problem solving is a conceptual and practical framework that can accommodate diverse data, epistemologies, and disciplines (Clark 1998). The analytic framework of Lasswell (1971a) is comprehensive and helps users find, analyze, store, recall, and relate important information for use in creating realistic problem solving alternatives. A complete description of interdisciplinary problem solving methods is provided by Lasswell and McDougal (1992).

Conservationists must take multiple vantage points to best see and understand the complex factors affecting social process and decision making in endangered species recovery. Interdisciplinary problem-solving will hopefully grow in importance as the requirements of actual species conservation become more fully appreciated. The response calls for contextuality and problem orientation. Interdisciplinary problem solving does just that, tending "toward *contextuality* in place of *fragmentation* and toward *problem-oriented* not *problem-blind* perspectives" (Lasswell 1971a:8, italics in original). This in turn requires using multiple methods. In very general terms, interdisciplinary problem solving involves four elements: problem orientation, social process mapping, decision process mapping, and standpoint clarification. These elements must be integrated.

Problem orientation is a strategy to analyze problems and invent solutions in a rational manner (Wallace and Clark 1999). To permit more complete identification and definition of problems, goals that people seek should be laid out relative to the problems under study. Historic trends must be described to see if events are moving toward or away from goals, and the factors or conditions that have influenced trends must be determined. Projections of future trends are possible if past trends and conditions are known adequately. Lastly, potential solutions must be invented, evaluated, and selected (assuming projections are viewed as harmful). If these five tasks are carried out comprehensively, yet selectively and realistically, a practical solution will likely be found.

Social process mapping is an effort to understand the social context in which all problems are embedded (Clark and Wallace 1998). Social process focuses on the political and moral components of problem solving. Every problem setting, regardless of its subject matter, is comprised

of participants with interacting perspectives. Participants employ whatever values, or assets, they have through different strategies to obtain desired outcomes. The outcomes have additional effects (e.g., power, well-being, respect, affection). Values are both the things for which people strive (outcomes) and the assets they use to get them (e.g., wealth, enlightenment, skill, rectitude). They are the medium of exchange; values are used, exchanged, shaped, or shared to gain more values. In any social and decision process, participants both indulge in and are deprived of values. Eight value categories are recognized by Lasswell (1971a): power, wealth, enlightenment, skill, well-being, affection, respect, and rectitude.

Decision process mapping is an analysis of the decision-making process involved in problem solving (Clark and Brunner 1996). Decision process involves the rational (i.e. is it reasonable?), political (i.e. is it possible?), and moral (i.e. is it justifiable?) dimensions of problem solving. Decision processes consist of six interrelated functions, or activities. (1) Intelligence must be gathered about a problem and its context. (2) In turn, information obtained through intelligence must be debated and discussed, and solutions must be recommended, advanced, and promoted. (3) Rules or guidelines must then be established to address the problem. (4) Subsequently, the rules must be specified and enforced, and resulting disputes must be resolved. (5) All of the functions of the decision process must be appraised. (6) Finally, the process must be terminated, often as a result of the problem being redefined. Lasswell (1971a) recommends performance standards and preferred outcomes for each function. In actual practice, not all of these functions are always carried out.

Observational/participant standpoints consist of a person's value orientations and biases, and stem from personality, disciplinary training, parochial/universal experiences, epistemological assumptions, organizational allegiances, reference groups, and other sources. All people have standpoints, including those who engage in endangered species conservation (Clark and Wallace 1999). People should seek to clarify their own standpoints and understand the perspectives of other people involved or concerned. Often practitioners are not explicit about or do not recognize their own standpoints, risking incomplete and biased analyses.

Empirical study can yield data on problem orientation, social and decision process variables, and standpoint. These categories must be considered repeatedly in interdisciplinary problem solving because information is cumulative. Multiple methods — qualitative and quantitative, observational and experimental, intensive and extensive, contemplative and manipulative — are required to obtain empirical data. This overall process should function as a disciplined, self-corrective framework, the utility of which can best be appreciated by applying it to actual problems.

In species recovery, reasonable explanations of the causes and consequences of endangerment are needed as the basis for practical action and cooperation. And multiple methods provide the only reliable approach for obtaining comprehensive answers to key questions about a recovery challenge. Multiple methods are required to address biological and social problems and fully map the context of the problems. Endangered species professionals should therefore use appropriate disciplines and methods to understand problems and find solutions. All methods have both strengths and limitations. By focusing attention on certain areas of inquiry, single methods create blind spots. By using multiple methods, researchers can minimize blind spots and avoid the fragmented views, knowledge, and actions that rise from single methods. Integrating multiple methods requires that professionals use an interdisciplinary framework for understanding the problem.

Two types of information are recognized in endangered species recovery: ideological and technical. Ideological information includes "facts about the thoughts, feelings, and conduct of human beings. Other facts are technical" (Lasswell 1966:123). Because ideological information is about words and deeds (actions), which may be contradictory in a single person or group, both forms of information should be studied using multiple methods to gain insight. Qualitative methods are often used to triangulate on problems because people often are not capable of rationally explaining their intentions (Dey 1993). So, training programs are necessary to expose students to contextual concepts, problem orientation, and methods of obtaining, processing, and utilizing data.

Little interdisciplinary problem solving has been carried out to date in black-footed ferret recovery, although it has been called for, as well as described repeatedly, by a few participants (Clark 1989, 1997; Reading 1993; Miller et al. 1996). The official ferret program as carried out by government agencies has begun to consider social science considerations (Hutchins et al. 1996), but these remain under-appreciated, poorly addressed, and little integrated with the biological aspects of the recovery challenge (Reading et al. 1997). As such, the official recovery program has made little progress toward utilizing interdisciplinary approaches (see Clark et al. 2000). By addressing the biological and social science aspects of the recovery challenge separately (i.e. a multi-disciplinary approach), practitioners risk

devising fragmented, possibly contradictory solutions.

Perhaps the best interdisciplinary approach to endangered species recovery is the decision seminar (see Clark 1997). This group effort explicitly calls for problem-solving by addressing all of the dimensions of species conservation — problem orientation, social process mapping, decision process mapping, and standpoint clarification. It further requires that multiple methods be used, including both biological and social research. The entire effort is guided by an integrated analytic framework described by Lasswell (1971b), Brewer (1974, 1986), Burgess and Slonaker (1978), Willard and Norchi (1993), and Clark (1997). We recommend using this approach in species recovery.

Conclusions

Endangered species conservation is a complex and diverse undertaking. The scope of species recovery is variously interpreted. Often it is viewed as largely or solely a biological task, but when analyzed more comprehensively, species recovery is seen to encompass social science and interdisciplinary considerations as well. As a result, multiple methods are increasingly being used and additional methods will be invented and adapted to meet the multi-faceted challenges of species recovery. Over time, the self-correcting impact of experience will hopefully modify and integrate these diverse methods and move endangered species recovery towards an explicit interdisciplinary approach. An interdisciplinary approach; that is, a contextual, problem-oriented, and a multi-method approach to endangered species conservation, can be expected to improve our knowledge both of and in decision processes and thus make us more effective. Interdisciplinary approaches can also contribute to the development of expertise in the formulation of endangered species policy and management in terms of realizable objectives and strategies. At the least, this should be the aspiration.

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applications

Photos by Richard L. Wallace (L to R): Galapagos fur seal (*Arctocephalus galapagoensis*) and Galapagos sea lion (*Zalophus californianus wollebaeki*); Galapagos sea lions; California sea lion (*Z. californianus*).

Organization and Management of Endangered Species Programs

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Abstract
Biologists involved in endangered species conservation are skilled in the scientific and technical aspects of their work. However, it is equally important that they understand how to organize and manage an effective endangered species recovery program, as well as participate in it. Organizations are commonplace in society, but attention to their structure and function are often taken for granted, especially so in species conservation efforts. People involved in recovery programs would benefit from a clear understanding of how different organizational approaches can either hinder or facilitate their work. Just as species live in environments, recovery programs exist within "task environments" showing the properties of uncertainty, complexity, diversity and instability. Models with significant uncertainty require a structure that allows for proper generation and management of information throughout the life of the project. Bureaucracies are ill suited to this task, for example. Therefore, the management process must include effective teams that are flexible, quick, and based on a task-oriented and communicative approach. Planning within an effective team will require continual reevaluation, analysis, and adjustment. Teams should not be formed using hierarchy, reliance on rules, or many regulations. Therefore, it is important to have a leader who can create a "team environment." A leader who is skilled in conflict management and can separate the rationality, politics, and ethics involved in all efforts. Finally, teams must rely on explicit frameworks for analyzing organizational problems, and making changes. Paying attention to the managerial and organizational aspects of a recovery program can greatly improve the recovery record of endangered species programs.

Introduction
Endangered species recovery is nearly always difficult, and as a result, conservation biologists need to use the best tools, skills, and experience available. It is not always easy to determine the precise causes for dwindling, small populations and habitats and to devise timely, efficient means to restore them to evolutionary health. While the use of good biology is absolutely essential to species recovery, other factors of an organizational nature are also indispensable, such as problem analysis and problem-solving strategies, organizational design, work group effectiveness, and clarity and specificity of goals and objectives. Inadequacy in any of these factors may result in inefficiency and ineffectiveness, and ultimately, the species may not be recovered.

In this paper, we introduce organization and management concepts and recommendations that can help the work of conservation biologists and managers. We offer only a brief introduction to the complex organizational dimension of restoration work. We also direct you to the extensive literature of this field and to several checklists and self-tests that allow you to diagnosis your present situation.

The organizational dimension of restoration work
The challenge of successful species restoration includes many organization and management issues (Clark 1989), although this fact often goes unrecognized (Clark 1986). It is obvious that good science is needed in restoration work. It is less obvious to many people that good organization and management are also needed. Our study of the organizational dimensions of conservation work and our participation in various species restoration efforts have led us to conclude that an explicit understanding of how organizations arc structured and how they function is essential to successful conservation. By studying the activities and structures of programs and teams, for example, we

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can learn which ones best support the demands of conservation work (Clark et al. 1989). Understanding organizations and knowing how to make them work for species recovery can make the difference between a program that succeeds and one that fails (Argyris and Schön 1978; Clark 1985).

Unfortunately, it is common for professionals in many disciplines to ignore or depreciate the value of these organizational factors. They see only the biological, technical aspects of the problem and under appreciate organization and management dimensions. Because of this, their job may be harder than it should be. They may unconsciously create impediments or barriers as a direct consequence of how they organize and manage themselves, how they structure their thinking and actions, beginning with how they identify problems, how they define solutions, and especially how they design and implement jobs and working relationships. Because of this failure and because of the urgency and the risks in recovery efforts, conservation professionals would do well to incorporate knowledge of organizations into their repertoire of skills and to learn how different organizational designs and management modes can either facilitate or hinder their work. Extensive research on many different kinds of organizations has revealed common problems, patterns, and concerns. For example, it is estimated that 50 to 75% of organizational behavior, patterns, and problems is common to most organizations (Galbraith 1977). A little of this kind of knowledge can go a long way in saving species.

Embarrassingly little attention is paid to designing and managing organizations and decision-making processes in conservation despite evidence of chronic and obvious problems. Yaffee (1982) described many of these problems in his classic study of implementation of the Endangered Species Act, including: slow decision-making; rewards for incompetence and penalties for aggressive, effective action; overly rigid bureaucratic controls; long hierarchies of authority; and importantly, scientific and bureaucratic conservatism. These problems are probably more prevalent than is currently recognized in recovery efforts. People are surrounded by organizations all their lives. They take them so much for granted that their pervasiveness and influence are taken as a matter of fact. This has led organizational designers to observe that: "People who live their entire lives in organizations and are surrounded by them have only the vaguest knowledge of their workings — or underlying logics" (Jelinck et al. 1981:4).

Task environments and information processing models

Restoring species, of course, requires that we take their environments into consideration. Plants and animals evolve in dynamic environmental contexts. Indeed, the reason many species are now endangered is because these contexts have been drastically altered by humans. Just as species live and act in environmental contexts, the restoration task is recognized by organization designers to have an "environment." The sum total of all the forces and factors — technical, organizational, and policy — that affect the work of species recovery is the task environment. There are internal and external aspects of the task environment (Clark 1985; Clark and Westrum 1989).

The systems properties of many endangered species task environments are uncertainty, complexity, diversity, and instability (Clark et al. 1989). Uncertainty is the difference between what conservationists know when they start a recovery effort and what they must eventually know to be successful. In the beginning, uncertainty is often great. There are complex relationships between endangered species and their biological and physical environments often showing thresholds and indirect and nonlinear relationships. Such relationships possess much natural variability. Uncertainty and complexity lead to unpredictability.

There is uncertainty not only in ecological systems themselves but also in the organizations involved. There are often differences in perception and expectations among the individuals and organizations involved (Hrebiniak 1978). Many differences exist between field level agency managers, top level bureaucrats, university researchers, conservation organizations, and others. For example, even though all these individuals may agree on the goal or end - to save the species - they frequently disagree on the means. When you figure these differences into the hundreds of decisions or clearances that must take place in a typical recovery effort, it can be seen that it is virtually impossible to create an effective, efficient, and equitable program without a good working knowledge of organization management principles.

Organizational designers offer what they call "information processing models" for programs confronted with much uncertainty, such as recovery programs (Daft 1983). These models view the task basically as one of proper information generation and management. They generally illustrate that programs confronted with much uncertainty (e.g., little information and how to solve a problem initially) need to be structured and operated in special ways. Every program should have the capacity to gel and process information matched to the demands of the task environment. To the extent that a program 's information processing requirements change over time, the task of structuring and managing the program is a continuous job in itself. In the be-

ginning, programs should be highly, flexible. As the problem gets resolved, eventually more fixed, standardized procedures can be used.

Task forces and project teams

Task forces and project teams can be one of the most useful program elements for endangered species recovery (Clark and Westrum 1989). Small, flexible teams are useful because, with the unpredictability of the task environment, problems arise which do not respond to traditional rules, roles, and regulations of bureaucratic management. The work team, once it has adequate resources, can move quickly to stay ahead of problems. A good team can generate and process needed information rapidly offering up solutions to the recovery task. We all know of so-called teams, for example, that are just rigid extensions of standard bureaucratic structures and operating principles. These are teams in name only and they often perform poorly in endangered species conservation.

The team needed for restoration, by contrast, should be task and action oriented, focused on getting the task completed successfully. It must be willing to accept the uncertainty and risk inherent in endangered species challenges. Considerable emphasis must be given to quality information flow and continuous evaluations. The amount of administrative control over the team will vary from case to case, but fundamentally, administrators must be committed to the task and provide the latitude necessary for professionals to do the work.

To be effective, individual team members must be perceptive, energetic, willing to work without close supervision or extensive rules and regulations, and able to learn well. Team membership should be based on an individual's political contribution to solving problems and less on the political representation he or she may provide. Both agency and nongovernment participation is necessary. A team set up and operated this way stands a much better chance of being successful than one which is not.

Understanding the character of your organization

The previous descriptions of task environments and task forces and project teams are all characteristics of task oriented organizations. Not all organizations are task-oriented, however. There are also power, role, and people orientations (Harrison 1972, 1975). These four orientations are defined and accompanied by a questionnaire about them which you can take to learn about your own organization's culture (Harrison 1972, 1975).[1] If the wrong culture or orientation is used by the team or the overall program, it is unlikely that the restoration job will be successfully met. So it is essential to understand the type of culture your organization has, and if it is not a task orientation, it needs to be changed to one that is.

Let's look briefly at the concept of organizational cultures. At the core of every organization is a culture or system of thought that is the central determinant of its character (Harrison 1972, 1975). The culture is a set of values and cognitive perspectives that are largely shared by members. Some people become highly socialized to organizational cultures, whereas other people are less well socialized. "An organization's culture affects the behavior of its people, its ability to effectively meet their needs and demands, and the way it copes with the external environment" (Harrison 1975: 169). Much of the conflict between and within organizations is the result of cultural differences between organizations or subunits within the same organization.

From an operational point of view, an organization's culture may or may not be well matched to the conservation work to be done. If it is, it will aid task completion; if not, it will hinder the work. Both the program's culture and the team's culture should be predominantly task-oriented to be most matched to the work of species restoration. In task-oriented conservation teams, members should have no ideological commitment to authority and order per se in such programs (Clark and Westrum 1989). Authority should be seen as legitimate if it is based on knowledge and competence and is used to meet the recovery task. Authority is illegitimate if it is based on power or position and is not used to meet task objectives.

Managerial processes

How should task forces and project teams be managed in a complex and uncertain task environment? Special attention must be given to management processes. Whether recovering species or conducting other complex tasks, organization and management concepts have wide application in problem-solving situations. Management is the use of people and other resources to accomplish objectives. This very brief overview of terminology, theory, and perspectives has practical value you can apply (Mintzberg 1971; Brickloe and Coughlin 1977; Kanter 1983; Boone and Kurtz 1984; Steersetal 1985). We will describe briefly four of the primary functions that take place in organizations, focusing on how these functions should be carried out in the high performance teams that could be useful in conservation.

Organizing teams

The way a team is set up and run provides a map of tasks to be performed, responsibilities, and reporting relationships. Obviously, a marine combat team should be organized differently from a day-care center or a pro-

Musk deer (*Moschus moschiferus*) by Richard P. Reading.

gram to save an endangered species.

Getting the organization right for a restoration team should be a major concern. Given the task environment of restoration work, the overall program should have little formalization and few hierarchical levels, rules and regulation. Elsewhere, we have described many organizational concerns in conservation (e.g., Clark et al. 1989). The bureaucratic centralization of decision making and management functions should be minimal. For example, referring problems upward within bureaucratic hierarchies may destroy team cohesion and will frequently result in critical time lags if decisions by top management are delayed too long, if lines of communication become too long, if too many people are involved, or if the relevancy of the issue becomes distorted by the time it takes for the administration to make a decision.

Planning in team

The kind of planning that an effective restoration team uses may be quite different from that typically used by bureaucracies. In teams, planning requires continual reevaluation, analysis, and adjustments - all directed toward the restoration goal. Plans need to respond quickly to changes suggested by field operations. Extensive preplanning and rigid overplanning should be avoided.

Establishing and putting a plan in place involves decision-making. Both the team and supervisors in the overall program must understand the overall system of decisions being made. The people and the decision-making process should collectively focus on the task. Team members are usually highly skilled in conservation science and management, and they should be included in all decision-making and planning.

Decision analysis has been used successfully in several endangered species recovery plans (Maguire 1986). In short, decision analysis is a form of risk assessment wherein the problem is outlined in a "decision tree." It is extremely valuable in unpredictable technical and socio-political task environments; endangered species restoration is a prime example.

Leading teams

Leadership of the team and the overall program should be task-oriented. The team leader should be a team builder and a skilled manager of conflict. Differences of perception and interests will arise in any joint task, but coupled with emotionalism, differences can be magnified to unproductive levels. Team leaders should be evaluated on the overall performance of the team and not solely on their individual performance or on the basis of their employing agency's incentives. Team leaders can find themselves in a dual role. One role is task-oriented and the other representation of their employing agency. The two roles can be incompatible, so team leaders should possess an ability to separate scientific fact from inference or judgments that reflect policy and politics.

Controlling teams

Controlling teams is necessary to maintain working relationships and to insure that performance standards are met. In restoration teams consisting of professionals, the control function will largely be self- imposed by the members themselves, assuming a commitment to the task, an environment that provides feedback on team performance, an evaluation system, and appropriate recognition and rewards for performance.

All team members should participate in defining the problem they are working on, in designing appropriate strategies, and in agreeing upon the standards on which their performance will be judged. Once all members have accepted the legitimacy of the task and the performance standards, then controlling the task becomes less formidable. Feedback on individual and team performance should come regularly as the team conducts its activities.

Analyzing organizational problems and developing action plans

Endangered species recovery requires a framework for analyzing organizational problems and for implementing change. For example, a team may recognize that their day-to-day effectiveness is hampered by a lack of freedom to confront one another on relevant task issues. Hav-

ing agreed that they need to talk more openly, each team member waits for someone close to begin. After considerable frustration, they may ask, "Why can't we change the way we work together?"

In this example, there may be many reasons to be more open. An important one is that team members must perform effectively for their own sakes, for the good of the team, and for their employing organizations. Accomplishing needed changes, even if they are well recognized, is not always an easy task. Often forces hidden in the sociology of the team hinder change and may require a professional organizational consultant. By the same token, other problems, both organizational and technical can be effectively addressed by the team directly if they follow a systematic process of problem-solving and action-planning.[1] This procedure is self-explanatory and could be used by teams, agencies, and organizations experiencing technical, organizational, or other problems.

Conclusions

There is evidence of poor performance in endangered species programs in this country (Kohm 1990). Many of these problems can be traced to poor design and mismanagement of organizations. Once biologists understand this, they will be able to apply the concepts, terms, and descriptions used in this introductory paper and the extensive literature cited to identify, analyze, and begin to rectify the problems in their own programs. The task of restoring species and their habitats to a healthy status is difficult enough without being hampered by poorly designed and managed organizations, especially when researchers in these fields already have valuable concepts and techniques which arc directly applicable to conservation programs. It seems clear that conservation biologists must become knowledgeable about what makes for a good recovery program and how to achieve it.

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Footnote

1. Additional information is available from the senior author.

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Learning as a Strategy for Improving Endangered Species Conservation

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Abstract

Many people believe that the endangered species conservation process is not working very well. Extinction rates remain high, and few species have recovered to healthy, viable populations in secure habitats. Improving the professionals' and organizations' learning abilities that are involved in species recovery may upgrade conservation, perhaps significantly. Learning, however, involves more than changing or fine tuning experimental scientific methods. It requires a commitment to focus systematically and explicitly on learning capabilities from the individual, professional, organizational, and policy levels. Effective, proactive learning improves performance by looking critically, but constructively, at past performance, current problems, and the context of the problem(s), and applying the lessons to new situations. Though organizations involved in endangered species conservation need to learn, the way that individuals and organizations do learn is still unclear. This paper reviews current learning theory which offers ideas and suggestions, reviews current barriers to learning, and suggests ways to facilitate improved learning to upgrade our conservation efforts. If individuals and organizations involved in biological conservation can learn and apply lessons of hindsight, and then translate them into foresight for future efforts, species recovery and protection can greatly improve. The very health of the entire ecosphere is at stake.

Introduction

Justification for the Endangered Species Act of 1973 (ESA) is largely based on recognition that if the biotic enterprise is damaged by the extinction of too many species, the current functioning of ecosystems will be lost or diminished, and the consequences for humans will be unpredictable, but most definitely harmful. Its is vital that the ESA policy be refined, administered, and applied well to conserve species and their habitats. Improving the learning capability of professionals and organizations is the strategy most likely to be successful in this regard. This paper examines learning at multiple levels to improve species and ecosystem recovery and conservation.

Learning at individual and organizational levels

Learning is the process of using information to adjust one's responses to the environment, or the process of detecting and correcting "errors," i.e. mismatches between expectations and outcomes (Argyris and Schön 1978). Learning to meet practical conservation goals successfully involves more than refining scientific methods. We must focus on learning capabilities and processes at both individual and societal levels in pragmatic ways. Fundamentally, we must learn to how to learn more effectively — an approach that improves performance by explicitly seeking information about our own past performance, the dynamic status of the problems we face, and the context of these problems (Clark 1993). This focus on learning brings four targets to attention — individual, professional, organizational, and policy. Learning in any one of these four may affect learning in all the others. An explicit learning strategy requires that inquiry and redirection are common, new ideas welcomed, bridging rewarded, and responsibility for outcomes shared.

There has been considerable experience with endangered species conservation since passage of the ESA, but it is debatable how much of this has been explicitly and systematically converted to organizational or societal learning or how much improvement has actually occurred in species survival (see Yaffee 1982, 1994; Tobin 1990; Kohm 1991; Alvarez 1993). The sad fact is that, as Argyris and Schön (1978:9) noted, "there are too many cases in which organizations know less than their members." Organizational learning capability, in government, business, and NGOs, has been shown to affect important organizational outcomes and policy implementation (Glynn et al. 1992). In this case, the level of performance in restoring endangered species is largely a function of the ability of organizations to learn form past experience and apply the lessons to new situations.

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Learning theory

Exactly how individuals, professionals, organizations, and policy systems learn is not known. Parson and Clark (1995) provide a good overview, in the context of sustainable development, of numerous theories that explain the phenomenon of individual learning. Some theories focus on people's behavior and what factors (e.g., social, cognitive, symbolic) motivate it. Others emphasize people's rationality, and its "boundlessness," as they make decisions, learn, or solve problems. Other theories look at information processing, i.e. the need to filter and structure vast amounts of incoming information. Parson and Clark (1995:436) also summarized the cognitive sciences' definition of learning: "Learning is an experience-driven change in the internal cognitive structure used to represent information. People respond to disparity between their cognitive structures and feedback from their behavior by revising their cognitions." There is also a body of learning theory dealing with the joint development, or "codetermination," of individual thought/learning and social/cultural contexts. Learning by individuals is prerequisite to organizational or policy learning.

For significant improvements to occur in endangered species conservation, organizations must learn. Such a statement seems obvious, but few organizations set explicit learning goals or track their learning performance. No recovery or management plan that I am aware of specifically lists learning as a goal. Leeuw et al. (1994:2) point out that "organizational learning is usually not a deliberate enterprise, but an ad hoc endeavor used for problem solving." In part, the concept of organizational learning is relatively new; many key advances were made beginning in the 1970s building on theories about individual learning (e.g., Argyris and Schön 1978). Recent interest in organizational learning (see Senge 1990) stems from the fact that it has a vast array of practical implications. But despite its potential uses in improving endangered species conservation, these ideas and techniques are little known in species restoration circles. Organizational learning depends on individual learning, probably in one of two ways. It has been theorized that organizational learning is the sum of its individual members' learning, which is not as simple as it sounds. According to Parson and Clark (1995:439) "What each individual learns may be complexly contingent on the choices and learning of other group members (e.g., in pursuit of high level coordinated performance by a group such as a basketball team, a string quartet, or a recovery team). Or the means of individual learning might be through activities that depend on the participation of other group members, such as discourse, imitation, or shared activity." Alternatively, group learning may be analogous to individual learning except that it takes place at a more complex level of society, i.e. it may be "autonomous, determined by group-level causal processes that correspond to the processes shaping individual learning" (p. 439). Thus, one could speak of organizational perception, memory, or changes in behavior and beliefs.

Etheredge and Short (1983:42), in their study of learning in government agencies, proposed that learning ought to result in "increased intelligence and sophistication of thought and, linked to it, increased effectiveness of behavior." Etheredge (1985:66) drew on three criteria to measure increase in intelligence: "(1) growth of 'realism', recognizing the different elements and processes actually operating in the world; (2) growth of 'intellectual integration' in which these different elements and processes are integrated with one another in thought; (3) growth of reflective **perspective** about the conduct of the first two processes, the conception of the problem, and the results which the decision maker desires to achieve" (emphasis in original).

Similarly, Argyris and Schön (1978) emphasize the change in "reflective perspective" in their distinction between "single-loop learning" and "double-loop learning." In single-loop learning, organizations develop skills to scan their environment, set goals, gather better information, use it in planning, and monitor their own performance in relation to their goals. The entire process is conducted within the context of the organization's central cultural norms and traditions, i.e. its understanding of how to do business and the adequacy and reasonableness of its strategies. Many organizations become good at changing organizational strategies to meet unchanging norms.

But some "errors" are not easily corrected within the framework (Argyris 1992). Sometimes the error or conflict challenges the norms themselves. A program selected to achieve certain goals may be implemented successfully, for instance, yet not be adequate to achieve the goals. It may be that, in the words of Leeuw, et al. (1994:9) "evaluations precipitate debate on core organizational issues when they not only ask the question 'how well are we doing,' but also, 'does it make sense to do it, even if it is being done well?'" Organizational learning in these cases requires more than a single feedback loop of changing strategies: it requires a double feedback loop that also reexamines the standards by which the organization operates. The process must start with recognizing the unexpected outcomes, acknowledging that they cannot be "corrected" by doing the same thing better, and developing a new and different perspective on the problem. Double-loop learning must insti-

tutionalize systems that "review and challenge basic norms, policies, and operating procedures in relation to changes occurring in the environment" (Morgan 1986:89).

Many of the people and organizations engaged in endangered species conservation could benefit from these concepts and criteria. Appraisal of restoration efforts, for instance, would be improved by willingness to examine both personal and organizational norms as well as the success of particular programmatic elements. As Senge (1990) suggests, organizational learning depends on developing new values and assumptions, new "action rules," new capacities in both cognition and language, and new practices. Many of the supposedly intractable and recurring problems of recovery programs could be overcome by adopting new approaches to learning. The practical benefits in terms of improving efficiency, developing operational process and saving species would be enormous.

Barriers to learning

There are inherent limitations on learning both by individuals and groups. These limitations are at play in endangered species conservation as in many other settings. Michael (1995) notes that three barriers to learning may be largely unconscious at the individual level, but nonetheless real. First, sociocultural constraints against learning are part of every human myth system and its "shared set of tacit assumptions" (p.469). "Our belief that we are independent agents deters us from recognizing how very much our beliefs and behavior, our way of evaluating persons and events are shaped by our myths and our habits" (p. 469). Second, emotional factors also weigh against learning. New ways of understanding the world may create uncertainty, risk, threat, a sense of vulnerability, and anxiety. Third, there are cognitive constraints on how our minds perceive, collect, understand, and analyze information, assess its reliability, and comprehend its massive quantities and complexity. "Learning to perceive and to evaluate the 'facts' differently, including experiencing them from the 'rationality' of other interests, and then learning to act differently with regard to them" (p. 473) may be an overwhelming task.

A number of intrinsic limitations on learning have been recognized within organizations, too, particularly bureaucratic ones. Morgan (1986) cites three such barriers. First, organizations impose fragmented structures of thought on their employees and discourage them from thinking for themselves. Organizationally-set goals, structures, roles, and routines sharply define patterns of attention and responsibility for people within the group. Even successful single-loop learning may inhibit asking deeper questions about the organization's underlying assumptions, norms, and learning capabilities (Argyris 1992). Second is the system of bureaucratic accountability that fosters defensiveness. The organization and its employees may make excuses, deflect responsibility, or obscure issues and problems that might make them look bad. This may be manifest as "cover ups," manipulation of images and impressions, or telling superiors or the public what employees think they want to hear. Third is the difference between what people say and what they actually do. Employees "develop espoused theories that effectively prevent them from understanding and dealing with their problems" (Morgan 1986:90). "Groupthink" pressures may reinforce these tendencies (Janis 1972).

Etheredge (1985) identified several barriers to governmental learning (see also Osborne and Gaebler 1993). First, agencies tend to adopt similar policies and programs across all circumstances. Second, decision processes in agencies tend to be closed, relying primarily on information sources that confirm agency tendencies. Third, government agencies commonly demonstrate errors in judgment and perception: they underappreciate valuable data, dismiss outsiders' suggestions, and base judgements on wishful thinking. Fourth, early appointments of people to important positions tend to determine later outcomes. Fifth, there is a tendency within bureaucracies for no one to accept complete responsibility. Sixth, policy meetings are usually highly ritualized, which reinforces patterns of collective decision making and bypasses "intellectual integrity" (p. 98). Seventh, group decision processes are generally "designed to affect choices rather than to clarify them" (p. 99). Finally, organizational learning is inhibited when decision makers underuse or penalize information form subordinates.

Many of these "self-blocked learning" patterns appear over and over again within organizations, and the same strategies for organized behavior are repeated — despite continuing incongruities between people's expectations of how their actions and decisions will affect matters and the actual outcomes and effects.

Improving conservation by improving learning

The constraints on achieving a more learning-based approach to endangered species conservation are fundamental cultural, biological, and organizational factors. Yet, the necessity of change is widely recognized. To put it simply, we need to learn how to learn explicitly and systematically at all levels-individual, professional, organizational, and policy. A number of suggestions have been put forward to implement and facilitate improved learning and reorientation of our approach to conservation.

Michael (1995:475-484) offers nine recommendations for improving learning in the context of the renewal of ecosystems: (1) "Use the metaphoric power of language." Michael points out that war (and its derivative sports) is a pervasive metaphor used to describe many of our society's activities: "These metaphors tacitly emphasize we/they, before/after, winner/loser, beginning/ending, fixed boundaries in time and space, and relationships that map poorly onto the amorphous information world…and onto the fluid ecological environment...[And] it is usually by these metaphors (data never read alone) that activists and policy makers present their proposals" (p. 476). He suggests building an alternative vocabulary of metaphors that more accurately reflect the realities of "an amorphous, problematic, information-rich world of multiple myths described by such words as reciprocal, resilient, circular, emergent, development, ebb and flow, cultivate, seed, harvest, potential, fittingness, both/and" (p. 477). Such metaphors might come from the fields of biology, ecology, music, storytelling, and learning itself. (2) "Use myth reinforcement to encourage learning." Traditions that esteem learning have long existed within Western culture-science, exploration, art, athletics, "American ingenuity" — and these should be highlighted and strengthened. (3) "Acknowledge uncertainty and embrace errors." Learning requires recognition of many future uncertainties: "When uncertainties in the outcomes of proposed policy and action are acknowledged, perceived risks and vulnerabilities increase. However, options and the opportunities for resilience also increase." (p. 479). (4) "Minimize the learner's sense of vulnerability." Michael notes that learning groups are more successful when they acknowledge that there are other significant issues besides 'the facts,' including individual fears and "protecting organizational turf or political expediency." (5) "Use facilitators rather than chairpersons." Training in the skills of group facilitation can be extremely beneficial to a group's learning. (6) "Introducing training of group process skills." Special training can also help group members overcome predisposition's toward poor listening, interrupting, "withdrawal from active participation, resistance to every suggestion, long-windedness, putting down other participants, and scapegoating" (p. 481). (7) "Provide short-term reinforcements/rewards." To help counteract the inherently long time frames of environmental management, Michael calls for the invention of rituals that regularly recognize and reward learning and acknowledge the many risks taken. (8) "Reinforce the learning mode by becoming educators." Educators at all levels can practice modeling this new kind of learning, including using more appropriate metaphors and thus changing the social context. (9) "Use disasters and crises as learning occasions." Sudden, even violent, disruptions in the world provide a potent and unique opportunity for learning that could be anticipated and capitalized through scenario construction or gaming simulation. These nine can be applied to endangered species recovery, as can the following suggestions.

Other authors have offered useful suggestions for upgrading the learning performance of organizations, although they have not specifically addressed the conservation arena. Morgan (1986:91-95) summarized four general principles: (1) "Encourage and value an openness and reflectivity that accepts error and uncertainty as an inevitable feature of life in complex and changing environments." (2) "Encourage an approach to the analysis and solution of complex problems that recognizes the importance of exploring different viewpoints… This is best facilitated by managerial philosophies that recognize the importance of probing the various dimensions of a situation, and allow constructive conflict and debate between advocates of competing perspectives. In this way issues can be fully explored, and perhaps redefined so that they can be approached and resolved in new ways. This kind of inquiry helps an organization absorb and deal with the uncertainty of its environment rather than trying to avoid or eliminate it." (3) "Avoid imposing structures of action upon organized settings…When goals and objectives have a predetermined character they tend to provide a framework for single-loop learning… More double-loop learning can be generated by encouraging a "bottom-up" approach to the planning process." And finally, (4) "Make interventions and create organizational structures and processes that help implement the above principles."

Westrum (1986) provided seven principles for developing "generative" rationality within organizations, i.e. a strategy of creating problem solving: (1) "Encourage system-wide awareness for all members of the system. No one can be expected to help solve the system's problems if they do not understand what those problems are. An empowered periphery must be one aware of overall goals and approaches." (2) "Encouraging creative and critical thought for all organization members. Although some members of the organization will contribute disproportionately, it is vital to realize that some important ideas may come form unlikely sources." (3) "Link the parts of the system whose work is independent. The members of a task system must understand each other's work if they are to co-operate in solving the system's problem — not just their

own. It is not enough to identify with the system as a whole. Without seeing integration as an important task, organization members will perform their contributions often in blissful ignorance of what the rest of the organization requires." (4) "Scan the system's parts for relevant solutions or contributions. Use the best solutions regardless of their origins. Every organization should examine the ability of its intratelligence system [what an organization knows about itself] to do this. It may be useful to develop formal exercises to generate alternatives. The fruits of these exercises should be formally transmitted and acknowledged." (5) "Reward communications and activities that show a desire to contribute to the entire system's thought process. Although today's contribution may not be the answer sought, tomorrow's contribution will never come unless today's is recognized. 'Good try' is always superior to 'No good.'" (6) "Avoid over-structuring. Most of the organization's resources should be used in coping with problems, not in building up the private domain of its leaders. It is a natural tendency for parts of systems to entrench themselves. It is equally certain that resisting this tendency is necessary to maintain generativity." (7) "Examine mistakes honestly. Generative systems characteristically deal with mistakes as system problems rather than as person problems. While genuine negligence should be punished, oversights and inadequacies are human. The important issue is to identify the source of the mistake, not punish the person who made it. The ability of the system to repair its problems is strongly related to the willingness of people in it to open themselves to criticism. This willingness is greatest when criticism is dispassionate and impersonal."

The myriad ideas and approaches covered here can be boiled down to a single notion, best expressed by Morgan (1986:91): "In essence, a new philosophy of management is required, to root the process of organizing in a process of open-ended inquiry…The whole process of learning to learn hinges on an ability to remain open to changes occurring in the environment, and on an ability to challenge operating assumptions in a most fundamental way." Institutions that deal with the conservation of endangered species in America, including the professions, science, government management agencies, and non-profit sector, are currently not organized this way.

Conclusions

It is widely perceived that current endangered species conservation is not working as expected. Extinction rates are high and accelerating; few endangered species have been returned to healthy, viable populations. ESA reauthorization efforts provide an opportunity to improve conservation significantly at the legislative level. Numerous other practical opportunities for improvement exist at the individual and organizational levels in many field efforts (Clark et al. 1994). Learning is an approach that could be widely applied. Active, explicit, and systematic learning about human systems (organizations, professions, policy making, etc.), as well as endangered species and ecological systems, would ground conservation efforts in realism and enlarge their scope significantly.

In recent years, new responses to biodiversity conservation have come forward. Ecosystem management proposes to conserve biodiversity in large regional biotic systems with protected core areas, buffer zones, and interlinking corridors. This would be accomplished by coordinating management on large spatial and temporal scales based on watersheds and natural biotic communities, thus protecting more species and habitats than previously, and it is hoped, preventing species decline. Comprehensive regional planning has always been suggested as a way to integrate planning and management for wildlife (including endangered species), natural resource use, land use, air and water quality, development, and transportation at local, regional, state, and federal levels (e.g., California Governor Wilson's "Strategic Growth Plan"). These two initiatives to "scale up" conservation efforts contain the seeds of a learning approach to multiple levels, but neither one embodies a fully-recognized focus on learning as a significant tool to improve conservation.

Michael (1995) concludes that "there are two kinds of learning: one for a stable world and one for a world of uncertainty. Learning appropriate for the former world has to do with learning the right answers and learning how to adapt and settle into another mode of being and doing. Learning appropriate for our world has to do with learning what are the useful questions to ask and learning how to keep on learning since the questions keep changing." (p. 484). The future health of the nation and the planet is directly linked to maintenance of the biotic enterprise on which all human activity ultimately depends. The opportunity for significant improvements in biological conservation exists in the cultivation and expansion of our learning abilities, i.e. in learning how to learn and applying the lessons of our experience.

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Karner blue butterfly (*Lycaeides melissa*) by James and Karen Hollingsworth, USFWS.

Prototyping for Successful Conservation: the Eastern Barred Bandicoot Program

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Abstract
*Prototyping is a practical response to the need for innovation, creativity, and new initiatives in endangered species conservation. Though prototyping is an inventive approach to diverse problems that strives to develop a model on which to base future programs, it has not been utilized fully in species conservation programs despite its growing record of positive benefits. Prototypes are flexible, creative processes and designs for detecting and correcting errors that cannot be otherwise detected in uncertain, original, and spontaneous systems, such as in recovery programs. Endangered species conservation is an ideal instance where prototyping may well significantly upgrade recovery efforts. Successful prototyping requires that all participants agree to participate, that the leadership is cooperative, that the process is open and creative, and that participants' primary objective is improving performance, not power or some other personal or organizational goal. A prototyping exercise, carried out in Victoria, Australia, beginning in 1988, to facilitate the conservation and recovery of the endangered eastern barred bandicoots (*Perameles gunnii*), met with success as the population increased from 150 individuals at one site to over 700 individuals at seven sites over the next few years. Lessons learned in this prototyping exercise are easily transferable to other endangered species recovery efforts, including: (1) explicitly using a prototyping strategy to guide recovery efforts; (2) embracing an interdisciplinary, problem-oriented approach; (3) using small, knowledgeable teams; (4) clarifying goals and establishing open, accountable decision-making mechanisms; and (5) evaluating all aspects of the recovery exercise systematically and regularly.*

Introduction
Prototyping is a proven strategy to solve complex, challenging tasks like those posed by endangered species recovery efforts. Prototypes are small scale, exploratory interventions in social or policy systems to implement a trial change, such as changing people's assumptions about how they should interact or who should share what kinds of power. With the primary goal being to gain information, prototypes are structured as innovative, interactive processes for active learning. They are the creative, corrigible initiatives that, if successful, can provide the basis for structuring later pilot projects. Prototyping thus is a means of upgrading professional and organizational practice and knowledge in general (Lasswell 1963, 1971a). Our experience on three continents shows that the prototyping strategy has not been employed explicitly or systematically in endangered species conservation to date, despite the significant improvements it offers to our collective conservation efforts.

In this paper we introduce the prototyping strategy using the Australian eastern barred bandicoot (*Perameles gunnii*) management program as an example. We offer five prototypical considerations that we believe are transferable to other endangered species programs.

Prototyping: Theory and use in endangered species conservation
Prototypes are innovative approaches to problems that are geared toward development of a model on which to base future actions or programs. The underlying philosophy was presented by Lasswell (1971b: 192): "The approach described here is especially pertinent to the aspiration of all who would innovate fundamental changes. The aspiration towards relevance implies the will to grasp and

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change reality. Programs of this kind can be expedited by the spread of a technique that builds self-correction into its every application."

Prototypes are used as a learning technique and as a template for future action; as such, they serve as exemplars or archetypes. Successful prototypes encourage other programs to adopt their fundamental features or key elements, thus providing a model for replication and continual revision (Lasswell 1963). Prototypes can be official or unofficial, and are commonly employed in the business world. For example, auto manufacturers set up prototypes of varying kinds, ranging from special problem solving teams to experimental car designs (Westrum 1994). The prototyping idea is achieving a standard of operation that represents a new model. Once this is done, pilot projects can be carried out on a large scale. The aim of prototyping is to discover and lay "the foundation for orderly replication of the revised prototype model" (Lasswell 1963:112).

Trial changes are made in programs or policies as a way to facilitate self-observation, build insight, and enhance prospects for success. Such changes thus can not be tightly controlled like scientific experiments, although the existence of some replicable features makes them similar to experiments. Nor can they be left solely to political manipulation and control. Their uniqueness makes them similar to case studies as a way of learning about a system. Because conservation programs lie somewhere between science and politics — their conditions can not be totally controlled in a scientific sense, nor should they be managed only by bureaucratic officials and politicians — prototypes are particularly useful as a means of initiating changes and gaining insights about such programs.

Prototypes differ from preplanned pilot studies in that they remain more flexible and creative. The self-correcting element is key. Prototyping efforts are usually managed by a small group of researchers/initiators who are "deeply concerned with contributing to knowledge and professional skill" and fundamentally committed to the success of the project (Lasswell 1963: 95). Because of the uncertainty, originality, and spontaneity in social systems the can not predict at the outset which strategies will be most effective. Thus, "part of the challenge of the approach is to discard and adapt throughout the course of the project" (Lasswell and McDougal 1992: 896). However, they should not modify the project too quickly or too often. It must be granted an adequate trial period to develop some support, legitimacy, and "power" before being re-evaluated. Even though the goals of a project may be clear, as in the clear goal of recover the bandicoot species, numerous ambiguities may persist: "hence an aim of prototypic study is to devise a better strategic programme" (Lasswell 1971a: 190). Prototypes thus establish a process for detecting and correcting errors, a procedure for accumulating successes and weeding out failures (Brunner 1995, personal communication). In their emphasis on continual learning and creativity, prototypes require clear, detailed, and comprehensive explanations of all aspects of the prototype including all actions undertaken (Lasswell 1971b).

Work settings characterized by high complexity, uncertainty, and conflict — which certainly describes endangered species recovery programs — benefit most from prototyping (Brunner and deLeon 1983). Several conditions increase the probability of successful prototyping. First, all participants in the program should agree to participate, although not everyone need fully understand the exercise. Second, leadership should agree to the general principals and approach of prototyping. Third, the process must be open and creative. Fourth, top professionals should be included and their opinions respected. Finally, people involved should be interested in improving performance rather than gaining power — i.e., keeping politics at a minimum (Lasswell 1971b). Prototyping efforts may be strongly opposed by some interests that prefer the status quo (Lasswell 1963), and for the effort to be effective, participants must neutralize such opposition. Prototyping is only possible in supportive contexts not dominated by issues of power and control.

The Australian bandicoot prototyping effort: A test case

A prototyping exercise was initiated in 1988 to facilitate the conservation and recovery of endangered eastern barred bandicoots in Victoria, Australia. While few of the programs participants were formally familiar with prototyping as such, most were committed implicitly to the idea and practices of prototyping and agreed to participate. We believe several components of our prototyping effort are transferable to other endangered species conservation programs.

Eastern barred bandicoots are relatively small (500 to 900g) nocturnal marsupials with thin snouts, strong curved claws, and pale bars on their hind corners. They feed primarily on soil invertebrates and are highly fecund, with the shortest gestation of any mammal (12.5 days) and the ability to give birth every three to four months. *P. gunnii* once inhabited the grasslands and grassy woodlands of Victoria and Tasmania, but after a 99+% decline in range and abundance, the species is threatened with extinction on mainland Australia. Bandicoots suffer from extensive habitat alteration and degradation, predation by introduced red foxes

(*Vulpes vulpes)* and feral and domestic cats (*Felis catus*), motor vehicle collisions, disease, and possibly pesticides (Seebeck et al. 1990). By the end of 1991, only 109 bandicoots were known to survive on the mainland in four populations: one in the wild, two in small nature reserves with anti-predator fencing, and one in captivity.

Throughout the 1970s intermittent research on the species, status and distribution took place, and in the early 1980s, active but limited management commenced. Initially the recovery program was loosely organized, although a variety of conservation activities were initiated, including habitat protection and enhancement, predator control, motorist warning signs, community education, and formation of recovery teams (Arnold et al. 1990). Success was limited. In 1988, a prototyping effort was begun, including rigorous research (e.g., Clark and Seebeck 1990). A population viability analysis estimated a 100% chance of extinction of the wild population in 25 years and a much shorter mean time to extinction (Lacy and Clark 1990). Concurrently, results from annual field surveys indicated a strongly decreasing population trend. Although captive breeding and reintroduction were initiated in 1988, these populations were not self-sustaining. This combination of factors accelerated conservation efforts.

The continuing downward trends also lead participants in late 1991 to call for an in-depth programmatic review of all recovery efforts up to that time (Reading et al. 1992). They looked at all factors and forces affecting the program, both external and internal: biological/technical, organizational, socioeconomic, and power/authority. The evaluation identified the following weaknesses:

(1) incomplete knowledge about many factors that were likely responsible for bandicoot decline;

(2) under appreciation of the urgency of the situation;

(3) insufficient strategic planning with specific recovery targets, timelines, and responsibilities;

(4) little information on important sociological and organizational variables;

*(5) no regular, systematic program evaluation as a basis for learning and im*provement.

This evaluation, a key part of the prototyping strategy, was crucial. In a cooperative, trustful, and supportive problem-solving setting, it permitted all participants to identify problems and their likely consequences. Participants examined and evaluated various alternatives to alleviate the problems. The overall prototyping philosophy provides the flexibility to adapt conservation initiatives to the actual conservation challenges quickly and successfully.

The context of the bandicoot case made prototyping possible at that time because of the relatively low profile of the program, the limited number of participants, and loose organization, the willingness of participants to examine a variety of options for the future of the program, the lack of debilitating conflict, the support or neutrality of key actors towards prototyping and the concept of developing a model program, and the primary interest of most participants in program success (i.e. bandicoot recovery). Both internal and external support for the program was high. Additional support for prototyping developed as the program began meeting success.

The bandicoot recovery program was reorganized in early 1992 as a result of the group's evaluation (Backhouse 1992; Backhouse et al. 1994a). The restructuring set up a central decision-making authority and four expert teams or working groups in captive management, wild population and reintroduction, economic and sociological issues, and public relations. New work arrangements better communication flows and improved decisions making invigorate the conservation effort. Mandatory written evaluations were discussed in monthly meetings as a basis for modifying actions.

The eastern barred bandicoot's status improved dramatically under the program reorganization and new operations. Goals were clarified and attention was focussed on a much wider array of organizational issues, for example. This resulted in a dramatic increase in both captive and reintroduced populations and in improved wild and captive management. Also, standardized monitoring was put into place, new reintroduction sites were located and evaluated, and more regular ongoing formal and informal evaluations were undertaken. The net result was the growth of the dwindling population to over 700 individuals by late 1993 (Backhouse et al. 1994b). While recent success bodes well for the species, the eastern barred bandicoot remains far from recovered (Humphries and Seebeck 1995).

A continuing commitment to the prototyping strategy encourages adaptability of conservation efforts and eventual bandicoot recovery. But as the status of the bandicoot improves, government budgets shrink, and public support oscillates. Maintaining commitment will not be easy.

Prototypic elements transferable to other endangered species efforts

The following lessons learned from the bandicoot prototyping effort are transferable to other endangered species programs (Clark et al. 1995).

(1) *Explicitly use a prototyping strategy to guide the recovery effort.* Participants should agree to use a flexible, adaptive approach to their

thinking, organization, research, and management. It is likely that some conservationists have already used a prototyping approach, but have not used the term to describe their method or recognized that the theory exists. Theory on prototyping should explicitly guide each application, and as theory is more widely and successfully applied, it will gain prominence and acceptance.

(2) *An interdisciplinary, program-oriented approach is essential.* Numerous disciplines offer useful, even necessary, knowledge and approaches for species recovery; combining them all in an effort to understand problems is essential. This will not happen on its own. Prototyping demands an interactive, flexible effort that can integrate disciplines pragmatically. Participants need to have the skills and leadership to make this approach function successfully.

(3) *Use small, flexible teams knowledgeable and skilled in the full range of concepts and methods available.* Dynamic teams can address the highly complex, uncertain, and urgent challenges facing conservation programs, including things like captive propagation, reintroduction, community relations, and decision making. For the most part, teams functions effectively in the bandicoot program as they concentrated reliable information, facilitated communication and collaboration, provided support among members, and increased performance and innovation.

(4) *Clarify goals of the prototyping exercise and establish open, accountable decision making mechanisms.* Goals should be formally and clearly articulated. They should be set up collectively by all participants, should remain task-oriented (e.g., species recovery), and should be easily measured (e.g., number of animals or populations, dates of task completion, area of habitat protected) to the extent possible. At the same time, goals should remain open and be revisited frequently to see if they are still relevant to progress and changing circumstances. The complexity and uncertainty characteristic of conservation programs should not preclude or rigidify conservation actions. Decision-making should be a transparent, open, participative process, based on the most reliable, available knowledge and collective judgement. However, clear lines of accountability must be maintained.

(5) *Evaluate all aspects of the prototyping exercise systematically and regularly.* Frequent formal and informal evaluations provide participants with the opportunity to reflect on their situations, their actions, and the outcomes and effects. The group should constantly assess how its actions are helping to achieve the overall goals and whether there are better means to reach goals. It is also important to assess how discrete actions complement each other to reduce redundancies and increase integration.

Conclusions

Prototyping is an answer to the need for innovation, creativity, and new initiatives in endangered species conservation. The recent success in the eastern barred bandicoot program in Australia demonstrates the benefits of bringing together a small group of committed people, developing a core of trust and openness, attempting to initiate small, well-deliberated changes in a program, and embracing the flexibility to adapt to feedback. The emphasis is on learning and the process is self-correcting. Small-scale innovations like this could be initiated at any level in any of the hundreds of endangered species recovery programs now underway. Again, it is a way of accumulating success and weeding out failures, and it provides exemplars to be copied, improved, and incorporated into existing policy and institutional practices. Every recovery program can develop its own systematic approach to learning and improvement through prototyping and report its results to all those concerned with conserving biological diversity.

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Eastern barred bandicoot (*Perameles gunnii*) by Richard P. Reading.

Improving Group Problem Solving in Endangered Species Recovery: Using the "Decision Seminar" Method

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Abstract
Endangered species recovery requires the confluence of technical skills, most often represented by biology and ecology and their many adjuncts, and social and organizational skills. Over the history of endangered species protection, the social and organizational skills necessary for successful species recovery have often been lacking in recovery programs. As a result, these programs often exhibit weaknesses involving coordination and cooperation among program participants. We discuss and propose the use of methods to improve recovery programs by focussing on and augmenting social and organizational aspects of program implementation and evaluation. The methods we promote fall under the rubric of the "decision seminar," developed by Harold Lasswell and used successfully in many contexts over the past half century. We discuss two examples of endangered species programs which utilized aspects of the decision seminar — one unsuccessfully, in the United States, and one successfully, in Australia. Using these examples, we illustrate the benefits and utility of adopting the decision seminar in endangered species recovery programs.

Introduction
Endangered species recovery programs require collaboration and effective problem solving among participants — government agencies, landowners, conservation organizations, industry groups, resource users, and others. The best way to achieve this is by participants agreeing on what the recovery problem is, its context, and how to solve it. Optimizing recovery means using old methods better and adopting new ones as needed. In fact, the Endangered Species Act of 1973 (ESA), Marine Mammal Protection Act of 1972 (MMPA), and other laws and administrative rules for protecting species and habitats all seek to enhance coordination and collaboration as one means to improve recovery. However, in the 30-year history of the ESA and MMPA no formal approach has been adopted in this regard, other than use of recovery plans as mandated by the ESA. Recovery plans are often technical documents aimed at directing biological research and management. They are not designed to take a complete, problem oriented look at the recovery challenge or address its full context in any single case. Rarely do recovery plans offer guidance on how to effectively manage the organizational complexity involved in recovery efforts, for example. In reality, diverse participants with competing values and perspectives can and do impede recovery, unintentionally or otherwise. This makes solving recovery problems that much harder. As a result, collaboration in recovery programs is often ad hoc or haphazard, even in cases where a plan clearly delineates the roles and responsibilities of program participants and where lead agency staff make deliberate efforts to bring participants together. Clark and Westrum (1989) have written on the need for guidance in the formation and operation of high-performance teams in endangered species recovery.

Here, we describe, illustrate, and call for the widespread use of a proven method — "decision seminar" — to improve success of recovery efforts. Burgess and Slonaker (1976) give a clear and thorough description of how to carry out a decision seminar. To date the decision seminar method has been little used in species recovery, but it promises to significantly improve conservation.

I. The Hawaiian monk seal case
This case, although it did not use the decision seminar method, illustrates its benefits, in part by counter (negative) example. The Marine Mammal Protection Act created the federal Marine Mammal Commission (MMC), a small independent agency of the executive branch charged with overseeing and providing recommendations on federal and state marine mammal programs under the ESA and MMPA. Over its history, MMC has undertaken a num-

ber of meetings fashioned after the decision seminar method, with varying levels of success. In 1989, while on the MMC staff, one of the authors (RLW) helped to organize a meeting of participants in the Hawaiian monk seal recovery program to address problems in program implementation and evaluation. The Hawaiian monk seal is among the world's most endangered seals, with a current population numbering fewer than 1,500 individuals that has declined about 60% since the late 1950s (National Marine Fisheries Service 2001). It is found in the Hawaiian Archipelago, predominately in the atolls and islets to the northwest of the main Hawaiian Islands. Pressures facing the monk seal population include predation by sharks, mauling of young and female monk seals by adult males, starvation of young seals, disease, environmental contaminants, human disturbance, injury or entrapment in marine debris, and both operational and biological interactions with commercial fisheries (Ragen and Lavigne 1999).

Recovery efforts

The lead agency for monk seal recovery under the ESA and MMPA is the National Marine Fisheries Service of the U.S. Department of Commerce (NMFS), which manages both research and management activities in the program. Other agencies and organizations have been involved in monk seal recovery due to their ownership of monk seal habitat, operations in monk seal habitat, advocacy of monk seal issues, or the relevance of their expertise in addressing problems with monk seal recovery. They include the U.S. Fish and Wildlife Service, Hawaii Department of Land and Natural Resources, Western Pacific Fishery Management Council, U.S. Navy, U.S. Coast Guard, Sea Life Park of Hawaii, and Earthtrust.

The monk seal program, as directed by NMFS, has a history of organizational dysfunction (Lavigne 1999; Wallace 2000; Wallace in press). The MMC was responding to these problems in calling its meeting. Problems included NMFS's refusal to convene the monk seal recovery team between 1984 and 1989 despite alarm over the declining monk seal population and problems of inefficiency. The program showed problems in data collection, analysis, peer review, and publication during the 1980s (Marine Mammal Commission 1990). Among the goals of the MMC-sponsored meeting was to promote a collaborative and coordinated approach to the many complex, interrelated issues challenging NMFS's efforts to protect and recover the monk seal and its habitat.

The meeting took place in La Jolla, California, at NMFS's southwest regional research laboratory, the parent office to the NMFS laboratory in Honolulu where the monk seal program is housed. While it was not modeled explicitly on the decision seminar, it initially shared both structure and goals with the decision seminar method described below. The meeting involved a core group of agency personnel and non-agency scientists who were then either responsible for making decisions concerning the monk seal research and management programs or were experienced monk seal researchers. Among the concerns they addressed were the effects of various human activities on monk seals and their habitat

Non-governmental advocacy groups were not invited to attend. The participants were selected solely for their knowledge, skill, and experience in monk-seal related research and management and their status as authoritative decision-makers in the monk seal program. The meeting was convened and moderated by MMC staff who were skilled in group dynamics and strategic planning, knowledgeable about monk seal recovery issues, but were not directly involved in monk seal decision making. The meeting was held over the course of two days in a conference room overlooking the Pacific Ocean, where participants could stretch their legs while taking in a view of the beach, ocean, or sunset. Food and drinks were provided. In all, an effort was made to make the meeting a comfortable occasion in which participants could focus on the agenda — monk seal recovery. The agenda, which was drafted by MMC and shared and revised with the input of the participants prior to the meeting, indicated that the two days would be devoted to strategic planning to address specific shortcomings in the monk seal program. This meant that participants would be expected to critically evaluate their past actions, develop shared goals for addressing existing problems, brainstorm alternatives to address identified problems, and then commit to actions necessary to achieve the goals.

Meeting results

The meeting was a failure. MMC made a strong attempt to run the meeting such that it would have a lasting effect on the monk seal program through the work and commitments of its participants. However, a commitment by key agency participants to changing the status quo operation of the monk seal program never materialized. This was due to several circumstances. First, agency staff approached the meeting with some trepidation due to the perception that they would be subjected to criticism for past and current problems. Second, MMC, despite having sought the input of participants prior to the meeting, set and controlled the agenda, which meant that other participants did not feel the same level of commitment to the meeting as did MMC. Third, as the meeting wore on it became clear that much of the onus of improving the program's operation was being placed on NMFS. While this was appropriate given NMFS's responsibilities as lead federal agency under the law, at the meeting key NMFS staff began to feel put-upon, and thus less open to the process that

was occurring. Fourth, participants other than NMFS staff tended to either side with MMC in pursuing its agenda for the meeting and monk seal program or to be noncommittal.

As a result, NMFS staff became increasingly defensive and thus less interested in a collaborative effort to secure program goals, which in any case appeared not to be shared goals, but rather MMC's. All of these factors conspired to reduce the commitment by NMFS staff to MMC's goals for the meeting and thus to making the meeting a productive one. Instead, as the meeting wore on discussion devolved into a series of proposals for programmatic changes, which, due to other participants' lack of buy-in, appeared as MMC attempting to micro-manage the monk seal program. The failure of the meeting was caused by NMFS's resistance to improving its programmatic actions under the ESA and MMC's lack of skill in managing the meeting to reduce the conflicts that undermined it. For example, as the meeting progressed and it became clear that participants were not achieving the goals they desired, closed-door meetings among sub-groups began to occur during meals and at night which de-emphasized the importance of the primary meeting. Following the meeting, NMFS's staff and program returned to the status quo — relations between NMFS and other program participants was unchanged with the exception that NMFS finally convened the recovery team, which has meet regularly ever since. Nonetheless, little changed to improve the shortcomings in the program that MMC had identified.

Comparing the decision seminar model as described below to this meeting illuminates its shortcomings: the meeting was not based on a shared commitment to goals and the meeting was not run such that tension among participants would be reduced and collaboration could occur. Had efforts been made at the outset by both MMC and NMFS to establish a meeting format that would be mutually supportive, the outcome would likely have been different. Given the resistance of NMFS to MMC's and other participants' recommendations for NMFS action, a truly collaborative format might have resulted in fewer changes to the monk seal program than were originally sought by MMC. The benefits, however, might have been an improvement in participants' willingness to evaluate the program through a critical, constructive discussion, thus opening the door to improving implementation in the future. As it turned out, the meeting failed to improve implementation, evaluation, or the level of discourse that occurred among program participants.

II. The decision seminar

One promising method for achieving a more successful collaboration and coordination is the decision seminar (Clark 2002). Decision seminars are a continuing series of moderated, structured sessions involving selected participants in the recovery process. They are designed to promote identification of problems realistically and agreement on strategies for solving them practically.

Method and features

The idea and structure of the decision seminar was developed by Harold Lasswell as a means for carrying out problem solving and decision making that stabilizes people's expectations and goals in a management policy process (Lasswell 1960, 1971a, 1971b). Speaking generally, Lasswell (1960:216) noted that "it is increasingly perceived that modes of group problem solving are needed that improve the probability of realistic, comprehensive and timely solutions," an observation which applies directly to endangered species recovery today and underscores the importance and potential of the decision seminar method.

Decision seminars are a structured method for integrating the many different approaches to group meetings that are necessary to develop solutions to complex problems. Lasswell (1971a, 1971b) and Burgess and Slonaker (1975) describe the basic functions and components of a decision seminar. First is a dedicated core group of individuals committed to meeting regularly and for as long as is necessary to address the problem (maybe years). This is necessary for the group's knowledge and experience to grow as a unit and to avoid the need to repeatedly return to basic foundational issues with the addition of new members in the later stages of the seminar. This requirement underscores the importance of participants agreeing to join the group because they have a primary interest in solving the problem at hand. Lasswell (1971a) suggests a self-selected membership, but in the context of endangered species recovery, participants in a decision seminar must represent all the participants whose involvement is necessary to achieve recovery goals for the species or population in question. Changes in core group membership will likely occur (e.g., disruptive group members should be asked to leave). Nevertheless, the core group must remain stable enough over the life of the seminar so that the goals can be accomplished in a timely fashion (particularly where increasing species mortality or habitat loss is occurring). Sub-groups may be formed to address individual aspects of the overall problem and outside experts may be asked to join the group temporarily as the need arises.

Second is commitment of group members to carrying out an agreed-upon and specific agenda. This is necessary to avoid diffusion or misappropriation of the goals of the group and to keep the group operating with the overriding recovery goal in mind. The more specific the tasks and the clearer the understanding of each member's

responsibilities the better, even if certain tasks are abstract (e.g., conceptual brainstorming, so often necessary to address complex problems). For recovery programs, "goal inversion or substitution" occurs and the recommendation helps avoid that and other problems (see Clark 1997).

Third are frequent meetings. Meeting frequency will be influenced by the logistical complexity of bringing group members together. For recovery programs where research and management actions are being taken at a rapid pace, frequent — perhaps weekly or biweekly — meetings may be necessary. The more frequently the group meets, the greater the likelihood that the goals of the seminar and recovery program will remain clear and current, and the tasks taken will support goals.

Fourth is an emphasis within the group on being actively and systematically self-reflective. One of the benefits of the decision seminar is that group members become familiar with each other to the point that each may assess the other's contributions in a purely constructive (i.e. not threatening) fashion. This promotes an atmosphere of discussion and insight rather than formal administrative appraisal and ritualized interaction. As well, recovery group members gain the ability to critically evaluate their individual and collective decision making ability, an action that if successfully undertaken improves group operations over time.

Fifth is a contextual approach to problem solving in which boundaries are put around the topic at hand in order to establish a common understanding of the limits of the group's mandate. In the case of a recovery program, there will be two contexts to delineate. One concerns the recovery program itself, so the group must identify where the boundaries of their authority and abilities fall with regard to research, management, and enforcement actions. The other context concerns the group and its members' responsibility to each other to promote a sound decision making process.

Sixth is clear agreement on the overall operational and task-oriented goals and to stay focused on them when presenting and using information in recovery. Without consensus on goals, the group risks becoming divided over research and management methods, data, and the process and outcome of evaluations. For recovery programs, this can be divisive and impair the process and interpersonal working relationships.

Seventh is an understanding of the role and utility of multiple methods in recovery programs and group decision making processes. When discussing recovery actions, the group must welcome consideration of strategies from all disciplines that might help reach recovery goals. Similarly, group members must be open-minded about diverse methods of achieving group goals. This will be the harder task because it is unlikely that all group members will have experience with the practical, intellectual exercises (e.g., role-playing, simulation, gaming) that may be used to encourage sound decision making.

Eight is a focus on innovation and creativity. Group members must agree on the appropriateness of taking intellectual risks when discussing and planning tasks for the recovery program. Put another way, they must leave room for brainstorming sessions in which idiosyncratic ideas are welcomed alongside conservative ones and all are explored for their utility in achieving the goals.

Ninth is an agreed-upon location where the group can receive the support it needs to function productively during its meetings. For recovery programs, this means a setting that is functional and comfortable. The group needs adequate space and support to carry out its deliberations. For example, it may need plenty of wall space to permanently display data on trends and conditions of the recovery effort. This visual material can be constantly updated and it can be used to orient the group from meeting to meeting.

What sets a decision seminar apart from other methods of group work in endangered species recovery is its emphasis on building skills and knowledge on problem solving that will improve decision making in the future. Most group work in endangered species recovery is focused on one or more specific recovery tasks (e.g., reducing mortality) and lacks a self-reflective emphasis on learning how to use group methods in the most effective manner. With a set of guidelines such as those given above, foundational training (either self-administered or sought from outside experts with experience in decision seminars), and open minds, a group may convene even without a member experienced in professional group dynamics and still accomplish the goals of a decision seminar.

A critique

Decision seminars have been used successfully since the 1950s in fields outside of endangered species recovery. These have produced benefits to education policy in the United States (Bolland and Muth 1984, 1987), community development in Peru (Dobyns et al. 1971; Holmberg 1958), and the re-establishment of democratic governance in Afghanistan following the end of the Soviet occupation in the 1980s (Willard and Norchi 1993), too mention only a few instances.

Based on this and other experience, decision seminars are particularly well suited for addressing complex and often highly technical policy processes that involve diverse knowledge, skills, and innovative problem solving strategies (Brewer 1975). They can reduce conflict, improve communication, shift the focus of decision making from reactive to proactive, promote leadership skills among members, and decrease prob-

lems associated with hierarchy and competition between stakeholders (Cunningham 1981).

The issue of group leadership is critical, and in this regard decision seminars may take many forms. Seminars can be led by a person outside the management process under scrutiny by the seminar. In this case, the outsider must be someone who is well respected by all group members and who they are willing to welcome into the group in a leadership capacity to help the group achieve its goals. Optimally, an external leader would be someone experienced with group dynamics who can assist in refining the approach to learning and operating as a cohesive unit. As well, a decision seminar can be led by a person within the group, chosen by group members. In this case, the leader should have direct involvement and expertise in the issue at hand. They should be respected and willing to cede certain authority in achieve group goals. Also, they must be able to help the group focus on both group processes and outcome goals. Finally, a decision seminar may be leaderless or led by consensus of group members rather than a single person. This is the most challenging leadership model because it requires an unambiguous shared commitment to goals and responsibilities and willingness by all group members to participate vigorously in every aspect of every group activity.

In their review of past decision seminars, Bolland and Muth (1984) identify the most prevalent shortcoming of the decision seminar method of problem solving: that group members will default to a standard day-to-day or "brush fire" mentality and lose the seminar's emphasis on learning, reflection, and insight. These factors are all directed at how to most effectively operate as a group to achieve common goals.

The benefits of decision seminars can far outweigh and overcome weaknesses in ordinary endangered species recovery in the United States and elsewhere. Because endangered species recovery is a crisis-oriented discipline, most practitioners are too busy working in the moment to consider approaches to learning and decision making that might benefit them both today and in the long run (Clark et al. 1994). However, by becoming skilled and experienced in the methods of the decision seminar, people will increase both the effectiveness and efficiency of decision making and improved species conservation. As with all new approaches to professional practice, there is a learning curve that must be passed before the full benefits of the method can be reaped and become fully evident.

III. The eastern barred bandicoot case

Perhaps one of the most successful applications of the decision seminar method in endangered species recovery occurred under the direction of one of the authors (TWC) in Australia. This effort was focused on the eastern barred bandicoot in Victoria (see Clark and Seebeck 1990 and the 10 papers therein; Backhouse et al. 1994; Clark et al. 1995).

The problem

The bandicoot is one of the most critically endangered species in Victoria, showing a 99+% loss of abundance and range by 1998. At that time it was nearing extinction with less than 150 animals in the wild at a single location and few individuals in captivity. Key data about the species and its plight were absent and the organization and commitment needed to effectively recovery the species was lacking. Later research showed the species was declining about 25% per year.

The solution

In 1988 a new partnership was set up to achieve species recovery and develop a model program. A key element in this was a decision seminar mode of organization and operation. It was not declared formally that the new partnership would use a decision seminar format. Instead, the partnership used a decision seminar modus operandi in an informal way to guide interpersonal and inter-organizational interactions, data gathering and analysis, and decisions about how to proceed. It was put in place without calling attention to it so that recovery team members and interested parties could stay focused on bandicoot conservation, better interact with one another, and do so in an active learning mode.

The effort conformed to all nine features of a decision seminar listed above. First, a dedicated core group of individuals met in the field, office, and decision room often for about five years. Second, committed members eventually came to carry out an agreed-upon and specific agenda. Third, members met in various combinations frequently. Many meetings were informal and no decisions were made. Fourth, certain group members encouraged others to be actively, and systematically self-reflective. Fifth, members were contextual and bounded the problem practically. Sixth, the group was goal oriented. Seventh, the team used multiple methods. Eight, some members focused on innovation and creativity. Ninth, the group acquired the minimal support needed for productive meetings. It took time and work to achieve these features, and even in the end, not all members were fully or productively engaged. Achieving these operational features allowed the bandicoot recovery group to be problem-oriented, contextual, and use multiple methods in its work.

By the mid- to late 1990s, the species' status had improved dramatically. Bandicoot numbers increased to 1,000+ individuals at six reintro-

duction sites, plus the original wild population, and a captive program. Prospects looked good for eventual recovery of the species. The decision seminar method deserves much credit for these accomplishments. However, it was impossible to permanently institutionalize the decision seminar method into the bandicoot program or the parent agencies involved. The causes of this were elections and changes in government policy and agencies. The agencies were dramatically reoriented to very conservative agendas and clients, including reorganizing them to mimic for-profit organizations. This included downsizing, transfers, and loss of staff in the bandicoot program. Budgets were also drastically cut. These changes prevented the benefits of the decision seminar from being fully capitalized on beyond the first 5+ years of the recovery program.

Conclusions

Decision seminars are a means to improve endangered species recovery. The two cases described here — the Hawaiian monk seal and the eastern barred bandicoot — illustrate variables that contribute to the failure or success of group work in recovery. Successful recovery often hinges on relationships among participants and their ability to work collaboratively; to identify problems realistically in a timely fashion; and to follow though with solutions. Identifying problems means giving full attention to the social process or context involved. For a decision seminar to succeed, its members must achieve and maintain a focus on the process of group work and the outcomes of the seminar, both in terms of recovery actions and the group learning process. Ideally, when a decision seminar is complete, the outcomes include: biological trends supporting a reduced need for recovery actions and a group of highly trained problem solvers ready and able to contribute much-needed skills and knowledge to other group recovery activities. Decision seminars, if used widely and with skill, hold promise of greatly improved endangered species recovery. They also offer a way to grow a population of professionals whose skills, knowledge, and experience raise the old standards for problem solving and set new ones for the entire field of endangered species recovery.

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The Population Viability Assessment Workshop: A Tool for Threatened Species Management

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Abstract
Population viability assessment (PVA) is a powerful tool in assessing the viability (i.e. likely persistence) of small populations, and in setting target numbers and area requirements for species recovery. By using computer models, four types of extinction processes can be simulated, and the effects of both deterministic and stochastic forces can be explored. PVA's also explore the outcome of management options. The utility of PVA was demonstrated at a workshop in Heidelberg, Victoria, Australia. Using the computer program, VORTEX, to simulate genetic, demographic, environmental, and random events, workshop participants: (1) examined the status of data on six threatened species (mountain pygmy-possum, Burramys parvus*; leadbeater's possum,* Gymnobelideus leadbeateri*; eastern barred bandicoot,* Perameles gunnii*; long-footed potorroo,* Potorous longipes*; orange-bellied parrot,* Neophema chrysogaster*, and helmeted honeyeater,* Lichenostomus melanops cassidix*); (2) simulated their vulnerability to extinction; (3) examined outcomes of management options to restore the species; (4) estimated population targets needed for recovery planning; and (5) evaluated the potential of PVA as a teaching aid to illustrate extinction processes and management options. Workshop results showed that the majority of the species were highly susceptible to local extinction, though more field data would have been helpful. Simulation of management options demonstrated that early action in conservation management could have significantly reduced the current predicament of these species and that use of PVA's could greatly improve conservation management for all six species. PVA's are therefore highly useful in the planning and carrying out of species recovery programs.*

Introduction
Population viability assessment (PVA) is a procedure that allows managers to simulate, using computer models, extinction processes that act on small populations and therefore assess their long-term viability. In both real and simulated populations, a number of interacting demographic, genetic, environmental, and catastrophic processes determine the vulnerability of population extinction. These four types of extinction processes can be simulated in computer models and the effects of both deterministic and stochastic forces can be explored. In turn, the outcome of various management options, such as reducing mortality, supplementing the population, and increasing carrying capacity can also be simulated. Thus, PVA provides managers with a powerful tool to aid in assessing the viability of small populations and in setting target numbers for species recovery as a basis for planning and carrying out recovery programs. In addition, having performance-based management programs enables progress to be quantified and assessed. PVA also offers managers a powerful strategic planning and policy tool when vying for limited financial resources. This paper describes a PVA workshop that used a stochastic computer simulation to model small populations of, and explore management option for, six threatened/endangered wildlife species in Victoria, Australia.

The workshop
The workshop was co-sponsored by the Department of Conservation and Environment (DCE), Victoria, and the Zoological Board of Victoria (ZBV), in cooperation with the Chicago Zoological Society (CZS) and

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was held at the Arthur Rylah Institute for Environmental Research (DCE), Heidelberg, Victoria, from May 28 through June 1, 1990.

The objectives of the workshop were to: (1) examine the adequacy of data on the six threatened species; (2) simulate the vulnerability to extinction by using PVA; (3) examine outcomes of various management options to restore the species; (4) estimate population targets needed for recovery planning; (5) evaluate the potential of PVA as a teaching aid to illustrate extinction processes and management options.

The six species were: mountain pygmy-possum (*Burramys parvus*); leadbeater's possum (*Gymnobelideus leadbeateri*); eastern barred bandicoot (*Perameles gunnii*); long-footed potoroo (*Potorous longipes*); orange-bellied parrot (*Neophema chrysogaster*); and helmeted honeyeater (*Lichenostomus melanops cassidix*).

The 32 people attending the workshop represented experienced field biologists and wildlife managers with detailed knowledge of these and other threatened species. A month prior to the workshop all participants were provided with background reading material (e.g., Shaffer 1981; Brussard 1985; Samson 1985; Gilpin 1989; Lacy and Clark 1990). A questionnaire on life-history parameters to be completed on each species as a basis for entering values into the computer was also provided. Following an introduction and overview of PVA, the participants formed teams and commenced work. Simulations, analysis, and discussions were ongoing over the next five days. The first week concluded with a report and review of each team's progress. During the following week, teams further refined their simulations and commenced preparation of a final report with management recommendations.

Population viability analysis: the VORTEX model

The workshop used a computer program, VORTEX, to simulate demographic and genetic events in the history of a small population (<500 individuals). VORTEX was written in the C programming language by Robert Lacy for use on MS-DOS microcomputers. Many of the algorithms in the VORTEX were taken from a simulation program, SPGPC, written in BASIC by James Grier (Grier 1980a, 1980b; Grier and Barclay 1988). (See Lacy et al. (1989), Seal and Lacy (1989), and Lacy and Clark (1990) for earlier uses of VORTEX.)

Life tables analysis yield average long-term projections of population growth (or decline), but do not reveal the fluctuations in population size that would result from variability in demographic processes. When a population is small and isolated from other populations of conspecifics, these random fluctuations can lead to extinction, even in populations that have positive population growth on average. Fluctuations in population size can result from several levels of stochastic effects. Demographic variation results from the probabilistic nature of birth and death processes. Therefore, even if the probability of an animal reproducing or dying is always constant, the actual number reproducing or dying within any time interval would vary according to the binomial distribution with mean equal to the probability of the event (p), and variance given by Vp = P*(1-P)/N. Demographic variation is thus intrinsic to the population and occurs in the simulation because birth and death events are determined by a random process (with appropriate probabilities). Environmental variation (EV) is the variation in the probabilities of reproduction and mortality that occur because of changes in the environment on an annual basis (or other timescales).

VORTEX models population processes as discrete, sequential events, with probabilistic outcomes determined by a pseudo-random number generator. VORTEX simulates birth and death processes and transmission of genes through the generations by generating random numbers to determine whether each animal lives or dies, whether each adult female produces broods of size 0, 1, 2, 3, 4, or 5 during each year, and which of the two alleles at a genetic locus are transmitted from each parent to each offspring. Mortality and reproduction probabilities are sex-specific. Mortality rates are specified for each pre-reproductive age class and for reproductive animals. Fecundity is assumed to be independent of age after an animal reaches reproductive age. The mating system can be specified to be either monogamous or polygamous. In either case, the user can specify that only a subset of the adult male population is in the breeding pool (the remainder being excluded perhaps by social factors). The males in the breeding pool all have equal probability of siring offspring.

Each simulation is started with a specified number of males and females in each pre-reproductive age class and the breeding age class. Each animal in the initial population is assigned two unique alleles at some hypothetical genetic locus. The user specifies the severity of inbreeding depression, which is expressed in the model as a loss of viability in inbred animals. The computer program simulates and tracks the fate of each population and then produces summary statistics on: the probability of population extinction over specified time intervals; the mean time to extinction of those simulated populations that went extinct; the mean size of populations not yet extinct; and the levels of genetic variation remaining in any extant populations.

A population carrying capacity specified by the user is imposed by a probabilistic truncation of each age class if, after breeding, the population size exceeds the specified carrying capacity. The program allows users to model trends in the carrying capacity, as linear increases or decreases across a specified number of years.

VORTEX models environmental variation simplistically (which is both an advantage and disadvantage of simulation modeling), by selecting at the beginning of each year the population age-specific birth rates, age-specific death rates, and carrying capacity from distributions with means equal to the overall averages specified by the user, and with variances also specified by the user. Unfortunately, rarely do we have sufficient field data to estimate the fluctuations in birth and death rates, and in carrying capacity, for a wild population. The population would have to be monitored long enough to separate sampling error statistically from demographic variation in the number of births and deaths, from annual variation in the probabilities of these events. Such variation can be very important in determining the probability of extinction, yet we rarely have reasonable estimates for most populations of conservation concern. If data on annual variation are lacking, a user can try various values, or model the fate of the population in the absence of any environmental variation.

VORTEX can model catastrophes as events that occur with some specified probability and which reduce survival and reproduction for one year. A catastrophe is determined to occur if a randomly generated number between zero and one is less than the probability of occurrence (i.e. a binomial process is simulated). If a catastrophe occurs, the probability of breeding is multiplied by a severity factor that is drawn from a binomial distribution with a mean equation to the severity specified by the user. Similarly, the probability of survival for each age class is estimated in a similar manner.

VORTEX also allows the user to supplement or harvest the population for any number of years in each simulation. The numbers of immigrants and removals are specified by age and sex. VORTEX outputs the observed rate of population growth (mean of N[t]/N[t-1]) separately for the years of supplementation/harvest and for the years without such management, and allows for reporting of extinction probabilities and population sizes at whatever time interval is desired (e.g., summary statistics can be given at five-year intervals in a 100-year simulation). Overall, the computer program simulates many of the complex levels of stochasticity that can affect a population. Because it is a detailed model of population dynamics, often it is not practical to examine all possible factors and all interactions that may affect a population. The user, therefore, must specify those parameters that can be estimated reasonably, leave out of the model those that are thought not to have a substantial impact on the population of interest, and explore a range of possible values for parameters that are potentially important but very imprecisely known. A companion program, VORPLOTS, was used at the workshop to produce plots of mean population size, time to extinction, and loss of gene diversity form simulation results.

Equipment required

VORTEX requires an MS-DOS microcomputer with at least 640K of memory. A math co-processor speeds up the program substantially. The VORPLOTS plotting program produces files in the Hewlett Packard Graphics Language (HPGL), for use on a HP plotter or equivalent.

A Kodak Dataview EGA enable projection of a computer display via an overhead projector onto a large screen so that all participants could observe demonstrations of VORTEX during initial training.

Computers were used during the daily sessions primarily for explanatory analysis with relatively few run (100 or fewer) of a simulation; more extensive analysis were run overnight. A test with 100 runs would take from 15 minutes to three hours, depending on the machine used and the size of the population being simulated.

The workshop results

Each team documented its activities and provided a preliminary report of the simulations completed, conclusions, and assessment of the conduct of the workshop, and the usefulness of the PVA process. Results will be published in peer-reviewed scientific journals by each term.

All cases show similar results. First, most species and populations were highly susceptible to local extinction. Any further habitat loss or fragmentation or reduction in population size and density would result in rapid extinction. Second, in all cases, more field data would have been helpful. Third, management options to stave off extinction were identified and results were simulated. Options included strict habitat protection, enhancement of existing habitat or restoration of lost habitat, captive breeding, and reintroduction of animals to existing habitat patches in which the species has become extinct in recent decades or to newly created habitat. Various combinations of management strategies were recommended for future management. Fourth, the simulations demonstrated that if proactive conservation management had been undertaken even five to 10 years ago when populations and habitats were considerably larger, the task of present day managers would be much more tractable. And fifth, im-

proved conservation management for all six species is expected to result from the PVA exercises, enhanced research, and subsequent on-the-ground management. Three cases illustrate these conclusions: the mountain pygmy-possum (Mansergh et al. in prep.), eastern barred bandicoot (Myroniuk and Patrick in prep.), and orange-bellied parrot (Brown et al. in prep).

Mountain pygmy-possum

The mountain pygmy-possum is a small marsupial restricted to alpine and subalpine (> 1500 m altitude) rock screes and boulderfields with heathlands. The species has been well studied and much information is available on its ecology (Mansergh 1989). Diet consists of invertebrates, seeds, and fruits. Breeding occurs from September to December, with litter size of three to four. The young become independent by mid-January. Females can breed in their first year, and can live up to nine years. An unusual feature of the life history of *Burramys* is the fact that sexes are segregated during the non-breeding season. The adult population is heavily biased towards females (6F:1M) because of the very high mortality experienced by males post-dispersal.

The current total population is estimated to be 2,300 breeding adults of which 80% are females. The species is regarded as vulnerable in Victoria and rare in New South Wales. The species is also susceptible to climatic changes associated with global warming. The mountain pygmy-possum exists as a number of discrete populations isolated from each other on mountaintops. A total of seven populations, ranging from 20 to 850 individuals (representing the situation in the wild) was modeled. High probabilities of extinction were observed in small (<150 animals) populations at 25 and 50 years; this could account for the absence of the species from apparently suitable habitat within its range. The large populations had a decreased likelihood of extinction. When modeled with a small but steady decrease in carrying capacity (1% per annum) such as could occur through climatic change with global warming, the probability of extinction increased greatly (to 45% in the case of the largest Victorian population of 850 individuals, over 50 years). Disturbance to habitat and further fragmentation of populations would increase the likelihood of extinction.

Eastern barred bandicoot

The mainland population of this marsupial species was formerly distributed over about 23,000 sq km of volcanic grassland in western Victoria. This population has now declined to 200 or fewer individuals restricted to remnant habitat near Hamilton (Clark and Seebeck 1990). The species is polygynous, with females capable of breeding from three months of age and males from four months of age. Gestation lasts about 12 days, with litters comprised of one to five offspring (usually two to three); young remain in the pouch about 55 days. Females are capable of producing several broods per year. In spite of the very high reproductive potential, the population is believed to be declining at about 25% per annum. Juvenile mortality at dispersal from the nest is very high (>90% within the first year). The decline of the species is attributed to habitat modification from pastoral activities and predation from introduced predators, including the red fox (*Vulpes vulpes*) and the cat (*Felis catus*).

Wild and captive populations of the eastern barred bandicoot were simulated. Modeling the wild population using available data without any change to current management indicated 100% probability of extinction within 25 years, with a mean time to extinction of 7.2 years ($\pm$ 2.1). Doubling the carrying capacity and leaving mortality unchanged had negligible impact on the probability of extinction and increased the mean time to extinction by only two years. Doubling the carrying capacity, reducing mortality by 30% and supplementing the wild populations with the liberation of captive-bred animals greatly enhanced prospects for survival of the wild population. Under this scenario the probability of extinction was reduced to 0% over 25 years with a mean final population size of close to the carrying capacity of 300 animals. Modeling the existing and proposed captive populations allowed investigation of a variety of scenarios. The existing captive population of 16 pairs has an extinction probability of 83% over 25 years with a mean time to extinction of 21.5 years. Doubling the number of adult pairs decreased the extinction probability to 0% but the surviving population had very low genetic variability, and there is little potential to harvest juveniles for release into the wild. Increasing the captive population to 62 adult pairs increased genetic variability and the potential to harvest juveniles without jeopardizing the captive population. Maintaining a captive population of 62 adult pairs (in two groups at separate locations to avoid catastrophe but managed as one population) and establishing two semi-captive populations with a capacity for 400 animals gave the best prospects for long term survival, maintenance of genetic variability, and production of sufficient offspring to consider reintroduction to suitable habitat within their former range. The exercise highlighted the need for a combination of management actions, rather than any single action, to prevent the almost certain extinction of the wild population under the existing management regime. Reduction of mortality by predator control and traffic management is essential for the survival of the eastern barred bandicoot. Captive management will be an im-

portant part of the recovery program, but with a more intensive program than that currently underway.

Orange-bellied parrot

The biology and ecology of the orange-bellied parrot is comparatively well known (Loyn et al. 1986). The species is one of the rarest and most threatened birds in Australia, with a total population of 150 to 200 individuals. The orange-bellied parrot breeds in coastal southwest Tasmania in woodlands adjoining extensive sedgelands. After breeding, it migrates across Bass Strait to overwinter in coastal regions of southern mainland Australia. The birds feed in a variety of coastal habitats including grassland, saltmarsh, and dune systems, showing strong preferences for particular habitats and food types in different parts of their winter range and at different times of the year. An estimated 40 breeding pairs annually produce a total of 50 to 70 juveniles. The orange-bellied parrot is considered endangered. Loss of coastal habitat for development and trapping for the aviculture trade are considered to be the primary causes of the species' past decline. Pressures for development on or adjacent to its main wintering areas and habitat alteration are now the main threat to its survival. A captive breeding program is now underway to ensure the future survival of the species.

Populations were modeled using the current carrying capacity (150), a reduced carrying capacity (50), and an increased carrying capacity (500). Simulations, which involved varying mortality, capture, and supplementation rates of the wild population, were run for all carrying capacities. Simulating the existing population using current data and management regimes indicated that the species would remain extant over the next 50 years at least, and stood a good chance of surviving for 100 years. Reducing the carrying capacity to 50 under current conditions somewhat surprisingly did not increase the probability of extinction over 50 years, although genetic variability was greatly diminished. As would be expected, increasing the carrying capacity to 500 birds further reduced the prospects of extinction and greatly increased the genetic variability of the population. When modeled with an increased juvenile mortality rate (75% of 50%), the population with the reduced carrying capacity showed a 70% probability of extinction within 50 years, while the current and increased carrying capacity populations showed extinction probabilities of 20% within that time. Imposing a capture and release captive breeding program on the populations only slightly decreased the extinction probability of the reduced carrying capacity, high mortality population, but greatly improved the heterozygosity in the reduced carrying capacity, current mortality population. No extinctions occurred in the current and increased carrying capacity populations even at the high mortality levels, when simulated with supplementation from a captive breeding program. The simulations indicate several points. Juvenile mortality is of great significance to the health of the population. Any increase above the present rate of 50% greatly increases the probability of extinction, even with an enhanced habitat carrying capacity. The captive breeding program is an important back-up to the wild population, and will be extremely valuable if the wild population declines.

Evaluation of the workshop

An evaluation was considered to be an important part of the workshop. All participants rated the background material supplied prior to the workshop as good to very good. Provision of background material was essential as very few participants had any prior experience with PVA. Organization was rated as very good to excellent by participants. The key to success was the large number of microcomputers available so that two to three people per computer was possible. Presentations were rated as very good to excellent.

The workshop format was considered to be a highly successful way of presenting PVA. PVA was considered to be a useful tool to aid threatened species management, providing its application and limitations were understood. PVA can focus attention on questions that should be addressed through additional research. PVA can be applied to well-studied taxa, and the general principles can be applied more widely to other taxa providing program characteristics are kept in perspective. All participants would recommend PVA as a management tool.

Conclusions

The PVA workshop proved a very useful way of quickly learning a new technique for threatened species management and conservation. PVA was applied to six species allowing a critical, quantitative analysis of extinction probabilities, as well as exploring management options to prevent species loss. PVA results will be used in forthcoming management plans and actions directed towards restoring these species to a status from which they will be relatively immune to extinction form random processes. In the future, it can be expected that PVAs will be carried out on additional endangered species to help manage their recovery.

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Red hills salamander (*Pseudotriton ruber*) by C.K. Dodd, Jr., USFWS.

Towards an Endangered Species Reintroduction Paradigm

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Abstract
Reintroduction programs are becoming increasingly more common, but most fail. We suggest that one reason for this lack of success is a narrow focus on biological and technical aspects of the reintroduction challenge to the exclusion of other important elements. We provide a more holistic paradigm for approaching reintroductions that centers on key actors who influence, and are influenced by a continuum of variables. Our model includes four classes of interacting variables: (1) biological considerations (ecology, genetic concerns, reintroduction techniques, etc.); (2) issues of authority and power (control of resources, laws and regulations, relations between actors, etc.); (3) organizational aspects (program structure, bureaucratic behavior, organizational cultures, etc.); and (4) socioeconomic considerations (people's values, attitudes, and perceptions, economics concerns, etc.). This model can aid people interested in reintroductions become more successful. More comprehensive approaches to reintroduction promise to improve success rates.

Introduction
In response to the current extinction crisis, managers and conservationists are searching for innovative, more effective methods of species conservation. One such method is the translocation or reintroduction of species into formerly occupied habitat. As the list of threatened and endangered species lengthens, the need for employing reintroduction as a conservation tool increases (Jones 1990).

Most reintroductions, however, fail (Griffith et al. 1989). One reason for this, we suggest, is that the programs suffer from a narrow concentration on biological and ecological considerations and exclude a host of other equally important elements. As Clark (1989:3) stated: "Most descriptions of endangered species recovery focus only on the biology of species, thus creating the unrealistic view that conservation and recovery are strictly technical biological tasks. In fact, numerous non-biological factors and forces have direct, immediate and paramount significance to endangered species recovery, and if the conservation movement is to be effective, it must explicitly recognize the complexly interactive impacts and contributions of all the various dimensions."

Kellert (1985:528) also noted: "A compelling rationale and an effective strategy for protecting endangered species will require recognition that contemporary extinction problems are the result of socioeconomic and political forces." It has been our experience that these important elements often go unrecognized by most individuals working on endangered species reintroduction efforts.

To increase awareness and understanding of the importance of these elements, we are developing a systematic, more holistic approach to endangered species reintroduction which explicitly includes socioeconomic, organizational, and political (power/authority) aspects, as well as biological sciences and technical aspects. A broadly applicable paradigm for the reintroduction of endangered species promises to enhance success rates greatly by providing managers and conservationists with a framework for guiding future species' reintroductions. The paradigm can both expedite the restoration process and render it more comprehensive, systematic, and rational.

Reintroduction paradigm
Key actors are the focus, or center, of the model (Figure 1). The key actors influence, and are influenced by, several variables associated with reintroductions. Key actors are usually easy to identify in specific programs. Although the variables form a continuum of influencing factors that affect each other in complex ways, we distinguish four variable classes: (1) biological/

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technical; (2) authority/power; (3) socioeconomic; and (4) organizational (Figure 1). These are briefly described below. Several variables important to species recovery were previously identified and discussed by Clark and Kellert (1988), Clark (1989), and Kellert and Clark (1991).

Biological/technical aspects

Booth (1988:241) summed up part of the difficulty of restoring endangered species: "[A] continuing problem with reintroductions is that biologists must often contend with manipulating a dwindling species they do not fully understand. Wild animals in wild settings have a way of upsetting the best laid plans."

Reintroduction is often an uncertain, risky venture. Indeed, Griffith et al. (1989) found that most past reintroduction attempts failed, and Kleiman (1989:152) suggested that "high costs, logistical difficulties, and the shortage of suitable habitats make reintroduction unfeasible as a conservation strategy for most rare and endangered species held in captivity." Nevertheless, several reintroductions occur each year and many more are planned. Of all the factors influencing endangered species reintroduction success, the biological and technical aspects are the most obvious and most often stressed (see almost any U.S. Fish and Wildlife Service Recovery Plan).

Plans must carefully consider prospects for the species' survival in the release area given the characteristics of the organism and the ecosystem with which it is associated (Griffith et al.1989). Important considerations include autecology (e.g., life history characteristics, habitat requirements, scarcity), population ecology (e.g., demographics, genetics, dispersal), and community ecology (e.g., predator/prey relations, competition, biotic and abiotic interactions; Stanley-Price 1989; Kleiman 1989). Because of the rarity of most endangered species, pertinent information is often absent and not easily obtained (i.e. technical uncertainty). However, time is at a premium and conservationists must proceed in the face of uncertainty using the best available data.

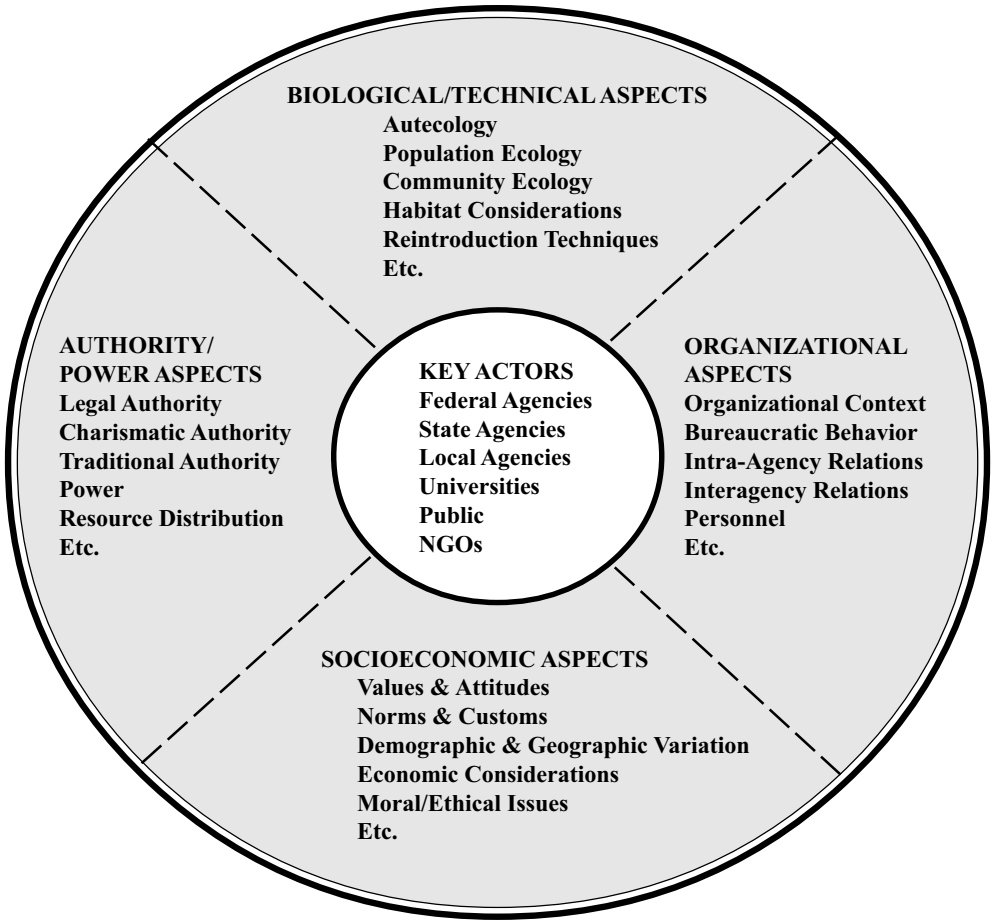
In addition to ecological considerations, plans must address reintroduction techniques. Kleiman (1989) and Griffith et al. (1989) identify several important aspects of reintroduction techniques, including a well managed, self-sustaining source population, release site preparation, preparation and training of animals to be released, and demographic and genetic considerations in animal selection.

Getting the biology and technical considerations right is, in itself, a difficult and demanding job. Obtaining and using this information at the right time and in the right way only compounds the species restoration challenge.

Authority/power aspects

In any situation where multiple actors are working toward a common goal, issues of authority and power arise and can potentially dominate the

Figure 1. Universe of Reintroduction Paradigm Considerations.



interactive process. Endangered species recovery programs are no different. For example, in the California condor (*Gymnogyps californianus*) case, Snyder and Snyder (1989:176) observed that: "The process of attempting to preserve this species has been as much a political as a biological endeavor and has involved endless polemics, confrontations, and debates, as well as endlessly shifting alliances, as old controversies have been resolved and new issues have arisen." Endangered species programs tend to be characterized by broad participation, high visibility, and large financial resources. In addition, the restrictive nature of the Endangered Species Act (ESA) often mobilizes libertarians, agricultural interests, natural resource extractors, and others fearful of losing traditional power or authority (Yaffee 1982; Reading and Kellert 1993). The interplay of organizations, laws, traditional roles, and power differentials can result in power struggles and ideological conflicts, which can significantly limit the effectiveness of the overall program and in some instances potentially cripple the entire reintroduction effort (e.g., see Kohm 1990).

Authority relationships and power dynamics among key actors evolve as programs are carried out, although in many instances, traditional inter-organizational relations and preexisting laws, regulations, and mandates are set and strongly influence the development of inter-actor relations. Weber (1968) recognizes three types of authority: (1) legal authority, in which legitimacy is based on formal laws rules and regulations; (2) traditional authority, wherein legitimacy rests with tradition, custom, or loyalty; and (3) charismatic authority, which finds legitimacy in devotion based on perceptions of exceptional qualities of leaders by their followers or subjects. Any restoration program can contain all three kinds of authority, and their interactions can lead to unproductive conflict.

Resource distribution and power regimes are closely related to concepts of authority, and to each other. Resources include money, personnel, knowledge or expertise, land tenure, and, importantly, control of the animals to be reintroduced. In some programs, conflict centers on who has authority over the animals and the decision-making process surrounding the animals. Power both determines and is determined by the control of these resources and by authority (Lindblom 1980). Power maintained in the absence of legal authority often results in charismatic or traditional authority dominating a program, which, in turn, often evolves into legal authority.

For these and other reasons, local people, organizations and individuals staffing many restoration programs are constantly vying for power and authority. Factors influencing the power structure and power relations of local communities and organizations include the land tenure patterns, access to, and control over, resources, property relations, social stratification, and traditional authority (Clarke and McCool 1985; Kellert and Clark 1991).

Organizational aspects

A major variable in the success or failure of a restoration effort is the kind of organizational system used. As Clark and Cragun (1991:1) concluded: "Understanding your organization and knowing how to make it work for species recovery can make the difference between a program that succeeds and one that fails." The organizational dimension is perhaps the least explicitly perceived and understood of the four variable classes by people involved in species restoration. This fact has profound implications for the kind of organizational system used to restore a species and its effectiveness efficiency, and adequacy (see Clark et al. 1989).

Since several organizations often participate in endangered species recovery efforts, organizational considerations should be given explicit professional attention because they can affect the success of these programs. Understanding organizations permits description, diagnosis, and prescription of situations and problems encountered within them (Gordon 1983). Even apparently technical problems may have unrecognized organizational biases because of the high uncertainty and wide decision-making latitude characteristic of endangered species recovery programs (Yaffee 1982; Clark 1989). The inability of the black-footed ferret (*Mustela nigripes*) recovery program to maintain a wild population of ferrets was at least partially attributable to organizational failures (see Clark and Westrum 1987; Clark et al.1989).

An organization, especially a government-dominated bureaucracy has several dimensions. First, there is the context of the organization, including its internal and external environments, its structure, its culture, its goal orientation, and the characteristics of its personnel. The internal environment is shaped by several factors, including specialization and interdependence, competition and conflict, status equalization, and over staffing (Warwick 1975). Factors shaping an organization's external environment include complexity, uncertainty, threat, dispersion, diversity, and change (Warwick 1975; Gordon 1983). An organization's culture and its goal orientation are derived from philosophies, legislation, policies, and the kind of professionals it has as staff (Byars 1984).

Second, and closely related to organization context, are variables associated with bureaucratic behavior. These include policy formation and implementation, managerial orthodoxy or obedience, standard op-

erating procedures (SOPs), degree of organizational conservativeness, and constituency/public relations (Yaffee 1982; Gordon 1983). Within agencies, formal policies are often significantly altered by substantial discretion in implementation and administration, which exists because policymakers lack the technical knowledge to specify implementation policies (Lindblom 1980; Yaffee 1982). Finally, organizations are sensitive to external pressures from controllers, clientele groups, constituencies, allies, and adversaries (Yaffee 1982; Warwick 1975). This is why restoration programs rapidly bureaucratize even to the point of stifling creativity and problem solving (see Clark and Westrum 1987).

The last category of organizational variables is inter- and intra-agency relations. Agency relations often deal with the authority and power issues discussed above, but difficulties may arise from differences in the organization characteristics mentioned above. In addition, organizations often struggle for control of communication (Weinstein 1984).

The kind of organization that dominates nearly all endangered species restoration efforts is conservative, government bureaucracies with fixed SOPs. In some cases, power differentials and states' rights versus federalism ideology can come to dominate the kinds and frequency of interactions among the program's organizational actors (Ernst 1990). In turn, this has major implications for the actual work of restoring the endangered species.

Socioeconomic aspects

The socioeconomic context of the endangered species reintroduction effort is critical to the performance of the program. For example, Tilt (1989:38) observed that: "The general public's perception of an endangered species issue may not seem important to a wolf lover or a darter supporter. But if the general perception runs against an animal or plant's continued survival, all the biological data in the world will be useless against the perception."

A systematic examination of socioeconomic aspects is necessary to understand the values, attitudes, and perceptions held by people involved with, and potentially influenced by, endangered species reintroductions. Such considerations are usually lacking or insufficient in endangered species management efforts (Kellert 1985).

Local support is crucial. The experimental reintroduction of eastern timber wolves (*Canis lupes lycaen*) into the Upper Peninsula of Michigan during the mid-1970s illustrates this. All four wolves were killed within eight months of being released. Hook and Robinson (1982:382) examined local attitudes following the release and suggested that "the wolf's future in Michigan depends upon the attitudes of Michigan residents toward this animal." Assessing public views and knowledge of wildlife permits program managers to design pertinent and effective public relations campaigns to develop support and to enable people to make more rational and intelligent decisions (Kellert and Berry 1980; Reading and Kellert 1993).

A number of factors influence people's attitudes and values towards wildlife, including many characteristics of the species (e.g., phylogeny, morphology, size, sentient capacity), the perceived worth of the animal, and its symbolic nature (Kellert and Berry 1980). It is far easier to gain support for species with high public appeal (i.e. the 'charismatic megafauna') than for lesser-known and so-called 'lower' life forms (Westman 1990). Values of wildlife and attitudes toward wildlife are strongly influenced by the perceived economic or material worth of the animal. These include aesthetic, ethical, ecological, biological, recreational, cultural, utilitarian, genetic, and unknown or undiscovered values (Ehrenfeld 1976; Ehrlich et al. 1977; Rolston 1981; Kellert 1987). The perceived worth of a species is, in turn, often based on knowledge of the species, moral and ethical issues (i.e. animal rights), and traditional market values (i.e. pelt values). Local norms and customs can also play a strong role in shaping attitudes and values, especially in the absence of accurate knowledge. Variations in norms and customs often follow demographic and geographic patterns.

Values and attitudes towards endangered species in general, the ESA, and endangered species recovery programs are also important. Threatened or endangered status elicits fear and hostility among certain sectors of society (e.g., agricultural interests) and compassion support among others (e.g., members of conservation organizations; Reading and Kellert 1993). Negative attitudes are often based on real and perceived fears of the restrictive components of the ESA, which many people view as a threat to their livelihoods and lifestyles, on negative attitudes toward wildlife, and on the effects of past recovery programs (Reading and Kellert 1993). Positive attitudes are often rooted in recognition of, and concern for, the loss of biodiversity and positive attitudes toward wildlife (Kellert 1985).

Finally, there are economic aspects. In spite of their importance, most of the values of species conservation are difficult to quantify and therefore often ignored. Costs associated with reintroduction, however, are more easily ascertained and more often stressed. Bishop (1978) stresses the irreversibility of extinction and its implications in terms of unknown future losses. He suggests that society should avoid extinction unless the costs of maintaining viable populations are unacceptably large.

Conclusions

As reintroductions become more important in endangered species conservation and management, the need for more systematic, holistic reintroduction efforts grows. Such efforts should address the socioeconomic, political, and organizational aspects of species reintroductions more comprehensively, rather than focusing strictly on biology, as is currently the case. All the variables discussed above affect the success of reintroduction programs. Incorporation of these variables into reintroduction efforts promises to minimize problems, barriers, and conflicts, and enables the program to draw upon the constructive expertise of each key actor involved. It is crucial that reintroduction plans address these aspects to ensure orientation of all the actors toward successful reintroduction and rapid, efficient movement toward that goal.

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Implementing Endangered Species Recovery Policy: Learning As We Go?

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Abstract
Endangered species recovery programs face many challenges; chief among them is the implementation challenge. Implementation is a complex, dynamic, and multifaceted task requiring skilled leadership, an effective problem solving heuristic, and the capacity to learn and change course as feedback suggests. In contrast, too often technically-oriented participants often assume that endangered species recovery is a purely biological problem and thus overlook the many extra-biological dimensions. For example, these participants and the overall recovery programs may not pay attention to critical policy and organizational variables that ultimately determine if the program succeeds or fails. Examples from the endangered black-footed ferret recovery program identify and describe four aspects of recovery programs that directly complicate implementation challenges. First is the inherent "complexity of cooperation" among multiple participants involved. They often have distinct, different perspectives and use contradictory criteria by which success is measured. Second is "goal displacement" wherein the species conservation task is replaced by bureaucratic imperatives such as control and power goals. Third is the use of "inappropriate organizational structures" to interrelate the work, workers, and the species/environment. And fourth is "intelligence failures and delays" wherein key information is overlooked, underappreciated, or not obtained and used at all. This and other factors lead to costly delays. Learning from these four kinds of problems and avoiding them requires professionals and leaders to use knowledge from policy process and organizational design fields, subjects typically not taught in conventional conservation biology programs. A commitment to learning and problem solving can help recovery programs avoid common implementation mistakes and achieve a successful species conservation outcome.

Introduction
Those involved in endangered species recovery programs often face extremely complex situations as they tackle the nuts-and-bolts work of saving species. Recovery programs that have developed over the last 15 years have had to deal with technically demanding biological tasks and uncertainties, limited resources, numerous participants, and intense public scrutiny and involvement, among many other difficulties. These factors combine to make species recovery a complicated, interactive, technical, and administrative challenge. Professionals working in these programs often view recovery primarily as a biological problem. They have generally given much less explicit attention to policy and organizational variables in recovery programs, instead attributing problems simply to bad luck, lack of resources, "politics," or uncommitted individuals in other organizations. Yet the organizational arrangements, decision-making processes, and other policy variables affecting recovery programs can be as critical to success as technical and biological tools. A better understanding of the policy and organizational dimensions of endangered species work could greatly enhance the effectiveness of many recovery programs.

Participants in recovery programs often view the problems they encounter as unique to their species and their program. But problems stemming from inappropriate organizational and decision-making arrangements may be more generic and prevalent than is currently recognized in recovery efforts. By looking at these programs through a policy and organizational framework, common patterns may be detected which would otherwise remain underappreciated or invisible. Lack of attention to these aspects of recovery can result in ineffective and inefficient programs, and ultimately in species extinction.

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With so much at stake, it is imperative to develop a framework for analysis and to learn from past and ongoing recovery efforts in order to improve future programs.

Notable successes have been achieved in many recovery programs. For example, the American alligator (*A11igator mississippiensis*) recovered rapidly in many parts of its range as a result of federal and state protection under the Endangered Species Act (ESA) (Endangered Species Technical Bulletin 1985). Yet many accounts of endangered species recovery programs refer to implementation difficulties encountered by participants (e.g., Duff 1976; Carr 1986; Askins 1987). In this paper, we discuss four common features of recovery programs that have led to implementation problems. First, species recovery is a tremendously complicated task, often involving numerous participants who must somehow integrate their diverse perspectives into a workable program. Second, these participants often have conflicting goals, some of which have more to do with controlling the recovery coalition than saving the species. Third, explicit consideration of organizational structure appropriate to the task of saving species is rare; recovery programs tend to develop into traditional hierarchical bureaucracies. Fourth, intelligence failures and program delays often occur because of preconceptions held by decision makers and the large number of "clearances" required in programs with multiple participants.

To illustrate our points, we draw on examples from the ongoing black-footed ferret recovery effort, which has much public and professional attention. Even though we focus on the recovery effort in the years 1981 through 1986, from the discovery of the Meeteetse population until its extinction in the wild, the four implementation themes addressed in this paper were apparent throughout the past 15 years. Our use of the ferret case history could be misunderstood as blame finding and negative, and in fact, we have been urged to forget past, acknowledged implementation mistakes. We feel strongly, however, that unless these persistent features of implementation are scrutinized and given some meaning through a policy and organizational framework, they will never be recognized for what they are and managed effectively. By using the ferret example as illustration, we are not implying that it is an especially good or bad program. Rather, we suggest that the examples may be representative of the implementation problems found in many recovery programs, and that the lessons to be learned from examining them can be useful in many other cases.

In the second section of the paper we suggest ways to improve the policy, organizational, and individual dimensions of recovery program implementation. Recovery programs are an implementation device in the larger policy process, and participants must have knowledge of this process. The organizational dimension involves the structure and management of the recovery program itself, including such factors as who is permitted to participate, how information is gathered and used, how authority and control over the program are allocated, how decisions are made, and how disagreements within the recovery coalition are resolved. The individuals who make up recovery teams are part of these policy and organizational dynamics and can have roles of influence. Careful attention to all these overlapping and interactive elements is essential.

The black-footed ferret story

The black-footed ferret (*Mustela nigripes)* is the most critically endangered mammal in North America. It was listed in the U.S. Fish and Wildlife Service's (FWS) Redbook of Endangered Species in 1964, and it was placed in the FWS endangered species priorities list in 1976. It is a solitary, nocturnal carnivore preying almost exclusively on prairie dogs (*Cynomys sp.)*. The ferret spends almost all of its time below ground in prairie dog burrows where it hunts and finds shelter. In the 137 years since the ferret's scientific discovery, only two small populations have ever been studied — one in South Dakota (1964-1974) and the second near Meeteetse, Wyoming (1981-1987). Both wild populations are now extinct.

In 1920, an estimated one million ferrets existed in 40 million hectares of habitat (prairie dog colonies) over 12 states and two Canadian provinces (Anderson et al. 1986). Widespread and long-lasting prairie dog poisoning programs, with the goal of rangeland improvement, destroyed ferret habitat. This loss, combined with other factors, such as diseases, pushed ferrets to the edge of extinction by 1980. In fact, many people and agencies considered the ferret extinct by that time.

The Meeteetse ferrets were discovered serendipitously: a ranch dog killed a dispersing male. The source population of ferrets was found nearby occupying 37 prairie dog colonies (about 3,000 ha) scattered over about 260 square kilometers on nine ranches in a mix of private and public lands. The presence of this ferret population surprised everyone. A few months after the discovery, the FWS transferred authority for the ferret recovery program to the Wyoming Game and Fish Department. Ferret ecology and behavior were extensively studied, as ferrets were observed directly, tracked in snow, and radio-collared. Spotlight surveys each summer revealed peak annual numbers (1984, 129 ferrets including 25 litters). Annual ferret losses were high, about 50-90+ % (Forrest et al.

1988). By early July 1985, counts showed a much lower population than in all previous years (58, including 13 litters). By early September, mark/recapture population estimates showed that the population had declined to 31±8 ferrets. By early October, the population had declined to 16±5. And by November, only about six ferrets were thought to remain in the wild. The catastrophic loss of about 150 ferrets between fall 1984 and fall 1985 was documented. During July to September 1985, ferrets were lost at the rate of one every two to three days. The decline was thought to be caused by canine distemper, a disease 100% fatal to ferrets. Techniques were developed to locate ferrets and extensive searches were conducted over several states. No ferrets or recent sign were found.

During the fall of 1985, six Meeteetse ferrets were captured to prevent loss of the species. These ferrets were housed in close proximity, and two ferrets infected with canine distemper transmitted it to the other four. A1l six died shortly thereafter. Another six were hastily captured and housed individually; all survived. These six, added to the six thought to exist in the wild, constituted the world's known population — about 12 individuals in early 1986. In 1986, the six captive ferrets did not reproduce, but the six wild ferrets produced 10 young in two litters, and most were added to the captive population. This brought the world's known population to 18, all in captivity. The captive ferrets produced seven surviving young in two litters in 1987. No more wild ferrets were found. Breeding success was better in 1988, with 44 young in 13 litters being produced. Ten of the 44 young born in 1988 died. The fate of the species now depends on the captive ferrets and any wild ferrets that may exist (Maguire et al. 1988).

In late 1985, the International Union for the Conservation of Nature and Natural Resources' (IUCN) Captive Breeding Specialist Group entered the ferret recovery program in an advisory role, bringing considerable technical information and expertise to the captive breeding program. The captive population is presently held in a single location in Wyoming. The agencies responsible for the ferrets are planning to divide the population in order to minimize the chances of the entire population being eliminated by a disease epidemic or other catastrophe (Oakleaf 1988). The participants in the ferret program hope to use captive-bred ferrets to establish a second or third captive breeding colony in other states in late 1988, and an Interstate Coordinating Committee has been formed to identify potential reintroduction sites (Thorne 1988).

Black-footed ferret (*Mustela nigripes*) by Richard P. Reading.

Implementation problems in recovery programs

1. Complexity of cooperation: multiple participants and perspectives

Like most endangered species programs, the ferret program includes a number of governmental and nongovernmental participants, who became involved — formally and informa1ly — for a variety of reasons. More than 20 organizations and 100 individuals have participated in the ferret program since 1981. The primary participant groups are the FWS, the Wyoming Game and Fish Department, ranchers, and the conservation community. The management complexities involved in coordinating the actions of multiple participants in wildlife programs can compound an already difficult biological task (Harvey 1987). This is not to argue that participation should be limited to only a few. To the contrary, a multiplicity of participants provides an essential diversity of knowledge, skills, and perspectives as well as a useful system of checks and balances that contribute significantly to recovery. But to capture these needed interests and skills and meld them into productive, coordinated action requires a carefully constructed and managed program and an explicit and effective decision and policy process.

Each participating organization in a recovery program possesses a distinct perspective from which it sees the program, its operation, and other actors. Each organization may differ from the others in its sense of urgency about recovery of a species and in its thoughts about the best location and means for recovery. For example, conflict arose between participants in the ferret case over the question of when and where to initiate a captive breeding program.

Because perspectives vary so much, the participating organizations may have contradictory criteria by which each measures program success. For example, some agencies gauge success primarily by increases in a species' numbers, successful captive breeding, or gains in data collection leading to letter understanding of

the species' ecological requirements. For others, the major criterion of success is the degree to which they can prevent public controversy or effectively control key aspects of the program. Disagreement over these criteria has led to conflicts in recovery programs, as technicians, scientists, managers, and administrators seek to impose their readings of the "facts" and their values on other participants (see Latour 1987).

2. Goal displacement: task goals versus control goals

All participants in endangered species programs genuinely seek species recovery. Despite this common goal, however, program participants often disagree about the means to achieve it, for a variety of reasons: professional disagreements; legal and procedural differences; differences of opinion on leadership and proper organizationa1 roles; and direct incompatibility of the suggested actions with other goals held by their organization (or simply a preference for these other goals) (see Pressman and Wildavsky 1973). Participants may try administratively to redefine the recovery program to fit their own agencies' perspectives and priorities, which can be quite inflexible (Yaffee 1982).

In some cases, a very obvious conflict arises between the "task goal" (i.e. saving the species) and the "power/control goal" of some agencies (i.e. gaining and maintaining control of the recovery program). "Goal displacement" occurs when an agency becomes more focused on power/control goals than on substantive biological task goals. A program driven by power/control goals is likely to compromise the biological task goals when the two come into conflict, as they invariably will. If the organization relies on a bureaucratic top-down style of decision making, control and power goals tend to dominate, whereas if goals are set from the bottom up, by those individuals most directly in contact with the species, task goals tend to dominate (Daft 1983).

A conflict between task and control goals was evident over all the years of the Wyoming ferret recovery program. The Wyoming Game and Fish Department, which had been given lead agency status by the FWS, wanted to keep the ferrets within the state and carry out captive breeding only after the state had developed facilities to do so. Weinberg (1986: 65) wrote, "As [Wyoming] officials acknowledge, they never seriously considered allowing ferrets to leave the site [for captive breeding]. 'We'd have no control over them.'" Analysis indicates that Wyoming's insistence on controlling the program created unproductive conflict and caused delays (Carr 1986; May 1986).

3. Organizational structures

One major cause of a program's failure to meet its goals is the use of inappropriate organizational structures (Hall 1987). Most recovery challenges go well beyond the boundaries of any single organization. Coalitions are formed which must integrate diverse structures, ideologies, and standard operating procedures to meet the common task goal. But agencies setting up a new recovery program rarely give explicit thought to how the recovery coalition should be structured. Programs are often set up along standard bureaucratic lines, not because such an arrangement has proven to be the most effective, but because no other structure is considered. This limits the set of ideas that seem plausible, and that are tried. In the first 15 months of the ferret recovery program, the recovery coalition's organizational structure evolved from a simple matrix to a traditional bureaucratic arrangement, where remained (See Figure 1).

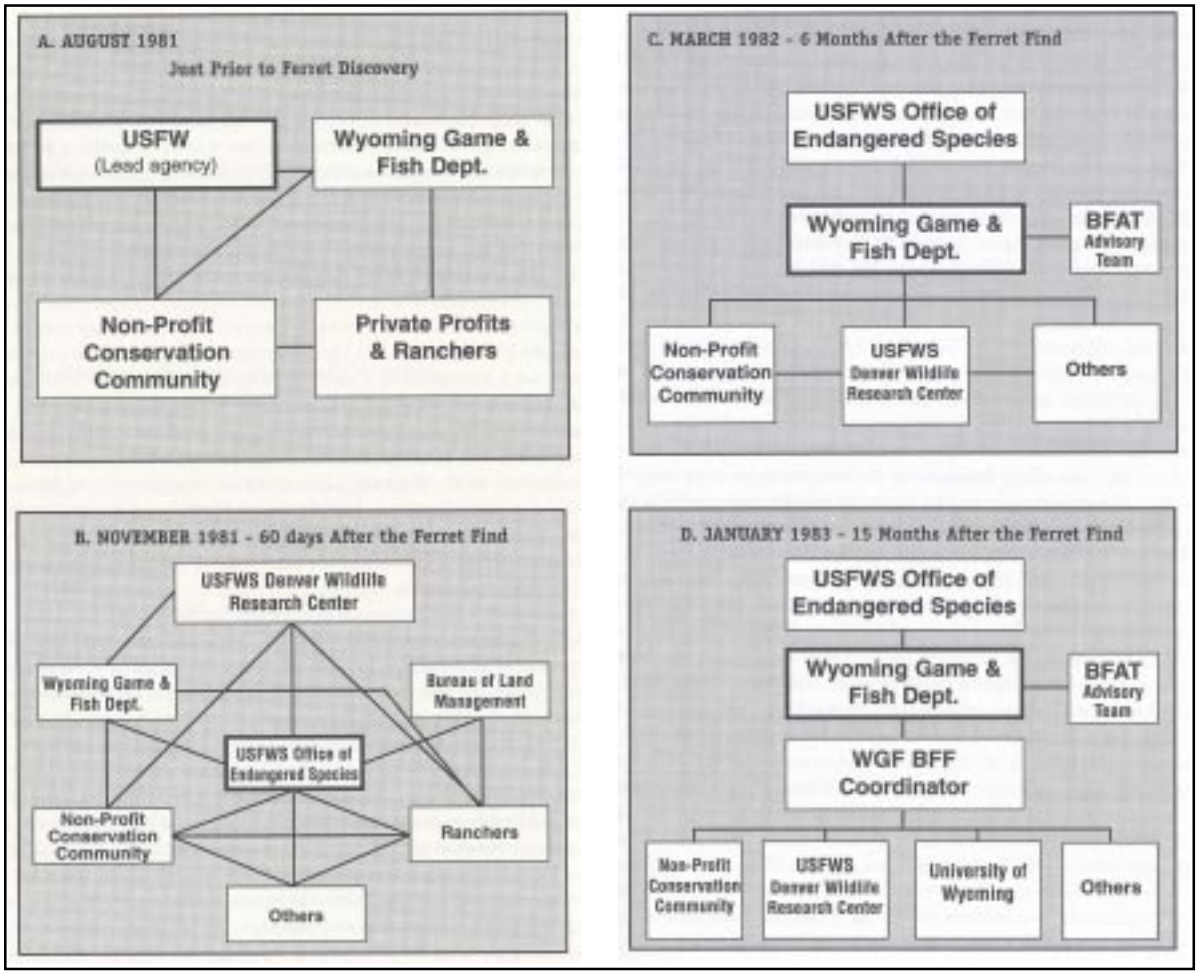
Organizational structure has profound effects on task divisions, resource allocations, distribution of information, and controls, and hence on the overall effectiveness of the program. If task goals cannot be met or are stifled because of structural constraints, then the program will falter or fail. Bureaucratization is implicated as a root cause of implementation problems (War 1975). Those who implement recovery programs should give explicit consideration to other organizational structures, such as horizontally-coordinated task forces and project teams (Clark and Cragun 1994).

Program structure is both a detriment and an outcome of organizational power. A structure that concentrates decision-making authority and control in the hands of one agency makes it easy for that agency to reduce or eliminate the role of other organizations, and to control information for its own benefit. The lead agency in the ferret program used several widely recognized bureaucratic mechanisms (Salancik and Pfeffer 1977) to consolidate its power. For example, it filled positions of power in its "advisory" team with its own personnel (e.g., "chairman and secretary"). By restricting permits and limiting contact with the press, it also controlled data generation and public access to that data. The bureaucratic structure chosen by Wyoming helped to solidify its top-down control over decision making, allocation of resources, definition of participant roles, and the timing and location of recovery activities. Unfortunately, this structure also closed the decision-making process to significant available information and suggestions for solutions from both inside and outside participants, and reduced the program's ability to be creative and responsive (see Etheredge 1985).

4. Intelligence failures and delays

Intelligence failures and delays have

Figure 1. Organizational arrangements for recovery of the black-footed ferrets: (A) simple matrix; (B) complex matrix; (C) bureaucracy; (D) heightened bureaucracy (Clark and Harvey 1988).



been common problems in recovery programs, resulting in part from conflicts among participants, goal displacement, and use of inappropriate organizational structures. Quality decision making depends on intelligence (i.e. the use of information or the "acquisition, analysis, and *appreciation* of relevant data." (Betts 1978:61, emphasis in original)). Even when information is available to decision makers, a variety of factors may lead them to dismiss it as erroneous, inaccurate, or misleading. In the ferret program, agency officials at first discounted 1985 field data indicating that the ferret population was in a rapid decline. Officials took the most sanguine view of the situation, arguing that it was just a normal population fluctuation, that the field methods and data were in error, or that the ferrets had migrated elsewhere (Weinberg 1986; Randall 1986; Zimmennan 1986).

A root cause of intelligence failures, according to Betts (1978), is that decision and policy makers operate under policy premises that constrict perceptions and lead to "selective inattention" to facts and outright "blindness" in some instances (Lasswell 1971; Schon 1983). These preconceptions can block learning, change, and adaptation (Etheredge 1985). Organizational arrangements that stifle legitimate dissenting views exacerbate intelligence failures.

In such a difficult and uncertain task as recovering species, where numerous participants are involved, disagreements over the best course of action are to be expected. When dealt with constructively, such disagreements and conflicts have been valuable to recovery programs by providing alternative ideas and solutions for the group to consider. But the need to reach agreement on these points of contention has often caused delays. In some cases a participant who was intensely opposed to a program, and who had adequate resources to block it, has held up recovery actions until major concessions were made.

There is evidence that this occurred in the ferret case. Because Wyoming initially had no captive breeding facility, resources to build one, or staff to man one, and because of their agency's strong opposition to sending ferrets to other facilities outside Wyoming, captive breeding

could not move forward when first called for. Extensive bargaining over several years between Wyoming and other participants and the dramatic collapse of the wild population ensued before Wyoming initiated captive breeding in 1985 (Weinberg 1986; Randall 1986).

Not all delays are intentional. Some delays result from the time required to formulate and approve plans and funding requests or from competing demands on participants' time. Regardless of the source, program delays are often difficult to separate from program failures (Pressman and Wildavsky 1973). Does Wyoming's move to breed ferrets in captivity, which occurred a year or two later than recommended by field teams and conservationists (Weinberg 1986) and after the wild population had sharply declined, count as failure or as success? In view of the captive breeding program's results in 1988, some observers may reasonably argue, "better late than never." Although the outcome of the captive breeding program to-date gives cause for optimism, we should not assume that the program's delays were of no significance. If we can learn from past mistakes, we collectively can be more responsive to such crises in the future.

Improvements

How can participants in recovery programs begin to deal with these implementation problems and others? To improve future performance in conserving species and the ecosystems on which they depend, appreciation of the actual complexity of the work to be done is required. This means developing a broad understanding of the interactive web of biological, organizational, and policy components involved. Such a "systems perspective" can be very different from the conventional views held by traditional biologists and bureaucrats, views which are rooted in single university disciplines and reinforced in certain agency cultures and loyalties (Brewer 1988).

Improvements in recovery programs are possible in three areas: policies, organizations, and individuals — in addition to the constant striving to improve technical biological work. The ideas presented below are a brief look at some analytical and problem solving techniques and approaches that could help to broaden participants' perspectives and improve their ability to adapt quickly to the demands of species recovery. We are aware that many recovery programs face extreme resource shortages, and that participants may view some of these suggestions as being too time consuming and expensive to be practicable. We argue that these ideas and techniques can help recovery programs anticipate and avoid common pitfalls that have hindered efficient and effective action in the past. Since we can give only the briefest introductions to these ideas and techniques, we urge readers to delve into the literature cited for more thorough explanations.

1. Improvements in the policy process

By policy, we mean the complex set of interactive decisions and actions by which societies and governments establish goals based on their values and establish the means to reach those goals (Ham and Hill 1987). It is essential in defining a recovery challenge to explore thoroughly its history, scientific and management context, and trends, and to identify all factors which may have a bearing on the success of the program. Evidence suggests that some of these factors, particularly policy and organizational variables, are underappreciated or "invisible" to some participants. Organization and management structures, resource limitations, uncertainty, and jurisdictional and control issues are just a few of the variables which can fundamentally affect the decision and policy processes and ultimately the outcome of a recovery program. Many of these variables involve participants' values. The policy sciences offer analytical tools that can minimize the subjective distortions and simplifications that cause many implementation problems (Lasswell 1971). The policy sciences' problem-solving tools are specifically designed to address both technical and value-laden issues. Policy scientists look at how knowledge is used in the decision and policy processes, and simultaneously, at how well these processes are working. By contrast, technical experts tend to generate basic knowledge and pay little attention to complex decision processes.

One model that could be very useful for recovery programs is the "decision seminar," a technique designed to allow a group of specialists and decision makers to integrate their knowledge to solve complex problems (Lasswell 1960; Brewer 1975). A core group of l0 to 15 participants must be willing to commit the time needed to understand the problem (over months or years, if necessary), although the seminar is also open to outsiders. An explicit problem-solving orientation is used. The group maps the context of the problem and determines its vast trends, probable future outcomes, and options available to solve the problem. The process by which decisions are made is also explicitly and continuously considered. Participants' independent assessments of the problem are compared, common views are discussed, and discrepancies are considered. All relevant methods for analysis of the problem are used, and new methods are encouraged. When the group arrives at a decision, responsibilities for carrying it out are assigned. Documentation of participants' activities becomes the group's "institutional memory" (Brewer 1975). An inter-

Daurian pika (*Ochotona daurica*) by Richard P. Reading.

disciplinary approach is essential. Many recovery programs incorporate some aspects of the decision seminar model. But, for the most part, they lack the explicit attention to multiple methods and the breadth of analysis that characterize decision seminars. Recovery programs, which fully adopt a decision seminar format, could be expected to improve both their openness to problem-solving techniques and their awareness of their own decision-making processes.

Another specific tool that has proven useful in species recovery programs is decision analysis which allows managers to integrate ecological theory, objective data, subjective judgments, and financial concerns in making decisions under conditions of uncertainty (Maguire 1986). Probabilistic models are developed relating the outcomes of alternative actions to random events in the environment, and probability values are assigned to each possible outcome of a decision. For example, the probability of extinction of a species can be estimated under current management conditions and then compared with extinction probabilities under different management scenarios. The probabilities and effects of random events such severe weather and disease, and the costs of different management actions can be explicitly considered. Parties that dispute the facts can see where they agree and disagree and suggest ways of assembling information to resolve disputes. Analysts have applied decision analysis to the critically endangered Sumatran rhino (*Dicerorhinus sumarensis*) and other species (Maguire et al. 1987; Maguire et al. 1988).

"Adaptive management" (Hollings 1978) is a third way of guiding recovery group actions. From this perspective, decision making should be treated explicitly as a process of making mistakes and correcting errors (Brewer 1988). Instead of seeking and relying on a single "best answer," managers should consider many plausible approaches and solutions, adapting to changes in the problem and its context. The key to adaptive management is to monitor the outcomes of decisions carefully so as to learn from each and to cut losses when solutions are not working. Since recovery programs almost always involve risk and uncertainty, managers should use contingency planning to anticipate the possibility of failure.

Through the decision seminar process, using decision analysis and adaptive management, an explicit understanding can be gained not only of the substantive problem but of the processes most useful for solving it. Some movement in this direction has occurred in the ferret program. The participation of the IUCN Captive Breeding Specialist Group (CBSG) in the ferret recovery program since 1985 has improved the program's technical capabilities and broadened discussion of a range of ideas and problem-solving approaches. This has brought the program a little closer to the decision seminar model than it was before. Although the program still functions under several policy and organizational constraints dictated by Wyoming, CBSG's participation to-date has resulted in a more focused problem-solving orientation and has contributed greatly to the success of the captive breeding effort.

2. Organizational improvements

The second kind of improvements needed in recovery programs is organizational. Organizations are more than just a collection of individuals; they persist over time and have established norms, traditions, and activities above and beyond the individuals who direct and staff them. They are major determinants of the behavior of those individuals and major actors in policy implementation. The nature of endangered species recovery programs — complex, rapidly changing, and highly uncertain — requires organizational arrangements that fit these task properties. Highly bureaucratized organizations with rigid standard operating procedures probably lack the flexibility needed. Recovery program managers should question whether the program's organizational structure is hindering the recovery effort. Organizational development consultants could provide valuable expertise in matching recovery program structures to organizational tasks and environments.

An effective organization should process information well and learn rapidly from its own mistakes. Useful organizational models for endangered species recovery include task forces and project teams operating under adaptive management and decision seminar guidelines. (Task forces tackle temporary problems, and project teams address problems that need long-term, continuous coordination; Daft 1983). A recovery team should ideally be composed of professionals with formal training and experience, who are focused on completing the job successfully and willing to accept the uncertainty and risk inherent in endangered species challenges.

Certain characteristics are key to the effective functioning of recovery teams. As the recovery task and its

larger context change, the team must be able to respond quickly and adaptively, using all available information. Communication practices, which facilitate high creativity, such as emotional supportiveness, brainstorming, and non-personally directed evaluation of ideas, are helpful. A willingness to examine any and all alternatives is essential. Teams must avoid "groupthink," in which disagreements and conflicting perspectives are muted in the interest of maintaining group cohesion (Janis 1972). A strong, mutually supportive atmosphere in which mistakes will not result in withdrawal of the group's support is important. Mistakes and failures should be viewed as occasions for learning and for improving the system.

Clark and Cragun (1994) provide a framework for analyzing organizational problems and for implementing change in species recovery programs. This 14-step procedure includes four major stages: problem identification, development of alternative strategies, development of an action plan, and implementation and evaluation of the action plan. It can guide participants in defining problems and objectives, identifying forces that could help or hinder movement toward objectives, analyzing strategies to overcome obstacles, outlining specific tasks to be accomplished, and evaluating the success of their efforts. It provides an explicit method for recovery programs to use in solving both technical and organizational problems.

3. Individual improvements

Improvements can also occur at the individual level. Many participants and observers believe the root cause of faltering programs is misguided or selfish individuals. This "human relations" view of organizations oversimplifies the many complex organization, management, and policy aspects introduced here (see Hall 1987; Ham and Hill 1987.) Individuals are molded and constrained by conventional experience and established policy prescriptions. Analysis is often less important than values and preconceptions as a basis for decision making, and agency structures and procedures. Nevertheless, individual performance in a recovery program is an important factor in the success of the program and it can, in many cases, be improved.

An admonishment often heard is that if only individuals would act with more professional integrity, a program could significantly be improved. But as Betts (1978:82) noted, "Integrity untinged by political sensitivity courts professional suicide." Betts suggests that individuals can try to improve programs by asking hard questions of their superiors, acting as socratic agnostics, nagging decision makers into awareness of the full range of uncertainty, and making authorities' calculations harder rather than easier. But most leaders will not appreciate these approaches by individual professionals (e.g., Craighead 1979; Homocker 1982; Clark 1986). Simply providing more reliable facts or new arguments to decision makers will not reverse their basic beliefs. Analysis is often less important than values and preconceptions as a basis for decision making (Betts 1978). Real solutions depend on the openness of decision makers and their understanding of the premises they use in accepting or rejecting intelligence. Individuals should continue trying to improve their programs, but they should do so with an understanding of the potential politic consequences of their efforts.

The sheer complexity of endangered species and ecosystem conservation tells us there is no single, straightforward, technocratic recipe for success. The essential challenge in species and ecosystem conservation, as in complex situations, has always been addressing unbounded problems successfully when our analytical resources are bounded (Ascher 1986). Real improvements will come about by refining the conceptual tools that enhance understanding of complex conservation problems and by developing practical tools that allow the problem to be dealt with realistically. A number of conceptual and practical tools already exist but go largely unused. Improvements will not come quickly, even with increased use of these tools. There are many barriers to learning and improvement (Etheredge 1985), but with so much at stake in every recovery program, we must learn to recognize and overcome those barriers. The full extent of these problems across all endangered species recovery programs is unknown. But we hope that this paper will stimulate further documentation, discussion, and analysis, and we are hopeful that improvements will ensue.

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Saiga (*Saiga tatarica*) by Richard P. Reading.

Conserving Biodiversity in the Real World: Professional Practice Using a Policy Orientation

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Abstract

Conservation biologists often take the view that their role is simply to provide biological information to policy makers and resource managers, not to engage in the overall conservation process about endangered species conservation. Considering the many challenges to biodiversity conservation, stemming from social, political, and economic issues, we argue that professionals could better aid species recovery if they broadened their role and activities, as well as knowledge and skill, beyond conservation biology. A more effective professional approach to endangered species conservation might be to teach conservation biologists a "policy orientation" to their important work. A policy orientation encourages its holder to best integrate the biological and social sciences to help managers, leaders, and the public make sound choices, and to solve problems effectively. In order to apply this orientation, biologists must first understand the conservation (policy) process. One practical model of this process describes six phases or activities through which all policies and programs pass (i.e. initiation, estimation, selection, implementation, evaluation, and termination). Therefore, we recommend that university conservation biology programs, particularly at the graduate level, teach policy orientation and that professionals actively make an effort to learn and apply a policy orientation. Significantly improved endangered species conservation can be expected from using this innovation.

Introduction

The unifying goal of conservation biology is the preservation of biological diversity through the maintenance of viable ecosystems. Even though there is general agreement about the paramount goal, there is debate among its practitioners as to the scope of acceptable professional practice. We believe that a "policy orientation" can complement rigorous scientific methods and is essential for achieving many conservation aims. Furthermore, scientific professionalism need not be sacrificed. We briefly examine the elements of the biodiversity conservation challenge and how professionals can better meet this challenge with a "policy orientation" that we introduce. Unfortunately, most university programs provide few opportunities for future professionals to learn what a "policy orientation" is, much less how to apply it responsibly and practically to benefit biodiversity conservation efforts.

The biodiversity conservation challenge

Conservation biology is a "mission-oriented crisis discipline"(Soulé 1986:3) that exists to address the challenge posed by the loss of biological diversity. Few would debate the ultimate aims of conservation biology, but what is less clear to professional conservation biologists is their specific role in meeting this challenge. The loss of biological diversity has multiple causes and efforts to redress losses will require contributions from many disciplines. One approach conservation biologists have adopted is to use scientific methods to provide information useful to natural resource managers or decision makers. This approach uses tools such as field surveys, population viability assessments, and analyses of preserve design and management. Some conservation biologists are apt to accept the view that production of useful biological knowledge is the only goal of their profession. While we accept that good science must remain at the core of conservation biology and that there should be limits to the sort of advocacy a scientist pursues, it is a practical mistake to limit the training and experience of conservation biologists to scientific fields only.

Few would deny that the ultimate causes of biological impoverishment are social, political, and economic in nature. Conservation biology, however, should not be about directly

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changing the social forces that are causing our environmental problems. Murphy (1990) is right when he concludes that conservation biology should be about providing the scientific information necessary to correct the problems leading to the loss of biological diversity. But we need to recognize that the process of correcting biological problems takes place in the same social and political arena as the processes that are driving environmental degradation in the first place. If conservation biologists are to be effective in promoting solutions to environmental problems, they must understand the non-biological factors behind environmental change and be willing and able to participate effectively and offer solutions in the arenas where social change occurs. Providing the scientific information to guide policy, and not "just provoke it" (Pool 1990:673), is necessary for real conservation actions. Hales (1987:81) identified one aspect of the problem in noting that the "trained analytical approach of the biologist, or any other disciplinarian, often seems to lead to fragmented problem definitions and unimaginative solutions, the success of which, over time, is not particularly impressive."

An alternative, and we argue more effective, way for conservation biologists to approach the challenge posed by the loss of biological diversity is to understand the policy process well enough to maximize opportunities so that science-based recommendations are applied. It is at this level that a policy orientation to conservation biology can be most helpful, particularly when the policy sciences are taught along with the biological sciences in a comprehensive university training program. In discussing the weaknesses of endangered species recovery programs, Clark (1989:3) states:

"Most descriptions of endangered species recovery focus only on the biology of the species, thus creating the unrealistic view that conservation and recovery are strictly technical, biological tasks. In fact, numerous non-biological factors and forces have direct, immediate and paramount significance to endangered species recovery, and if the conservation movement is to be effective, it must explicitly recognize the interactive impacts and contributions of all the various dimensions."

For conservation biologists to be successful, they must become more proficient at understanding the processes that drive environmental degradation and at providing remedial strategies and tactics. Accepting this premise still leaves some questions as to the scope of acceptable professional practice for conservation biologists. Conservation biologists are and must remain above all else scientists; applying scientific methods to conservation questions. Systematic, rational, fact-theory driven, experimental, and "objective" science is a must. However, if experience or knowledge of the policy process makes conservation biologists more effective, how much farther should they go? As Orr (1990:9) asked, "how should those calling themselves conservation biologists deal with politics and the question of management in their research, writing and teaching?" If knowledge of the policy process is valuable, how should it be incorporated into training programs for conservation biologists?

The professional challenge: a problem of definition

The limitations of traditional wildlife management programs and "normal science" (see Kuhn 1970) that promote narrow, "technical," "fix-it" approaches, and their failure to encompass the biodiversity conservation challenge, have been outlined by Clark (1986, 1988), Norton (1988), Orr (1990, 1991) and others. More recently, Soulé (1990:1) observed that "solutions to environmental problems have as much to do with politics and perceptions as with biological fact…when it comes to influencing public policy, we will need political as well as research skills." Yet, the question remains, where should the science of conservation biology end and the advocacy of other constituencies begin? Should conservation biology assume itself to be a "value-free" science, merely providing information to resource and political managers? Or do conservation biologists have an obligation to "participate with the public in a debate regarding the very nature of ecological health, even while trying to protect it?" (Norton 1988:238).

A growing number of authors have suggested that conservation biologists need to become more proficient at understanding, participating in, and anticipating policy processes. Firstly, Noss (1989) concluded that effective conservation biologists must walk the narrow line between science and policy-making and address concerns raised by both. Secondly, Carr (1987:86) observed that good conservation biologists should be "willing to use their training and analytical skills beyond the confines of biology, reaching out to examine the cultural or sociological factors that bear on the survival of their favorite species." Thirdly, Maguire (1990:125) recently presented a scheme to guide conservation biologists towards responsible advocacy, by using risk analysis to assess management options and illuminate "the consequences of silence and inaction" should traditional scientific conservatism prevail.

Can conservation biologists actually play an effective role beyond the confines of biology without sacrificing their effectiveness and credibility as scientists? Can both capabilities exist in the same individual

professionalism? We believe the answer is "yes" — a professional can be expert in scientific pursuits and at the same time possess an explicit orientation to the policy process.

How can a policy orientation help professional conservation biologists?

We all know of instances where good scientific knowledge has been ignored, dismissed, misapplied, or only partially used by decision and policy makers (see, for example, Snyder 1986). If conservation biologists are to make greater conservation gains, they must facilitate the integration of decision and policy processes with reliable information. The way a scientist presents data and interacts with decision makers and the public may very well make the difference between the success or failure of a conservation program. The stakes are high when extinction of species or the loss of biological communities can result from inappropriate decisions and policies. Conservation biologists, therefore, must produce reliable knowledge through research and participate in the socio-political context in which that knowledge is used. The term "policy orientation" was coined by Harold Lasswell (1951). "Policy" is a broad strategic intent to accomplish a goal (Brewer and deLeon 1983); the aim here being the conservation of biodiversity. "Orientation" reflects a direction or the relationship of an idea or concept to the dynamic policy process. Having a policy orientation means having knowledge that is directly useful *in* the process as well as having knowledge *of* the process itself (Lasswell 1971). Therefore, conservation biologists must have two kinds of knowledge. First, the biological skills to generate basic and applied knowledge; and second, the social science skills to encourage the wise use of scientific knowledge by policy makers.

The policy sciences study decision and policy processes, using both experimental hard science and observations or experience in order to determine how these processes work independent of their reliance upon technical knowledge (see Lasswell 1971). The term policy science

"is not another way of talking about the 'social sciences' as a whole, or of the 'social and psychological sciences.' Nor are the 'policy sciences' identical with 'applied social sciences' or 'applied social and psychological sciences'…Nor are the 'policy sciences' to be thought of as largely identical with what is studied by the 'political scientists' (Lasswell 1951:3)."

Policy scientists are problem-oriented, focused on defining and solving real-world problems (Brewer and deLeon 1983). They use a variety of tools to understand the context of a problem as completely as possible; examining its history and trends, explaining the trends, projecting the trends into the future, evaluating the trends, and inventing and selecting alternative solutions. Policy scientists' problem-solving approaches are not reductionistic or "positivistic" (see Brunner 1988; Norton 1988; Clark 1993), in the sense that discipline-based biological science and even much of conservation biology tends to be. It is beyond the scope of this small paper to develop this observation and contrast the problem-solving approaches of the policy and conservation sciences. The policy sciences are a fundamentally different way of thinking in contrast to traditional science; they are a way of thinking, in the sense that logic is a way of thinking. Norton (1988) adequately outlined the limitations and failures of scientific positivism as a philosophy for problem-solving and the need for a new post-positivistic philosophy. Even if a conservation biologist possesses only a little policy science knowledge or a few of its problem-solving skills, it might make a considerable difference in constructively influencing the pertinent decision and policy processes.

Having a useful "map" of the policy process is essential for a policy orientation. Just as there are models of ecological systems, there are also models of policy processes. These models can aid in practical applied conservation by revealing the many aspects of a problem's setting and useful paths of action. The models can direct one's intellectual attention and highlight areas where information is lacking (Brewer and deLeon 1983). People adept in the policy process have been likened to expert, general problem solvers (Lasswell 1971; Buffington, 1989). A conservation biologist, expert in science, can also be expert in general problem solving without compromising his or her scientific standing. The practitioners' primary interest may be conservation science, for example, but they should also have an interest in the decision and policy processes that use their science. If such biologists are viewed to be outside the bounds of accepted professional practice, then perhaps the bounds need to be redefined.

The best model of the policy processes that we know of was developed by Brewer and deLeon (1983), based on Lasswell (1971), and describes the six phases through which nearly all policies or programs pass. They are: problem identification (initiation); expert analysis and technical considerations (estimation); policy formulation, debate, and authorization (selection); specification and application (implementation); expost appraisal (evaluation); and discontinuation or revision of the policy or program (termination). Each of these phases can be very complex, but there are recurring characteristics and weaknesses in each phase

regardless of the specifics of the case (Ascher and Healy 1990). Examples of weaknesses in several phases of conservation programs have been described in Kohm (1991). If a conservation biologist is knowledgeable about these phases and what is likely to happen in each, then he or she is in a position to influence outcomes of decisions and policies and aid biodiversity conservation. We readily acknowledge, however, that not all decision and policy processes are accessible for improvements.

The Brewer and deLeon (1983) policy process model was modified and expanded in 1988 (Clark and Kellert 1988; Kellert and Clark 1991) to fit more explicitly the needs of people interested in the conservation of biodiversity and management of wildlife resources. This modified model employs the same six phases and identifies four classes of "factors or forces" that make up the policy dynamic: biophysical (physical properties of the resource), valuational (human values about the resource), social-structural (property rights and access to the resource), and institutional-regulatory (organizations and their directives).

More conservation biologists now recognize the need for a policy orientation in their professional practice, but not all authors refer to it by that label. Three illustrations of this point follow. Lovejoy (1989:329) noted that "An awareness of this public role [of conservation biologists], whether sought by ourselves or thrust upon us uninvited, is essential. We do not help either science or society by evading our social responsibilities as experts." Deskmukh (1989:321) concluded that: "As conservation biologists we can help decide what to conserve and where, within a policy framework that we should help to formulate." Lastly, Clark and Kellert (1988:7) noted that if the field of conservation science "is to contribute fully and adequately to the critical societal decisions affecting the future abundance and well-being of our nation's flora and fauna, then it seems essential that young wildlife professionals be sufficiently educated in the complexities, subtleties and techniques of the policy process."

The training for conservation biologists could benefit from broadening the scope of what they teach to incorporate a policy orientation to conservation.

Professionals and the future

In addition to the obvious need for good science education, there is growing recognition that university conservation biology programs should teach an explicit policy orientation. Professional conservation biologists educated with a policy orientation can be expected to be more effective in achieving conservation aims.

A policy orientation can be introduced at an undergraduate level, but is most effective in Master's and Ph.D. programs, after students have had some "real" world working experience. Beissinger (1990:457) calls for an expanded course requirement for conservation biologists to incorporate disciplines outside the traditional departments, and recommends that "Conservation biology may be best taught at the master's level, where breadth of knowledge, scientific methodology, and problem-solving skills can be emphasized…" We assert here that an essential problem-solving skill that should be taught is a policy orientation involving explicit, practical, applied knowledge of the policy sciences. With a policy orientation as introduced above, conservation biologists should be able to communicate and participate within the public policy dynamic with enhanced creativity and leverage applied to our common goal of preserving biodiversity.

Space precludes a complete description of a sample course that teaches a policy orientation. Our experience in a graduate-level course at Yale University's School of Forestry and Environmental Studies offers one example. Our course was titled: "Species and ecosystem conservation: developing and applying a policy orientation." It sought to educate conservation biology students about the professional, institutional, and policy settings in which they are likely to work. The course surveyed a range of policy and organizational theories, techniques, and contexts using exercises and national and international case studies. It examined the policy sciences, as well as the conservation sciences, in some detail and applied problem-solving concepts and tools to various species and ecosystem conservation challenges. It included a survey of techniques, such as population viability assessment and geographic inventory systems, and how these are used in decision and policy processes. Perhaps the greatest value of the course came from examining cases where good traditional science had failed to lead to effective conservation actions. By explicitly recognizing the limits of science to produce desired results, students were forced to explore and learn about other skills and perspectives that promise to make future biodiversity management efforts more effective.

Our course at Yale is just one example of how a policy orientation can be incorporated into a training program for scientists. We encourage students and faculty associated with similar programs to reach out to colleagues in other disciplines, notably economics, sociology, and political science which share similar interests in conservation and wise management of natural resources. They should collaborate with them in transdisciplinary efforts to examine how

conservation biology can be made more effective.

Conclusion

Given the urgent threats to biodiversity, it is crucial that conservation scientists, managers, administrators, policymakers, and others be as effective as possible. As "the relationship between people and the biological resources upon which their welfare depends" changes (McNeely et al. 1990:16), new methods of addressing conservation issues are required. This changing relationship and its consequences are being appreciated in various ways. For example, Gorbachev (1990:33) said: the "greening of politics is an affirmation of the priority of values common to humanity…and [the development of] a new and contemporary attitude toward nature." An example, on a modest scale, is the origin of the profession of conservation biology. The leadership and professional activities of conservation biologists have much to offer in these uncertain times of extraordinary global environmental change. Nevertheless, we should constantly question how professional conservation biologists can be most effective in meeting the overall biodiversity conservation challenge and bringing about Gorbachev's "new contemporary attitude toward nature." We are convinced that knowledge of how to apply a policy orientation can significantly improve professional effectiveness.

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Mexican gray wolf (*Canis lupus*) by Jim Clark, USFWS

Black-Tailed Prairie Dog Conservation: A New Approach for a 21st Century Challenge

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Abstract

*Black-tailed prairie dog (*Cynomys ludovicianus*) policy is highly contentious. We use the policy sciences to examine how prairie dog conservation became so controversial and suggest ways to increase the prospects for success. We begin by describing the context of prairie dog management — who is involved and how they interact. Stakeholders with diverse values, strategies, sources of power, goals, and demands conflict in their struggle to influence prairie dog management. This conflict stems from the diverse perspectives and interactions of those involved, including ranchers, conservationists, animal rights activists, agency personnel, prairie dog shooters, developers, and the general public. We next examine management and policy responses to the problem. The agencies have begun responding, but are largely offering a replay of old ideas, perspectives, and patterns of interaction that contributed to the decline of prairie dogs. The current mixed federal and state agency program is highly fragmented, and likely will meet with limited success. Progress has been plagued by a narrow focus on biological issues, agency inertia, powerful special interest political forces, and negative attitudes. To improve matters, we suggest keeping participation open and including all stakeholders. We further recommend using adaptive, interdisciplinary, and multimethod approaches. Using a "best practices" approach would capitalize and build on past successes. Only by improving conservation practices can we hope to restore the black-tailed prairie dog to levels that permit it to function as a keystone species across the Great Plains.*

Introduction

The ongoing conflict about black-tailed prairie dog (*Cynomys ludovicianus*) policy is one of the most contentious wildlife conservation issues in the United States. In 1999, the United States Fish and Wildlife Service (USFWS) designated the black-tailed prairie dog as a "candidate species" for listing under the Endangered Species Act (ESA). One journalist said "[S]ome worry that any effort to protect prairie dogs will ignite a range war between endangered species advocates and landowners." Broadly speaking, the overall goal of prairie dog management, and the assemblage of associated species (i.e. the prairie dog ecosystem), is to ensure the ecosystem's viability in well-distributed populations in ways that benefit from broad public support (Clark et al. 1989). Achieving this goal is proving very difficult in practice because "Today's West is at war over natural resources, with wildlife the refugees" (Frasier 1999:A8). How did this issue move to the top of controversies? In this paper we examine this and other questions and suggest ways to achieve prairie dog conservation in a more cooperative, practical way.

We begin by describing the context of prairie dog management — who is involved and how they are interacting. Next we examine management and policy responses to the problem. Finally, we offer recommendations to improve matters. We use the policy sciences in our analysis, which requires that we address both the content (e.g., biology) and procedures (e.g., human interaction) involved (Clark et al. 2001; Clark 2002). We have more than 35 years combined experience in prairie dog management. We seek to contrib-

ute constructively to prairie dog conservation, lessen the conflict involved in the current effort, and achieve a successful conclusion in the common interest.

Who is involved? What are their perspectives?

For decades prairie dog policy was characterized by stability. Soon after Europeans began settling the Great Plains to ranch and farm, the U.S. Government embarked on a campaign to eradicate prairie dogs. At that time, around 1900, biologists estimated that prairie dogs inhabited 41 million hectares (Mac et al. 1998). Prairie dogs were classified as agricultural pests. Near consensus existed among scientists (most employed by the United States Department of Agriculture), livestock ranchers, and other appointed and elected government officials that these rodents consumed as much as 50 to 75% of the forage available for cattle and must be diligently controlled (Division of the Biological Survey 1902; Merriam 1902; State of Colorado 1915; Jones 2000).

The prairie dog issue became salient because the situation changed; new players with a new set of demands gained power in the political arena. By 1960, prairie dog populations had dwindled to about 600,000 hectares — a reduction of more than 98%. The 1960s also brought a rise in citizen environmental consciousness with social movements devoted to reducing industrial pollution and saving declining species. The new science of conservation biology emerged and often conflicted with science serving industrial and agricultural constituencies. Though the U.S. had some early wildlife conservation laws on the books (e.g., the Lacey Act of 1900 protected some game animals and the Migratory Bird Treaty Act of 1918 regulated hunting of designated birds), the 1973 Endangered Species Act brought a sea change with sweeping protection for plant and animal species deemed endangered or threatened.

The contemporary prairie dog sociopolitical arena reflects a tension rooted in these shifts. In 1998 black-tailed prairie dogs covered only 280,000 to 320,000 hectares (Biodiversity Legal Foundation 1998; National Wildlife Federation 1998). The further decline of prairie dogs is no longer universally viewed as the success of science and technology to control an agricultural pest, but also as a failure to protect a species important to an entire ecosystem. The data and what they mean for policy are highly disputed among interested groups. The movie *Varmints* captures much of the conflicting views of people involved in contemporary prairie dog management (Hawes-Davis 1998). The complexity, and conflict, stems from the diverse perspectives of people now involved and the way they choose to interact with one another. Currently, many well-organized groups hold deeply-felt, but contradictory views on prairie dog management. To understand the issue requires that we know who is involved and why. Each participant has a unique vantage point, holds special interests, and often "defines" the problem in a narrow and incomplete manner that reflects these interests; thus each viewpoint proposes a different solution (Weiss 1989).

Ranchers

The agricultural industry generally wants prairie dogs eliminated or held at low numbers. Ranchers believe that prairie dogs reduce forage and crops available for their livestock and livelihood. More broadly, they feel a changing economy and culture threaten their traditional lifestyle. They also see that they are losing control over public and private grazing lands, particularly when species are protected under the Endangered Species Act. Ranchers' views of prairie dogs are an outgrowth of a worldview that promotes domination over nature, libertarianism, an endless frontier, and the control of nature for economic gain. Ranchers use their beliefs, the powerful symbol of the American cowboy, and their traditional influence over local politicians to support their interests.

Conservationists

These participants view prairie dogs as a native keystone species and demand their protection. They tend to be motivated to conserve and expand prairie dog populations because of their importance to prairie ecosystems. The root of this viewpoint lies in assumptions and philosophies associated with ecological and conservation thought, the right-to-existence for all organisms, and changing human relationships to the natural world (Kellert 1995). The myth challenges other popular and powerful myths that define quality of life in solely economic terms, instead arguing that society should balance some economic growth for a healthy environment. Powerful symbols include wilderness, endangered species, and charismatic animals. Proponents largely distrust and often vilify big business (e.g., corporate America) and natural resource extractors, including many, if not most, ranchers.

Animal rights activists

Animal rights activists want decreased human impact on the environment and desire an end to pain and suffering to prairie dogs caused by poisoning and other extermination methods. They support extending legal rights to animals that are now reserved for humans (Wise 2000), including prairie dogs. The views of animal rights activists can be traced to the urban animal welfare movement, and developed into a powerfully organized interest in the last few decades (Rudacille 1998). These stakeholders, often in conjunction with conservationists, demand increased involvement in wildlife and public land management and often use lawsuits, media publicity, and appeals to public

pressure, including citizen ballot initiatives, to achieve their interests.

Agency personnel

Federal, state, local, and tribal agency personnel hold personal views that vary greatly, but can be quite similar within a single agency. Despite multiple use mandates, most agencies are strongly influenced by a more limited number of special interests (e.g., hunters, loggers, miners, or ranchers), and this influence is manifest in policies that often clash with the common interest (Meier 1993). In extreme cases, this leads to agency "capture" by a special interest group that the agency was created to manage or regulate (Clarke and McCool 1985). There are also struggles for power among the agencies (Fischer 2000). State, local, and tribal government personnel maintain an interest in maximizing power vis à vis the federal government, especially in the western U.S. Despite these differences, some broad generalizations among agencies are possible. Agency personnel generally embrace the "technical rationalist/expert" role (see Clark 1997). In this view, control of nature for human purposes is both possible and desirable, and professional resource managers should be entrusted with making decisions and manipulating nature. With respect to prairie dogs, formal agency policy at all levels resulted in substantial prairie dog declines over past decades. Today, most agencies seek to keep prairie dogs off the endangered species list, and often this goal appears to be more important than species conservation (e.g., see BLM 2000; EDAW 2000; NGPC 2001). In addition, an anti-prairie dog attitude remains strong among wildlife professionals and especially land managers, but this is changing (Reading 1993).

Recreational shooters

Recreational shooters form a small but vocal stakeholder group. They want prairie dogs to be abundant enough to serve as live targets for their shooting. Shooters view themselves as highly skilled agents of control for agricultural pests and identify with the agricultural community. They mostly embrace a libertarian view, one that is an offshoot of the frontier/cowboy worldview. Prairie dog shooters want free access to public lands for hunting with minimal government regulation, and they support continued shooting opportunities provided on many public lands and Indian reservations. They influence prairie dog management by actively promoting their interests and enlisting support of ranchers, gun rights activists, and local businesses that benefit from their pursuits.

Black-tailed prairie dog (*Cynomys ludovicianus*) by Richard P. Reading.

Developers

Developers play a restricted role in the prairie dog management debate, but they are key stakeholders along Colorado's Front Range, for example. Developers focus on generating wealth for themselves and view prairie dogs as pests that interfere with urban development. As housing tracks are put in, prairie dogs are killed or relocated. Developers are searching for inexpensive solutions to the prairie dog management challenge that will permit them to continue developing land (e.g., exterminate or move animals in the way of development).

General Public

The American public is diverse, and most citizens are unaware of the prairie dog conservation problem. However, public support for conserving wildlife is strong. For example, a survey by Czech and Krausman (1997) found 84% of the public support the current ESA or would like it strengthened. Some publics, such as homeowners living near urban prairie dog colonies, are a part of the development debate. Zinn and Andelt (2001) found that support for prairie dogs increased with the distance respondents lived from prairie dog colonies in the city of Fort Collins, Colorado. Alternatively, some of the most vocal supporters of prairie dogs in urban environments are people living near the colonies who like to watch the animals or recognize their ecological importance (Prairie Dog Coalition 2002). Fox-Parrish (2002) found that antagonism toward prairie dogs increased as their exposure to and experience with prairie dogs increased among the general public in rural Kansas. Many Native Americans with traditional cultural beliefs consider prairie dogs to be a species with which they are intimately interconnected. They demand that everyone can and should be more connected to nature, that all species are important, and that therefore the tribes are obligated to protect and restore native communities on reservation lands.

Prairie dogs

Black-tailed prairie dogs are participants in this issue too, as are a myriad of other associated species. Prairie

dogs are one-kilogram ground squirrels that live in colonies of strongly defended family groups, known as "coteries" (Hoogland 1995). One of five species of prairie dogs, the black-tailed form is the only species that inhabits the Great Plains, ranging over most of the short and mid-grass prairies from southern Canada to northern Mexico. Because they are colonial and live in burrows they excavate, and constantly clip tall vegetation, prairie dogs alter the grassland ecosystem's structure, processes, and composition (Kotliar et al. 1999). To ecologists, these changes indicate their importance as a "keystone species" that enriches ecosystem function in a unique and significant way disproportionate to their abundance (Miller et al. 2000). Their interest, to the extent their interest can be known, appears to be for continuation of their species and individual well-being. Miller and Reading (2002) list eight threats facing black-tailed prairie dogs: continued habitat destruction; uncontrolled recreational shooting; introduced diseases (especially plague); inadequate regulatory mechanisms by government agencies; continued and widespread poisoning; the inability of prairie dogs to respond evolutionarily to present threats; lack of adaptive management; and negative attitudes toward prairie dogs.

Right or wrong, humans will decide the prairie dogs' fate. The categories delineated above provide a general characterization of the players involved in prairie dog policy. Many participants fall into more than one category; much variance exists within categories. Intensity of belief and the degree to which individuals are willing to work with other groups vary as well. However, conflict and polarization largely typify interactions between groups in the prairie dog policy arena that have included lawsuits, arrests of activists at protests, and even threats of violence (Gutierrez 1998; Proskocil 1999; Fong 1999). While some debate can be constructive, unmanaged conflict can erode trust in government institutions and lead to policy failure.

Prairie dogs as a policy problem

Defining the prairie dog "problem" practically is a challenge. As Weiss (1989:97) noted, "problem definition is a package of ideas that includes, at least implicitly, an account of the cause and consequences of undesirable circumstances and a theory about how to improve them." Key questions include: "Just what is the problem?;" "How big is it?;" and "Who is it a problem for?;" as well as "What might be done about it?" Prairie dog conservation is about making choices, like "How will the prairie dog ecosystem be managed?" and "Who gets to decide?" In other words, it is largely a human value problem in decision-making, although many technical elements are involved. In fact, much of the behind-the-scenes politics is masked by technical discussions. The answers to the last two questions are determined by who has authority and, especially, control of the management process. Authority means having the right to make a decision, and control means having the power to carry out an action in the face of opposition.

Prairie dogs on the political agenda

Black-tailed prairie dogs made it onto the U.S. political agenda as a conservation issue in 1998 when several conservationists petitioned the USFWS to list the species as threatened under the ESA (National Wildlife Federation 1998; Biodiversity Legal Foundation et al. 1998). The USFWS had rejected an earlier petition filed by Biodiversity Legal Foundation and Sharps (1995).

Following the second petition, all participants positioned themselves either for or against the petition and utilized their resources to substantiate or refute its claim that prairie dogs were or were not in need of special help. In some cases, participants recognized that prairie dogs needed protection, but stated that they favored local control over federal listing as the best way to manage the species. Persuasion as well as coercion were used to influence the evolving definition of the prairie dog conservation "problem," shape a preferred "solution," and control the overall decision-making process to the maximum extent possible (see Clark 1997). Attention during this phase focused on the USFWS. Ranchers and government agencies, especially state agencies, largely opposed listing. The states, in particular, banded together to form an anti-listing coalition.

Caught between savvy conservationists, ranchers, and state governments, often backed by their representatives in the U.S. Congress, the USFWS took the most risk-averse path. The agency decided to designate the species as "warranted" for listing as threatened under ESA, but "precluded" it from listing because of other, higher priority species that needed attention first (USFWS 1999). The USFWS appeared reluctant to grant prairie dogs candidate species status, and so far has abdicated its responsibility to protect a species it accepts as meeting the requirements for ESA protection. The USFWS's 90-day and 12-month findings supported a definition of the problem as articulated in the petitions, that prairie dog populations had indeed declined by as much as 99% due to threats including habitat loss, plague, inadequacy of existing regulatory mechanisms, and long-term rodent control (USFWS 1999; USFWS 2000). This move sent shock waves through the Western cattle and real estate industries (Matthews 1999:8). The "warranted, but precluded," or candidate species, designation focused the controversy that had been brewing for years and fueled great activity by agricultural interests, government land and wildlife management agencies, nongovernmental conservation organizations, scientists, and others (e.g., Predator Conservation Alliance 2001; Thacker 2001; Prairie Dog Coalition 2002).

The agencies respond

In response to the candidate species designation, federal land management agencies made some prairie dog management changes. The U.S. Forest Service declared a temporary moratorium on poisoning prairie dogs within National Grasslands. The U.S. Bureau of Land Management also ceased poisoning prairie dogs on land it manages, and both agencies began more active prairie dog conservation, such as temporary shooting bans. The USFWS recommended including incentives for landowners in the 2002 farm bill to pay landowners for helping to conserve prairie dogs. But the USFWS basically turned prairie dog management over to the states that had lobbied for control of implementation, moving the states to center stage. A directive to them that "doing nothing" was not a policy option accompanied delegation of authority to the states. The USFWS retains oversight of states' efforts and reviews the status of candidate species each year.

The states have begun responding to the USFWS's "warranted, but precluded" ruling, but progress toward prairie dog conservation has been slow. The 11 states within the range of the black-tailed prairie dog formed the Interstate Black-tailed Prairie Dog Conservation Team and produced a conservation plan, the "Black-tailed Prairie Dog Conservation Assessment and Strategy" with subsequent draft addendums, to conserve the species and address factors causing its decline (Van Pelt 1999; Luce 2001a, 2002). The draft interstate plan's main goal appears to be to prevent listing prairie dogs under the ESA and the associated loss of control over management (Miller and Cully 2001). That goal arguably takes precedence over recovery of the species — a classic case of goal substitution driven by competition for power. Throughout the draft plans, recovery is never discussed as such; instead, the plans refer to prairie dog conservation with respect to precluding the need for listing under the ESA (Luce 2002).

The objectives of the draft interstate plan ". . . set an adaptive management strategy target to increase occupied acreage [of prairie dog colonies] to exceed 1% of historic range in the next 10 years (by 2011)," while stating that present acreage figures are "slightly less than 1% of historic (Luce 2002:13)." Thus, the plan is striving for a vague goal that is just marginally better than the status quo. In addition, the plan never clarifies how success or failure in adaptive management will be assessed, or how the plan will be adapted or terminated. The draft interstate plan goes on to call for conducting additional research and monitoring, identifying focal areas that contain high densities of prairie dogs, creating financial incentives for cooperating landowners who conserve prairie dogs, and increasing regulation of and oversight over prairie dog shooting and poisoning (Luce 2001c, 2002). The draft plan also permits unrestricted shooting and calls for providing money to cooperating landowners for poisoning, even if a state remains below its target objectives for prairie dog acreage.

After three years, the interstate plan remains in draft form, but all states are developing conservation plans and some states have begun taking action (Luce 2001b). For example, a few states have removed "pest" species designations from prairie dogs and others are working toward that end (Predator Conservation Alliance 2001). A number of state agencies have also started regulating prairie dog poisoning and shooting, which were formerly unlimited (Luce 2002). Arizona, Colorado, and South Dakota have already banned shooting for part or all of the year, primarily on public land (Luce 2002). In 2002, Colorado started a $600,000 pilot program that uses lottery money to provide financial incentives to landowners that conserve prairie dogs (Davis 2002). Other initiatives include developing education programs and exploring the use of regulatory amendments to the ESA to encourage participation by landowners, tribes, and state agencies, such as Candidate Conservation Agreements with Assurances.

Annual reviews by the USFWS and states claim the agencies are making adequate progress (USFWS 2001; Luce 2001b). Indeed, some progress has been realized at the federal and state level, but it has been slow to arrive. Conservation efforts thus far have been largely evaluated by the agencies themselves; a task ideally conducted by an external organization with no stake in the outcome (Kleiman et al. 2000). Montana, North Dakota, South Dakota, and Wyoming already claim that they exceed the target figures laid out in their individual state plans. (Luce 2002). Colorado and Wyoming suggest they already exceed the draft interstate plan's target figures (CDOW 2002; Luce 2002).

What the states have so far proposed and carried out is necessary for prairie dog conservation, but far from sufficient. Calls for more research, frequent meetings, and regular revising of the draft plan give the impression that the states are working toward conservation goals, but these activities are not substitutes for effective policy and real action. The draft interstate plan promotes traditional decision-making, without fully addressing how the states will reverse their lack of success in protecting the prairie dog ecosystem to date. Instead, the interstate plan, the perspectives behind it, and the interests it serves, offer a replay of old ideas and patterns of interaction that have for decades contributed to the decline of prairie dogs. As a result, current prairie dog conservation efforts are plagued by a narrow focus on biological issues, agency inertia, powerful special interest political forces, and negative human attitudes toward prairie dogs. In addition, agencies have dominated conservation planning, with little input from other important stakeholders.

One of the most significant deficiencies of the interstate and individual state plans are their failure to provide mechanisms for addressing the sociopolitical factors affecting prairie dog conservation policy. The plans fail to establish how the states will manage their political environments, such as powerful conservative governors, agricultural lobbies, urban and suburban developers, and conservation interest groups. For example, how will the interstate plan address the fact that politically powerful stakeholders (e.g., ranchers) hold strongly negative attitudes toward prairie dogs that leads them to continue fighting conservation initiatives and arguing for continued poisoning (e.g., see Reeder 2002). Both state and federal agencies have pitched simplistic solutions to this problem. For example, the agencies advocate landowner incentives as a primary tool to protect the species. While potentially helpful, incentives are insufficient, as they do little to address the underlying negative attitudes toward prairie dogs held by many stakeholders (Reading et al. 1999; Lamb et al. 2001; Fox-Parrish 2002). Ranchers are already resisting voluntary measures, even financial incentives that reward prairie dog protection on private land (Omaha-World Herald 2002). Indeed, an incentive program in Colorado was largely unsuccessful in finding ranchers willing to participate, possibly because they dislike prairie dogs for far more than financial reasons (e.g., prairie dogs are seen as symbols of poor land stewardship, a loss of control over public and private land, outsiders telling them what to do, and threats to their lifestyles; Reading and Kellert 1993; Reading et al. 1999). There is a also risk of non-compliance to new rules, especially poisoning and shooting restrictions that are difficult to monitor on huge swaths of private and public land.

Overall, the draft plan currently offers little that is new, creative, and helpful in maximizing cooperation among stakeholders. The plan offers no recognition of these complex and contentious sociopolitical variables and no methods to provide policy-relevant information about them. This is not surprising, given the traditional, biological focus of the training that most conservationists and wildlife and land managers receive (Clark 2001). However, the states ignore sociopolitical variables at their own peril.

Inattention to the relevant social context can lead to increased tension and ultimately policy failure. Problems exist that impede prairie dog conservation. Some states face hostile state legislatures and commissions. For example, in 2001 the Wyoming Game and Fish Commission voted to bar the state from endorsing the states' conservation plan. And recently, Wyoming joined North Dakota and Colorado in withdrawing from the official interstate effort, calling into question the new organization's ability to coordinate effective regional conservation. In addition, animal rights and conservation groups have sued to gain protection for prairie dogs resulting in resource intensive court battles for federal and state agencies (McCullen 2000).

Currently, the prairie dog program is on a fixed course and there seems to be no effort by either the federal or state agencies involved to seek out more effective management in the common interest. The program chosen is the most conservative and the closest to the status quo as possible. Moreover, it is failing to advance the common interest in ensuring the survival of prairie dogs and the viability of prairie dog ecosystems in ways that benefit from broad public support.

How can prairie dog conservation be improved?

The prairie dog conservation challenge is complex and contentious and it likely will not yield to more government bureaucracy. The practical problem at hand now is to decide what can be done to improve matters.

One of the biggest challenges is convincing the key participants that achieving broad public support for and realizing prairie dog conservation is in the common interest and in their own interest. For example, how will ranchers, who see prairie dogs and prairie dog conservation as threatening to their livelihood and lifestyle, ever tolerate prairie dog protection policies? Why should conservationists care if enacted policies receive broad support when for many the goal is conservation using science not public opinion as indicators, regardless of the level of coercion needed to achieve it? Opponents resistant to popular conservation proposals risk provoking more coercive regulations — such as ESA measures — which they despise. They also risk losing some popular support for agricultural programs that are increasingly contested by the conservation community. On the flip side, even strict prairie dog protection codified by the ESA is likely to fail without the political will needed to effectively implement and enforce enacted policies. It is the state and federal agencies, those formerly charged with eradicating prairie dogs that will have discretion over the application of prairie dog conservation measures.

We recommend building new cooperative relationships and expanding on successful practices to date — "practice-based" approaches. Practice-based conservation is adaptive management at its best. It involves finding and taking advantage of opportunities that exist or can be created to address problems. Practice-based conservation involves three steps, each of which requires on-going evaluation (Kleiman et al. 2000). First, participants identify the "best practices" being employed. Second, these are adapted and applied to similar circumstances elsewhere in the prairie dog's range. Finally, the most effective practices are diffused as widely as possible, where professionals continue to

adapt, refine, and upgrade them relying on their own experience. Such adaptive management should be carried on endlessly. Thus, the prudent way for conservation to proceed is to find and continually upgrade performance in the light of experience (Clark and Brunner 1996). Independent evaluations of policies and practices are essential to prevent self-serving appraisals. "Watch dogging" the agencies and helping them to learn and upgrade their performance is necessary. We have chosen to highlight a few of what we consider "best practices," each of which could be improved through evaluation and refinement.

Outcome-driven initiatives

While the federal and state governments have not considered alternatives to the interstate prairie dog plan, some bottom-up approaches are worth considering. Several private individuals and organizations have initiated conservation projects for black-tailed prairie dogs in recent years. For example, several recently created land trusts focus on conserving wildlife and ecosystems. With respect to the prairie dog ecosystem, the Southern Plains Land Trust was founded in 1998 to capitalize on the relatively low price of land in and around southeastern Colorado. They focus on land inhabited by prairie dogs and located close to large blocks of public land. Their experience has much to offer others involved in prairie dog conservation. Similarly, other non-profit organizations, such as The Nature Conservancy, and for-profit organizations, such as Turner Enterprises, Inc., are purchasing land and working to restore prairie dogs and their associated species. They and their collaborators have taken an experimental approach to restoring the prairie dog ecosystem that promises to benefit similar restoration efforts throughout the range of prairie dogs (Truett et al. 2001).

Process-focused initiatives

Opening up a dialogue between traditional antagonistic stakeholders holds the promise of reducing unproductive conflict and stimulating discussions that can help dispel inaccurate myths and build bridges for conservation. Such dialogues must occur in "safe-harbor" situations, where people feel safe to come together and freely state their true opinions without resorting to rhetoric (i.e. opening "real" dialogue among stakeholders). For example, in 1999 the Denver Zoological Foundation and the Northern Rockies Conservation Cooperative held a daylong workshop at the Denver Zoo on prairie dog conservation. Participants included representatives from the Western Governor's Association; ranching, animal rights, environmental, and conservation organizations; and tribal, city, county, state, and federal government agencies. Many of these individuals and groups had never met in such a setting before. Although the workshop was a modest beginning, it succeeded in bringing together diverse interests, in sharing values, concerns, and strategies for addressing prairie dog management, and in opening a dialogue for future collaboration, coordination, or at least communication. Unfortunately, this process was discontinued, but it serves as a model that could be duplicated and expanded in the future.

Process/outcome initiatives

Montana was the first state to set up a prairie dog working group to seek appropriate conservation and management of prairie dogs within the state. The group recently put together a management plan (Montana Prairie Dog Working Group 1999), which involved state and federal agencies, tribal representatives, conservation organizations, and private interests and builds on the Montana Prairie Dog Management Guidelines developed in 1988 by the Montana Black-footed Ferret Working Group (1988). Focusing on both prairie dog species (black-tailed and white-tailed) that inhabit Montana, its goal is "for the state of Montana to provide for management of prairie dog populations and habitats to ensure long-term viability of prairie dogs and associated species." Five objectives follow and a strategy to meet each objective is outlined. Annual review is required. Although lacking in some areas, the plan is the product of a cooperative effort among diverse interests over several years and is arguably the best state plan currently addressing prairie dog management. More importantly, it provides a basis for upgrading conservation planning and implementation in the future.

Several other best practices should be identified, adapted, and spread among participants in prairie dog conservation efforts. Particularly important areas for analysis include federal agricultural policies (including both working to halt perverse agricultural subsidies that encourage prairie dog eradication and creating incentives for landowners that manage their properties for prairie dog conservation), initiatives on tribal lands, actions undertaken at the city and county levels, federal land management (including national grasslands, wildlife refuges, parks, and monuments, as well as lands managed by the BLM), and applied research, especially on managing introduced diseases. We suggest holding well-mediated, problem-oriented workshops on each of these issues to facilitate the process.

Finally, prairie dog conservation requires sound leadership at all levels. Leaders should strive for a strong, open, objective, fair, and competent leadership style. Westrum (1994) refers to such competent, dynamic leaders as "maestros." Maestro coordinators could greatly improve both social and decision processes in prairie dog conservation efforts by facilitating information flow, communication, coordination, efficient use of resources, the identification and dissemination of best

practices, and more. Quality leadership at state levels is also required for similar reasons.

Conclusions

Black-tailed prairie dog populations have declined dramatically and become increasingly fragmented over the past century. That decline has important implications for the entire ecosystem because of the prairie dog's role as a keystone species. The USFWS recognized the plight of the prairie dog in 1999 by declaring the species warranted for listing under the ESA. However, the USFWS also precluded such listing, stating the need to focus on other, higher priority species. Prairie dog conservation is highly contentious, wherein stakeholders with diverse values, strategies, sources of power, goals, and demands conflict in their struggle to influence the prairie dog management process. The current mixed federal and state agency program is highly fragmented, especially among the federal and state governments. The current program likely will meet with limited success. We recommend a more innovative response.

We suggest that prairie dog conservation is more likely to succeed if participation remains open and includes the full range of stakeholders. This requires movement toward adaptive, interdisciplinary, and multi-method approaches. We provide recommendations for using a "best practices" approach that capitalizes and builds on activities that have already proven successful in prairie dog conservation. Using workshops and a more representative, open, and flexible organizational structure offers a better chance for resolving the conflict of values currently dominating prairie dog conservation and moving more quickly toward more effective and efficient practices that are acceptable to more stakeholders. Despite recent attention to the plight of the black-tailed prairie dog, the species continues to decline across most of its range. We must improve conservation practices if we hope to restore the black-tailed prairie dog to levels that permit it to function as a keystone species across the Great Plains.

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Great Ape Conservation in Central Africa: Addressing the Bushmeat Crisis

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Abstract
*The commercial trade in bushmeat presents an immediate and rapidly growing threat to Africa's great apes and other wildlife. Unresolved, this trade risks extinction of many ape populations within 10 to 20 years. Although great apes, including gorillas (*Gorilla gorilla ssp.*), chimpanzees (*Pan troglodytes ssp.*), and bonobos (*Pan paniscus*), make up only one to four percent of the widespread trade in wildlife, they are a key focus of this problem for a variety of cultural, economic, ecological, political, medical, and ethical reasons. A solution to the bushmeat crisis requires changing the outcome of many existing decision processes involving diverse participants. This requires a multilateral and interdisciplinary effort to find and support actions that are appropriate, effective, and respect each nation's decision-making authority. This paper examines the decision process for this issue and recommends ways to resolve the problem, including information coordination, development of nutritional and economic alternatives for urban people, and public awareness campaigns across Africa and the world.*

Introduction
The great apes and other wildlife are disappearing from large areas of Central Africa, largely due to hunting for bushmeat. Conservationists seek to maintain remaining wildlife and restore populations back to healthy, viable levels in ways that benefit from lasting public support (Robinson and Bennett 2000; Bushmeat Crisis Task Force 2002). Achieving this common goal is difficult given the rate of wildlife loss and magnitude of forces driving bushmeat hunting. Many areas now contain little wildlife, a condition known as the "empty forest syndrome" (Bennett et al. 2002:28). This conservation crisis is an outcome of many choices by many people that together form a complex decision process that must be understood and addressed if the crisis is to be resolved. Resolution of the crisis also requires addressing growing nutritional, educational, and other local demands. Despite the fact that the majority of wildlife species hunted are elephants, duikers, pigs, rodents, and other primates, Africa's great apes (gorillas, chimpanzees, and bonobos) dominate media coverage of the bushmeat crisis (Stein and BCTF 2001), perhaps due to morphological, behavioral, and genetic closeness between humans and apes (Beck et al. 2001). This focus is also important for cultural, economic, ecological, political, medical, and ethical reasons (see Noss 1998; Gao et al. 1999; Auzel and Wilkie 2000; Eves and Ruggiero 2000).

This paper gives a brief overview of the bushmeat crisis, especially with respect to great apes, its context, and ways to improve conservation. We use the learning and analytic approach described by Clark et al. (2001) and Clark (2002) to examine and present this case. This empirical, systematic approach is problem oriented, contextual, and multimethod. It has been used to understand and improve other complex conservation challenges in an interdisciplinary manner.

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The context of the great ape crisis

The bushmeat crisis is caused by humans making decisions to hunt and consume animals, almost to the point of extinction in some instances. A complex set of choices stands behind these decisions. Before examining these decisions, it is essential to understand who is involved in the problem, how, and why. This requires that we look briefly at the human context of the species loss problem.

The people involved — the social context of the problem

Examining the human social process allows us to understand who is involved, as well as their perspectives and values, the situations in which they interact, the strategies they use to achieve their goals, and the outcomes and effects of these interactions (Lasswell 1971). These features comprise the social process of the bushmeat crisis and embedded in this social process lie the solutions for this conservation and development problem.

There are many participants in the bushmeat crisis. Among them are the great apes themselves, hunters, traders, market sellers, urban consumers, governments, multinational corporations, and international conservation organizations. Participants include local, national, and international stakeholders. Logging companies, their financing institutions, and employees, for example, play a key role in facilitating the bushmeat trade, as these operations expose areas of forest historically off-limits to hunting and construct roads that facilitate rapidly transporting wildlife meat out of the forest and into urban centers. Other participants, including international coalitions such as the Bushmeat Crisis Task Force (BCTF), have recently grown in importance in this process. In thinking about how to resolve the problem, both temporary and permanent solutions lie within this set of participants.

Participant perspectives are as varied as they are numerous. The range of perspectives across government personnel are linked in complex relationships that determine the nature of their participation in the bushmeat crisis. These include national and international nongovernmental organizations (NGOs), industry developers (e.g., timber, mining, rail), and the public (bushmeat consumers in and out of Africa as well as foreign consumers of the products of natural resource exploitation). Examining the interaction of these relationships in greater detail is crucial to identifying potential solutions. It is important to note that the basic beliefs and worldviews of people involved in this issue are often at odds. Most Western conservationists adhere to a view of global scarcity that calls for conserving biodiversity to maintain ecological and human health. In contrast, many African communities have a perspective of local abundance (BCTF 2000) that guides their use of natural resources. Perceived responsibility for conservation in many of these communities rests outside the community and either belongs to some supernatural entity or with the government authorities (Mordi 1991). Their practices are justified in terms of well-being, survival, and security.

Participants interact in various situations; some are disorganized, while some are organized. The bushmeat trade extends from groups of hunters in the Central African rainforest to Central African logging concessions where the transport of meat is often facilitated via logging roads and vehicles. The meat is then transported to roadsides and small markets and then to urban restaurants and "chop bars" where the meat is consumed. Other participants, such as the international community, may be organized and interact in other political, economic, or diplomatic contexts, by designing policies or laws that affect land use, or in designing global agreements to protect endangered species.

All people possess and seek basic values, regardless of where or when they live. Lasswell (1971) identified eight base values that influence human behavior — power, enlightenment, wealth, well-being, skill, affection, respect, and rectitude. Many participants in the bushmeat trade are motivated by wealth and well-being. Many consumers are purchasing bushmeat to meet basic nutritional needs, as this is the only affordable source of protein available in markets, often costing less than domestic protein sources (Wilkie 2001). Most hunters, traders, and sellers are engaged in the bushmeat trade because it is a lucrative business. The cash generated is significant — it has been described as a billion dollar industry in Central Africa alone (Wilkie and Carpenter 1998). In contrast, scientists and the international community are driven by rectitude and enlightenment values. These values may be at odds with traditional and even the modern value systems of African societies.

Field researchers have discov-

ered that gorilla populations cannot be adequately protected if their existence is perceived as an obstacle to the well-being of human beings sharing the ecosystem (Tutin and Vedder 2001). There are attendant costs (such as crop raiding by gorillas and conflicts over conversion of gorilla habitat for agricultural production) for these local communities that, understandably, are interested in improving their family's standard of living in the short term through activities such as development, agriculture, and livestock grazing. In addition, some human populations that previously held taboos against hunting and eating great apes have ceased following these traditions and have begun eating these animals as human populations and the demand for affordable protein increases (Bowen-Jones 1998; Tashiro 1995).

Participants in the process utilize different strategies to obtain immediate and long-term goals. The international community engages in strategies of communication among elites of governmental and non-governmental organizations, as well as the general public. Conservation organizations, for example, may use education campaigns to assist key decision makers and the public's understanding of the ecological and social impacts of the bushmeat crisis. Bushmeat hunters, traders, and market sellers engage in primarily economic strategies, like maximizing their income, to indulge their chief values. Despite arguments for the economic contributions of the bushmeat trade to rural communities, the majority of wealth actually accrues to the traders and market sellers in urban centers, not to local people: "Access to capital allows traders to supply new hunting technology (e.g., guns, wire snares, flashlights, etc.) to hunters, who frequently remain in continuous debt to the traders…This debt peonage serves to increase hunting intensity", (Robinson and Bennett 2000:511). Not only is the income from bushmeat for local communities limited, this commercial trade removes a valuable protein source from subsistence communities. In the end, wildlife is destroyed and community values regarding the importance of wildlife for future generations are permanently compromised.

Choices involved – the decision context of the problem

The bushmeat problem is the outcome of many choices made by many people. To solve this problem, the current decision process must change so that choices made are life sustaining, not life destroying. A critically important question emerges: *Where is the most important point(s) of entry to effect change in the bushmeat crisis?* To identify areas for intervention, it is helpful to divide the decision process into smaller components and analyze each. Brewer (1983) identified six functions that make up a complete decision process — initiation (start up), estimation (defining the problem), selection (the plan), implementation (work in the field), evaluation (monitoring and appraisal), and termination (solving the problem and moving on or changing tactics). The decision process for a particular issue may pass through these functions more than once or simultaneously as the problem evolves.

It is difficult to identify when the bushmeat decision process was initiated. There were at least two initiation phases for this issue from an international perspective. The first was within the scientific community. In the early 1990s, Robinson and Bennett (2000) offered a global perspective of the bushmeat trade as a response to increasing awareness about unsustainable trends in wildlife exploitation. Although there were limited pockets of interest in the bushmeat issue from a public standpoint (i.e. media), a second, more likely initiation of the issue was the announcement that HIV/AIDS was linked directly to chimpanzees in Africa (Gao et al. 1999). This dramatic announcement and the potential links with the bushmeat issue galvanized a rapidly expanding effort to understand and address the crisis.

Throughout the late 1980s and early 1990s, research was conducted in Central Africa and around the globe (Robinson and Bennett 2000). The estimation phase included studies aimed at defining the problem, understanding its scope, and projecting its long-term impacts. Similar assessments took place throughout East and Southern Africa during the mid to late 1990s (Barnett 2000). Many people were surprised to learn that a bushmeat crisis was occurring in these regions as well.

Selection and implementation activities are currently underway internationally and locally. Many significant actions have recently taken place internationally, including actions by The World Bank, African Heads of State, CITES, and the IUCN. Four examples follow.

In 1998, the World Bank convened the first meeting of the Chief Executive Officer's ad hoc Forum on Forests. The World Bank considered this a critical step toward forging a working partnership between international forest industries and environmental and social development organizations. Working Group # 3ii on Tropical Africa continues to facilitate dialogue on sustainable forest management options, including wildlife management and the bushmeat trade and how such initiatives can be implemented in the Congo Basin (World Bank 2002).

Second, the Yaoundé Declaration was signed in 1999 as the result of the six nation Yaoundé Forest Summit. This event, organized by the

World Wildlife Fund, brought together heads of state from Central Africa to explore sustainable management of the Congo Basin. The Declaration committed signatories to implementing measures to protect these important landscapes. Following this historic event, ongoing policy initiatives, including alliances between groups such as World Wildlife Fund and the World Bank, are defining ways to implement the 12-point Declaration (WWF 2000).

Third, in Nairobi in 2000 at the 11th meeting of the Conference of Parties of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the international community agreed that there was clear evidence of illegal, widespread, and unsustainable trade in bushmeat, including endangered and threatened species. The Conference was particularly concerned about the trade's impact on endangered animals, such as elephants and the great apes. In response to this threat, the Parties agreed to form the CITES Bushmeat Working Group with the aim of identifying solutions that can be willingly implemented by range states (CITES 2001).

Finally, the World Conservation Union (IUCN) adopted a Bushmeat Resolution (IUCN 2000), originally drafted by the Bushmeat Crisis Task Force, recognizing bushmeat trade as a complex cultural and socio-economic issue that represents one of the world's most pressing conservation problems. Since then they have held a joint workshop with the Food and Agriculture Organization in an attempt to review the status of major taxa and identify an action agenda for addressing the crisis (IUCN 2000).

This list of international policy decisions illustrates the will to acknowledge the bushmeat issue as a priority focus area at senior political levels. NGOs, local communities, and governments are carrying out specific activities to address the crisis in Africa (BCTF 2002). These projects focus on a range of activities, including education, anti-poaching controls, research, policy development, identifying protein and income alternatives, and creating sanctuaries for apes (a.k.a. orphans of the bushmeat trade).

The evaluation and termination phases of the decision process are the least developed at this time. Although a number of policy and programmatic actions are taking place, there is currently no system for evaluating or communicating evaluation results. There is a clear need for a project that identifies, lists, monitors, analyzes, and disseminates information regarding the bushmeat problem and efforts to address it. Because evaluation has not adequately occurred, no termination or modification can take place (and none has).

Finding common interest goals

Given the complexity of the bushmeat crisis, a common interest goal that a majority of participants might agree to is to achieve sustainable wildlife conservation, including all African great apes, and ensure meeting basic needs [economic and protein] and human dignity for African human communities. Any effective bushmeat program must empower and ensure the health of local communities while simultaneously ensuring the long-term viability of wildlife populations. In addition, we risk species extinctions if we do not take immediate action to curb current trends in commercial wildlife exploitation.

The past, present, and future of the bushmeat crisis

Many causative factors underlie the bushmeat crisis and current trends are expected to continue into the foreseeable future unless effective action is taken soon. A brief examination of past trends, the causative factors behind them, and likely future trends are discussed below. Three trends are highlighted here — ecological, economic, and social-political.

Ecological trends

The last few decades have seen the rapid decline of great ape populations (Bailey and BCTF 2001). Wild chimpanzee numbers have declined from one to two million in 1900 to about 150,000 today (Goodall 2001). Bonobo populations are under severe threat from civil war and declining adherence to cultural taboos (Bailey and BCTF 2001). A number of gorilla populations have experienced significant declines from bushmeat hunting. The low reproductive rate of great apes makes them particularly vulnerable to hunting.

Despite earlier reports recommending the potential for utilization of wildlife as a major source of protein (Cremoux 1963; Asibey 1966), trends in unsustainable hunting have been recorded since the 1970s (Asibey 1974; Hart 1978). Forest ecosystems inhabited by African great apes are extremely vulnerable to over-hunting (Bennett et al. 2002). The low productivity of Central African Forests, especially compared to woodland, savannah, and marine ecosystems, means that these habitats may be unable to meet the future dietary and economic needs of human populations. This trend will likely persist as human populations increase, infrastructure grows, and supply and demand for bushmeat continue rising and causing further unsustainable wildlife harvests and extinction.

Economic trends

Africa is currently unable to meet demands for food through direct production. Insufficient foreign exchange is available to provide sufficient substitutes. As a result, wildlife consumption has increased in many areas to meet basic human needs. The resulting unsustainable exploitation to meet increasing de-

mands drives many local wildlife populations to extinction and causes hunters to exploit species not previously targeted (Ntiamoa-Baidu 1997; Robinson and Bennett 2000). Without engaging and implementing social systems that meet the basic economic and protein needs of Africa's growing populations, not only will many species of wildlife disappear, but also dependent human communities will face food shortages and resulting tragedy.

Improved transport systems and modernized hunting methods have contributed to dramatic increases in wildlife exploitation and resulted in unsustainable harvests in nearly every area where commercial bushmeat hunting occurs (Robinson and Bennett 2000). The combination of the large-scale impacts of international logging operations, the limited capacity for enforcing existing wildlife laws, and the lack of economic alternatives presents a multi-layered challenge to curtailing the trade. These regionally and internationally driven economic trends will likely increase as human populations place more pressure on the world's natural resources.

Socio-political trends

Although the ecological and economic trends above predict a dim future for wildlife populations in general and Africa's great apes particularly, a simultaneous positive trend provides hope. Increasingly, stakeholder groups are improving their ability to leverage power and resources to address conservation issues collaboratively. Expanding use of the Internet for information sharing and the widespread understanding of the need for broad collaboration among stakeholder groups have resulted in unprecedented cooperation among those working to solve the bushmeat crisis. The rise of collaborative initiatives such as BCTF and the Ape Alliance and the effectiveness of their approach exemplify this trend.

In addition, high-level decision makers have demonstrated a shift in perspective and have begun a committed focus on resolving the unsustainable utilization of wildlife. Such efforts include the previously mentioned Yaoundé Declaration as well as the UK Bushmeat Campaign and the US Congressional Oversight Hearing on Bushmeat in the House Subcommittee on Fisheries Conservation, Wildlife and Oceans. The focus of these campaigns include not only the importance of assuring ecological systems that function but also the necessary engagement of private industry and development efforts. International conservation efforts must consider African nations' stated priorities involving development in innovative ways. It is essential that awareness about the importance of ecosystem health and how it relates to human health and economic strength be raised. Although research on efforts toward integrated conservation and development projects have shown limited success (Peters 1998; Browder 2002), current trends suggest the essential nature of assuring a matrix of land-use options including a core system of protected areas coupled with establishment of systems that engage industry developers in environmentally appropriate land use activities. Examples of this include the innovative approaches in northern Congo (Brazzaville) to include wildlife management and bushmeat control programs in logging concessions (Glave 2001) as well as current efforts to address impacts of bushmeat hunting in coltan mining operations in eastern Democratic Republic of Congo.

Recommendations

Improving the bushmeat crisis requires changing the social and decision processes in ways that support sustainable wildlife conservation. Fortunately, a heightened sense of the moral, political, and cultural importance of great apes inspires conservation action. In this light, we evaluate the most practical and justifiable entry points in the decision process.

First, a review of the decision process identified a need for evaluation of current bushmeat policies and programs (Kleiman et al. 2000). This evaluation process is being led by the Bushmeat Crisis Task Force, which plays a significant role in providing timely information to key decision makers, media, wildlife managers, local communities, and others to assist in developing specific actions that directly address the problem.

The Bushmeat Crisis Task Force was established by several of the world's leading wildlife organizations and given a mandate of establishing a network of individuals and organizations from the US, Europe, and Africa involved in addressing the bushmeat problem and providing an information base to help its members identify appropriate solutions and take action. BCTF's primary goals are to: (a) work with its general members to focus attention on the bushmeat crisis in Africa, (b) establish an information database and mechanisms for information sharing on the issue, (c) engage African partners and stakeholders in addressing the problem, and (d) promote collaborative planning, decision-making, fund-raising and actions among the members and associates.

Second, a review of the social context revealed a set of actors who are often at odds with one another's base values, perspectives, and problem identification (Robinson and Bennett 2000). Because the urban market demand for bushmeat is one of the significant driving factors behind the bushmeat trade it is the most likely entry-point for successful mitigation. It is unlikely that hunters will refrain from killing an animal large enough to generate a profit and trans-

port easily (Wilkie and Godoy 1996). If hunting of apes is to end, it will be because they are either no longer available or profitable to hunt.

Developing economic and protein alternatives in areas with high human populations is a primary mitigation technique. Focusing efforts on urban, rather than rural, locales is critical since control programs are likely to have the greatest impact and opportunity for success in urban centers where resources are concentrated and information can be transmitted quickly. Solutions to the crisis should enable increases in the availability of both economic and protein alternatives in urban centers where the demand driving the bushmeat trade originates.

Third, a public awareness campaign is needed that focuses on increased recognition and the eventual reemergence of traditional cultural taboos and totemic status of great apes. Mordi (1991) suggests that conservation action follows a three-phase evolution in developing nations. The first phase is theistic passivism wherein wildlife's abundance is attributed to some external force. Responsibility for wildlife rests outside the individual and society, and with some supernatural force. The second phase, naturalistic passivism, is initiated by Western education and culminates in a general understanding that wildlife can indeed be depleted and that the rate of habitat loss is increasing. Responsibility for wildlife conservation in this phase is seen as belonging to the central government, still outside the individual but within society. In the third and final phase, humanistic activism, concern for wildlife loss is based within the local society and individual. It is brought about by "A combination of widespread education, severe depletion of animals, and an incipient self-recrimination for the imminent loss of the cultural heritage that animals represent" (Mordi 1991:147). The transition to such a phase rests with the middle class. Mordi (1991:148) suggests, "self-blame is precisely the unsettling force which will awaken the educated and economically secure middle class to the urgent need for personal involvement in animal conservation."

To shift African perspectives towards personal responsibility and behavioral changes regarding the bushmeat crisis, a massive awareness campaign is essential. This campaign must be developed by African experts for the African public, and should link the severe depletion of great apes and other species to African cultural heritage. Focusing on the urban middle class may provide a unique opportunity for conservation action, as African societies become increasingly urbanized and, like the rest of the developed world, further removed from the reality of rural communities and natural ecosystems. This is an optimal intervention point for two reasons. First, it enables participants in the bushmeat issue to target efforts in areas of highest human and bushmeat commerce density. Second, this option has a great chance of immediately impacting the target audience in areas where substitutes — both economic and protein — have a greater chance to occurring. In addition, it enables local communities to retain some level of legal wildlife harvest to supplement both income and protein needs.

A focused and effective media campaign is already showing promising results in Ghana, where Conservation International (CI) has led a unique prototype effort (Bakarr et al. 2001). Following a local meeting, community leaders agreed that an appeal to the public that focused on the totemic link of wildlife to ethnic groups would be optimal. Such an approach is exactly what Mordi (1991) described as humanistic activism. The loss of cultural heritage coupled with severe depletion of wildlife and effective awareness campaigns enables understanding of the personal significance of such loss. It is this personal connection with loss that engages people to action through accepting individual responsibility.

CI's Bushmeat Campaign in Ghana has already begun to generate results with significant numbers of chop shop sellers deciding not to sell illegal bushmeat (Okyeame, personal communication). The BCTF is partnering with several institutions, including CI in West Africa, to implement a pilot program called The Bushmeat Promise which provides individuals with a statement of promise to sign stating they will take individual action on the bushmeat issue. These promises will be tracked through a database system to document and further encourage individual responsibility toward addressing the bushmeat crisis.

As discussed above, focusing on great ape conservation is justifiable and practical for multiple reasons. At the most basic level, all species of great apes are either endangered or critically endangered, and all are sensitive to even low hunting rates. Beyond their moral and cultural significance, great apes are also central economically and politically. Great apes can generate enormous funds for wildlife conservation through ecotourism, which can increase local community support for conservation. Furthermore, great apes are the focus of several large-scale conservation funds (US Great Ape Conservation Fund, UNEPs Great Ape Survival Project). Great apes are protected from hunting both nationally and internationally, which provides a political and legislative mandate for conservation. Finally, great apes and bushmeat are at the center of one of the most significant human health issues facing the globe — HIV/AIDS. Protection of Africa's great apes could hold the key to both current and future global human health issues as

populations of primates are found to be living with pre-cursor strains of HIV which may provide a useful link to enabling development of solutions for humans living with AIDS.

Conclusion

The crisis affecting great apes has galvanized participants in a way that few conservation issues have. Solving this crisis will require the collaborative involvement of the private sector, governments, universities, non-governmental organizations, and the general public. In addition, we must understand the social and decision processes surrounding the bushmeat crisis because it is at their nexus that solutions will be found. We identify several methods of addressing this problem. First, we can upgrade evaluation of current bushmeat policy and programs as a basis for improving future intervention. Second, we must generate economic and protein alternatives in areas of high human population as soon as possible. Third, we should carry out an effective public awareness campaign in the urban centers across Africa and elsewhere to develop the broad-scale support necessary for implementing conservation programs.

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Galapagos tortoise (*Geochelone elephantopus*) by Richard L. Wallace.

Projeto Abraço Verde: A Practice-Based Approach to Brazilian Atlantic Forest Conservation

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Abstract
The Brazilian Atlantic Forest of the Interior is experiencing dramatic human pressure as newly landed communities increase farming along the edge of the remaining fragments of this important ecosystem. This paper describes and analyzes a project developed to reduce these pressures and restore the forest fragments. This practice-based approach addresses the lack of practical farming education in government land redistribution policies through a cooperative agroforestry project aimed at local "landless" farmers and large landowners. The program provides skills and technical assistance to farmers, contingent on participants including a majority of their trees in buffers to forest fragments. In order to transplant this cooperative program to regions facing similar pressures, it is necessary to establish trust among participants prior to commencing with the program; understand participant needs and expectations; and keep the program simple. Incorporating these three elements into a cooperative project results in a more successful and rewarding conservation program.

Introduction
The Brazilian Atlantic Forest is one of the most critically endangered ecosystems in the world (Downie 2001). When Portuguese explorers arrived on the shores of modern-day São Paulo, Brazil, the Atlantic Forest covered 125 million hectares along much of the Brazilian coast and into Paraguay and Argentina. Today, only 7% of the forest remains in small forest fragments (Anonymous 2000). This massive destruction is the consequence of intensive conversion to agricultural land during Brazil's population expansion of the mid-twentieth century.

The remaining fragments of the Atlantic Forest continue to face human pressures. Conservation International designated the Atlantic Forest as a biodiversity hotspot due to its high levels of diversity and endemic plants and animals. Of great interest are the primate species of the forest, including the several species of lion tamarin (*Leontopithecus sp.*), muriqui (*Brachyteles arachnoids*), and howler monkeys (*Alouatta palliata*), many of which are critically endangered (Downie 2001). São Paulo is the most developed state in Brazil, and its few remaining interior Atlantic Forest fragments in the Pontal do Paranapanema region serve as the remaining habitat for the endangered black lion tamarin (*L. chrysopygus*) (Valladares-Pádua et al. 2002). Morro do Diablo State Park, a 35,000-hectare forest, is the largest fragment in the region.

In addition to wildlife in the region, there are significant human settlements. In recent years, the community around Morro do Diablo State Park has grown with the arrival of "landless" people, represented by the Landless Workers Movement (Movimento dos Trabalhadores Rurias Sem Terra, MST). In addition to the "landless" community, the other major group in the region is large landowners. Brazil has a strong history of aristocracy, with 40 to 60% of the land owned by 3% of the population (Mark 2001). This discrepancy in land ownership has led to increasing conflict between "landless" people and large landowners. The São Paulo state government, working with landowners, developed a negotiation process in which landowners donate 30 to 70% of cleared land to "landless" people of the Pontal do Paranapanema region in exchange for official title to the remaining property (Cullen et al. 2001). According to Cullen et al. (2001), much of the land donated to "landless" families is marginal and borders on sensitive forest fragments. The land redistribution process lacked a comprehensive program to provide these newly landed families with the skills and technological assistance needed to make productive use of their small farms.

This paper examines a program developed to address the problem arising from land redistribution without a program to assist new landowners in minimizing their impacts to the

Brazilian Atlantic Forest of the Interior. This paper describes and evaluates the Green Hug Project (Projeto Abraço Verde, PAV) in terms of its social context, decision-making process, and ability to meet conservation goals. Further, it appraises the project in terms of its applicability to other forest fragments and regions facing similar pressures. Finally, recommendations are made to ensure effective application of the PAV in other forest fragments.

Information for this paper was collected from various sources. Most important were personal communications with Institute for Ecological Research (Instituto de Pesquisas Écológicas, IPÊ) staff and our personal experiences in Brazil. Staff interviews included Claudio Pádua, Director of Conservation Science for IP,Ê and Suzana Pádua, President of IPÊ. Online resources such as the IPÊ website and websites dedicated to the "landless" movement in Brazil were also used. Finally, newspaper and magazine articles proved useful in understanding the complexity of the Brazilian government and the "landless" issues. We employed the policy sciences framework to wade through this complex conservation problem and prototype.

The Pontal do Paranapanema situation

The problem facing the Pontal do Paranapanema region is how to accomplish conservation goals while improving the quality of life for the human community. IPÊ set out to address this problem using an adaptive and multi-faceted project as a prototype, or small-scale, innovative program coupled with a guiding goal (Brunner and Clark 1997). While prototypes are similar to pilot programs and controlled experiments, they are adaptive in nature, permitting changes as problems and difficulties develop in order to strengthen the project and achieve conservation objectives. Prototyping has been used in other ecosystem management situations (Clark 2002, including bandicoot (*Perameles gunnii*) conservation in Australia; Clark et al. 1995). The guiding goal of this effort was to provide small "landless" farmers and large landowners with the resources and skills to improve agricultural productivity while protecting and restoring forest fragments. A secondary goal of the project was to apply successful elements at a broader scale to similar problems in other regions, with the possibility of including such a program in national land redistribution policies.

The social context of this problem is complex, particularly at the national scale. Land redistribution is one of the most contentious issues in Brazil, and while few organizations participate, the membership of participating organizations is large. At the heart of the conflict are the Brazilian national government, the São Paulo state government, MST, international human rights non-governmental organizations (NGOs), Brazilian and international environmental NGOs, and the landed aristocracy of Brazil. Currently there is little effective communication among participants, with the Brazilian government actually criminalizing the MST as a terrorist organization (Veronese 2001). Faced with the complexity of the land redistribution issue, the PAV reduces the scale of the problem to more manageable terms by addressing a single portion of the issue. Additionally, PAV builds trust and opens lines of communication among the three main stakeholder groups; environmental NGOs (e.g., IPÊ), "landless" farmers, and large landowners (Table 1).

Instituto de Pesquisas Écológicas (IPÉ)

The organization responsible for building and implementing PAV — IPÉ — was formed in 1992 as a research organization dedicated to the conservation of wildlife in the Atlantic Forest. During the organization's infancy, its founders, Claudio and Suzana Padua, realized the need to combine conservation science with community participation. Environmental education programs within the communities in the Pontal do Paranapanema region became an important component of IPÉ. As IPÉ grew, its position in the community was strengthened through cooperation with local landowners in conservation projects and environmental education. These cooperative conservation projects were mainly agreements between landowners and IPÉ for permission to conduct scientific research in forest fragments on private land. Relationships were also formed with the local "landless" community in the region, mostly through interviews regarding hunting and poaching in the forests. These relationships generated a strong level of affection between IPÉ and its community (Valladares-Padua, personal communication).

As the "landless" issue became more contentious in the late 1990's, IPÉ sought a way to assist the "landless" in managing their new farms and protecting the forest fragments. Due to the relationships already in place, IPÉ was able to design PAV to address these needs.

"Landless" farmers

The "landless" farmers of the Pontal do Paranapanema region are a well-organized group supported by MST. Prior to 1998, the "landless" in the Pontal do Paranapanema region were without legal property title. They were squatters on large private ranches and had no legal right to farm, nor were they provided assistance from the state or national governments (Valladares-Padua, personal communication). During this period, the "landless" families viewed land redistribution as the solution to their

Table 1. Social Context of the Green Hugs Project (Projeto Abraço Verde – PAV).

	PARTICIPANTS		
VARIABLE	**"Landless" farmers**	**Large landowners**	**Instituto de Pesquisas Ecológicas (IPÊ)**
Participant Trait			
Identification	*Formerly "landless" *Granted land by state govt. *Well organized community	*Own majority of land in Brazil and area in question *Land redistributed by govt to small farmers	*Environmental NGO *Took primary responsibility to resolve land use problem and protect Atlantic Forest fragments
Expectations	Practice traditional farming techniques	Maintain control over land with little responsibility	Restore Atlantic Forest and corridors with farmer's assistance
Beliefs	With land ownership comes the ability to support families	Ownership and control of land should remain with the historical landowner	Cooperation and support of communities leads to ecosystem conservation of wildlife
Base Values (1,2)	Rectitude: ethical right to make a living	Wealth: among the richest citizens	Affection: support and cooperation of farmers and landowners
	Skill: understand basic farming techniques	Power: their property, their control	Enlightenment: knowledge and understanding of Atlantic Forest and local communities
	Power: strong political force	Well-being: possess access to healthcare and food	Rectitude: ethical responsibility to conserve nature
Strategies	*Farm to best of abilities *Utilize forest to increase productivity	*Engage in "land for legal title" deals with government *Participate in PAV	*Environmental education program in community *Ecological research *Establish PAV prototype
Values promoted by Strategies	Wealth, well-being, skill	Wealth, affection	Enlightenment, affection, rectitude

1. Assets or resources used by participants to achieve their goals (Clark and Wallace 1998).
2. Eight value categories include affection, enlightenment, power, rectitude, respect, skill, wealth, and well-being. For a complete description of the eight values see Laswell (1971).

problems, believing that subsistence crops and small-scale dairy operations would sustain the community (Cullen et al. 2001).

In 1998, the "landless" were awarded land tenure to the once private ranches. Land was removed from its original owners and redistributed in 35-acre farms among the families (Cullen et al. 2001). The "landless" now had control of the land they desperately wanted, but soon found that traditional agriculture could not provide for the needs of their families and community. Many of these new farms bordered the forest fragments that provided the farmers with resources such as fuelwood, fodder, and wildlife to supplement the subsistence crops.

For the "landless" farmers, PAV provided an alternative to traditional subsistence farming and an opportunity to address their needs, particularly well-being. In addition, the PAV provided skills to the "landless" farmers that would in turn increase wealth in the community.

Large landowners

The aristocratic landowners in the region play an interesting role in PAV. Prior to the 1998 land redistribution, the large landowners enjoyed many of the benefits of owning large tracts in Brazil. The government provided tax incentives to maintain productivity on the land, and this was easily accomplished through cattle grazing and other activities with limited labor costs. The majority of landowners in the Pontal do Paranapanema were not dependent on these lands for their livelihood, but rather saw the ranches as symbols of their wealth and power (Valladares-Padua, personal communication). The presence of squatters ("landless" families) on their lands angered the large landowners, but they did not aggressively enforce their ownership rights (Valladares-Padua, personal communication)

In the mid 1990s, tensions increased between the large landowners and the "landless" community, leading to a negative image of the landed aristocracy to the public at large. During this period, IPÉ approached several landowners with significant forest fragments regarding accessibility for scientific research. Several land-

owners agreed with the hope of improving relations with the community.

The large landowners in the Pontal do Paranapanema region sought to maintain the status quo. In the face of the land redistribution program, many of these landowners sought to cooperate with PAV in order to maintain a level of control over their remaining resources and improve their image within the community.

Designing the Projecto Abraço Verde

Design of the PAV effort began in 1995 when IPÊ realized the need to protect Atlantic Forest fragments on private land. Morro do Diablo State Park was the only protected area in the region and, while large at 86,000 acres, it could not sustain viable populations of most wildlife species (Cullen et al. 2001). Given the pressing need to ensure preservation of other forest fragments and the construction of corridors linking fragments, IPÊ recognized the necessity of community cooperation (Pádua 2001). During this early initiation stage, staff from IPÊ worked closely with large landowners and "landless" families to encourage conservation of the forest fragments.

Between 1995 and early 1998, IPÊ staff worked closely with large landowners and the "landless" community to determine the needs of participants. In addition, scientific data from forest fragments were collected to determine which fragments likely served as corridors or sinks for wildlife from Morro do Diablo (Cullen et al. 2001). IPÊ also conducted surveys of "landless" individuals regarding hunting and poaching within the forest fragments. Based on this information, IPÊ sought to increase cooperation with large landowners on a restoration prototype, while maintaining ties with the "landless" community through environmental education.

In late 1998, IPÊ was forced to reinitiate the decision-making process in response to a government land redistribution policy that awarded 15 hectares to each of the "landless" families in the Pontal do Paranapanema region. This action by the large landowners and state government forced IPÊ to reconsider their earlier project and begin efforts to develop a new prototype. This time a new, more pressing issue developed. Forest fragments once surrounded by land owned by a single family were now encircled by up to 50 families.

Reinitiating the prototyping process, IPÊ altered the focus of data collection to better match the needs of the "landless" community. Based on information gathered during the new and original estimation phases, "landless" participants identified their greatest needs as uncomplicated agriculture techniques that could increase productivity, a fuelwood source for the community, and the possibility of moving from subsistence to cash crop agriculture (Cullen et al. 2001).

PAV was established based on a community dialogue among IPÊ staff, "landless" farmers, and large landowners. The driving force of PAV is an agroforestry program in which IPÊ staff provides instruction and a nursery with appropriate species for fuelwood, non-timber forest products, and increasing nutrient levels in soils (Cullen et al. 2001). Farmers agreed to plant 60% of their seedlings along forest edges, with the remainder planted elsewhere on the farms or sold in local markets. In addition to the nursery and training courses, PAV hired representatives from the "landless" community to serve as community advocates, to ensure healthy communication among participants. Community members were also employed to build and manage the nursery under IPÊ guidance.

As with most trial interventions, it is best to start small (Clark et al. 1995). In the case of PAV, 15 "landless" families with farms bordering a 400-hectare forest fragment participated in 1998. As issues concerning planting techniques and nursery management were resolved, 20 more families were included by the middle of 1999.

With the assistance of the community advocates, IPÊ staff members have continually monitored the prototype since its inception. The prototype is dynamic and flexible, allowing for incorporation of suggestions from participants. The prototype continues to expand and include more "landless" families and large landowners during implementation. The hope of IPÊ staff and other participants is that the prototype will become a powerful force in the region, shifting perceptions of the forest away from that of it being an obstacle toward one in which forest fragments are viewed as a useful resource that must be maintained. No termination is planned. Instead, participants hope that it becomes an independent program with continued input from all.

Why does PAV work?

To ascertain the utility of PAV as a prototype for other regions it is necessary to examine trends and factors influencing those trends. Four major trends in the Pontal do Paranapanema region permitted the PAV prototype: deforestation by "landless" farmers and large landowners; limited productivity of the farmland; hunting and poaching in forest fragments; and a land redistribution program that permits ownership of land along forest fragments (Table 2).

The historical trend towards deforestation in the region stems from a culturally based dominion view of land and resources. For much of Brazil's history, forests have been viewed as an obstacle for progress and development. In addition to the conversion of forest to pasture and agricultural land, the collection of fuelwood from within forest frag-

ments also contributes to deforestation in the region (Cullen et al. 2001). With limited income, many "landless" families depend on the forest to provide a heat source as well as fodder for livestock. As these activities continue, the Atlantic Forest ecosystem will eventually either be entirely converted to agricultural land or endemic plant species will be decimated, impacting the biodiversity for which the region is known.

The majority of farmland in the region was converted from forested land through slash and burn agriculture (Tabarelli et al. 1999). While this provided substantial nutrients during the infancy of these ranches 50 years ago, it has left a land with low nutrient levels (Cullen et al. 2001). Additionally, "landless" farmers were awarded thirty-five-acre farms during land redistribution. In order to provide some level of subsistence crops, farmers must utilize all thirty-five acres, with little crop rotation and other techniques that might provide increased nutrient levels in the soil. Many of the farmers are also unskilled or unfamiliar with methods to increase productivity of the land (Cullen et al. 2001). As "landless" and other small farmers continue using improper agriculture techniques, degradation of the landscape will increase leading to an increase in poverty in the region.

The third trend making the Pontal do Paranapanema region viable for an agroforestry prototype is hunting and poaching in the forest fragments. The "landless" community mainly conducts this activity, but some large landowners condone it on their land. The need for supplemental income and food sources are the greatest conditions contributing to this trend. As many small farmers are unable to provide for their families, they must rely on the wildlife for additional nutrition. As the farms continue to decline in productivity, poaching will increase leading to local extinction of many of the large mammal species endemic to the Atlantic Forest. Since many of these species are already critically endangered, these local extinctions may in fact be global extinctions.

Land redistribution and ownership of small farms is the final trend providing for the possibility of a PAV program. The Brazilian government is facing increasing pressure both nationally and internationally to increase land redistribution programs. Over the years, many areas like the Pontal do Paranapanema region of São Paulo will benefit from these programs. While these programs are a major step forward in human and worker rights, they fail to address the potential for environmental impact. The redistribution of land increases human proximity to and encroachment into forest fragments.

Each of these trends will continue to degrade the Atlantic Forest ecosystem under current policies. In many Atlantic Forest regions, a prototype such as PAV does not exist to address these trends and the future impact they will cause. The most realistic alternative to the inadequate land redistribution program is a prototype similar to that used in the Pontal do Paranapanema region. By including the local community in ecosystem conservation, many of the above projections can be avoided or even reversed. PAV encourages protection and restoration of the forest rather than deforestation. By planting important nutrient cycling species on farms, productivity will increase and subsistence agriculture may in fact be able to sustain many families, while other families may make a living from cash crops. As productiv-

Table 2. Characteristics of a situation that lends itself to the use of a conservation project similar to Green Hug Project (Projeto Abraço Verde – PAV). Items in *italics* represent alternative outcomes associated with a community agroforestry system such as PAV.

What's Happening	Why is it occurring?	Likely future?
Deforestation	Culturally–based, improper use of land; Forest viewed as an obstacle; Timber necessary for fuel	Destruction of the Atlantic Forest Ecosystem; *Protection and Restoration of Atlantic Forest fragments*
Limited Productivity of Soils	Overuse of 35 acre farms; Improper farming techniques	Degradation of the landscape; Increase in poverty among "landless" farmers; *Increased soil nutrient levels*
Hunting/Poaching Pressure	Wildlife necessary to supplement income and nutrition; Dependency on subsistence farming	Decline of wildlife populations; *Decline in hunting as a means to provide sufficient nutrition*
Land Redistribution or Ownership	Strong pressure from "landless" movement; Small farms with inexperienced farmers	Human encroachment into forest fragments; *Protection and respect for forest fragments*

ity increases, "landless" farmers will not be forced to resort to poaching wildlife from the forest fragments. And finally, protection of the Atlantic Forest will be a part of land ownership.

Given the controversial nature of land redistribution programs, the most proactive approach to resolving the policy problem is not at the national level, but rather the local level (Valladares-Padua, personal communication). The more technical assistance and training organizations like IPÉ can provide to newly landed communities, the greater the possibility for a reduction in harmful activities.

Recommendations

Several key concepts must be followed to successfully apply the PAV as a prototype in other regions facing similar challenges: (1) Establish trust before initiating the prototyping process to ensure positive communication among all participants. (2) Understand the needs of participants — be contextual. (3) Keep it simple. Prototypes are meant to be dynamic (Clark et al. 1995), and a large, complex program cannot adapt to changes in participant needs or goals.

First, the issue of trust is an important element to many policy problems. Without trust, participants often will be suspicious of other's actions and may be apprehensive about completely participating in the decision process. Prior environmental education programs in the community and collaboration with large landowners in ecological studies increased IP's visibility in the community and helped establish a high level of trust. Involving potential participants in less controversial activities can build trust and respect among all parties, especially when participants' well-being and wealth are affected (Brunner and Clark 1997).

Once trust has been established, the next step requires understanding participants' needs. Community members will only continue to participate if a prototype meets their goals and addresses issues they believe are important. Once agroforestry was selected as the backbone of the prototype, further discussion was required to understand which techniques would work best for the farmers (Cullen et al. 2001). By listening to the needs of the farmers, IPÊ was able to introduce agroforestry techniques that were straightforward, simple, and provided quick returns. Working with participants and addressing their needs increases the likelihood of their participation.

Third, keep the prototype simple. The success of the PAV prototype is in its simplicity and flexibility. Farmers' suggestions can be easily incorporated into the system and new techniques are disseminated quickly through a Community Advocate program. By starting small, a prototype can address problems as they develop. The PAV prototype started with 15 families and has grown to over 50. IPÊ incorporated all "landless" families and large landowners into the decision process, but selected a single forest fragment for the initial module. The project continues to grow and more nurseries are being built to accommodate more farms and forest fragments.

Conclusion

A land donation and redistribution program in the Pontal do Paranapanema region of Brazil provides formerly "landless" families with agricultural plots and an opportunity to achieve self-sufficiency. What the program does not provide, however, are the skills and assistance "landless" farmers need to be productive and conserve remaining fragments of the biodiversity-rich Atlantic Forest of the Interior. Rather than approach the conservation problem on a national scale, IPÊ sought to develop a localized "prototype," one that realistically addresses community concerns and protects these valuable forest fragments. The Projeto Abraço Verde has been a dramatic success both socially and ecologically. "Landless" families now have access to training and resources that increase productivity on their farms, but are also committed to using the training and resources to protect adjacent forest fragments (Cullen et al. 2001).

IPÊ was contextual when developing the PAV. Understanding participant needs and addressing those needs proved to be the most important element for the success. While IPÊ staff members were not familiar with the "prototyping strategy", they nonetheless used it in their program, successfully constructing a problem-oriented "prototype" to address a complex conservation problem.

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Path of the Tapir: Integrating Biological Corridors, Ecosystem Management, and Socioeconomic Development in Costa Rica

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Abstract

To address crises of ecosystem degradation and poverty in the central-southern Pacific coastal region of Costa Rica, communities must cooperatively define problems, goals, and strategies. The Path of the Tapir Program is not only about sustainable development for this region, but also serves as a model for the regional Mesoamerican Biological Corridor Initiative. This paper explores the case from a policy sciences perspective to reveal strengths and gaps in processes that might hinder program success. This case provides lessons that are useful in many settings within Mesoamerica by identifying shortcomings in decision making and methods to address them and illustrating how local leadership and involvement can help program managers identify diverse perspectives, values, and strategies of those who participate in or are directly affected by a selected program. In this way, managers can learn to avert social conflict and, in some instances, leverage conflict for constructive progress toward program goals.

Introduction

In the face of ecosystem degradation and poverty, communities in the central-southern Pacific coastal region of Costa Rica have demonstrated their ability to organize and self-govern through local committees, commissions, and associations (Rodríguez 2000; Stroud pers. comm.; Fernández et al. 2000). Nonetheless, many factors contribute to a lack of coordinated, effective effort to address regional problems. Specifically, communities lack common principles and practices for identifying problems, amassing knowledge, and translating knowledge into action.

Corredor Biológico Paso de la Danta (CBPD), or Path of the Tapir, is a locally-run effort to establish forest corridors along the Tinamastes and Costeña mountain ranges that parallel the central Pacific coast of Costa Rica. CBPD seeks to integrate conservation and socioeconomic development to capture social and economic benefits from the sustainable management of the region's resources. This paper analyzes the Path of the Tapir Program. The following sections present a contextual analysis of the program, analyze the history of the central problems, and provide alternatives for strengthening the local institutional and organizational foundations of the program.

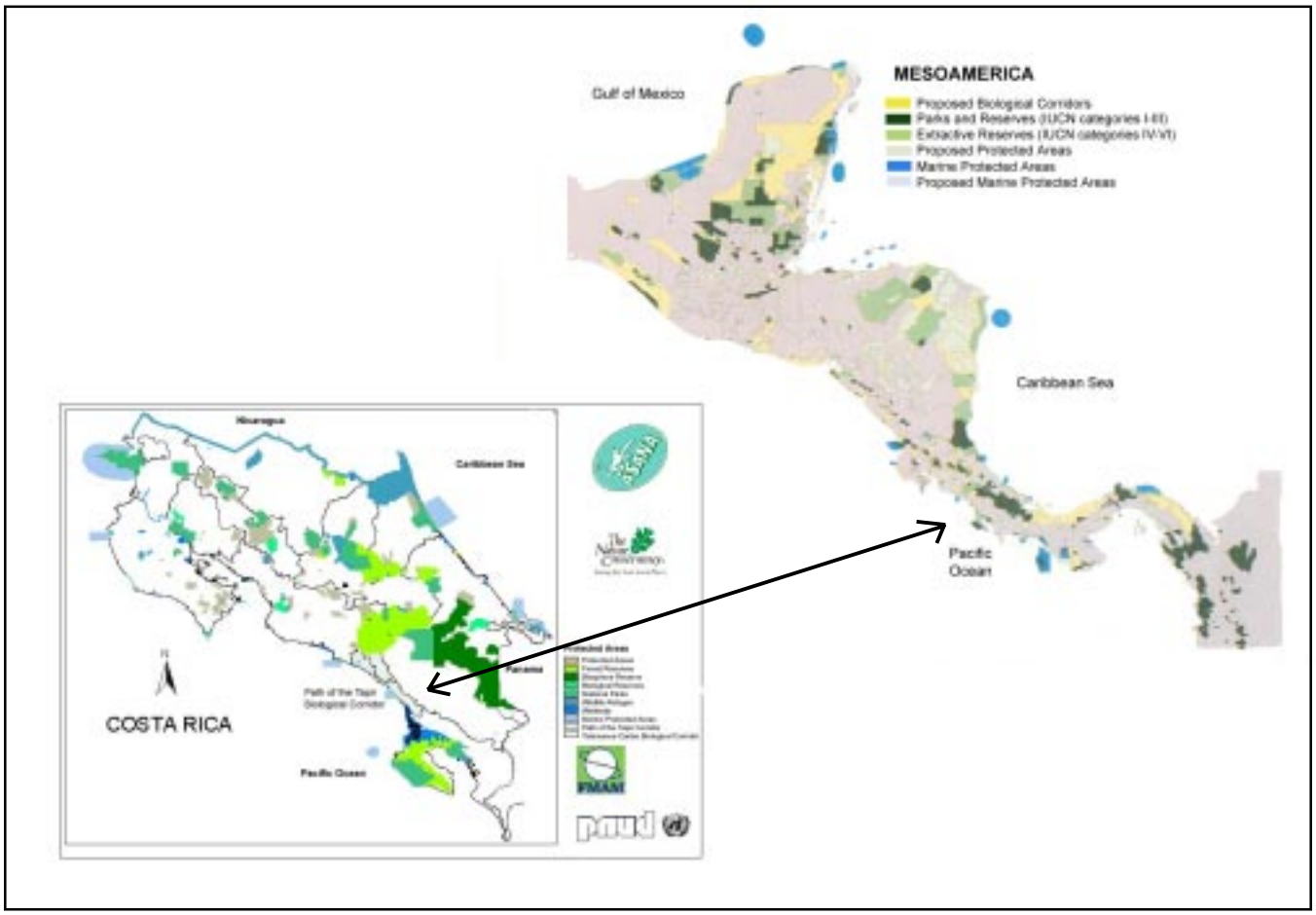
What is the problem?

The geographic area of CBPD is rich in cultural, biological, and habitat diversity. However, all three are threatened due to impediments to decision making and poor communication and cooperation between key program participants.

Path of the Tapir spans roughly 50 km in length, connecting Los Santos National Forest Reserve, Chirripó National Park, and La Amistad Biosphere Reserve with a mangrove estuarine system and a network of protected areas on the Osa Peninsula, including Corcovado National Park (see Figure 1). The elevation ranges from sea level to 1100 meters, with the 300- to 800-meter zone identified as the priority area for forest conservation and establishing corridors (Rodríguez 2000). The program area is principally located in the dry forest on the western slope of the coastal range, with distinct wet (May–November) and dry (December–May) seasons, and annual rainfall of about 4000 millimeters. Twenty-nine rivers run through this landscape, some reaching up to 30 meters wide (Rodríguez 2000).

While some endangered species, including large mammals such as tapir (*Tapirus bairdii*) and anteater (*Myrmecophaga tridactyla*) no longer inhabit the region, other endangered species such as margay (*Leopardus wiedii*), ocelot (*Leopardus pardalis*), jaguar (*Panthera onca*) and the trees quira (*Caryodaphnopsis burgeri*) — endemic to this region, alazán (*Tachigali versicolor*), ajo (*Caryocar costaricensis*), carey (*Elaeoluma glabrescens*), mimillo (*Minquartia guianensis*), and ojoche (*Brosimum alicastrum*) are still found in a few forested areas within this region

Figure 1. The proposed Mesoamerican Biological Corridor, right (Miller et al. 2001), and the Path of the Tapir Biological Corridor in Costa Rica, left (Rodríguez 2000).



(Rodríguez 2000; Stroud pers. comm.). The program area hosts many small mammal species, including 58 identified species of bats which serve as important pollinators (Rodríguez 2000). More than 320 bird species have been identified at Hacienda Barú, a 336 hectare reserve within CBPD boundaries (Stroud pers. comm.). Forty-one reptile species and 24 amphibian species were identified during a rapid assessment conducted in early 2000 (Rodríguez 2000). All of these species are directly affected by CBPD, although there are few formal mechanisms to give them voice in decision-making.

In addition to the terrestrial system, nearshore coral reefs, humpback whale (*Megaptera novaeangliae*) migrations, and Olive Ridley sea turtle (*Lepidochelys olivacea*) nesting grounds are some of the area's most prominent marine and coastal features.

Over the past century, natural habitat has been converted to agricultural uses throughout the region. This process has been stimulated by local and national settlement and development policies (Castro and Murillo 1997). Between 1960 and 1990, an expanding cattle industry was a major contributing factor to deforestation (Rodríguez 2000). Currently, industrial logging and the need for fuelwood reduce forested areas, resulting in ecological degradation (Stroud pers. comm.). As a result of these trends many species have now disappeared from the region or are found only in small, isolated pockets (Rodríguez 2000).

As a basis for economic development, The Nature Conservancy (TNC) identified at least 40 tree species of commercial timber interest, along with 43 species of orchids, 31 species of palms, 13 species of heliconias, eight species of begonias, seven species of *costaceas*, and 20 species of bromeliads (Rodríguez 2000). The presence of diverse mammals, birds, reptiles, and amphibians, as well as large forested areas and secure water sources, are important for ecologically-based tourism.

Path of the Tapir encompasses 28 communities, focusing on conserving privately-owned lands (Rodríguez 2000). Because all properties within the proposed corridor area are privately owned, outreach to and participation from all the communities — including hundreds of individual landowners and two dozen organizations — are necessary for the program to suc-

cessfully achieve its goals. The program must reconcile opposing perceptions of resource management, development, and wildlife conservation.

Clark and Wallace (1998) outlined methods for evaluating social processes in wildlife conservation and related programs. For CBPD, the 'social map' identifies (a) the major and minor participants; (b) their expectations and demands with respect to land management, economic development, and conservation; (c) the values that motivate their desires and actions; and (d) the situation in which the participants interact.

Path of the Tapir participants can be grouped into three main in-country clusters: community organizations; government; and landowners. Community organizations are clustered into seven sub-groups: cooperatives (local membership institutions organized around the production, collection, and distribution of agricultural products); foundations; women's groups; environmental groups; agricultural groups; community development associations; and the CBPD Coordinating Committee (Stroud pers. comm.; Rodríguez 2000). The government is represented by an appointed local liaison between the program and the Ministry of Environment and Energy (MINAE). National ministries and municipal government agencies have direct interests in and influence on the program. Finally, landowners fall into two subgroups: those landowners who participate in conservation management practices and those who do not. A fourth general category, participant observers, includes the author and other outside analysts and scientists who study or evaluate the program.

Participants' perspectives often differ, and thus their expectations and demands on the program differ as well. Tracking CBPD participants' perspectives is especially important because the region's demographics are currently undergoing rapid change (Stroud pers. comm.). Families who have farmed in the region for generations are selling their farms to foreigners and migrating from the rural communities to the more populated towns both within and outside the program area. These shifts in demographics and land ownership will affect the program, as land-use patterns, economic power, and views toward the natural environment change within the region.

Also notable is the recent coordination between diverse community groups throughout the region to address the problem of declining freshwater resources. This effort resulted in a broad-based, regionally supported petition to MINAE and the municipality to protect watersheds by suspending new logging permits (Stroud pers. comm.). While at times the diverse groups within the communities have cooperated well, this is typically only accomplished in response to crisis. More commonly, participants compete for power and control of limited funds, yielding a process marked by little coordination between organizations to identify common ground in perspectives, to plan cooperatively, or to negotiate and resolve conflicts in ways that further common goals.

Social maps may be used to help participants understand the broader social context within which they exist so they can better consider alternative positions to their own. "By making use of the different values that exist among people and societies, we can protect a wider swath of nature — and more fully appreciate biodiversity and the needs of human generations to come" (Perlman and Wilson 2000:3). A successful project will be adaptable, considering the diverse institutional cultures of participant organizations as well as the diverse social cultures of the region's inhabitants. CBPD has the opportunity to draw participants in through open, participatory processes. Success depends on the participants' abilities to collectively identify and address problems.

Path of the Tapir's 13-year history can be analyzed through the six-phase decision process (Brewer and deLeon 1983). This framework helps to identify positive aspects and gaps in deci-

Marine iguana (*Amblyrhynchus cristatus*) by Richard L. Wallace.

sion making which call for interventions. "Human decisions…determine whether species and ecosystems will thrive or vanish. Focusing on improving the human decision-making process is therefore key to achieving sustainability" (Clark et al. 2001:11).

In 1987, a small group of people within one community initiated a process to integrate economic development and ecosystem management by investing in social and natural capital with a long-term outlook for the region as a whole (Ewing 2000). Committee meetings and consultations began between the San José-based Center for Environmental and Natural Resource Law (CEDARENA) and other key individuals in the largest local town, Dominical. In these meetings, participants began to envision how to connect agriculture, tourism, and habitat protection and provide economic incentives for landowners to participate in CBPD (Stroud pers. comm.). In 1994, the Path of the Tapir program was created to coordinate these efforts and to consider the region's economic and conservation needs (Rodríguez 2000). Since that time, workshops, community meetings, and meetings with individual landowners have been held in collaboration with CEDARENA and the Association of Friends of Nature of the Central and South Pacific (ASANA) with the objective to share information with landowners and discuss how best to approach their economic and environmental concerns (Chacón pers. comm.).

Path of the Tapir is a local program being managed by local actors, although the program has received financial and technical support from national and international organizations. The Costa Rican office of The Nature Conservancy was hired specifically to conduct a rapid assessment for the program, and otherwise has not been involved in CBPD. The program has received funding support from the United Nations' Global Environment Facility. "At times the implementation has been very organized and coordinated, though rarely as an amalgam of all the groups" (Stroud pers. comm.). ASANA administers environmental education programs across the region. Landowners act individually and in small groups, and there is little ongoing coordination between communities in the region. As a whole, efforts to implement CBPD have been locally-administered, small-scale projects, which, with improved cooperation and communication, can serve as a model of regional collaboration.

The Nature Conservancy assessment contributed critical information for both evaluation and clarification of program strategy. In addition to identifying the biological, hydrological, and geological characteristics of the zone, the assessment identified local organizations and their focus of activities, and assessed local perceptions of conservation efforts within the zone (Rodríguez 2000). TNC surveys assessed the willingness of landowners to participate and reasons for participation and non-participation in conservation and sustainable land management practices (Rodríguez 2000). The overriding factor determining landowners' decisions to participate in CBPD is perceived economic benefit, while financial restrictions (e.g., liens on properties), titling discrepancies, and joint ownership prohibited involvement in some cases.

It is not clear how individual programs are being evaluated with respect to the overall Path of the Tapir program. Evaluation is critical for measuring progress toward established goals and objectives. The organizations or individuals that assume the responsibility for evaluation must have the trust and respect of program participants for their evaluations to bear legitimacy and not be viewed as politically motivated (Patton 1997). Although the program is just beginning, it is not clear how success will be measured, who will be responsible for measuring it, and what will happen once a corridor network is in place. Termination does not signal an end, but rather the closure of one chapter and the opening of another. It is essential that this transition from implementing corridors to monitoring and maintaining them be planned in a way that does not derail preceding initiatives. The lack of a transition plan for this natural progression in management objectives could ultimately prohibit CBPD from reaching long-term goals of sustainability.

The strategy selected for CBPD is similar to the landscape-level ecoregion strategy of TNC. The approach is decided first — in this case a network of forest corridors formed to connect two other protected area networks — followed by a survey of the biophysical and ecological characteristics of the region. Human influences on the landscape are considered in terms of impacts (e.g., roads, fence lines, field/forest boundaries) that isolate habitat fragments. It is only in the final stages, once specific regions have been targeted for conservation, when regional managers meet with local landowners to assess strategies for incorporating them into the process (Toomey pers. comm.). Given the authoritative nature of this style of decision process, CBPD managers must decide whether or not this is an appropriate strategy in terms of building local trust and confidence in the program. Without legitimate authority to do so, the imposition of a regional conservation plan on an area characterized by private land holdings at the least will garner distrust with some individual landowners, and at most could stimulate regional backlash against the program. Given the low individual awareness of CBPD as

revealed in the rapid assessment, it is not clear that CBPD has a clearly designated authority (Rodríguez 2000).

Working land easements — legal land use restriction contracts that allow for specified resource management prescriptions such as timber extraction — and land trusts are examples of creative strategies for local consideration. One potentially successful program has been initiated between ASANA and the World Bank. In this scheme, landowners can receive payments for environmental services (e.g., watershed maintenance) in exchange for developing and implementing a clearly specified, formal land management plan for their property. These agreements are supported by legally-binding contracts. This model program is an example of how markets can be created to bring direct economic benefits to individual landowners in exchange for the local, national, and global ecosystem services they provide through conservation stewardship of their property. While initial results seem positive in terms of short-run participation and increased land values as a result of forest protection, the long-term benefits and stability of this program are uncertain.

Historical trends, conditioning factors, and projected future outcomes

One way CBPD managers might measure program success is to assess whether or not it meets the following broad tests (Clark 2002): Is the program ecologically sound? Is it socially and politically feasible? And, is the program morally just? If not, interventions will be met with resistance, thus inhibiting the decision process. Program leaders must work together with key participants to formulate legitimate decision-making strategies. Attention should be given to establishing criteria for evaluation, and should include mechanisms that assign and enforce accountability. Feedback mechanisms built into implementation and evaluation plans facilitate rapid and effective response to bottlenecks. Few of these processes are evident in the overall CBPD program. While there are many devoted and talented people working on this program, there do not appear to be any well-conceived, comprehensive, and coordinated strategies among participants to address the complex environmental and socio-economic problems of the region.

Instead, should current biophysical, socioeconomic, and organizational trends continue, there is potential for increased social tensions due to conflicting demands and expectations among participants. It is likely that continued independent actions, especially those that focus solely on economic growth (e.g., re-routing the Inter-American Highway through this zone, and the boom in commercial and residential development) or environmental restoration and conservation (e.g., private reserves), will soon lead to conflict between participant groups. Projects driven by sector-specific goals compete for funding and force participants to take sides in determining which projects are carried out at the expense of other interests. At this juncture, the leading organizations in CBPD need to help participants establish common goals and develop cohesive, interdisciplinary strategies to evaluate progress toward achieving those goals.

Recommendations

Based on its current status, there are a number of possible directions the program can take. Maintaining insufficient cooperation and coordination among participant groups will lead to weak institutional support for regional land management. A variation on this approach targets solutions that focus on imported financial and technical resources (e.g., tourism development and niche-market monoculture plantations) such that individual projects and participants remain isolated. A third alternative targets investment in communication skills and building organizational capacity of key participants. With forums for public participation and the skills to promote constructive dialog, local institutions will be better prepared to address the complexity of this program and to adapt, based on what is learned along the way. The third option offers the greatest benefit to the most people over the longest period of time, and will contribute the most in terms of building a replicable prototype for the region.

Unlike laboratory or highly controlled field experimentation, prototyping involves the systematic observation of institutional practices rather than a list of specific, measurable variables, as a strategy to pretest multiple policy options (Lasswell 1971). Indicators that demonstrate trends and magnitudes are subordinated to qualitative and context-specific observations, such as the participants' perspectives and expectations, and do not readily support aggregated, normalized data analysis (Lasswell 1971). Prototypes are different from pilot studies — they rely on creativity, strategic self-observation, and adaptation based on insights gained through the learning process (Clark et al. 1995).

One strategy to draw attention to policy problems is to exploit crisis situations. The gap in institutional capacity in the Path of the Tapir case is widened by crisis situations involving local infrastructure and poverty. Using crises as case studies, it is possible to illustrate the local relationship between economics and environmental quality, and to develop new, creative solutions through measures that promote institutional cooperation. The process of sustainable development is stimulated by building

capacity within local organizations. For example, with support from ASANA, a local school runs a management project for threatened sea turtles that addresses both conservation and economic objectives. Students learn social and technical skills they can take to other projects.

There is an immediate need to build social capital (e.g., skill, knowledge, culture, and organization) in the region. Training in social skills, such as decision process analysis and conflict resolution, is essential for creating the context for making sound decisions. The National Biodiversity Institute–INBio has successfully trained local "parataxonomists" who assist taxonomists in field collection and identification of Costa Rica's flora and fauna species (Allen 2001). Similarly, Global Environment Facility and other institutional investors should train "parasociologists" to support the management of local organizations and facilitate the decision-making process within CBPD. Investment in building the skills to explore and document previously unaddressed social structures reflects a process-oriented approach toward addressing complex, dynamic problems. Participants could design performance indicators to measure how this approach enhances skill, wealth, power, respect, well-being, and enlightenment in the overall system (Dobyns et al. 1971).

There is also urgent need for improving the regional infrastructure. This would bring development associations and municipal public works departments into the process to design bridges, roads, electrification projects, and new transportation networks in a way that meets the stated program goal of creating human settlements in harmony with nature (Ewing 2000). Interdisciplinary planning and an in-depth prior understanding of the perspectives of all participant groups will make significant contributions toward this goal. Evaluations comprised of a collection of disciplinary analyses typically fail to integrate the knowledge they generate into a contextually appropriate approach to identifying root problems and strategies to address these issues. "By addressing the biological and social science aspects of the recovery challenge separately (i.e. a multi-disciplinary approach), practitioners risk devising fragmented, possibly contradictory solutions" (Clark et al. 1999:101).

Hood mockingbird (*Nesomimus macdonaldi*) by Richard L. Wallace.

Professionally-led decision seminars and workshops that address communication and negotiation skills are possible forums to bring together regional planners and program leaders. Decision seminars build a core nucleus of people that work together over a number of years to explore the theoretical and practical processes of decision making (Lasswell 1971). Working groups can emerge from the seminar to focus on specific problems (Lasswell 1971). Traditionally, decision seminars are a formal academic process carried out in higher university, corporate, or government settings (Lasswell 1971), yet this concept could be strategically adapted to conform to the socio-cultural context of this region. Gathering leaders from the multiple institutions throughout the program area, this exercise would improve communication and decision making among local organizations, build trust and community, and is consistent with the spirit of education that Costa Ricans embrace in their culture. As Dobyns et al. (1971) demonstrated, prototyping includes measuring how an interdisciplinary planning approach enhances skill, wealth, power, respect, well-being, rectitude, and enlightenment in the overall system.

"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" (Primm and Clark 1996:1042). This requires effective evaluation procedures, willingness for self-reflection, and management styles that encourage creativity and flexibility. Success in regional efforts to manage private lands for both biological conservation and socioeconomic purposes will depend on building leadership capacity, mutual respect and trust among participants, and a commonly accepted problem definition.

Investing in organizational capacity and improving the relationships and coordination between participants in CBPD has several ben-

efits. First, this approach seeks to incorporate all points of view and facilitate constructive dialog, building trust and respect among participants. Second, this is a logical first step in the process of building local decision-making and management skills needed to develop and maintain long-term regional coordination. And third, improving communication skills helps participants identify creative opportunities where partnership is the most effective way to meet their own interests.

Conclusions

The goal of this analysis is to assist CBPD participants in understanding the processes of problem orientation, social context mapping, and decision making. The case study has revealed that the major barriers to successful implementation of the program have to do with policy problems and the decision-making process.

Ecological rehabilitation of degraded lands and the sustainable management of the region's natural resources are key components of the economic and social well-being of this region. However, implementing a successful project in this complex social setting requires more than simply providing a multi-disciplinary management plan.

Path of the Tapir has the potential to demonstrate what early investment in building social capital — negotiation and communication skills and organizational capacity — can achieve in terms of developing a successful prototype. In documenting how these investments improve decision making and ultimately affect program success, the prototype becomes a useful mechanism to transfer lessons across contexts (Dobyns et al. 1971). Investment that enhances local social capital rests at the heart of an integrated approach to conservation — this approach gives rise to the legitimacy needed to develop and implement a management plan. By focusing on alternatives that are ecologically sound, socially and politically feasible, and morally just, investors and program leaders have a much greater likelihood for successfully attaining both development and conservation goals (Brechin et al. 2002).

We desire a system in which organizations are working together toward common goals and addressing commonly perceived problems. In this system, individual organizations have the capacity to look clearly at problems and evaluate their actions in a larger context. Feedback mechanisms and well-defined performance indicators provide constructive information and are designed into the management system. An integrated, adaptive strategy will help CBPD succeed in securing habitat for endangered species and protecting water resources within the context of a sustainable socioeconomic system.

To serve as a prototype for the Mesoamerican Biological Corridor Initiative, the social context and decision-making processes within CBPD must be examined and described in a way that provides general lessons for other regions (Clark 1999). For example, lessons learned about how to implement and evaluate the program can be applied not only to other corridor projects involving private landowners, but also to cases involving national parks or marine sanctuaries. The comprehensiveness and interdisciplinary nature of the policy sciences framework allows us to move across scales and context in a holistic approach to natural resource management.

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California sea otter (*Enhydra lutris*) by Mike Boylan, USFWS.

If the Tasmanian Tiger Were Found, What Should We Do? An Interdisciplinary Guide to Endangered Species Recovery

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Abstract
*The Tasmanian tiger, or thylacine (*Thylacinus cynocephalus*), is a wolf-like carnivorous marsupial last reported in the 1930s in Tasmania, an island state of Australia. Although the species is likely extinct, sightings are reported annually. A fictional scenario is described in which a female thylacine with four pouched young is captured. This scenario is explored and an interdisciplinary approach to endangered species recovery is introduced. This approach is applicable to all endangered species recovery efforts and focuses on the principal dimensions of recovery: (1) orienting to the problem at hand and meeting it successfully; (2) understanding the recovery effort itself, its full context, and the required management (decision) process; (3) using a broad range of methods; and (4) integrating research results into a comprehensive recovery process (picture of the whole). By using this interdisciplinary approach, recovery can be systematically understood, best managed, and restoration prospects enhanced.*

Introduction
Some people believe that the Tasmanian tiger, or thylacine (*Thylacinus cynocephalus*), still exists in the wilds of Tasmania (Figure 1). Finding surviving thylacines would focus international attention on this magnificent animal. It would be viewed as our last chance to restore a unique member of Australia's and the world's natural heritage. Resources likely would be unlimited. Unfortunately, evidence suggests that the species is extinct both on mainland Australia and in Tasmania. Conservation did not come to the aid of this fascinating animal when it was most needed, decades ago.

If the thylacine did exist and was discovered, what should happen? Are we equipped to deal with such an important conservation challenge? What actions will we need to undertake to recover it? We know that endangered species recovery is always complex, risky, and a difficult task. The thylacine conservation scenario we present below clearly demonstrates this. The problem of recovering an endangered species can be guided using biological science, but more than biological science is required in species recovery. Information from other disciplines is necessary. People must be organized, knowledge and skill need to be mobilized and integrated, and an adequate decision process is required. The challenge becomes one of integrating diverse perspectives, knowledge, skills, and actions all focused on the species' recovery in a timely, reliable way. Clearly an interdisciplinary approach is needed (see Clark 1997, 2002). Exploring the thylacine scenario illustrates how an interdisciplinary approach could aid all recovery efforts.

This paper describes a fictional scenario wherein a live thylacine is captured. We explore an interdisciplinary approach to endangered species recovery applicable to this case and others. This approach is generalized and draws on systems thinking and the policy sciences. We provide a brief overview of the approach, identify relevant literature, and examine part of the approach (i.e. the "intelligence" function) in the limited space available.

Rediscovery of the thylacine

A scenario

Jack O'Halloran, a Tasmanian farmer from Black Creek, calls the local Department of Parks, Lands & Wildlife in Launceston. "Charlie I've got a problem 'ere, sumthins turned up youse might be interested in. She's in the back shed — chook feathers everywhere." Charlie asks Jack to describe the animal, as well as its condition and behavior. "Size of a large dog, sandy colour, but with them stripes down the back — that was what struck me" replied Jack. He also describes the animal resting quietly in the shed, under a table. The chickens were still excited. "Reckon it may have chased a chook in from the yard last night, was probably after some tucker, it's been pretty damn cold out here this summer. The shed door was closed, but I locked it after I peaked in. Pretty shook up I was — had a cuppa though, before I went to check again through the shed window and rang you," Jack said. "That certainly does sound worth investigating, hold tight I'll be there soon," Charlie tells Jack.

Charlie calls his assistant wildlife officer, Bob, down the hallway. He begins to relate the story, at the same time phoning his boss, the Director of Wildlife in Hobart, to alert him to the possibility of finding a live thylacine. Charlie says that they will call back, after a site visit to Jack's. Charlie and Bob then drive along the windy open forest road to Black Creek. Black Creek is 20 km west of Deloraine and 65 km west-southwest of Launceston. The area is known mainly for its wool production, and the landscape is dotted with flocks of sheep and lambs. Densely forested mountainous tracts surround Jack's property. A national park, Black Mountain, and an escarpment, the Great Western, lie south and southwest of the farming area. Jack meets the two officers at the gate and directs them toward the back of the house. They quietly approach the shed and observe the animal sleeping under the table. *It is a thylacine!*

They immediately call the Director, to inform him of events. He then calls the Minister as well as the Federal Endangered Species Unit and Federal Minister for Environment. A teleconference is arranged for that evening to decide what to do. Decisions must be made. Should the animal be turned loose immediately or should it be held in captivity? Many more questions need to be posed and answers rendered. All decisions must be based on reliable information and good judgment.

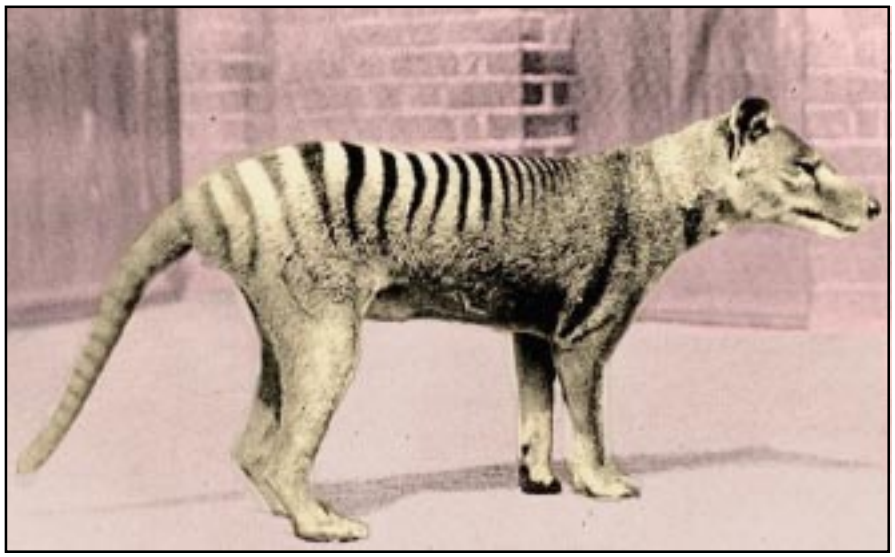
Thylacines

Before we consider recovery efforts, what do we know about the thylacine? The thylacine, also known as the Tasmanian wolf or tiger, is possibly one of the most widely known of the Australian mammals although it has not been captured for over 70 years (Dixon 1989). It is a large carnivorous marsupial and single member of the family Thylacinidae. It is sandy colored and has 15 to 20 distinct dark stripes that transverse its back, the number of bands varying between individuals. The color pattern may assist in camouflage. The thylacine has a large head that appears like that of a dog with long and powerful jaws. The tail of the thylacine is long and stiff, but unlike that of a dog it cannot be wagged laterally. The legs of the thylacine are relatively short. Because it is a marsupial, the female gives birth to small, undeveloped young that continue their development in her pouch.

The thylacine has a sad history, which is intimately linked with the way Australia was settled (Guiler 1985). This history reveals much about settlers' attitudes towards the land and its flora and fauna. The Dutch explorer Abel Tasman reported in 1642 that one of his crew had found footprints similar to the claws of a tiger on the shores of Van Diemen's Land (Tasmania). The first account of the animal from Tasmania was in the 1805 Sydney Gazette and New South Wales Advertiser and reported evidence of "an animal of a truly singular and novel description" and "certainly the only powerful and terrific of the carnivorous and voracious tribe yet discovered on any part of New Holland (Australia) or its adjacent islands." (see Dixon 1989).

The first scientific description of the thylacine was to the Linnean So-

Figure 1. Thylacine (South Australian Museum, Adelaide).



ciety of London (Harris 1808). In 1803, sheep were introduced to the fertile midlands of Tasmania by settlers. The area also provided habitat for thylacines, and most sheep losses were attributed to the thylacine, although wild dogs may also have caused losses (Guiler 1985). In 1830 the Van Dieman's Land Company introduced a bounty on the thylacine. Government bounties in place between 1888 and 1909 resulted in 2,184 payments (Guiler 1985; Dixon 1989). The last thylacine killed in the wild was in 1930, and the last known animal died in the London Zoo in 1931 (Dixon 1989). By 1936, the species was added to the Tasmanian list of protected animals. Over 70 years later no further specimens have been collected, but scores of sightings have been reported.

Thylacine recovery

The thylacine recovery effort faces many challenges. A number of critical decisions need to be made, some quickly. Because so many things need to be considered and addressed, the challenge is truly an interdisciplinary one. Because of this, all parties involved need to ensure that the decision process they set up to address thylacine recovery is of the highest quality — timely, reliable, comprehensive, trustworthy, and effective, among other things. In all likelihood, the thylacine will only be restored through a decision process that brings many people together and integrates their knowledge and skills. How the decision process is organized and managed will mean the difference between saving the thylacine or its loss forever!

Interdisciplinary approach

What is an interdisciplinary approach and how does one set up an appropriate decision process directed at solving the problem posed by the thylacine discovery? Both the decision process and the problem itself are human constructs — that is, they are both a concern and product of people interacting. Thus, recovering the thylacine is really about people as much if not more than it is about thylacines. As a result, the human social process or context of the thylacine conservation problem must be understood and addressed simultaneously with addressing the core conservation biology problem and setting up an effective decision process.

Fortunately, for our thylacine conservationists all these concerns have been dealt with many times by other conservationists in many other endangered species cases (e.g., Clark 1996a, 1997; Reading and Miller 2000). In fact, we now have so much experience in trying to save species that practical interdisciplinary guidelines about how to set up and carry out a successful recovery program have been developed and are beginning to be used. The principal dimensions of this interdisciplinary approach with respect to species conservation have been described in articles published in the Endangered Species *UPDATE* (Figure 2). These articles cover introductions to (1) the benefits of an interdisciplinary approach (Clark et al. 1992); (2) setting up decision processes (Clark and Brunner 1996); (3) understanding the social process or context of a case (Clark and Wallace 1998); (4) methods of focusing on core problems (Wallace and Clark 1999); (5) multiple methods (Clark et al. 1999); (6) understanding people's standpoints (Clark and Wallace 1999); and (7) learning about how to learn to be more successful (Clark 1996b). Several of these papers offer checklists and sets of questions for the thylacine conservationists to use. These papers, all reprinted in this special issue of Endangered Species *UPDATE*, can be consulted to develop a more complete understanding of this approach and thus we will not repeat them here in detail.

The interdisciplinary approach draws on systems thinking and the policy sciences (Lasswell 1971). Interdisciplinary approaches differ fundamentally from multi-disciplinary approaches, although many people use the terms interchangeably. Interdisciplinary approaches systematically integrate information from different disciplines into a unified approach, ideally that integration occurs before and during data collection (Clark et al. 1999). Alternatively, multi-disciplinary approaches rely on information from several disciplines, but that information is usually collected, evaluated, and used independently to make recommendations. The lack of integration can lead to recommendations from different disciplines that are incompatible or contradictory. For example, when a biologist and a social scientist made independent recommendations for core area delineations within a newly created national park that included indigenous people in Mongolia, there was almost no overlap between their recommendations (R. Reading, unpubl. data).

An interdisciplinary approach sees recovery as a type of problem with systems-like features (i.e. problem orientation, social process, and decision process) that must be successfully addressed (Figure 2). First, at the heart of endangered species conservation is a perceived problem that must be solved — in our case, recovering thylacines. The problem can be best appreciated by carrying out five interrelated tasks that make up rational problem solving (Wallace and Clark 1999). Second, because the problem is a concern for people who interact in a social process, this process represents the context of the conservation problem to be solved (Clark and Wallace 1998). Third, the people focusing on the thylacine conserva-

tion problem must work through a decision process that hopefully will end with species recovery (Clark and Brunner 1996). These three dimensions of saving the thylacine correspond to problem orientation, social process, and decision process (Figure 2). These dimensions describe the basic features associated with the interdisciplinary approach we recommend. Proponents of this approach, who are often systems builders, have developed a comprehensive framework for inquiry that embraces a complex set of terms, concepts, maps, values, institutions, function, process, and intellectual skills that are part and parcel of the whole system (Chen 1989). This system is imminently practical, but rarely employed in species and ecosystem conservation to date.

The interdisciplinary approach we present here is a different way to think about species recovery for most practitioners. There are many ways to conceive of species recovery. The most common approach is a conventional one that draws on biology, and its paradigms, models, and methods (experimental, predictive science). This approach typically assumes that the conservation challenge is largely or solely a biological problem, thus biologists are brought in to address it. The biological disciplines obviously have much to contribute, but recovery faces far more than simply biological challenges. For example, biologists may not be skilled in setting up or participating in a decision process (e.g., organizational or leadership skills — see Clark and Wallace's paper on values, this volume). Nor will they necessarily be able to systematically map and comprehend the full context of the conservation challenge. They may be limited in the kinds of methods they know and have little experience with integrative, interdisciplinary methods. This situation typically exists among the government bureaucracies that dominate species recovery programs. As such, most recovery programs employ conventional approaches based on the biological sciences, despite their many limitations and difficulties. These conventional approaches often exacerbate the inadequacies of trying to solve complex, multi-faceted problems with narrow or limited knowledge and skills.

The thylacine scenario

An examination of the thylacine scenario using the interdisciplinary approach permits us to begin seeing species recovery as involving tasks such as problem orientation and social and decision processes (Figure 2). In species recovery, these dimensions are intertwined in complex ways and they must be understood and managed successfully. Because the intelligence function — the gathering, processing, and dissemination of information — is such a vital activity in the thylacine decision process, our discussion focuses on it.

Social process

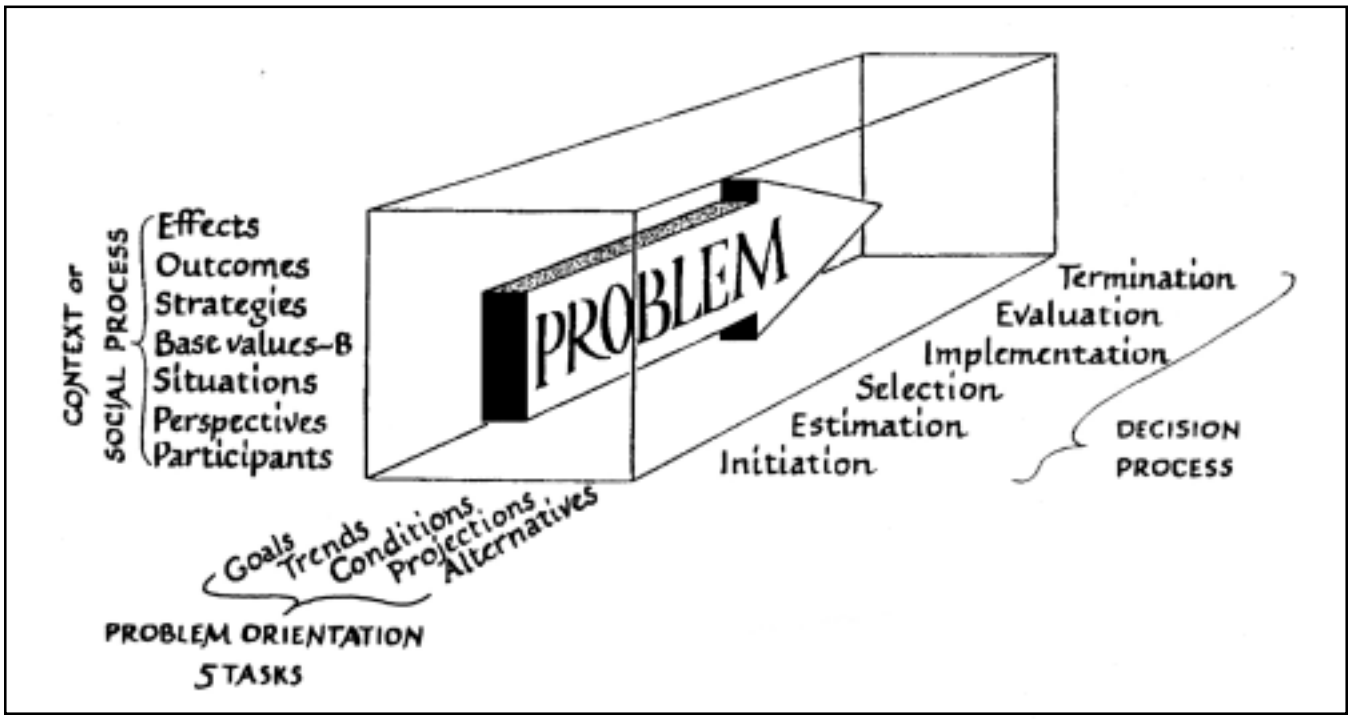
Because thylacine recovery is a human undertaking, knowledge of the social process is vital. Initially, some people, groups, and institutions will be involved in a rapidly organizing decision process. Other participants will become involved later. Participants *in* and people and groups *affected by* the process are often referred to as *stakeholders*, or key stakeholders. Participants are involved for different reasons; some will be included because of their authority and control responsibilities (e.g., state and federal governments). The Tasmanian Government would have a major role in organizing the social and decision processes. Perhaps an analogy can best illustrate what is involved. The thylacine is like a critically ill patient in a hospital, the Tasmanian Government is the hospital administrator looking after the patient. The administrator will need to coordinate specialist doctors who can contribute to the patient's medical well-being and eventual recovery. As time goes on, other specialists and generalists would become involved because of their knowledge, skills, and other resources (e.g., national and international scientific and conservation communities). NGOs such as World Wide Fund For Nature, Australian Conservation Society, the International Union for Conservation of Nature may offer resources, financial, technical, and educational aid. These participants will have different perspectives, values, strategies, and seek different outcomes. This must be understood, "mapped" (i.e. information and interrelationships organized and outlined), and managed openly and fairly if the decision process is to work well.

The public would also play a part in the conservation effort. Assistance from the public would be needed to find more thylacines. Outreach and publicity in the local area and beyond would be important for the public to understand the thylacine, its habits, what the recovery effort is aiming to achieve and how, and the significance of the effort. As time goes on, the social and decision processes become more complex. A wider network of people and organizations come to play important roles in the recovery process.

Decision process

A key initial step in the overall decision process is a well-organized intelligence activity that helps clarify the problem and its context (Figure 2). Intelligence is the first phase in the decision process, but it should remain ongoing over the life of the recovery effort. Much information must be gathered and organized from existing sources and new intelligence must be obtained. All of this information must be integrated and disseminated as a basis for debate (pro-

Figure 2. Illustration of the interdisciplinary problem solving approach introduced in this paper.



motion), decisions (prescriptions), and subsequent activities (invocation, application, appraisal, termination). These seven functions comprise a complete decision process. All decision functions will need to be carried out well if the thylacine is to be recovered.

The participants in thylacine recovery should make decisions based on available intelligence and a short but thorough debate about the problem and options for addressing it. They should make every effort to remain problem oriented.

In this case, let's assume they decide (prescription) to hold the thylacine temporarily in captivity at the Hobart Zoo. Plans are made to capture the animal that evening and house it in a quiet, off-exhibit accommodation. Keepers and vets from the zoo assist in the capture and transfer of the animal (invocation and application activities). The animal is examined (intelligence) and much to everyone's surprise is found to be female with four small pouch-young! It is likely that there are a few other thylacines in the wild, and a search plan must be developed. The possibility of setting up a captive breeding program is now a real option. Tasmanian biologists, familiar with the Black Creek area, based on knowledge of ecological systems in the region, predict that the wild population would consist of only a few animals, at best (intelligence). To ensure a well-functioning program, the rapidly forming recovery team also attends to social science considerations. For example, they evaluate likely attitudes of the local public toward thylacines and begin collecting additional data (intelligence). They also assess the ability of the growing number of participants to work well together (intelligence). Based on the available information, they decide to develop a public relations program and a special working group for thylacine recovery (prescription). The working group is formed that includes participants with diverse skills and the ability to work together in a team (invocation), and they rapidly begin working on the recovery problem (application). Participants take stock of how well they are orienting to the recovery problem and the rapidly emerging social and decision processes and conclude they are doing well (appraisal).

Many aspects of a growing and self-organizing decision process require attention, especially intelligence activities. As the social and decision processes become more active and complex, and as technical, social, and decision issues become more pressing, it is vital to attend to each of these diverse matters. There will be many biological, technical issues needing attention, but there will also be many social and decision process issues that are equally or even more important. The tendency of many officials and administrators is to simply rely upon their own bureaucracy to address these issues. Hard won experience in species recovery shows that this traditional bureaucratic approach can be disastrous (see Clark et al. 1994; Miller et al. 1996; Reading and Miller 2000).

Problem orientation

Orienting to the thylacine problem

requires that conservationists focus on all of the tasks associated with problem solving (Wallace and Clark 1999). To carry out sound integrated research, management, and policy and to avoid a "solution oriented" approach (wherein practitioners rapidly jump to solutions before fully understanding a problem), Harold Lasswell (1971) proposed a strategy for problem solving that consists of five tasks: (1) clarifying goals; (2) describing trends; (3) analyzing conditions; (4) projecting developments; and (5) inventing, evaluating, and selecting alternatives (Figure 2). We recommend using this approach in endangered species conservation, although it is applicable to any kind of problem solving, conservation or otherwise.

Much information already exists about thylacines, but more is needed, and quickly. From a biological perspective, a number of questions need answering quickly. The following questions, although not comprehensive, help thylacine conservationists orient to the biological aspects of the problem. These questions are about trends, conditions, and projections, and also a tentative look at alternatives. First, what do we know of thylacines: their life span, age of reproduction, number of offspring, mating pattern, care of offspring? Second, how would one go about caring for these unique animals in captivity? Third, what do we know of their behavior? Fourth, even though life history information is essential to successfully managing a species, it provides only a partial understanding of changes in a population's numbers and density. Fifth, because there are so few thylacine individuals in our scenario, we would need to know the genetic relationship of individuals to guide genetic management of captive and wild populations. Sixth, how would one find other thylacines in the wild? Seventh, if more animals were detected, should they be captured or left in the wild? The objective of a captive breeding program would be to restore populations to self-sustaining viable levels in the wild. How would we go about reintroducing captive-bred animals into the wild?

To this point, we have emphasized biological intelligence activities; however, information in many other areas is also necessary. A number of non-biological factors also affect thylacine recovery efforts. Intelligence on the social and decision processes can help focus problem orientation, for example. Such intelligence consists of information on the values and attitudes of the various stakeholders, method of organizing for recovery, power and authority relationships, economic considerations, pertinent legislation, and more. In addition, recovery programs are subjected to uncertainty, because, as we have seen for the thylacine, often very little is known about the biology of endangered species, so researchers may make errors of estimation and judgment. Such programs are complex because of the many individuals and organizations involved, all with a sense of urgency to succeed before extinction of the species. These considerations argue for adaptive management approaches to recovery that are experimental and permit rapid changes in approaches based on new information and frequent evaluation (Holling 1995). To enhance chances for success, the recovery process should remain interdisciplinary, with all aspects of the challenge, including social and decision processes, investigated and incorporated in adaptive approaches to decision-making and action.

Most of the considerations and work we have outlined in each of these areas (i.e. social process, decision process, and problem orientation) fall well outside of the biological disciplines in which most practitioners are trained. To improve our chances for successful thylacine recovery we therefore should be enlisting the support of social scientists and others with practical expertise in these areas. We should also be training future practitioners in endangered species recovery in these areas.

Conclusions

Our scenario of discovering a living thylacine has illustrated the complexity that typifies endangered species recovery efforts. We have only just touched upon some of the aspects involved. The scenario has introduced us to the contributions that modern interdisciplinary approaches, well founded in the policy sciences, can make to solve endangered species problems. Other papers in this volume explore these theories and concepts we briefly introduce here in more detail. All conservation problems involve social and decision processes, as well as problem definition; even though most practitioners probably do not recognize them as such. A significantly improved understanding each of these aspects of a problem therefore offers the promise of increased success rates in the future.

We based our scenario on an extraordinary animal, the thylacine. Because of its unusual and unique status in the animal world, people can easily identify with its plight and would likely mobilize rapidly for its recovery. Unfortunately, it is unlikely that the thylacine will be found. One wonders what the outcome would have been if, in the 1930s, the conservation biology perspective we endorse here had pervaded, and modern techniques had been available. Similar situations, however, are likely to develop in the future. Will our response be adequate to meet the challenge? How would the situation differ for a less glamorous species, such as an insect or "weed," or for a species surrounded by greater conflict, such as a large, dangerous carnivore

or an agricultural "pest?" Each of these scenarios exists today, but only the future will tell if recovery efforts will succeed.

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Yellow-headed blackbird (*Xanthocephalus xanthocephalus*) by Richard P. Reading.

Conclusion

Becoming a More Effective Professional: The Next Steps in Learning and Applying an Interdisciplinary Approach to the Conservation of Biological Diversity

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To increase our effectiveness at recovering endangered species we must apply the lessons we learn from our work, our colleagues, and the literature. Learning is best achieved by building on our successes, what we call a "practice-based" approach. Learning depends directly on people's willingness and ability to accept and try new approaches. This special issue of Endangered Species *UPDATE* provides concepts, tools, and examples of how we might learn more systematically and explicitly, thereby moving toward a new level of effectiveness.

In looking at interdisciplinary endangered species recovery in this volume, we have considered, among other things, the complexities of partnerships and teamwork, challenges of cooperatively and cogently identifying problems, the influence of peoples' values on decision making, the role of self-awareness in professional productivity, use of multiple methods, organizational improvements, prototyping, and the concept of interdisciplinary practice. We have taken these tools from the policy sciences and seen how to apply them in practice to address actual endangered species and ecosystem conservation programs and challenges on four continents.

So what should you do with the information in this special issue? We suggest using it as a launching pad for promoting interdisciplinary professionalism in your own work. You might start by asking questions of yourself and others in endangered species programs. These questions flow from this publication, and require you to place yourself in a comprehensive context by starting with the question: Where do you and your program fall with regard to the variables discussed above? Then continue with the following:

- How does your program use partnerships and teamwork? Are they effective? Is there a better way to employ these tools?
- How clearly do you and others in your program identify problems and develop alternatives to address them? Do you systematically attend to the five tasks required of problem solving (i.e. goal clarification, trend description, condition analysis, trend projection, and alternative creation)? If not, why not and what can you do about it? How can your program be more effective at identifying and addressing problems?
- How directly have you considered how your own values affect the decisions you make? How are the eight values (i.e. power, wealth, enlightenment, skill, well-being, affection, respect, and rectitude) shaped and shared through your recovery program? Do you assess the values of other participants in the decision making process, especially when their decisions affect you? How can they be employed more effectively?
- Does your program use a combination of ecological and social methods and integrate them practically and in a timely fashion? If not, how can improvements be made? Do you strive to accommodate professionals from fields outside of your own when the policy process calls for their involvement? Do you try to educate yourself about tools and methods in disciplines other than your own as they relate to your job or program?
- How can organizational improvements be made? What is your role in the formal or informal groups in which you participate?
- Is prototyping something that would help improve your program?

These questions all underlie a more fundamental set of questions, in part:

- In what ways are you an interdisciplinary professional?

- What have you done that contributes to practical problem solving or critical evaluation in your program to improve its performance?
- Do you engage in internal and external evaluations of your work in formal and informal settings?
- How have you increased the knowledge and skill you need to manage and operate within your program?
- Have you helped others to be more effective? How and with whom have you shared your experiences?
- Do you discuss with colleagues the benefits of the concepts, tools, or methods you use to be a more effective practitioner?
- Do you write them down to reflect on and be reminded of them later?

The answers to these and other questions provide the stepping stones to interdisciplinary professionalism. They are the rational next step beyond reading about and (we hope) benefiting from the information in this special issue. By answering these and related questions you are taking the next steps!

Finally, we ask you to share with us your experiences in professional practice that can contribute to our collective understanding of what it means to be an interdisciplinary professional (that is, one who asks and can answer the questions given above and use this information in successful recovery programs.). If you have an experience to share, please write it down and send it (via e-mail to rwallace@ursinus.edu). We will respond and, with permission, incorporate them into future papers on endangered species and ecosystem conservation. By encouraging this feedback, we hope to improve both the quality of discussions about professional practice and the process and outcomes of the vital work we all undertake — conserving the earth's biological diversity.

Florida panther (*Puma concolor coryi*) courtesy of the USFWS.

News from Zoos

Condors to Be Released in Mexico

Biologists from the US Fish and Wildlife Service, in cooperation with the Zoological Society of San Diego, the Los Angeles Zoo, the California Department of Fish and Game, and numerous Mexican partners, began ferrying six California condors from the Los Angeles Zoo to Mexico on August 12, 2002, flying the endangered birds by plane on the first leg of a journey to a remote mountain site where five will be released this fall.

Three of the birds were flown by private plane from Burbank, California to Tijuana, Mexico, said Mike Maxcy, principal animal keeper at the Los Angeles Zoo. The plane was to turn around and pick up the other three birds later. From Tijuana, the birds were to continue on by plane and truck to a remote and rugged site in the Sierra de San Pedro Martir, where they will remain in a mountaintop pen for several weeks.

Once acclimated, five of the condors, all juveniles, will be released to fly over what was once the southernmost extension of a range that stretched from Mexico to Canada. Condors have been absent from Mexico for at least 50 years.

"This is another piece of just fabulous habitat where we expect the birds to thrive," said Bruce Palmer, California condor recovery coordinator for the US Fish and Wildlife Service. "To have a place that is reasonably isolated and protected from people, this is important for the birds to develop."

The sixth bird, an older female, will remain penned at the site to act as a mentor for the other birds, who were all raised at the Los Angeles Zoo. She will eventually return to the zoo.

In the 1980s, biologists began an aggressive program to capture the last of the free-flying condors and breed them in captivity. Up from an all-time low of 22 birds in the early 1980s, there were 208 condors in the wild and captivity as of August 1, 2002.

As the captive population grew, biologists began returning the birds to the wild in 1992, releasing them in California and Arizona. The Mexico releases mark the international expansion of the recovery program.

The goal of the $40 million recovery effort is to establish two wild populations and one captive population of condors, each with 150 birds, including a minimum of 15 breeding pairs apiece. Since condors range so far, biologists will consider the Mexican colony part of the California population, with which it is expected to mix. [Source: Associated Press]

Fossil Rim Establishes Cheetah Conservancy

The Robert B. Haas Cheetah Conservancy will open at Fossil Rim Wildlife Center in the fall of 2002. The new conservancy includes seven pens, five of which will be used for public display and two for expectant females, in addition to a modern food preparation facility. The American Zoo and Aquarium Association's (AZA) Cheetah Species Survival Plan® (SSP) deemed the immediate construction of the conservancy vital to the long-term success of the captive cheetah population.

Funded by a generous challenge grant from the Robert Hass Family Philanthropic Fund of $2 for every $1 raised by Fossil Rim, the $300,000 conservancy will provide Fossil Rim the opportunity to significantly increase the North American captive cheetah population by instituting propagation techniques proven to be successful. Allowing the public a view of the conservancy provides Fossil Rim the opportunity to exhibit cheetahs in spacious, natural environments in an effort to raise awareness for the need to support conservation efforts in captivity and in the wild. [Source: AZA Communiqué]

Vancouver Aquarium Marine Science Centre Plants Salt Marsh

On April 16, 2002, staff members and volunteers of the Vancouver Aquarium Marine Science Centre planted a new salt marsh at the mouth of the BC Hydro Salmon Stream Project in Stanley Park. Salt marshes and wetlands found at the mouths of rivers and streams where fresh and salt water mix serve as a vital feeding and transition ground for salmon about to make their migration to the open ocean.

Volunteers from the Aquarium's RiverWorks program set up four rough plots at the mouth of the Stanley Park stream with layers of gravel, filter cloth, sand, and peat moss in which plants could take root. The plots were built with a barrier of large rocks to prevent erosion. RiverWorks, an Aquarium initiative, is an estuary clean-up program supported by community groups and volunteers. The BC Hydro Salmon Stream Project highlights the life cycle and importance of salmon and is free to the four million people who visit Stanley Park each year. Salmon return to the stream each fall and can be seen at the park's Alcan Salmon Pool Display. [Source: AZA Communiqué]

Information for *News from Zoos* is provided by the American Zoo and Aquarium Association.

News & Events

Biogeography Society Meeting

The International Biogeography Society (IBS) is holding their inaugural meeting on January 4-8, 2003, in Mesquite, Nevada. Biogeographers from around the world will deliver five symposia, and meeting participants are invited to submit titles and abstracts for poster sessions. For more information, see the IBS web site: http://www.biogeography.org.

Nonindigenous Aquatic Species

The U.S. Geological Survey has created the Nonindigenous Aquatic Species (NAS) web site (http://nas.er.usgs.gov), which was established as a central repository for accurate and spatially referenced biogeographic accounts of nonindigenous aquatic species. The NAS provides scientific reports, online/realtime queries, spatial data sets, regional contact lists, and general information. The data is available for use by biologists, interagency groups, and the general public. The geographical coverage is the United States.

Algae on the Internet

AlgaeBase is a new on-line database that provides information on algae of the world, including terrestrial, marine, and freshwater forms. Currently, the data is most complete for seaweeds, however information is constantly accumulated and updated. AlgaeBase is part of the SeaweedAfrica project funded by the European Union. For more information: http://www.alagebase.org.

IUCN Cat Specialist Group

As part of the IUCN's Species Survival Commission, the Cat Specialist Group consists of the world's leading scientists and wildlife managers involved with 36 species of wild cats in more than 50 countries. The Group provides data on the development and implementation of conservation programs and projects, serving as honorary advisors to the IUCN. The Cat Specialist Group web site provides information about the biology of wild cat species, cat publications, and links to other relevant organizations. For more information: http://lynx.uio.no/catfolk.

E-mail your announcements for the Bulletin Board to esupdate@umich.edu. Some items are provided by the Smithsonian Institution's Biological Conservation Newsletter.