Large Scale Conservation

Integrating Science, Management, and Policy in the Common Interest

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Darcy Newsome, EDITORS

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Preface

Achieving environmental sustainability at large scales has proven difficult. Ideally, the goal of large scale conservation should be to improve "human dignity" for all people so that we can live in and enjoy healthy, sustainable environments. However, data show that many people live in poverty and indignity, and many species, ecosystems, and environmental systems are currently overused, stressed, or degraded. Additionally, our professional systems and institutions for science, management, and policy are not presently designed to address conservation at large scales, so learning and change have been slow or nonexistent. Consequently, gains to be had in human dignity and sustainability require rapid learning and improvement. Because of the limitations of and an over-reliance on the principles—formula and doctrine—of scientific management, bureaucratic systems, and techno-rational expertise, both the number and scope of ordinary, governance, and constitutive problems are growing across the globe. Until we achieve environmental sustainability, human dignity will remain only an aspiration for billions of humans. Finally, without changes in the professions and our management and policy institutions, many more life forms may be consigned to extinction at the hands of humans.

There are numerous approaches to large scale conservation, including single and multiple use strategies, parks and protected areas, eco-regional approaches, integrated conservation and development projects, transboundary efforts, community-based initiatives, and adaptive governance approaches. Each approach is premised on a core set of basic beliefs (doctrines) about nature, resources, and humans, and implemented by a set of operating principles or formulas. Given the human dignity and sustainability goal of large scale conservation, not all approaches are equally useful or practical. It is possible to transition from current approaches, which are bounded and conventional, to a more sustainable, cooperative, and effective formula. The Yale School of Forestry & Environmental Studies graduate seminar on which this volume is based examines this diversity of formulas and doctrines, and harvests practical lessons in order to upgrade the practice of large scale conservation (Appendix A, this volume). It encourages learning and improvement through enhanced problem solving and leadership (Chapter 9, this volume).

Different approaches to large scale conservation reflect different origins, interests of originators, and contexts. Each approach emphasizes somewhat distinct goals and methods, and mobilizes different communities of practitioners, decision makers, and publics. Each approach stresses different conventional outcomes, such as nature

preservation, human sustainability, or poverty relief. Functionally, each initiative attempts to change decision making processes and value-institutions to favor its prescription (and doctrine). Being clear on goals and evaluative standards for particular projects is essential in order to close feedback loops and actively learn in systematic ways. Ultimately, upgrading the decision process is at the heart of all successful large scale conservation efforts. Consequently, *understanding how decision (governance) processes work and how to improve them is essential to successful leadership and problem solving*. This is the practice-based prototyping approach that is emphasized in the Yale seminar. Anyone can learn to use it. This volume will help you become knowledgeable and skilled in the pursuit of sustainable large scale conservation and human dignity.

This volume is intended for a broad audience, including experienced field-based practitioners, students new to the large scale conservation subject, policy makers who set strategic direction, and organizations managing large scale landscapes. Professors can use it to design courses, and practitioners will find it helpful in leading workshops and projects. Much of the volume is focused on the knowledge, skills, and leadership needed to improve large scale conservation. As such, the ideas and perspectives introduced here can be put in practice immediately.

This publication is divided into three parts, each with three papers, a conclusion, and appendices. Part I is especially relevant for practitioners and provides an overview of our theory and methodology. Chapter 1 offers a problem-oriented overview of large scale conservation in the common interest, defining key terms, and making recommendations. Chapter 2 presents our perspective focusing on a problem typology, a theory of human behavior (people seeking values through institutions using and affecting resources), and our conclusions. Chapter 3 surveys seven major approaches to large scale conservation. We recommend the adaptive governance approach.

Practitioners and students will be interested in the application of our approach, which is illustrated by the three case studies in Part II. All three cases were rapid appraisals by student teams. Cases were informed by Part I, but are not a literal follow-on from the theory in Part I. Cases include the Connecticut River watershed in New England, the Wind River Indian Reservation in central Wyoming, and the Greater Yellowstone Ecosystem in the Rocky Mountains. Other students in the Yale course over the years have looked at large scale efforts worldwide (see Appendix A). All three chapters make recommendations in the common interest.

Practitioners and teachers are directed to Part III, which describes strategies for group problem solving, analysis, and practice-based learning (including a specific chapter on best practices), as well as how to foster interdisciplinary leadership and problem solving in the service of large scale conservation and in other projects in the common interest. All are general in nature and focus on education. Chapter 7 is based on a class learning exercise using a workshop model to clarify best practices for large scale conservation. The workshop used a variety of methods helpful to practitioners anywhere. Chapter 8, on best practices, lays out the concept and recommendations on how to find and use best practices in the context of large scale conservation. Chapter

9 is a paper on learning interdisciplinary, integrative problem solving and leadership skills. These skills are highly useful in diverse conservation challenges and cases. Four venues are described for learning these skills. Recommendations are made to help people be successful.

The conclusion is short and offers final words on large scale conservation in the common interest. Three appendices describe the Yale seminar on large scale conservation, provide a guide for effective decision making in conservation, and offer worksheets for appraising and improving large scale conservation.

Our perspective in this volume differs from many publications in that we move beyond conventional typologies and problem definitions to focus on the contextual, foundational, and practical elements of large scale conservation, including the formulas, doctrines, and symbols that are always used, regardless of the case. We seek to capture diverse experiences in large scale conservation no matter what form they take—from single and multiple use to transboundary and ecoregional planning. Our volume is intended to help readers move beyond existing paradigms towards a more integrated, comprehensive, effective approach that seeks human dignity and sustainability for all.

Susan G. Clark, Aaron Hohl, Catherine Picard, and Darcy Newsome, Editors

Part I: Overview

Chapter 1

Large Scale Conservation in the Common Interest: An Overview

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ABSTRACT

This publication adds to existing literature on conservation management policy by offering a comprehensive, interdisciplinary, and pragmatic perspective to problem solving and leadership in the service of large scale conservation. Our analysis moves beyond conventional typologies and problem definitions to focus on the contextual, foundational, and practical elements of large scale conservation, including the formulae, doctrines, and symbols that are used. The diverse approaches currently in place are not equally effective, given the goals of human dignity and sustainability. This chapter provides an overview of large scale conservation and introduces the organization, rationale, and utility of this volume. A brief problem oriented appraisal of large scale conservation is offered, including a look at our goals, current trends in conservation, underlying conditioning factors behind those trends, and projections about whether current trends and conditions are heading us toward or away from the desired goals of environmental sustainability and human dignity. The chapter concludes by summarizing our proposed alternative—the practice of adaptive governance—which promises to be more effective in achieving these goals.

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Key words: *Large scale conservation, interdisciplinary problem solving, sustainability, common interest*

INTRODUCTION

A growing number of scientists, managers, and resource users worldwide recognize that short-term and narrowly focused remedies to environmental problems are not tenable. Traditional, expert-driven interventions based on the principles of scientific management have failed to meet demands for increased community participation in policy and management (Wilkinson et al. 2007). As a result, people are increasingly turning to large scale conservation strategies—from ecosystem management to transboundary conservation—to address the growing number, scope, and complexity of environmental problems (Gordon et al. 2005). However, facile solutions for alleviating environmental problems do not exist, and scaling up existing models is insufficient (Clark 1993). First, sustainable solutions must account not only for human uses but also for the needs of other species (Kellert and Wilson 1993, Bammer 2005). Second, they must attend not only to intergenerational equity, but also to spatial equity (Chapin et al. 2009, Oliver 2003). And finally, they must account not only for large spatial and temporal scales, but also for biophysical and sociopolitical complexity. The problem oriented approach used throughout this volume seeks to overcome the incomplete formulae currently being used by integrating knowledge and action to meet the twin goals of human dignity and sustainability.

LARGE SCALE CONSERVATION: A PROBLEM ORIENTATION

Diverse large scale conservation strategies are being intensely promoted and rapidly adopted around the world; however, there is no precise definition of the concept. Large scale conservation is used simultaneously to refer to increased *spatial* scales (e.g., landscape-level conservation), *ecological* criteria (e.g., biodiversity hotspots), as well as the need to attend to the *political* dimensions of conservation (e.g., transboundary protected areas and peace parks). These approaches are promoted under different labels and some come to have great symbolic appeal (e.g., the Yellowstone to Yukon, "rewilding" North America, and the "Free to Roam" initiative). With so many overlapping conceptions, definitions, and typologies in use, it has become increasingly difficult to distinguish among the diversity of approaches, and how they differ (if at all) with respect to their underlying assumptions (doctrine), formulas, and symbols.

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In this volume, we use the term large scale conservation to refer to conservation efforts that deliberately seek to function at larger and more complex spatial, temporal, and governance scales than previous efforts. Our approach requires that the mix of ordinary, governance, and constitutive challenges inherent at large scales

be addressed simultaneously and pragmatically. Larger spatial scales, for example, shift the target of conservation from individual protected areas to ecosystem services and functions and finally to human dignity and sustainability. Expanded temporal scales include explicit attention to the historical context and future impact of a conservation intervention. Finally, more complex scales of governance seek to expand participation, coordination, and cooperation in natural resource decision making. Fortunately, concepts and methods already exist to permit us to do this and these are introduced in the volume and further detailed in the literature cited.

Large scale conservation is inherently complex and requires integrating information and action from disparate disciplines and participants into a rational framework for decision making. A variety of research methods, policy instruments, and management approaches are currently used to address the challenges posed by large scale conservation. Our analysis differs from many existing efforts by adopting an explicitly interdisciplinary and problem oriented approach that focuses on the social and decision making processes that characterize large scale conservation. Being problem oriented instead of solution oriented entails clarifying participants' goals and values, describing trends, analyzing the conditions that drive these trends, and projecting future developments. Finally, it requires the identification, evaluation and selection of management policy alternatives. These problem oriented tasks must be addressed explicitly and systematically in an interactive fashion (Clark 2002).

Content and process

Large scale conservation is about both content and process issues, and their interrelationship (Clark 2008). The content (biophysical substance) of a problem and the process (relations, procedures, and decision making patterns) of its development and solution are two interrelated elements of any real world problem. Some practitioners and approaches to large scale conservation emphasize one dimension over the other. Typically content issues are featured, and process issues are underappreciated or ignored. For example, traditional ecologists and conservation biologists may emphasize biophysical content (e.g., ecological functions and processes) at the expense of attending to human processes, relations, or procedures (e.g., values, and decision processes). As Li (2007: 7) notes, "Questions that are rendered technical are simultaneously rendered nonpolitical. For the most part, experts tasked with improvement exclude the structures of political-economic [process] relations for their diagnosis and prescriptions." Conversely, social scientists (e.g., political ecologists, anthropologists, political scientists) tend to emphasize processes or relations (such as power and economic wealth) at the expense of other key social variables and biophysical dimensions, including the structure and function of ecosystems. Whatever the discipline used, each has strengths in clarifying challenges, but each also suffers from blind spots that cause important aspects to be overlooked and not integrated into the picture as a whole (Clark 1993, Clark 1997). We contend that successful large scale conservation efforts must simultaneously attend to both content and process issues in a manner that is realistic, explicit, and practical. Concepts and methods exist to do this but are underutilized at present in large scale conservation. The *adaptive governance*

approach proposed and detailed throughout this volume is an example of an integrated, balanced approach between content and process concerns.

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Our goals

We specifically recommend four goals for improving the design and practice of large scale conservation. These are human dignity, sustainability, common interest, and effective leadership. We offer these goals not as ambiguous abstractions (see Mirovitskaya and Ascher 2001, McDougal 1992-93, Hohl 2009), but rather as objectives that can be subjected to empirical criteria, standards, and tests, and achieved in practice (Brunner et al. 2002, 2005).

Human dignity

We believe there is no higher goal than human dignity (McDougal et al. 1980). Some may feel that discussions of such topics are far removed from natural resources, but large scale conservation cannot be achieved without sustainable, healthy societies based on human dignity for all people. The goal of human dignity arises from respect for the value of the individual, equal treatment under the law, individual freedom, and social justice (Lasswell and McDougal 1992: 34-35). It is a widely supported goal in human affairs, and is articulated in the United Nations Universal Declaration of Human Rights and many other constitutions, declarations, and conventions worldwide (Hunt 2007, Weston 2008, Mattson and Clark submitted). Human dignity rests on the principles of respect, participation, and freedom of choice. Applying these principles in practice is often problematic. The perennial challenge is to honor the principles without violating the basic rights of others. Freedom of choice, for example, requires mutual deference to others' choices. Finding the most efficacious approach to achieve human dignity in large scale conservation can be both difficult and contentious, but it is possible.

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Sustainability

Sustainability in large scale conservation requires maintaining the potential of a system to persist or improve its functioning and the benefits derived from that system over time. There are no precise criteria to determine if something is sustainable, although it is often painfully clear when policies and practice fall far short of sustainability (Mirovitskaya and Ascher 2001). Sustainability has been criticized as a

"woolly, ambiguous concept that is resistant to precise definition, fraught with internal inconsistencies, and difficult to apply in practice. It shares these difficulties with other core societal values, such as freedom, equality, and justice" (Sarewitz 2001: 74). To achieve institutions and practices of sustainability will require learning and change at the individual and organizational level (Clark 2002: 153-172). It will also require a special kind of strategic leadership and professionalism, which is why this volume stresses the importance of leadership skills, critical thinking, and problem solving.

Common interest

An interest is a demand for values made on behalf of a person or group and supported by expectations that the demand will be advantageous (McDougal et al. 1980: 205). A common interest is at stake "whenever people act on their perceived interests and form a community around an issue" (Brunner et al. 2002: 12). A distinction can be made between common and special interests. In the simplest conception, "interests are 'common' when they are shared, 'special' when they are incompatible with comprehensive goals" (Lasswell and McDougal 1992: 360). For example, safe drinking water and clean air are inclusive common interests. The common interest should not be assumed or taken to be permanent. Nor is it a collection of special interests that are fused together into a forced, 'win-win' scenario. The common interest is comprised of mutually dependent interests such that in order to further any one set of values the interests of other participants must also be advanced. It is "a process of balancing, accommodating, and integrating the rich diversity of culture, class, interest and personality which characterizes all arenas" (McDougal et al. 1980: 207). Finally, the common interest should not be confused with unanimity. "Unanimity is a euphemism for minority veto power, in which the negative decision of one community member enforces policies on all" (McDougal et al. 1980: 202).

Steelman and duMond (2009: 396) note that "we have lost the language, vocabulary, and ability to talk about the common interest." The job of clarifying the common interest in large scale conservation may depend on distinguishing between valid versus assumed or expedient interests (see McDougal et al. 1980). In practice, determining the common interest is full of procedural, substantive, and pragmatic challenges. We must relearn how to clarify, secure, and sustain our common interest. There are partial tests that can be applied to determine if a project or policy is achieving the goals describe above. These include a "procedural test" to determine if decision making is inclusive, participatory and representative, a "substantive test" that asks if concerns are valid, appropriate and broadly supported, and finally a "pragmatic test" that determines if participant's expectations have been upheld and policies/decisions work in practice (Cromley 2002).

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Leadership

Effective leadership is essential if large scale conservation is going to achieve the goals described above. Effective leaders show good timing, respond to clear needs, and may or may not be highly visible to the public. They inspire commitment and action, lead in problem solving, encourage broad-based involvement, and sustain hope and participation. Chief among their skills is helping to clarify goals, map events and social interactions, identify the underlying conditions that drive these events, project future outcomes, and select practical alternatives. Leaders understand the value demands and identities of potential followers, and use this knowledge to fully engage and meet the needs of participants. In short, they raise people and themselves to a higher level of motivation by empowering others and providing a new sense of perspective and energy. Finally, effective leadership includes promoting and safeguarding the process of deliberation in the common interest. The goal of this volume is to help practitioners and students to become skilled leaders–aware of their own standpoints and psychodynamics–in the service of large scale conservation.

Historic trends

A core premise of large scale conservation according to Noss (2002: 10) "is that the integrity of any piece of land or water is ultimately dependent on the health and quality of the broader landscape that surrounds it…therefore, larger scales are ultimately more meaningful than smaller, isolated efforts." A consequence of this premise has been an expansion of the scale and breadth of conservation efforts from isolated protected areas and single use management strategies to regional and even international efforts that transcend political boundaries and encompass multiple goals (e.g., integrated conservation and development projects). Large scale conservation approaches are justified as efficient, "science-based" strategies that enable practitioners and donors to identify the most effective means of expending their limited resources (Groves et al. 2002, Chapin et al. 2009).

Large scale conservation strategies are now embraced by every major conservation organization and donor agency around the world (Gordon et al. 2005). Between 1998 and 2008, the number of transboundary protected area complexes increased globally from 59 to 227 (Lysenko et al. 2007). Terrestrial protected areas now cover more than 12 percent of the earth's surface, and more land is now under official protected status than is currently used for permanent arable crops (Chape et al. 2003). However, in spite of the significant increase in the number, size, and type of large scale conservation initiatives established around the world, biological diversity and ecosystem services remain severely threatened.

According to the Millennium Ecosystem Assessment report, human activities have accelerated the rate of species' extinction by as much as 1000 times the historical average. This means that more biodiversity has been lost over the past fifty years than during any other period of human history (Millennium Ecosystem Assessment 2005: 10). Fifteen out of twenty-four of the world's ecosystem services considered in the Assessment are listed as "degraded," including air and water quality, the health of marine fisheries, and the ability to protect against natural

hazards. The costs of environmental problems are disproportionally borne by people with limited resources and access to decision making processes. This has in turn has led to increased tensions—even violence—over access to and control over the world's remaining natural resources. These trends suggest that simply increasing the spatial and temporal scale of protected areas, or harmonizing natural resource policies across administrative and political boundaries, is by itself insufficient to secure environmental sustainability.

Conditions

The widespread adoption of large scale conservation can be traced to three underlying conditions: innovations in the study of ecology, economic conditioning factors, and socio-political dynamics. Groves et al. (2002) highlight several advances in ecological research that led to the promotion of large scale conservation approaches. First, conserving ecosystem processes and functions—rather than individual species or habitats—allows for a wider assemblage of biological communities and ecosystems to be protected. Given that scientists are dealing with incomplete and changing data, protecting ecosystems and not individual species is a useful precautionary strategy. Second, research has demonstrated that ecosystems function across multiple spatial and temporal scales, and these factors must be considered when planning conservation targets and goals. Finally, ecosystems are not locked in a steady state or predetermined successional trajectory, but are instead characterized by dynamic, and often unpredictable fluctuations. Accordingly, ecologists argue that conservation interventions should focus on increasing ecological connectivity and resiliency if they are to achieve any lasting impact.

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Economic conditioning factors also play an important role in the rise of large scale conservation. First, large scale approaches should provide efficiencies by managing resources at ever increasing economies of scale. They may also increase net benefits for communities when the cost of conserving one particular location is offset by benefits of conserving a broader set of ecosystem services. Large scale approaches such as ecoregional planning are also used to make conservation more economically efficient by prioritizing conservation targets, in order to get the greatest return out of every conservation dollar.

Finally, as the world's population becomes increasingly connected and interdependent, there are social and political conditioning factors that encourage the coordination of natural resource policies across administrative and political boundaries. The cooperative management of wildlife and water across international

boundaries has, for example, been widely promoted as a way to promote regional peace and security (Ali 2007). Together these ecological, economic and socio-political conditioning factors work in conjunction to drive the growth of large scale conservation approaches across the globe.

Problem definitions

We identified three basic types of problems in large scale conservation which are further described in Chapter 2. First, there are a range of *technical* problems including a global decline in biodiversity, the degradation of ecosystem processes, and mounting pressures on the earth's resources as human populations expand. These technical problems threaten to impair the ability of future generations to live high quality, dignified, and sustainable lives. Second, there are *governance* problems as our decision making systems have proven inadequate to address the diversity and complexity of environmental problems that we currently face. This has led to increased demands for community participation in natural resource policy and management that our current institutions seem ill equipped to handle. Third, there are *constitutive* problems that concern the underlying assumptions, expectations and norms that guide the organization of our societies and determine how we carry out decision making. For example, our basic doctrine for managing natural resources privileges scientific management and economic efficiency, making it difficult for participants to identify, let alone secure, their common interests. These less than effective approaches have become institutionalized in many organizations' operations. Large scale conservation efforts are inherently complex and must address all three types of problems if they are to be successful.

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The future

Based on current trends and conditions, the Millennium Ecosystem Assessment projects that environmental problems–including significant losses of biodiversity and the widespread degradation of ecosystem services–are likely to continue unabated over the next fifty years. The report also suggests that our current governance systems, institutions and legal frameworks are ill suited to effectively manage large scale ecosystem processes such as international watersheds (Millennium Ecosystem Assessment 2005: 72). As resources continue to be degraded and threatened, participants are demanding greater participation in the decision making process. In doing so, they often run up against the limitations of governance and constitutive institutions. It is not clear, however, if such demands are having any lasting effects on the institutions and policies that govern large scale conservation. In short, the common interest has not yet been clarified, much less secured in most large scale conservation

initiatives. The papers in this volume suggest that the goals of environmental sustainability and human dignity are not likely to be achieved by relying solely on technological fixes, increased cooperation or additional research. Current approaches to large scale conservation can be improved by being more contextual, problem oriented, and attentive to the constitutive and governance processes.

Our recommendation

A growing consensus is emerging among conservation scientists, practitioners, and local resource users that contextual, and practical methods are essential when undertaking large scale conservation projects. This requires goal clarity (i.e., sound doctrine and standpoint clarification), understanding problems pragmatically and contextually, practical means (i.e., a workable formula), and ways to learn from experience (i.e., adaptation). We propose the practice of adaptive governance as a means to accomplish these objectives. Adaptive governance assumes that science is relational, but that the behavior of humans depends on context as much as scientific principles or disciplinary knowledge. Problem definitions are contextual and draw from both local and scientific knowledge (Wilkinson et al. 2007). Multiple methods are used to solve problems, some of which are qualitative, interpretive, and integrative. Adaptive governance relies on integrative decision making and sound judgment by skilled leaders in order to address multiple goals. Policy improvement depends on regular monitoring, evaluation and a comprehensive focus on how decisions are made. Failed policies and programs should be terminated, but lessons should also be harvested and disseminated from unsuccessful large scale conservation projects (Clark et al. 2000).

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The practice of adaptive governance calls for finding and describing successful conservation efforts, adapting and diffusing them widely, and creating new opportunities to build future successes. In practice, this first means that more inclusive social and decision making process must be created. This can help clarify values and expectations. Second, expectations and demands about the conditions under which a solution is possible must be identified. And third, expectations and demands about problem solving, coordination, and participation in decision making must be clarified. Adaptive governance strives to find ways to help people clarify, secure, and sustain the common interest in these tasks. This leads to integrated solutions and enduring outcomes. The goal is not to create "win-win" scenarios, but to identify mutually dependent and interdependent interests that are secured through an iterative decision making process that is effective and practical.

CONCLUSION

In this volume, we analyze three large scale conservation approaches that are attempting to address complex environmental problems in a sustainable fashion. All are "large scale," based on spatial, as well as temporal and complexity scales. All are facing significant challenges in identifying, securing and sustaining the common interest. We recommend adaptive governance as the basis for achieving dignity and sustainability goals and for learning. Best practices in large scale conservation can be identified, diffused, and adapted successfully (e.g., Brunner et al. 2002, 2005, Brunner and Clark 1997). In this volume we move beyond descriptive typologies of large scale conservation (e.g., Gordon et al. 2005) to explore and analyze the formula, symbols, and doctrine that underpin a diversity of large scale conservation models currently in use. We also advocate undertaking a comprehensive problem oriented approach that distinguishes among ordinary, governance, and constitutive problems and their interrelationship. Finally, we seek to clarify and upgrade the social and decision processes that are the very foundation of all large scale conservation efforts.

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Chapter 2

Pursuing Large Scale Conservation in the Common Interest: A Perspective

Susan G. Clark, Aaron Hohl, and Catherine Picard[1]

ABSTRACT

Practitioners of large scale conservation are addressing problems that can be understood and successfully remedied only by being more holistic and taking into consideration larger spatial, temporal and complexity scales than in the past. This requires a realistic appreciation of the problems at hand, better theoretical grounding, and being appropriately skilled. Successful large scale conservation may involve adopting new formulas, symbols, and supporting doctrines for some people and organizations to move beyond the conventional, disciplinary, and institutional practices that currently dominate many efforts. To encourage this transition, this chapter uses and draws on a problem typology to examine interrelated technical, governance, and constitutive problems inherent in large scale conservation. It also offers a logically, comprehensive theory of human behavior and natural resources policy in which "humans seeking values through institutions use and affect resources, both natural and cultural." This chapter is foundational to this volume. Both the typology and theory are used throughout the other chapters. At present, it appears that many people lack such a typology and theory. Among the practical implications of this typology and theory are that they require that the full suite of problems—ordinary, governance, and constitutive—must be appreciated and attended to in practical ways. The typology and theory provide an opportunity to advance conservation performance in the common interest.

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Successful large scale conservation may involve adopting new formulas, symbols, and supporting doctrines for some people and organizations to move beyond the conventional, disciplinary, and institutional practices that currently dominate many efforts.

Key words: *Large scale conservation, problems, ordinary, governance, and constitutive problems, humans, values, institutions, resources, common interest*

INTRODUCTION

Large scale conservation efforts are a response to the growing awareness that many environmental problems can be understood and successfully remedied only by taking into consideration larger spatial, temporal, and social complexity scales than in the past. However, successful large scale conservation requires more than just "scaling up" previous formulas such as "scientific management" and established organizational arrangements. Problems must be addressed holistically and contextually, and attention must be given to social and decision processes inherent in the case at hand. For this to happen, practitioners require critical thinking, problem solving, observation, management, and technical skills (Chapter 9, this volume). It is clear that people—practitioners, scientists, decision makers—need a theory of social and decision processes and problems to aid them in asking and answering important questions about themselves and other people and to understand the system of which they are a part as they do their large scale work.

In this chapter we introduce some important concepts for understanding problems in large scale conservation and present a theory for making sense of the human dimension in natural resource management. This theory has been used in diverse contexts, and illuminates ways to enhance sustainability and human dignity. Most current large scale conservation efforts do not attend to these foundational elements. This chapter offers a typology of problems and a theory of natural resource management and policy that are used throughout this volume.

PROBLEM ORIENTATION AND A PROBLEM TYPOLOGY

Problems can only be effectively addressed if people orient to them realistically. As Clark (2008: 21) notes, "This seems obvious, but too often we misconstrue a problem, identify the wrong problem, see only part of a problem, or overlook it entirely." Consequently, one of the major challenges facing practitioners of large scale conservation is articulating the most relevant problem definition. Practitioners must often navigate in the face of facile problem definitions that can be clearly stated and rigorously solved but, are irrelevant to the solution of real world problems. A problem definition may, for example, be highly relevant, but insoluble using old paradigms, professional skills, and institutions. Although it is common during the early phases of any decision making process to frame problems rather narrowly, typically in technical terms, and often based on special interests, large scale conservation problems are multifaceted, have wide-ranging effects, and do not lend themselves to narrow or technical definition. A narrow focus on problem solving rather than a contextually sensitive problem framing may lead a practitioner to uncritically accept a proposed solution without taking into account past trends and conditions, probable futures, or the value dynamics at play.

Problems can only be effectively addressed if people orient to them realistically.

Interventions designed to address technical problems (content or substantive concerns) but not value dynamics (process or procedural concerns) are likely to engender conflicts over whether a problem actually exists, what the best solution for the problem is, and what the best means of implementation are (Rocheport and Cobb 1990, Picard forthcoming, in press). We recommend adopting a problem oriented approach to large scale conservation that includes five tasks (Clark 2002). The tasks of problem orientation are goal clarification (identifying values sought), trend description (reviewing relevant history), condition analysis (identifying relevant scientific knowledge and data that might explain matters), trend projection, and alternative or solution analysis (including invention, evaluation, and selection of options). All five tasks should be initiated early in the decision making process and attended to on an ongoing basis throughout the life of the conservation effort.

Table 1 Examples of four problem types addressed by various large scale conservation approaches

	PROBLEM TYPE		
Large Scale Conservation Approach	**Ordinary (technical)**	**Governance**	**Constitutive**
Single & Multiple Use Management	Calculate maximum sustained yield	Distribute grazing rights among ranchers	Allocate authority to make decisions about land in the public domain
Ecosystem Management	Assess tradeoffs between species/ habitat conservation and extractive uses of resources	Develop Habitat Conservation Plans (HCPs)	Clarify treaty rights of tribes and first nations
Ecoregional Planning	Identify wildlife migration corridors	Implement legislation that protects corridors from fragmentation	Restructure traditional/permitted uses of resources by local communities
Trans-Boundary Management	Map cross-border habitats used by large herbivores and carnivores	Negotiate cross border/international natural resource management agreement	Balance valid and appropriate interests and create an arena for local and cross-border cooperation.

A comprehensive problem orientation often reveals three types of problems (Clark 2008)—technical (ordinary), governance (political), and constitutive (cultural). Practitioners of large scale conservation are often confronted with all three classes of problems (Table 1), although they may or may not recognize this fact. A tendency exists to misidentify the type of problem one is confronting and, consequently, pursue ineffective solutions (Box 1). Often these solutions are based on prepackaged disciplinary, bureaucratic, or institutional formulas.

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Box 1 Misidentification of problems in large scale conservation projects

Understanding Patterns of Human Interaction of Decision Making: An Initial Map of Podocarpus National Park, Ecuador (Cherney et al. 2009)

Rapid deforestation, poor water quality, rural poverty, and transportation difficulties are just some of the technical problems that participants are focused on in Podocarpus National Park. Underlying these problems, however, is the lack of arenas where people can discuss and balance their competing interests, or identify common interest goals. Moreover, the heavy focus on surveillance, planning, and promotion has resulted in a decision making process that restricts participation to experts and ignores the social context in which the park operates. The authors conclude that under-standing the role of deliberative arenas and how to deliberately change the structure and function of those arenas can greatly improve the efficacy of problem solving.

The Promise and Peril of Large Scale Conservation: An Appraisal of the Selous Niassa Wildlife Corridor (Picard, forthcoming)

The Selous Niassa Wildlife Corridor (located on the Tanzanian-Mozambique border) is designed to address two major problems: an increase in wildlife poaching and habitat fragmentation. Picard argues that while these are worrisome trends, they are driven by three conditioning factors that have been overlooked by the current (biophysical) perception of the problem. These include: (1) the historical impact of socialism which profoundly reshaped the physical landscape, and continues to influence social and decision process trends in the Corridor today, (2) the rapid transition to a neoliberal free market economy which created a demand for cash crops and (3) the socio-cultural concept of wilderness which has deeply influenced participants' expectations and identities, including how problems are defined in the first place.

The American West's Longest Large Mammal Migration: Clarifying and Securing the Common Interest (Cherney and Clark 2009)

Participants in the 170 mile pronghorn antelope migration in western Wyoming articulate three distinct problem definitions. The ecological-scientific view advanced by scientists and environmentalists focuses on bottlenecks in the migration route that will cause the antelope to be extirpated locally. The local rights problem advanced by some local residents and property owners suggests that the concerns about the antelope are a guise for environmentalists to lock up public and private lands. The cultural-heritage view advanced by others emphasizes the cultural significance of the migration while rejecting the

need for government intervention. The authors argue that underneath each of these problem definitions are governance and constitutive challenges to securing a common interest solution. In particular, the highly fragmented patterns of authority and control and the parochial perspectives of many participants (including scientists), impede resolving the issue satisfactorily.

Technical problems

Technical problems are what most natural resource professionals deal with in their day-to-day work (e.g., what is the estimated population of osprey in the Connecticut River watershed?). Scientific inquiry is typically organized into discrete disciplines that assume the world can be understood by breaking it down into component parts. The methods associated with disciplinary scientific inquiry are well suited to providing answers to technical problems, especially problems with well defined spatial, temporal, and other contextual boundaries. However, focusing exclusively on technical problems restricts the range of considerations, participation, and limits debate to those who have similar language, training, and resources. In contrast, all the chapters in Parts II and III of this volume focus on the social and decision processes involved in large scale conservation and move well beyond only technical considerations.

Governance problems

Governance problems arise out of the need to make decisions about policy. They deal with both the arenas within which and the processes by which decisions are made. Some people have difficulty characterizing or thinking about governance problems, how to diagnosis them realistically, and how to correct them. Nevertheless, moving towards sustainability requires healthy governance processes (Cortner and Moote 1999). For example, Cherney et al. (chapter 4, this volume) found that fragmented decision arenas in the Connecticut River Watershed created a barrier to developing effective, more comprehensive common interest conservation management policy. A narrow, localized focus in this case restricted deliberation to local issues at the expense of a holistic vision that could have enhanced system wide cooperation and outcomes. The problem identified by Cherney et al. is illustrative of many governance problems that arise when numerous participants with diverse perspectives are spread out over a large spatial area. Participants may not share the same value outlooks, and may lack a practical theory about the social and decision processes of which they are part.

Governance problems arise out of the need to make decisions about policy.

For example, to find common ground in managing natural and cultural resources, Folke et al. (2005: 441) found that,

"Adaptive governance systems [as we recommend in this volume] often self-

> organize as social networks with teams and actor groups that draw on various knowledge systems and experiences for the development of a common understanding and policies. The emergence of 'bridging organizations' seem to lower the costs of collaboration and conflict resolution, and enabling legislation and governmental policies can support self-organization while framing creativity for adaptive co management efforts."

The Connecticut River case is a clear example of where participants could better organize for improved governance outcomes.

Constitutive problems

Constitutive problems are implicit and fundamental, more so than either ordinary or governance problem. Most people find it hard to see these problems. Constitutive problems arise from the norms or rules that guide individual and collective decision making in a community or society. Constitutive norms determine how and why decisions are made, and who is involved in the decision making process – they represent the rules for making the rules about ordinary decision making interventions. The case studies in this volume suggest that models of large scale conservation can be improved by being more attentive to constitutive and governance problems.

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The implicit norms that underlie governance processes can be adjusted only by changing societal rules through what are commonly described as constitutive processes. Decisions affecting the constitutive process are frequently made unconsciously. The evolving structure of the constitutive decision process is often a result of the way in which a series of ordinary decisions were made, rather than an outcome of an explicit decision about how the overall constitutive process should work. In contrast to technical and governance problems, constitutive problems can be essentially opaque to those within a situation, making such problems difficult to identify, let alone address. Furthermore, few people engaged in large scale conservation projects are trained to understand constitutive process or identify constitutive problems. As a consequence, constitutive problems are overlooked, misidentified, and rarely addressed.

[1] See note at end of chapter

A THEORY OF HUMAN BEHAVIOR[1]

Managing natural resources in pursuit of large scale conservation requires integrating biophysical information into a rational framework or theory for decision making (Clark 2009). In this volume, the theory (and framework) that we use to understand

the integration task can be most simply stated as "humans seek values through institutions using and affecting resources" (Lasswell 1971: 19). The centrality of these four elements—humans, values, institutions, and resources—in policy cannot be overstated. Carrying out large scale conservation successfully requires understanding and improving the way people make decisions about themselves, their values, institutions, and resources. The theory is foundational to this volume and informs case studies in Part II, and education and leadership issues in Part III of this volume.

Humans

All people have perspectives made up of identities, expectations, and demands. Understanding the social process in a large scale conservation venture requires discerning the motivations of all participants by analyzing their values, perspectives, and actions. Additionally, one should be cognizant of the situations (arenas) in which participants interact and the strategies they use to pursue their objectives. If one hopes to achieve outcomes that respect human dignity and are in the common interest, arenas should be open (i.e. relevant stakeholders must be included and allowed adequate participatory opportunities) and transparent (Steelman and DuMond 2009). Furthermore, because common interest actions may result in value deprivations for some participants, decisions should be made in an arena that is perceived as legitimate by relevant participants.

The goals of participants in any large scale conservation effort are a reflection not only of their values but also of their perceptions, or standpoint. According to the maximization postulate (Lasswell 1971:16) people are "predisposed to complete acts in ways that are perceived to leave them better off than if [they] had completed them differently." One's standpoint is the perceptual lens through which one views the world. Standpoint is a function of personal experience, professional training, and organizational affiliation. Individual experiences inevitably lead to preconceptions and biases that limit our ability to be fully rational. They influence what specific outcomes we value, how and what we perceive to be problems, and what we see as reasonable solutions. Clarifying one's standpoint requires recognizing personal biases—whether they are personal, epistemological, disciplinary, organizational or parochial—and individual values. As discussed in Chapter 8 (this volume), standpoint clarification will not ensure complete objectivity, but may help to temper the effects of the biases.

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Values

Values are "orientations toward what is considered desirable or preferable by social actors," (Zavalloni 1980: 74) and are often used as "criteria for preference or choice or as justifications for proposed or actual behavior" (Williams 1970: 27, 442). Values are embodied in ethical principles, normative properties, and moral responsibilities of

society; they often appear as moral or ethical statements about conduct that is beneficial or necessary for attaining human dignity at the individual, group, and societal level. Values are at the very heart of daily life, individual meaning, and social meaning. Consequently, value dynamics must be understood in order to collectively articulate the common interest.

Although potential values are multitudinous, they can be classified in terms of eight base values which represent a comprehensive list of underlying human motivations (Table 2). Using this classification scheme allows one to study values objectively (Bell 1997) and focuses attention on the key role that values play in decision making. Particular things that are valued or desired (e.g., the presence of wolves in Yellowstone, preservation of cultural landscapes in the Connecticut River valley) can be ascribed to one of these values. For example, Cherney et al. (Chapter 4, this volume) attributed the Connecticut River Watershed Council's interest in promoting restoration, conservation, and the wise use of natural resources to a combination of rectitude and wealth. Although all eight values are at play in most human interactions, and relative preferences among the base values determine the importance placed on specific outcomes. For example, participants might argue about the moral imperative to save an endangered species (rectitude) versus preserving jobs (wealth and well being).

Table 2 Base values that motivate human behavior (Lasswell 1971)

Value	Definition	Analytic Questions
Affection	Desire for friendship, loyalty or love.	How are professional, friendship, and loyalty values used in decision process? What are the outcomes?
Enlightenment	Desire to give and receive information.	How is information given and received? What are the outcomes?
Power	Desire to make and carry out decisions.	How is power given and received in interpersonal and decision process? What are the outcomes?
Rectitude	Desire for moral or ethical standards.	What are the ethics at play in interpersonal relations and in decision process outcomes? What are the outcomes?
Respect	Desire to give and receive recognition within a community.	How is respect or deference used (or not) in decision process? What are the outcomes?
Skill	Desire to develop talents.	What kinds of skills are used (or not) in problem orientation and in decision process? How and with what outcomes?
Well-being	Desire for mental, physical, and spiritual health.	How is well-being, both physical and mental, affected by the decision process? What are the outcomes?
Wealth	Desire to control resources (money, land, human capital).	How is wealth used and affected (given and received) by the process?

Four basic types of strategies can be used to obtain desired value outcomes: diplomatic, ideological, economic, and coercive. In general, diplomatic and ideological strategies are more likely to be sustainable than coercive strategies. Collaborative management and learning typically combine diplomatic and ideological strategies seeking more sustainable management actions (Fernandez-Gimenez et al. 2008, Wondolleck and Yaffee 2000). Well designed economic strategies can also be powerful (e.g. payments to ranchers for livestock depredations in order to conserve large carnivores). However, coercive strategies have sometimes been clothed in the guise of economic strategies with appeals to economic efficiency and rationality (e.g. the expropriation of customary use rights for "the public good," or the fines and fences approach to park management).

Four basic types of strategies can be used to obtain desired value outcomes: diplomatic, ideological, economic, and coercive.

Institutions

Improving large scale conservation requires not only changing the way decisions are made and the content of those decisions, but also changing the constitutive factors that influence how we perceive of and think and feel about large scale conservation problems. Conventional appraisals of decision making usually fail to comprehensively examine both the decision making process and the decision making culture. A functional appraisal of the decision process requires analyzing all the specific functions (activities) that must be completed in order to move toward a preferred future. A complete decision process requires attending to seven decision functions (Table 3). Standards exist for evaluating the efficacy of each function (Appendix B, this volume). The decision process as a whole should be dependable, comprehensive, and integrative (Clark 2002). Although the functions can be carried out either sequentially or concurrently, it is important to attend to all seven functions since ignoring a function can lead to suboptimal outcomes. For example, plans end up sitting on the shelf when prescription and application are not considered in tandem.

A functional appraisal of the decision process requires analyzing all the specific functions (activities) that must be completed in order to move toward a preferred future.

Adequate appraisal of large scale conservation initiatives is especially important. Particular initiatives can be treated as *practice-based prototypes* or innovations (chapter 8, this volume). As these prototypes are applied, they should be monitored and evaluated in order to identify what works, why, and under what circumstances. Adequate appraisal requires: (1) determining whether an effort met its goals; (2) identifying shortfalls and accomplishments; (3) analyzing the causal factors behind the level of success of the effort; and (4) making recommendations on how future

efforts can be made more effective. Being clear on evaluative standards is essential to close feedback loops and actively learn at individual, organizational, and policy levels. Rigorous appraisal of prototypes will facilitate identifying best practices, diffusing those lessons widely, and adapting the lessons to new contexts. Appraisal of large scale conservation initiatives should also indicate whether the project passes the three tests of the common interest (Chapter 1, this volume).

Table 3 An overview of decision functions (after Lasswell 1971) and examples

		Examples	
Function	**Definition**	**Legal proceeding**	**Timber management**
Intelligence (Planning)	Gathering information about the problem	Congressional hearings	Cruise, market analysis
Promotion (open debate)	Weighing and recommending alternatives	Debates	Forest planning process/workshop
Prescription (selection)	Establishing the agreed upon response	Legislation	Management plan
Invocation (enforcement)	Preliminary effort to put a prescription into effect	Filing a legal case	Putting a sale up for bids
Application (implementation)	Final interpretation of the decision in practice	Court decisions	Harvest and receipt of proceeds
Appraisal (evaluation)	Comparing goals and performance of the decision	Congressional Budget Office review	Post harvest survey, annual accounts
Termination (conclusion)	Decision to end a prescription	Repeal or significant amendment of legislation	Revision of management plan

Institutions develop when habitual actions that were initially undertaken for pragmatic reasons take on a normative force (Berger and Luckmann 1966). Institutionalization allows us to construct our social reality. Institutions not only control behavior by dictating what actions are acceptable, but also free us to make decisions by letting us know what another's actions are supposed to mean. People take part in institutional cultures, which mediate how resource management decisions are made. According to Schein (1990: 111):

> "Culture can now be defined as (a) a pattern of basic assumptions, (b) invented, discovered or developed by a given group, (c) as it learns to cope with its problems of external adaptation and internal integration, (d) that has worked well enough to be considered valid and, therefore (e) is taught to new members as the (f) correct way to perceive, think, and feel in relation to those problems."

All people are part of cultures and subscribe to basic belief systems, or myths, about how the world works (May 1991, Patai 1972). Myths are not right or wrong, per

se, but some myths are more useful in a given context than others (Brown 2001). Within disciplinary cultures, myths are embodied in scientific paradigms (Kuhn 1970) and mental models (Senge 1990). Often epistemic communities develop around particular suites of issues and members of these communities play an important role in framing issues for debate, articulating causal relationships, proposing alternatives, and identifying negotiable elements (Haas 1992). Over time epistemic communities can develop distinct institutionalized cultures with their own sets of myths. Cultures have begun to develop around different approaches to large scale conservation (Chapter 3, this volume). Each approach is associated with a package of ideas, methods and underlying philosophies that guide practitioners as they make judgments and carry out conservation interventions.

Institutions not only control behavior by dictating what actions are acceptable, but also free us to make decisions by letting us know what another's actions are supposed to mean.

Myths can be defined in terms of doctrine, formula, and symbols. Although large scale conservation approaches have different origins and have been developed in different contexts, they all have been developed as part of an ongoing, adaptive process. Consequently, while there are variations in the doctrine, formula, and symbols employed by different approaches, there are also areas of similarity. Doctrine is the set of basic assumptions or philosophy that underlie an approach. The doctrine includes assumptions about the appropriate relation between humans and nature, the inherent value of biodiversity, and ecological and social paradigms. Formula is the set of operating principles that guide practices on the ground. The goals sought, the appropriate target of intervention, the acceptable methods, the degree of social and disciplinary integration, how decisions should be made, and who should make them are all defined by an approach's formula. Doctrines are seldom made explicit and, therefore, often go unchanged even in the face of public demands to do so. Symbols are used to promote and legitimize the approach. GIS maps, charismatic megafauna, and even "fences and fines" take on symbolic import as practitioners seek to promote, justify, and defend proposed interventions. Symbols, such as grizzly bears and wolves in the American West, are sometimes manipulated to convey implicit but very specific messages to a broad public audience.

Resources

Ecosystems are the basic resource unit of large scale conservation. As was noted in Chapter 1, ecosystems are being degraded and destroyed at unprecedented rates worldwide because of a complex mix of direct and indirect human activities. All living things depend on healthy ecosystems to provide life sustaining services. Consequently, destruction of native ecosystems is expected to have harmful and long lasting effects for all species, including humans. Avoiding or ameliorating harmful effects requires maintaining ecosystem structures, processes, and resiliency (Walker et al. 2004).

In addition to ecosystems as a whole, large scale conservation efforts are also intended to conserve ecosystem processes and functions. Large scale conservation projects may address concerns about preserving specific ecosystem services such as carbon sequestration potential, water quality and quantity, and fisheries. Additionally, attention is being paid to issues of spatial and temporal scale. For example, forest managers are now designating relatively young stands of trees for protection in order provide old growth habitat in the future, and protected areas are being designed with climate change in mind. Although large scale conservation efforts may eschew species specific interventions, charismatic megafuana, rare and endangered species, and old growth habitat still top the list of conservation priorities for donor organizations and individuals. It is often assumed that large scale efforts will benefit these individual ecosystem elements.

Sustainability is often depicted as a Venn diagram in which social, economic and environmental domains partially overlap. This picture suggests that ecosystems interact with social systems. It is an improvement on the framework that places man and nature in separate conceptual domains (Folke et al. 2002). However, it does not go far enough. Social systems do not merely interact with ecosystems; they are the context within which ecosystems are embedded. Today even the most "natural" of areas in the United States (e.g., wilderness areas) come about as a result of human management decisions and, consequently, are socially constructed. The line that separates wilderness from non-wilderness is primarily a management boundary on a map, not a natural feature of the ecosystem. Advances in large scale conservation will be more rapid when we start using a framework in which ecosystems are seen as fully embedded in social systems. Consequently, in addition to ecosystems and the biophysical elements of ecosystems, we must be attuned to the human resources that we are also striving to conserve. These include sustainable natural resource based industries and economies (e.g., fishing, ranching, forestry), cultural resources (e.g., opportunities for aesthetic and spiritual renewal), and social capital.

Social systems do not merely interact with ecosystems; they are the context within which ecosystems are embedded.

CONCLUSION

Large scale conservation in the common interest requires that people be clear about the nature of the problems they face, the utility of the theory they employ, and the features of the situation that they attend to and try to manage. To better ground our large scale conservation work, we offer a typology of problems and a theory to guide practitioners who wish to enhance sustainability and human dignity in the common interest. The problem typology distinguishes between ordinary, governance, and constitutive problems. Too often governance and constitutive problems are

overlooked or misconstrued. The theory we present is grounded in the observation that "humans seek values through institutions that use and affect resources." All four elements–humans, values, institutions, and resources–are open for empirical, systematic study. Skillful application of this theory enables practitioners to analyze the full suite of problems and develop realistic solutions. This problem typology and theory can significantly aid practitioners in achieving large sale conservation in the common interest.

Large scale conservation in the common interest requires that people be clear about the nature of the problems they face, the utility of the theory they employ, and the features of the situation that they attend to and try to manage.

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Endnote:

[i]Before looking at basic theory, a word on "theory" as used in this volume is necessary. A *theory* is a "conceptual scheme that attempts to organize and explain facts of nature in terms of general principles or laws," says McMartin (1995: 13). Good theories help: (1) explain and organize large bodies of data using a parsimonious number of variables, (2) suggest new ways of understanding that can be tested against experience, and (3) direct attention to key variables. A theory prevents us from becoming lost or bewildered or distracted by the details and complexity of the events we want to understand. Just as we base the practice of any kind of biological conservation on the theory of evolution, we also need a theory—comparable in power and validity to that of evolution in the domain of biology—for understanding elements of the social and decision processes including "human nature," values, institutions, and resources. Practitioners need a practical theory of these processes to aid them in asking and answering important questions about themselves and other people (see Clark 2002, Lasswell 1971). The theory described in this chapter grounds the analysis presented throughout this volume. Knowledge of this theory will benefit practitioners who are engaged in large scale conservation projects by helping them to understand how to more successfully operate relative to the social system and decision process of which they are a part and by orienting them to the underlying paradigms and myths being employed in their project. The paradigms and myths currently tell people how to recognize situations that are problematic and what to do about them. Being able to sort through these and choose the most promising approach is essential to effective problem solving and successful leadership.

Chapter 3

Approaches to Large Scale Conservation: A Survey

Aaron Hohl, Catherine Picard, Susan G. Clark, and Arthur Middleton[1]

ABSTRACT

Single and multiple use management is the classic and still dominant approach to large scale conservation. It is the embodiment of scientific management, a philosophic doctrine and formula, with supporting symbols, that is widespread. Its historical genesis is in the progressive era, but its antecedents stretch further back into American history. The formula employed in single and multiple use management and its offshoots have weaknesses that often prevent participants from identifying and securing their common interests. We describe six alternative approaches to large scale conservation—parks and protected areas, ecosystem management, integrated conservation and development, ecoregional planning, transboundary conservation, and adaptive governance—in terms of their doctrine, formula, and symbols. Most of these are modern variations on single and multiple use management, and share important elements of the doctrine and formula of scientific management. In so doing, they perpetuate a host of systemic problems. We argue that approaches based on scientific management should be replaced by adaptive governance, which is better suited to articulating the common interest, safeguarding human dignity, and promoting sustainability. Adaptive governance is more effective because it promotes fully contextual analyses, complete problem orientation, and common interest outcomes that enhance sustainability and human dignity. It eschews the rigid formulaic and doctrinaire interventions called for by scientific management. Adaptive governance evaluates decisions in terms of procedural, substantive, and pragmatic criteria and the common interest outcomes and effects.

Key words: *large scale conservation, single and multiple use management, parks and protected areas, ecosystem management, integrated conservation and development, ecoregional planning, transboundary, adaptive governance, scientific and adaptive management*

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Adaptive governance is more effective because it promotes fully contextual analyses, complete problem orientation, and common interest outcomes that enhance sustainability and human dignity.

INTRODUCTION

Various approaches to large scale conservation have evolved over time. Although significant overlap exists among the approaches and the terminology used to describe them, each one can be distinguished using doctrine, formula, and symbols. Doctrine is the set of basic assumptions (or philosophy) that grounds an approach. Formula is the set of standard operating principles and guidelines that govern project implementation and on the ground actions. Symbols are used to promote and legitimize the approach. By clarifying the distinctions in doctrine, formula and symbols that underlie each approach, participants are able to move past the array of confusing typologies and discern the true differences and similarities between large scale conservation approaches and the evolutionary development of the approaches.

Various approaches to large scale conservation have evolved over time.

In this chapter we survey seven relatively distinct approaches. First, we trace the development of the single and multiple use approach in the United States and discuss its limitations. Next, we discuss the archetypal parks and protected areas management approach, as well as four more recent approaches to large scale conservation. We argue that the doctrines of all six approaches are rooted in scientific management and, consequently, have important limitations. Finally, we describe adaptive governance, an approach whose doctrine promotes a culture of human dignity and environmental sustainability. We argue that this approach addresses the limitations of scientific management while incorporating the strengths of the traditional approaches. Consequently, we recommend its use when engaging with problems of large scale conservation.

SINGLE AND MULTIPLE USE MANAGEMENT: PHILOSOPHY, HISTORY, AND CRITIQUE

Single and multiple use resource management, in which humans manage nature for sustained use and/or profit, is the historical cornerstone of conservation from which other approaches to conservation have evolved. It is deeply institutionalized in natural resource management organizations and is used by governments worldwide (Kaufman 1960, Pinchot 1972). It is based on scientific positivism, economic efficiency, and expert authority. It divides the world into resource cells (e.g., soil, forestry, water, range, wildlife, fisheries, crops, recreation) and attempts to maximize

or optimize outputs from each cell. The formula is typically employed by bureaucratic organizations that are hierarchical, rely heavily on task differentiation, and employ specialized, skills-based professionals to seek optimal solutions to resource management problems (Williams 2002). Implementing contextually sound large scale conservation requires understanding the history and philosophical basis of single and multiple use management. Consequently, this section explores the tradition in some detail.

Philosophical roots

The intellectual history of single and multiple use management begins in the philosophy of the 17th and 18th century Enlightenment, the same intellectual revolution that gave birth to so much of modernity's progress, including liberalism and modern democracy. The philosophy of the period—and increasingly, the culture—conceived itself in opposition to the "Dark Ages" of the preceding millennium. Progress was cast in stark contrasts as light winning over darkness, advancement over stagnation, science over superstition, and freedom over authoritarianism (Gay 1996).

Although Enlightenment philosophy, science, and technology provided new tools for cultivating and subduing nature, the urge for mastery over nature predates the period. The drive to subdue wild nature occurred for both symbolic and practical reasons. Western mythology, religion, and histories had long idealized nature in cultivation and feared wild nature (Price 1954). Even before the Enlightenment, Europeans perceived wilderness as something alien and often dangerous—or in the words of Nash (1967: 9) as "an insecure and uncomfortable environment against which civilization had waged an unceasing struggle." To cultivate and subdue nature was to bring the boon of civilization.

The Enlightenment philosopher John Locke wrote extensively—and with real normative intent—on humanity's relation to nature. His *Second Treatise of Government*, written in 1689, would become the intellectual foundation of American liberalism and its institutions (Locke 1982). For Locke, political identity was founded on the ownership of property, which was created through the introduction of human labor to a chosen swatch of wilderness. Wild nature was useless—even vile—until converted for human use: "... land that is left wholly to nature, that hath no improvement of pasturage, tillage, or planting, is called, as indeed it is, waste; and we shall find the benefit of it amount to little more than nothing" (Locke 1982: 24). In Locke's view, one acre enclosed and cultivated was worth ten acres "lying waste in common" (24). In the same passage, he expands his ratio even further when he refers directly and presciently to America. Indeed, Locke's theories were dramatized as North America became the staging ground for an unprecedented experiment in political liberalism.

Alexis de Tocqueville, a particularly astute observer of American culture, perceived the depth of America's dominionistic and utilitarian relation to nature. In 1835, almost a century-and-a-half after Locke, he wrote,

> "The wonders of inanimate nature leave [Americans] cold, and, one may almost say, they do not see the marvelous forests surrounding them until

> they begin to fall beneath the axe. What they see is something different. The American people see themselves marching through wildernesses, drying up marshes, diverting rivers, peopling the wilds, and subduing nature. It is not just occasionally that their imagination catches a glimpse of this magnificent vision. It is something which plays a real part in the least, as in the most important, actions of every man, and it is always flitting before his mind (de Tocqueville 2000: 485)."

De Tocqueville's vision—one of a people valuing land for its utilitarian purpose—is essentially the large scale enactment of Locke's views.

America's dominionistic and utilitarian approach to managing nature was reinforced as efficiency was adopted as a core, almost sacred, American value by the Progressive movement of the early 20th century (Hays 1972). The gospel of efficiency, as applied to natural resources, held that the principles of scientific management could be used to optimize economic output and solve pending natural resource problems (e.g., perceived imminent shortages of food, water, and timber). A management system based on Frederick Winslow Taylor's model of scientific management—known as the Taylor System or Taylorism in the United States, and as "rationalization" in France and Germany—was adopted. The system claimed to increase industrial efficiency and output through the scientific study of labor and production, the elimination of waste, and a search for the single, best way (Kanigel 1997).

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If the single and multiple use method was ontologically rooted in scientism (Stenmark 1997), its ethical roots were utilitarian (Bentham 2000) and its epistemology was based on positivism. As we will see, Jeremy Bentham's principle of utility (i.e., act so as to produce the greatest happiness for the greatest number) was firmly entrenched in the minds of Progressive leaders in the conservation movement. Positivism holds that that scientific methods are the only means of obtaining authentic knowledge and that correct answers will emerge once a subject is understood in sufficient detail. In the words of Cortner and Moote (1999: 78), "the quantitative replaces the qualitative. . . . Knowledge that can be quantified, verified by empirical methods, and reduced to unified laws is prized." The failure of the reductionistic methods favored by positivists to adequately address some conservation problems would eventually spur the development of other approaches to large scale conservation. However, scientific management and positivism remained firmly entrenched in American politics and decision making (Lee 1995).

History

Well into the 19th century, the frontier mentality described by de Tocqueville played out as European settlers moved westward: forest and range land was converted to

agricultural uses; wildlife was harvested; mineral deposits were located and extracted. When forested land was unsuitable for agriculture, it was often managed using a strategy of "cut out and get out." Standing timber was rapidly cut and sold before the population moved to a new location (Cox 1985). Under the belief that "rain follows the plow" attempts were made to cultivate arid grasslands that were ultimately found to be incapable of supporting rain fed agriculture. Wildlife populations were exploited, sometimes to the edge of extinction. Perhaps the most famous examples are the passenger pigeon, the last of which died in 1914, and the American bison, brought back from the brink of extinction over the course of the 20th century.

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By the latter half of the 19th century, however, de Tocqueville's vision of Americans as incapable of seeing a forest until it began to fall under the ax was starting to be challenged. In a book that reviewed the effects of civilization on the natural world, George Perkins Marsh (1965: 29) wrote,

> "Man has too long forgotten that the earth was given to him for usufruct alone, not for consumption, still less for profligate waste. Nature has provided against the absolute destruction of her elementary matter, the raw materials of her works; the thunderbolt and the tornado, the most convulsive throes of even the volcano and the earthquake, being only phenomena of decomposition and recomposition. But she has left it within the power of man irreparably to derange the combinations of inorganic matter and of organic life, which through the night of aeons she had been proportioning and balancing, to prepare the earth for his habitation, when in the fullness of time, his Creator should call him forth to enter into its possession."

Marsh went on to assert that (1965: 36), "Man is everywhere a disturbing agent. Wherever he plants his foot, the harmonies of nature are turned to discords." Widespread concern over excessive and wasteful consumption—stimulated, in part, by the familiar imagery of wanton bison massacre and smoldering clearcuts—would fuel a nascent interest in developing new ways to relate to nature.

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Amid rising concern that America's inexhaustible natural abundance might soon be depleted, Theodore Roosevelt's administration prescribed a conservation strategy that would stabilize and prolong resource productivity in the nation's long-term economic interest (Box 1). In 1905, the U.S. Forest Service was established within the Department of Agriculture. Both Gifford Pinchot, the first chief of the Forest Service,

and the Forest Service itself have been closely associated with the development and implementation of single and multiple use management (Miller 2001).

Box 1 Excerpt from a letter (dated February 1, 1905) from Secretary of Agriculture James Wilson to Forester Gifford Pinchot officially informing the later of the transfer of Forest Reserves from the Department of the Interior to the Department of Agriculture. The letter was actually composed by Pinchot and his assistant Frederick Olmstead.

In the administration of the forest reserves it must be clearly borne in mind that all land is to be devoted to its most productive use for the permanent good of the whole people, and not for the temporary benefit of individuals or companies. All the resources of forest reserves are for use, and this use must be brought about in a thoroughly prompt and businesslike manner, under such restrictions only as will insure the permanence of these resources. The vital importance of forest reserves to the great industries of the Western States will be largely increased in the near future by the continued steady advance in settlement and development. The permanence of the resources of the reserves is therefore indispensable to continued prosperity, and the policy of this department for their protection and use will invariably be guided by this fact, always bearing in mind that the conservative use of these resources in no way conflicts with their permanent value. You will see to it that the water, wood, and forage of the reserves are conserved and wisely used for the benefit of the home builder first of all, upon whom depends the best permanent use of lands and resources alike. The continued prosperity of the agricultural, lumbering, mining, and livestock interests is directly dependent upon a permanent and accessible supply of water, wood, and forage, as well as upon the present and future use of their resources under businesslike regulations, enforced with promptness, effectiveness, and common sense. In the management of each reserve local questions will be decided upon local grounds; the dominant industry will be considered first, but with as little restriction to minor industries as may be possible; sudden changes in industrial conditions will be avoided by gradual adjustment after due notice; and where conflicting interests must be reconciled the question will always be decided from the standpoint of the greatest good of the greatest number in the long run.

These general principles will govern in the protection and use of the water supply, in the disposal of timber and wood, in the use of the range, and in all other matters connected with the management of the reserves. They can be successfully applied only when the administration of each reserve is left very largely in the hands of the local officers, under the eye of thoroughly trained and competent inspectors.

Very respectfully,
[signed]
James Wilson
Secretary [US Department of Agriculture]

Under this formula, managers divided the world into resource cells, which were abstracted from complex natural systems for conceptual and administrative ease. Individual cells were targeted and sorted by their economic value. For Pinchot, forestry amounted to scientifically-managed tree-growing. While other uses (e.g., water, grazing) of the national forest lands were recognized as important in theory, their economic value was usually assumed to be less than the value of timber and, consequently, they tended to be discounted in practice (Clary 1986). The Forest Service, under Pinchot's leadership, adopted a utilitarian creed: the greatest good for the greatest number in the long run. The agency's doctrine also reflected the fixation of newly industrialized nations on efficiency, technology, and positivistic science. By the late 1930s, this approach to conservation had been applied to other resource cells and had contributed to the creation of specialized agencies for managing specific resources at both the state and federal level (e.g., U.S. Fish and Wildlife Service, Bureau of Land Management, state Bureaus of Fish and Game).

Statutory standards promulgated in the mid-20th century (e.g., Multiple-Use Sustained-Yield Act of 1960, National Environmental Policy Act of 1970) called for agencies to satisfy the increasingly diverse interests of the public by managing multiple resource cells relative to one another and taking into account public comments. While the symbols (especially the symbolic language) and formula changed somewhat, these updates did not fundamentally alter the doctrine subscribed to under the original model. The doctrinal underpinnings of the single and multiple use tradition remain deeply institutionalized in government and academia although, in practice, the doctrine is often veiled in the language and symbols of newer paradigms.

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Critique

The single and multiple use approach has faced criticism, both from practitioners and outside groups (Kohm and Franklin 1997), for failing to be sufficiently contextual as it tries to adapt to a rapidly changing world and demands from a more diverse array of interests. The proliferation of specialized resource-based agencies has also been criticized for contributing to fragmented decision making and interagency competition (Brunner et al. 2005). While some practitioners of scientific management have looked for better ways to measure and rigorously quantify resource cells, critics have asked whether it is even possible to quantify all important attributes of resource systems (Ascher 2001). In some cases, organizations have responded by adopting the symbols of a new tradition while maintaining the same basic doctrine and formula (Hohl 2009). When this occurs, the adaptations that do take place are minor and at the margin; innovations are restricted to things that are congruent with the embedded doctrine and formula (Rutherford 2003). This defensive response

allows the organization to maintain its cultural structures and formula while deflecting pressure to make additional systemic changes (Kaufman 1960).

Historically, the doctrine of single and multiple use management encouraged the growth of bureaucratic conservation organizations that subscribed to scientism and positivism. In such organizations, it is assumed that natural resources can and should, be managed using reductionistic, quantitatively-based methods that strive to make the inherent "messiness" of natural resource management more "legible" (Scott 1998). Cortner and Moote (1999: 15) have noted that, "the legacy of the last 100 years of resource management is a politics of expertise, of maximum sustained yield, and of [special] interests." A reliance on experts and focus on technical issues restricted participation by other valid participants – in part because they were perceived to lack the requisite skills, experience, resources and technical training. Ultimately, the creation of arenas in which values could be shaped and shared was minimized and the decision process was turned over to anonymous experts whose decisions were perceived to be rational, efficient and objective.

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Taylor's scientific management formula ignored the complexity of human nature and psychology in its quest to control human labor and interaction with the precision and efficiency of a machine. Problems were viewed as technical issues to be resolved by reasoned experts. Knowledge not easily quantified (e.g., local or indigenous knowledge) was discounted or excluded from consideration. Normative questions that could not be answered using empirical methods (e.g., about social justice, human dignity, and the decision making process) were marginalized. Instead of taking contextual factors into account and developing common interest goals, efficiency in progress toward preconceived ends became the basic value. Ordinary citizens were left frustrated and alienated by the ascendancy of remote, insulated, and idealized professionals; decisions veiled defensively in the technical language of objectivity; and a seemingly misanthropic government that ignored real world problems.

At the same time, the administration of the resource bureaucracies became concentrated in government centers (e.g., Washington, D.C.). Under the bureaucratic governance formula, citizens found it "difficult to identify the remote officials and non-officials most responsible for policies that affect their interests and to hold them accountable amid the growing number and complexity of issues" (Brunner et al. 2002: 23). The concentration of decision making power in distant cities permitted special interests to wield more influence on decision making. Managers and administrators soon felt pressure to approve liberal resource harvests. In some cases, as in fisheries and wildlife, the intended beneficiaries of

Table 1 The myths associated with seven approaches to large scale conservation. Examples of symbols, overarching formula, key doctrinal points, and a representative user are listed for each approach.

Approach	Symbols	Formula	Doctrine	Example
Single and Multiple Use Management	"Greatest good for the greatest number in the long run"	Employ science-based expertise and knowledge to maximize extractive utility in an economically efficient manner.	Natural resources should be rationally managed to benefit society.	U.S. Forest Service
Parks and Protected Areas	Wolves in Yellowstone	Enforcement/policing strategies and scientific management used to preserve culturally, aesthetically, or biologically significant areas for recreational, educational, and scientific purposes.	"Man is everywhere a disturbing agent. Wherever he plants his foot, the harmonies of nature are turned to discords." (Marsh 1965:36)	Yellowstone National Park, USA
Ecosystem Management	Adaptive management plan	Balance utilitarian and political demands with ecosystem processes and functions.	The integrity of ecosystems is paramount and includes social, ecological and economic values.	Greater Yellowstone Ecosystem
Integrated Conservation & Development	Biosphere reserves	Integrate nature conservation, poverty alleviation and sustainable development goals.	Poverty, under-development and resource degradation are inextricably linked.	Annapurna Conservation Area Project (ACAP), Nepal
Ecoregional Planning	Spatial analysis technology (GIS, satellite imagery)	Designate, connect, and manage ecological zones that represent distinct assemblages of natural communities.	Protecting biodiversity from human from human damage requires maintaining/ restoring connectivity between protected areas.	World Wildlife Fund for Nature (WWF) Global 200 priority ecoregions
Transboundary Management	Peace Parks	Integrate conservation and development via coordination & collaboration across political boundaries in order to link fragmented ecosystems or processes.	Natural resources persist across political and administrative boundaries.	Great Limpopo Transfrontier Conservation Area Southern Africa
Adaptive Governance	Interdependent goals	Management is contextual, practical, practical, interdisciplinary and collaborative. Focused on substantive issues, procedural norms.	Human social relations are part of the solution. Uncertainty is expected, and flexibility is obligatory.	MendoFutures

resource management agencies became benefactors as license sales became a major revenue source. Withdrawal of governance from conflicted localities to distant cities made it more difficult to secure common interest solutions to local problems and left a legacy of distrust between local communities and resource management agencies.

The single and multiple use management approach to large scale conservation has often failed to identify and secure the common interest because it relies too heavily on science and scientific management at the expense of rigorously analyzing and incorporating the social context and value dynamics of particular resource management decisions. No matter how technical or allegedly impartial the expert's conceptions, decisions are ultimately grounded in human values. Under the single and multiple use approach, conservation fails in its primary goal—fulfilling a broad national interest, or, as Pinchot would have it, providing the greatest good for the greatest number in the long run.

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ALTERNATIVE APPROACHES TO LARGE SCALE CONSERVATION

A range of alternatives that attempt to rectify the perceived inadequacies of single and multiple use management have been proposed. However, most of these approaches have reproduced the problems of single and multiple use management because they have not adequately changed the fundamental doctrine. We profile several of the major alternatives below, paying particular attention to their doctrine, formula, and symbols (Table 1). Many of the innovations embodied by the newer approaches are beneficial. For example, incorporating knowledge of ecosystem processes (Ecosystem Management) and economic interests (ICDPs) into resource management decisions should result in decision making that is more contextual. However, we feel that fundamental doctrinal change is also necessary. A reductionist, instrumental, and positivistic science must be augmented by a holistic and integrative approach that can accommodate normative questions and non-traditional knowledge sources. Although the proposed alternatives summarized below share a notion of systems-level, holistic resource management, at their core many still remain grounded in a bureaucratic, positivist science-based approach. Consequently, we recommend adaptive governance as an approach that prioritizes cultural change, and addresses fundamental philosophical issues (Brunner et al. 2005). Adaptive governance focuses on developing practical, collaborative solutions that are sensitive not only to substantive issues, but also to procedural norms.

Parks and protected areas management

The national park model is typically traced back to the establishment of Yellowstone National Park in 1872, however the formula has antecedents in both Western and Eastern culture that date back to the earliest written records (Perlin 1991, Winters 1974, Nash 1967). Almost from their inception, tensions existed between the competing formulas of the Forest Service and National Park Service (Box 2) and bureaucratic rivalry became a permanent feature. Early conflict between the two amounted to an argument about formulas of use, not basic doctrines. The parks and protected areas approach to large scale conservation shares the strongly utilitarian aspect of single and multiple use approach. Sellars (1997: 16) noted, "the national park movement pitted one utilitarian urge—tourism and public recreation—against another—the consumptive use of natural resources, such as logging, mining, and reservoir development."

The parks and protected areas approach to large scale conservation shares the strongly utilitarian aspect of single and multiple use approach.

Box 2 Excerpt from *The Yosemite* by John Muir (1912)

"The making of gardens and parks goes on with civilization all over the world, and they increase both in size and number as their value is recognized. Everybody needs beauty as well as bread, places to play in and pray in, where Nature may heal and cheer and give strength to body and soul alike. This natural beauty-hunger is made manifest in the little window-sill gardens of the poor, though perhaps only a geranium slip in a broken cup, as well as in the carefully tended rose and lily gardens of the rich, the thousands of spacious city parks and botanical gardens, and in our magnificent National parks—the Yellowstone, Yosemite, Sequoia, etc.—Nature's sublime wonderlands, the admiration and joy of the world. Nevertheless, like anything else worth while, from the very beginning, however well guarded, they have always been subject to attack by despoiling gainseekers and mischief-makers of every degree from Satan to Senators, eagerly trying to make everything immediately and selfishly commercial, with schemes disguised in smug-smiling philanthropy, industriously, sham piously crying, "Conservation, conservation, pan utilization," that man and beast may be fed and the dear Nation made great. Thus long ago a few enterprising merchants utilized the Jerusalem temple as a place of business instead of a place of prayer, changing money, buying and selling cattle and sheep and doves; and earlier still, the first forest reservation, including only one tree, was likewise despoiled. Ever since the establishment of the Yosemite National Park, strife has been going on around its borders and I suppose this will go on as part of the universal battle between right and wrong, however much its boundaries may be shorn, or its wild beauty destroyed.

> These temple destroyers, devotees of ravaging commercialism, seem to have a perfect contempt for Nature, and, instead of lifting their eyes to the God of the mountains, lift them to the Almighty Dollar.
>
> Dam Hetch Hetchy! As well dam for water-tanks the people's cathedrals and churches, for no holier temple has ever been consecrated by the heart of man."

The parks and protected area approach focuses on geographically well-defined areas, which are designated, regulated, and managed to achieve specific conservation objectives. The approach rests on a doctrine that preserves protected areas as places of intrinsic biological, cultural or scenic value. Accordingly, the model often treats human agency as a threat—as opposed to an integral element—of nature. In its most conservative form the protected area approach was characterized as a "fences and fines" model that "locked up" landscapes and relied heavily upon coercion and force to achieve its objectives. When this approach proved unsustainable, a more liberal form of the model emerged (e.g., biosphere reserves) that permitted resource use and extraction within certain management zones. The IUCN has now established a classification system (IUCN 1994) that recognizes the legitimacy of diverse uses of protected areas. The categories range from strict wilderness areas and national parks that restrict human agency (categories I and II) to sustainable use areas, which allow human occupation and resource extraction (category VI).

The model relies almost exclusively on professionals and agency experts to inform decision making. There have been criticisms, especially in developing areas, that parks and protected areas have profound negative impacts on how local residents access, use, and interact with natural resources (West and Brechin 1991, Western and Wright 1994). Charismatic megafauna (e.g., bears, wolves) have also played important symbolic roles in both the defenses of and attacks on this approach (Clark et al. 1999). Critics argue that the establishment of protected areas has resulted in the displacement of local residents, exacerbated existing inequalities within communities, disrupted social structures and cultural traditions, and threatened the overall health and well-being of local communities (Ghimire and Pimbert 1997 Redford, Kent H. and Fearn, Eva (2007) "Protected areas and human displacement: A Conservation Perspective." Wildlife Conservation Society working paper no. 29. Bronx, NY). More recently professionals have sought to adapt this tradition in response to people's demands to access and use protected areas for farming, timber harvesting, grazing, or hunting. Adaptations have also been proposed that are designed to devolve authority over resources to the local level, and distribute benefits to those who bear the costs associated with parks and protected areas. As this happens, this tradition becomes more similar to the "integrated conservation and development" tradition described below. In each case, the protected areas model remains embedded in a doctrine that privileges scientific management and positivism over contextual data such as values, identities, and perspectives of people involved. The use of participation for example, as a means to a pre-determined end, and not a goal unto itself, exemplifies how little the doctrine has changed over time.

Ecosystem management

The ecosystem management tradition is a rapidly evolving approach which originated during the 1980s and 90s in response to perceived limitations of the single and multiple use approach (Meffe 2002). Instead of utilitarianism, the approach is grounded in the land ethic of Aldo Leopold (Box 3). The approach draws upon modern ecology as it attempts to conserve ecosystems while at the same time providing multiple resource values in ways that are ecologically appropriate and socially acceptable (Mirovitskaya and Ascher 2001). One of the broadest definitions of ecosystem management concludes that it "integrates scientific knowledge of ecological relationships within a complex sociopolitical and value framework toward the general goal of protecting native ecosystem integrity over the long term" (Grumbine 1994: 31). However, no universally accepted formula for operationalizing the concept exists and different practitioners of ecosystem management almost certainly ascribe to different doctrines. Yaffee et al. (1999) identified three major variations of the ecosystem management formula currently in use: (1) environmentally sensitive multiple use, (2) ecosystem-based approaches to resource management, and (3) ecoregional management. Symbols employed by practitioners of this approach include adaptive management plans; attempts to incorporate a range of stakeholders concerns—including socioeconomic concerns—often via public meetings or workshops; and a privileging of large scale temporal and spatial dynamics of ecosystems (e.g., FEMAT 1993, Rutherford 2003).

The ecosystem management tradition is a rapidly evolving approach which originated during the 1980s and 90s in response to perceived limitations of the single and multiple use approach (Meffe 2002).

Box 3 The land ethic as defined in an excerpt from A Sand County Almanac and Sketches Here and There by Aldo Leopold (1989, original edition 1949).

> "The land ethic simply enlarges the boundaries of the community to include soils, waters, plants, and animals, or collectively: the land.
>
> This sounds simple: do we not already sing our love for and obligations to the land of the free and the home of the brave? Yes, but just what and whom do we love? Certainly not the soil, which we are sending helter-skelter downriver. Certainly not the waters, which we assume have no function except to turn turbines, float barges, and carry off sewage. Certainly not the plants, of which we exterminate whole communities without batting an eye. Certainly not the animals, of which we have already extirpated many of the largest and most beautiful species. A land ethic of course cannot prevent the alteration, management, and use of these 'resources,' but it does affirm their right to continued existence, and, at least in spots, their continued existence in a natural state.

> In short, a land ethic changes the role of *Homo sapiens* from conqueror of the land-community to plain member and citizen of it. It implies respect for his fellow-members, and also respect for the community as such."

Critics have argued that the concept is not clear enough for public policy or specific management applications (Fitzsimmons 1996). Additionally, the tradition has been criticized for not adequately taking into account the multiplicity of interests and values represented (Bissix and Rees 2001). Typically, ecosystem management has been implemented by natural resource management organizations that have traditionally stressed biophysical sciences (e.g. U.S. Forest Service, Bureau of Land Management). Consequently, it is not surprising that many retrospective studies of ecosystem management projects have found that practitioners have not sufficiently integrated social and economic dynamics with ecological concerns (Butler and Koontz 2005, Charnley 2006, Dekker et al. 2007).

Typically, ecosystem management has been implemented by natural resource management organizations that have traditionally stressed biophysical sciences (e.g. U.S. Forest Service, Bureau of Land Management).

Ecoregional planning

Ecoregional planning emerged during the 1990s as a strategic, "performance-based" planning tool for large scale conservation (Groves 2003). The approach has been widely disseminated and is now used by several large non-governmental organizations (including The Nature Conservancy, the World Wildlife Fund for Nature, and the Wildlands Project). Such planning would be almost impossible without ready access to large amounts of data, and Geographic Information System (GIS) maps play a prevalent role both in the formulation of plans and as symbolic representations of the approach. An ecoregion is defined "a relatively large unit of land or water containing a geographically distinct assemblage of species, natural communities, environmental conditions" (WWF 2009). The doctrine of ecoregional planning rests on the perception that protected areas were historically established based on an ad hoc process guided by the presence of charismatic megafauna, scenic values, or large concentrations of wildlife, and less by the principles of landscape ecology. The result was the establishment of protected areas "too small to sustain the full spectrum of processes that sustain diversity" (Soule and Terborgh 1999: 6). In order to more effectively and efficiently conserve large landscapes, the ecoregional formula identifies and prioritizes the ecological attributes of a landscape including habitat types, ecosystem services, and the richness of biodiversity and then selects a set of target elements (i.e., species and communities) and levels of representation for each target (TNC 1994). Described as a "science-based approach" or "conservation by design," the tasks of classification, priority setting, and decision making are often

dominated by conservation practitioners and other experts. The overall management goal is to maintain or restore natural ecosystem processes, ecological resiliency, and biological diversity.

Ecoregional planning is often criticized for being technologically narrow and mechanistic in its planning, and not fully contextual (Brosius 2003). Proposals often ignore the very real and ongoing uses to which the landscape is being put; in its most extreme form, it has justified the exclusion of human activities from large portions of the landscape as the most appropriate way to preserve nature. Because of the fundamental disconnect between what is proposed and the complex context of the landscape, ecoregional planning can overlook the ongoing social and decision making processes. Critics also argue that the approach privileges technocratic skills, and devalues local knowledge and experience (Box 4). Given that ecoregional plans are often insufficiently contextual, they have encountered stiff resistance at the local level by participants who feel excluded from the decision making process (Chapin 2004).

Box 4 Excerpts from the website of the Wildlands Network (2009) which (A) outlines the organization's conservation methodology and (B) provides details about stakeholder involvement.

A. Each WND [Wildlands Network Design] is generated through a systematic process that adheres to five key principles:

1. Establish planning boundaries based on ecological features.
2. Compile existing data on biological resources and identify those that are most of biodiversity.
3. Set clear biodiversity conservation goals and carry out explicit and objective conservation area design in support of those goals.
4. Evaluate the degree to which conservation goals are currently being met in existing areas and identify new areas needed to meet those goals.
5. Involve a broad array of stakeholders in design and implementation.

B. Involve a broad array of stakeholders in design and implementation

It is critical to involve regional stakeholders, scientific and otherwise, in the process of designing and implementing a network design. The draft network design should undergo a series of rigorous expert reviews before a final design is released. This process should be guided by a scientific advisory committee made up of committed scientists who are familiar the region or with the Wildlands Network's scientific methods, who can guide and direct necessary research, fieldwork, and data collection by staff, interns, and volunteers. At the same time, we work closely with our partners to integrate the network design process with local and regional efforts to identify and protect conservation areas.

Integrated conservation and development projects (ICDPs)

Integrated Conservation and Development projects (ICDPs) attempt to ensure the conservation of biological diversity while attending to the needs of local people (Box 5). The approach is grounded in the paradigm of sustainable development and is particularly prevalent in developing countries. It gained popularity in the 1980s and '90s as the protected area formula fell under increased scrutiny for its negative impact on local livelihoods (Western et al. 1994). As practitioners searched for a substitute for the "fences and fines" approach to conservation, the ICDP model was proposed as a participatory and contextually sensitive method for balancing the needs of conservation with the demands for poverty alleviation and sustainable development. Common ICDP formulations include: biosphere reserves, buffer zones, multiple use areas, and regional development programs. The goal of most ICDP efforts is to educate and benefit local communities through a mix of nature conservation and socio-economic development. Often the formula requires including local peoples in intelligence gathering and decision making. Ideally, it mitigates or deflects pressure on conservation areas by devolving decision making and/or benefits to local residents. The approach seeks behavioral change by compensating people living in and around parks and other conservation areas who have lost access to natural resources or are negatively impacted by wildlife populations (McShane and Wells 2004). Eco-tourism and other resource-based income generating projects and developments are oft-cited symbols of the success of this method.

Integrated Conservation and Development projects (ICDPs) attempt to ensure the conservation of biological diversity while attending to the needs of local people.

Box 5 Articulating the doctrine, formula and symbols of Integrated Conservation and Development Projects (ICDPs).

Doctrine

"Protected areas are under increasing pressure from the expanding scale of human activities, they are underfunded, and traditional "fences and fines" approaches are unable to balance the competing objectives between protected areas and local people. In response ICDPs attempt to ensure the conservation of biological diversity by reconciling the management of protected areas with the social and economic needs of local people. . . . Efforts to promote local social and economic development activities among communities adjacent to protected areas distinguish ICDPs from other conservation approaches. The underlying (and often unsupported) assumption is that people who are made better off as a result of development projects will refrain from the illegal exploitation of a nearby protected area" (Wells et al.: ix-x).

Formula

1. *Conceptualization:* biological, socio-economic surveys conducted by technical experts.
2. *Endorsement:* Participatory meetings held with local residents to explain ICDP objectives.
3. *Funding:* Donors and host governments establish project agreements and fund ICDP.
4. *Capacity Building:* Buildings constructed, project staff and equipment procured, capacity building and educational activities undertaken in project villages.
5. *Implementation:* sustainable income generating opportunities launched based on the sustainable use of natural resources.
6. *Evaluation:* wildlife censuses, attitudinal studies, socio-economic surveys, Log Frame 'outputs.'

Symbols

—1980 World Conservation Strategy and the 1982 World Parks Congress in Bali

—Biosphere reserves, bufferzones, multiple-use areas, large scale development projects with links to nearby protected areas and integrated sustainable use projects.

ICDPs have received considerable criticism in recent years, even from some of the model's originators (Brandon et al. 1998, Chapin 2004). The criticisms include a general lack of success in practice, unclear objectives, vague linkages between the twin goals of development and conservation, and ambiguous definitions of community (Barrett and Arcese 1995). Critics also suggest that ICDPs overlook the limitations of government, fail to target key ecological threats, and underemphasize the utility of law enforcement (Terborgh 1999). Despite these criticisms, the doctrine that underpins the ICDP model—namely breaking ecosystems into resource cells in order to balance conservation with poverty alleviation—continues to inform many large scale conservation interventions in the developing world.

Transboundary management

A transboundary protected area is "an area of land and/or sea that straddles one or more political boundaries . . . whose constituent parts are especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed cooperatively through legal or other effective means" (Sandwith et al. 2001: 3). The doctrine of transboundary conservation assumes that ecosystems and their attendant functions (for example wildlife migration routes) transcend political and administrative boundaries, and therefore their use and

management requires cross-boundary cooperation and coordination. The concept of connectivity, both spatially and rhetorically, is integral to the transboundary conservation formula (Goodale et al. 2003). The formula includes identifying biologically significant but fragmented habitats, which are then connected via corridors or contiguous protected areas, or indirectly through complimentary policies or the cooperative management of resources across a border. The approach acknowledges the role of social and political realms in managing landscapes—though it may underemphasize the complex and contested social and political landscape of international border regions. Transboundary conservation efforts also have significant implications for national security and territorial sovereignty (Ali 2007).

The doctrine of transboundary conservation assumes that ecosystems and their attendant functions (for example wildlife migration routes) transcend political and administrative boundaries, and therefore their use and management requires cross-boundary cooperation and coordination.

Transboundary conservation deploys a range of symbols to convey a shift from the original protected area approach to a model that is (at least rhetorically) concerned with promoting participation, benefit sharing and collaboration (Box 6). GIS-based maps are frequently used to illustrate the need for increased ecological connectivity and to rationalize the approach based on scientific principles. Critics argue that while the ecological benefits of transboundary conservation have been well articulated, the dynamic social context of border regions—including colonially constructed boundaries, vulnerable populations, and a history of armed conflict—are often overlooked. Transboundary approaches are also subject to many of the same critiques of the ICDP and protected areas approach including displacement, inadequate local participation, and the exacerbation of existing inequities (Wolmer 2003). While a relatively new approach, transboundary management appears to be most successful where local support is strongest. In such settings, top-level leaders can foster, encourage, and nurture these sentiments and efforts (Zbicz 2003).

Box 6 Transboundary conservation in practice: Vision and mission statements of the Great Limpopo Transfrontier Park in southern Africa (Great Limpopo 2009). The park is a joint initiative between Mozambique, South Africa, and Zimbabwe.

Description

The establishment of the Great Limpopo Transfrontier Park is a process that will link the Limpopo National Park in Mozambique, Kruger National Park in South Africa, Gonarezhou National Park, Manjinji Pan Sanctuary and Malipati Safari Area in Zimbabwe, as well as two areas between Kruger and Gonarezhou, namely the Sengwe communal land in Zimbabwe and the Makuleke region in South Africa. The total surface area of the transfrontier park will be approximately 35,000 km^2. The

establishment of the Transfrontier Park is the first phase of creating a bigger transfrontier conservation area measuring a staggering 100,000 km².

Once open, tourists will be able to drive across the international borders of the three countries within the boundaries of the park. In addition to the usual game-viewing opportunities, visitors will have a broad range of new attractions including bird-rich tropical wetlands, lake cruises, tiger-fishing, rugged 4 x 4 adventure drives, and much more. A mix of cultural experiences will be offered, with traditional healers explaining their trade, story-telling, foods, dance, music, handicraft and art to explore and enjoy.

The Great Limpopo Transfrontier Park will be a world-class eco-tourism destination, with extensive private sector involvement, but managed to optimize benefits for sustainable economic development of local communities and biodiversity conservation.

Vision

To achieve inter-state collaboration in the conservation of trans-boundary ecosystems and their associated biodiversity, promoting sustainable use of natural resources to improve the quality of life of the peoples of Mozambique, South Africa and Zimbabwe.

Mission

To collaboratively establish and manage, on a sustainable basis, a viable Great Limpopo Transfrontier Park with full stakeholder participation, including local communities, fostering regional cooperation, biodiversity conservation, and cross-border socio-economic development.

Adaptive governance

Adaptive governance is the latest and most comprehensive of the large scale conservation approaches we examined. It is not to be confused with adaptive management, often associated with single and multiple use management and positivism. The tradition of adaptive governance is intellectually rooted in the policy sciences (Laswell and McDougal 1992). Unlike other approaches, which focus more on substantive than procedural issues, the basic unit of attention in adaptive governance are the social and decision making processes (Brunner et al. 2005). The tradition's doctrine holds that large scale conservation should strive to secure the common interest, which includes a healthy present and sustainable future for both people and the environment. It assumes that securing the common interest requires effective social processes that permit timely, open, fair, and comprehensive use of information, people, and resources. The social and decision processes must be open to all reasonably interested parties and must allow all participants—even disparate and opposing interests—to feel respected.

Adaptive governance is the latest and most comprehensive of the large scale conservation approaches we examined.

The formula advocates fully contextual analysis and eschews rigidly formulaic interventions. This involves evaluating individual decisions in terms of procedural, substantive and pragmatic criteria (Steelman and DuMond 2009). While scientific reasoning is recognized to have an important role (Ascher 2004), science is not privileged above all other considerations. Decisions must be open to multiple scientific methods and forms of knowledge, and also, importantly, to uncertainty. Decisions must account for local context and complexity. Finally, decisions must be coupled with meaningful monitoring so that adjustments can be made if desired outcomes are not being achieved. Symbols of this method include inclusive arenas in which information is shared and discovered, transparent analyses, rigorously analyzed alternatives, and participatory decision making.

Unlike other approaches, which focus more on substantive than procedural issues, the basic unit of attention in adaptive governance are the social and decision making processes (Brunner et al. 2005).

Few groups focus on the adaptive governance approach, per se. However, proponents of all the other traditions seek to change decision outcomes, even if they remain entrenched in narrow, techno-rationalistic approaches. In some cases, adaptive governance-like solutions have been arrived at independent of any explicit reference to the adaptive governance approach (Brunner et al. 2002, Brunner et al. 2005, also see Box 7). In a sense, this tradition targets the very foundation of large scale conservation—the human dimension at both individual and community levels and in the most fundamental relationship of people and nature.

Box 7 Vision statement of MendoFutures (2009), a grassroots organization in Mendocino County, California.

MENDOFutures

Our Vision

We are a community of people, resources and unique beauty. We produce economic vitality that is highly visible, is good for people and is good for the ecology. MendoFutures' vision is to be a catalyst in creating:

- A healthy community that engages in the ecological, economic and equity (E^3) issues of our community.

- Locally sustainable and renewable.
- A community that has a shared identity and sense of ownership for its activities and its commitment to creating a future together.
- A place that mobilizes and focuses its resources toward its future through sustainable practices
- A place that knows how to work together. A place that has an "infrastructure" of effective community engagement and communication processes. A community that values diversity of opinions and culture.
- A community that values education as a way of building awareness and connections to our diversity, our resources and possibilities. We teach the old ways in new ways.

CONCLUSION

Sustainability and human dignity are important societal goals, but achieving them in large scale conservation has proven to be difficult. Despite a century of symbolic updates, the basic formulae and doctrine of natural resource management have remained relatively static. The core weaknesses of the single and multiple use approach has been an over-reliance on scientific management and its purely positivistic worldview. As a result of these two doctrinal elements, the approach has been largely technical and bureaucratic. Approaches based on the single and multiple use doctrine are inadequate for addressing problems in social and decision processes and incapable of addressing constitutive problems. Consequently, they are not sufficient to address the complex challenges of large scale conservation. We must look elsewhere for innovations and solutions. Sound leadership and change at technical, political, and cultural levels is required to bring about wide-scale change. Adaptive governance offers a holistic and fully contextual approach, but implementation proceeds slowly and incrementally.

Adaptive governance offers a holistic and fully contextual approach, but implementation proceeds slowly and incrementally.

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Part II: Cases

Chapter 4

Large Scale Conservation in the Connecticut River Watershed: Moving from Competition/Fragmentation to Collaboration/Integration

David Cherney, Yuko Kurauchi, Alex McIntosh, and Kim Mortimer[1]

ABSTRACT

As conservation organizations move away from small-scale efforts and increasingly engage in planning at an ecosystem or watershed level, new methods of thinking and practice are needed. Analyzing conservation efforts in the Connecticut River watershed provides insight into the challenges faced by other large scale conservation initiatives. The persistent policy problems faced by conservationists in the Connecticut River watershed include the structure of decision making arenas, goal legitimacy and substitution, and overreliance on scientific management. Shifting toward conservation policies that better secure the ecological health of the watershed, maximize opportunities for social justice, and augment democratic practice requires that participants interact in novel ways. The three interventions recommended for improving participant interactions (decision seminar, problem orientation workshop, and practice-based learning) can be implemented by regional participants or future researchers.

Key words: *large scale conservation, policy sciences, conservation planning, Connecticut River Watershed, decision process*

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INTRODUCTION

As conservation organizations move away from small scale efforts and increasingly engage in planning at an ecosystem or watershed level, new methods of thinking and

practice are needed. In the Connecticut River watershed in the northeastern United States, conservation organizations, both governmental and non-governmental, are experimenting with innovative approaches to conservation at larger scales. In spite of these organizations' well-meaning efforts, it is widely agreed among participants in the region that successful long-term conservation of the Connecticut River watershed has yet to be realized. Several persistent policy problems exist and contribute to a poorly functioning decision process.

This paper provides a contextual overview of large scale conservation in the Connecticut River watershed and identifies major process-oriented challenges faced by participants. The recommendations presented in this chapter are oriented toward all people interested in this subject. However, the recommendations are just as practical for participants interested in increasing the effectiveness of the watershed's policy process and conservation.

Standpoint and methods

The authors of this chapter embarked on a rapid assessment (March 24-28, 2004) along the Connecticut River to gain knowledge of this system (Figure 1). The observational standpoint of the students performing this analysis is reflected in the recommendations that follow. Therefore, it is appropriate to briefly scrutinize the standpoint and methods employed, in order to form a more complete understanding of this analysis.

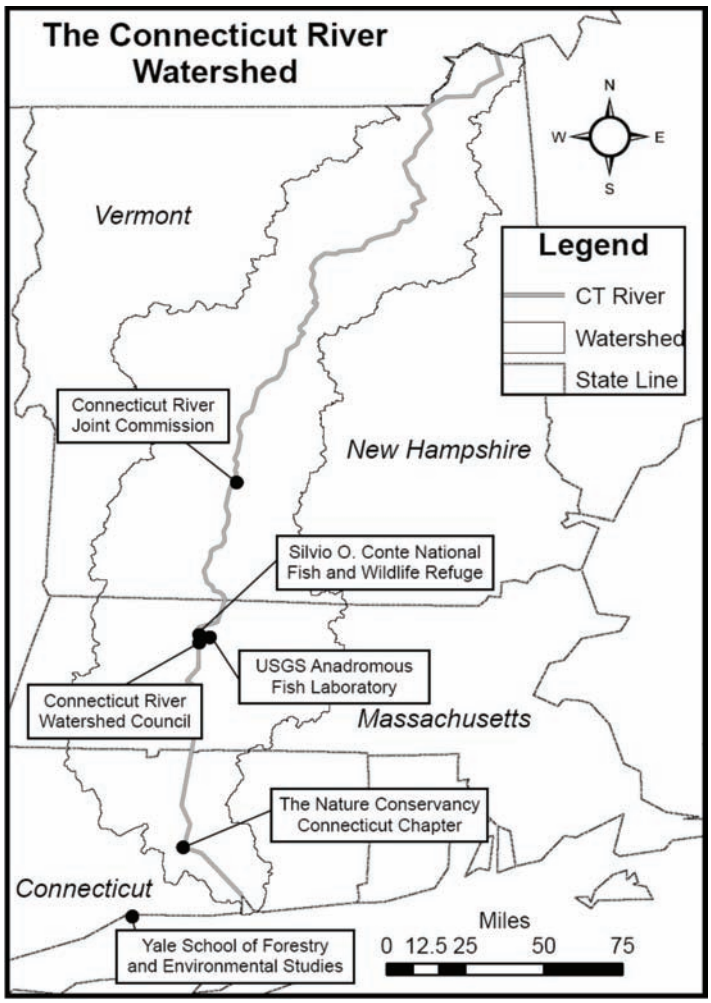
Certain base values prevailed among the student evaluators. Students were primarily enlightenment- and skill-driven, eager to "test out" and further develop their skills and knowledge as policy analysts in a real world scenario. In other words, students were interested in bringing their learning and experiences to help improve conservation efforts focused on the Connecticut River. A rational, academic vantage point prevailed, which, when combined with a relative lack of historical or contextual understanding of the Connecticut River system and its conservation actors, resulted in a tendency to apply generalized understandings to this large, complex natural system. Our outside vantage point also offered some advantages enabling us to perceive and analyze the system as a whole rather than individual parts.

The policy sciences' framework and propositions were used to guide our inquiry (see Lasswell 1971, Lasswell and McDougal 1992, Clark 2002). Information for this appraisal was collected from multiple sources. Students arranged informational sessions with five organizations engaged in large scale conservation of the watershed (Table 1). These meetings consisted of presentations by the host organization followed by a period of questions and discussion. During the meetings, students gained insight into the history of the various organizations, the challenges they face, and the conservation strategies they employ. A basic content analysis of materials and websites of each organization was conducted to compare institutional values, symbols, and goals to understand the context of this region.

The Connecticut River watershed was selected as a case study by the authors of this chapter because of the large area represented and the diverse set of environmental, social and economic issues faced by its inhabitants. In contrast to long-term, more

detailed studies, a rapid assessment is a research tool that allows an analyst to gather and process a significant amount of information in a short period of time (del Campo and Clark 2009). The aim of this method, from a policy sciences perspective, is to develop a snapshot of the likely challenges faced and possible means of intervention (Clark and Ashton 1999, 2004). Our intent was to explore the strategies used by different organizations attempting to conduct large scale conservation efforts within the Connecticut River Watershed. Although our travel and meetings did not present us with a complete picture of the region, many useful insights were unearthed. Over three days our class met with representatives from five groups: The Nature Conservancy (TNC), the U.S. Geological Survey Conte Anadromous Fish Laboratory (USGS), the Connecticut River Watershed Council (CRWC), the Connecticut River Joint Commissions (CRJC) and the U.S. Fish and Wildlife Service Silvio O. Conte Refuge (USFWS).

Figure 1 Locations visited during the Connecticut River Rapid Assessment



The Connecticut River watershed was selected as a case study by the authors of this chapter because of the large area represented and the diverse set of environmental, social and economic issues faced by its inhabitants.

Table 1 Main characteristics of organizations visited during Connecticut River appraisal

	CT River Watershed Council (CRWC)	CT River Joint Commissions (CRJC)	U.S. Geological Survey (USGS)	USFWS, Silvio O. Conte Refuge	The Nature Conservancy (TNC)
Type of institution	NGO	Governmental (state)	Governmental (federal)	Governmental (federal)	NGO
Enforcement	Non-regulatory	Non-regulatory	Non-regulatory	Regulatory (inside Refuge)	Non-regulatory
Lobbying capacity	High	Low	Low	Low	Low
Principal funding mechanism	Private donations and grants	State funding	Federal appropriations; clients	Federal appropriations	Private donations
Recognition by other organizations	High visibility	High visibility	High visibility	High visibility	High visibility
Level of partnership with each other	Moderate	Moderate (focused in VT and NH)	Minimal	Moderate	High, but on their terms
Flexibility to change	Medium	Resistant	Limited only to biophysical context; institutional constraints	Limited only to biophysical context; institutional constraints	Medium

Our intent was to explore the strategies used by different organizations attempting to conduct large scale conservation efforts within the Connecticut River Watershed.

CHALLENGES FACED

The Connecticut River is New England's largest river system and was recently designated one of fourteen American Heritage Rivers (EPA 2006). The watershed encompasses over 11,000 square miles of land throughout four states: Connecticut, Massachusetts, New Hampshire and Vermont (CRWC 2006). Several endangered

species exist within the watershed, a contributing factor in the decision to list the tidal wetlands in southern Connecticut as "Wetlands of International Importance" under the Ramsar Convention (CDEP 2004). In addition to its ecological importance, the watershed has a rich cultural heritage. Rural farming villages and urban commercial centers have relied on the watershed for over 250 years (Delaney 1983). As urban sprawl, habitat fragmentation, and non-point source pollution increase throughout the region, conservationists are looking for ways to preserve this ecosystem. While many regional conservation organizations and natural resource management agencies are focused on improving the watershed—and the definition and concept of improving varies between organizations—few have developed effective strategies for navigating the complex political and social dimensions.

The Connecticut River is New England's largest river system and was recently designated one of fourteen American Heritage Rivers (EPA 2006).

Participants in the Connecticut River system are focused on solving a range of challenges that they believe are contributing to the degradation of the ecosystem. These challenges include, but are not limited to: impaired water quality, invasive species, wetlands loss, acid rain, dams, native species decline, and loss of historical culture. Addressing these challenges is a necessary component to maintaining the health of the watershed, but simply solving these ordinary problems is far from sufficient. In contrast to the challenges focused on by the regional organizations, this assessment looks at the functional, process-oriented challenges faced by participants in the region that act as barriers to lasting conservation solutions.

We sought to assess the policy challenges faced by participants and the goals and specific values for each group visited. Persistent decision process problems faced by the various stakeholders were also identified (Table 3). These problems range from biophysical concerns (e.g. point source pollution, invasive species) to cultural (e.g. clashes of world views, methods of conservation) to decision making (e.g., transboundary management, technocratic vs. democratic control). The scope of our analysis focuses on the constitutive challenges faced to secure a process allowing the watershed's community to find common ground.

Goals

Understanding a public policy problem requires a detailed understanding of the common expectations of a community. Problems do not exist independent of human interpretation; they are conflict between a desired state of affairs (goals) and the current or projected future conditions (Clark 2002). The five organizations visited were asked what an ideal Connecticut River Watershed would look like (Table 2). All five organizations support the general objective of "securing the health of the Connecticut River Watershed," while fully realizing that this statement is subject to multiple legitimate interpretations. For example, four out of the five organizations

Table 2 Organizational perspectives visited during Connecticut River appraisal

	Connecticut River Watershed Council (CRWC)	**CT River Joint Commissions (CRJC)**	**U.S. Geological Survey (USGS)**	**U.S. Fish & Wildlife Service (USFWS) Silvio O. Conte Refuge**
Formula for conservation	Advocacy + Education = Conservation	Community partnerships = Maintaining cultural heritage	Biodiversity + Good science = Good management	Education + Science + Land acquisition = Sustainable management
Vision / objectives	1) Promote restoration, conservation, wise development, and use of the natural resources 2) Protect and conserve fish and wildlife 3) Promote and encourage an understanding among citizens (need to conserve)	1) Advocate and ensure public involvement in decisions with affect "their" river and "their" valley 2) Create a citizens' river corridor plan 3) Describe the cultural heritage of the Valley	1) Help visualize the desired future condition [of the CT River] 2) Publish the tools that will "give managers and planners the ability to 'see' in a dynamic way the present and future conditions of the watershed."	1) "to involve the people of the watershed, especially landowners and land managers, in environmental education programs and cooperative management projects" (only during initial phase through public hearings) 2) "Cooperative strategies and a landscape viewpoint will be required to protect the natural diversity of the watershed"
Symbols	Dams Fish and fish ladders Atlas Logos River steward(s) CT River (*the* river) "Working in partnership with people to protect the *Connecticut River*"	Cultural heritage CT River (*their* river) Logos; Book *"The catalyst for cooperatively meeting the Valley's challenges is the Connecticut River Joint Commissions, who seek a strong and vibrant economy while capitalizing on the natural wealth of this place."*	Anadromous fish USGS Logo *"Science for a changing world"*	Fish and wildlife Invasive species Migratory birds Maps USFWS Logo *"The Silvio O. Conte National Fish and Wildlife Refuge* is no ordinary Refuge!" Roman columns (formula)
Values (entry points into the organization)	Rectitude and wealth (resources)	Respect	Skill and wealth (resources)	Enlightenment

Table 3 Basic overview of decision making by organizations visited during Connecticut River appraisal

	Organizations			
	CRWC	**CRJC**	**TNC**	**USFWS**
Entry point in Decision Process (Clark, 2002)	Intelligence, promotion, invocation.	Appraisal, promotion, application, and quasi-prescription.	Intelligence, promotion, invocation.	Intelligence, prescription, application
Organizational Effectiveness (As judged by other participants)	Less now than in prior years.	They are meeting their own standards, but not necessarily furthering the goal of large scale conservation along the CT River.	Their projects are ad hoc and largely opportunistic. They are perceived in a negative light due to funding conflicts.	Their projects are ad hoc and largely opportunistic.
Positive roles	They are a well-established organization, with moralistic standards.	They have a good reputation for "conservation" in their area, and high social standing.	With wealth, overall reputation, power and social standing, they are in a great position for positive change.	They have great vision and ideals.
Persistent problems	Disorganization within, uncertainty in where to go, lack of respect and wealth.	They have no desire to expand, perhaps exemplifying a disconnect in reaching a common goal.	The 800-lb gorilla-complex.	Lack of promotion and integration of social aspects.

surveyed understood this goal primarily in terms of improving the biophysical aspect of watershed. In contrast, the Connecticut River Joint Commissions (CRJC) interpreted it as focused on the overall quality of life for the human inhabitants. These multiple interpretations do not prevent us from using this shared statement, as the various interpretations are not mutually exclusive.

Understanding a public policy problem requires a detailed understanding of the common expectations of a community.

Persistent problems

Each organization visited believes they have been successful in undertaking a variety of on-the-ground projects and activities that relate to their priorities for the Connecticut River. For example, the USGS implemented a successful program, over the last 10 years, to reintroduce anadromous species into the Connecticut River watershed (http://www.lsc.usgs.gov/CAFLindex.asp). The Connecticut River Joint Commission has concentrated on creating an historic understanding of the northern portion of the watershed to promote a shared sense of community and caring for the river (http://www.crjc.org/partnership.htm). These are just two examples of many success stories encountered. However, despite the effectiveness of any single organization's strategy, there is broad agreement that conservation in the Connecticut River system is far from realized.

Using the shared goal statement as a basis for our identification of policy challenges, three persistent policy problems facing participants in the conservation of the Connecticut River watershed were identified: arenas, goal substitution, and the scientific management paradigm. These problems are not organization specific; they are institutional challenges that have caused difficulty in "securing the health of the Connecticut River Watershed" as a whole.

Using the shared goal statement as a basis for our identification of policy challenges, three persistent policy problems facing participants in the conservation of the Connecticut River watershed were identified: arenas, goal substitution, and the scientific management paradigm.

Persistent problem #1: Arenas

One of the major limitations to achieving successful conservation in the Connecticut River system is the current structure of the arena. Arenas are physical places, or zones of interaction, where participants engage each other to reconcile their interests (Cherney et al. 2009). These situations include town hall meetings, litigation,

informal discussions/meetings, financial markets, and many others. Situations can be understood functionally in terms of their geographic, temporal, value-orientation, and (inter)crisis components (Lasswell 1971). An arena that aims to serve the broad public interest will ideally be open to broad participation (McDougal et al. 1981).

It is widely agreed that the Connecticut River watershed arena is highly fragmented. The current political fragmentation is evident in the division of the watershed into the jurisdiction of four states, over 300 cities, and various federal agencies. The fragmentation is also apparent in the history and traditions of the region, in particular New England's concept of "home rule." Home rule is a governance tradition where a central authority devolves both authority and control to a regional or local level. Fragmented systems of authority and control are often desirable in a policy setting, because they orient governance toward shared local interests (Brunner et al. 2005).

This fragmented, decentralized system may have been an ideal form of governance in the historical context of the region. However, the narrow and localized focus restricts both access and consideration of issues to the concerns of the communities immediately adjacent to the Connecticut River. To achieve the large scale conservation related goals for the watershed, some level of communication and coordination amongst participants is necessary. For example, controlling actions of participants in Vermont can potentially affect participants in Massachusetts, who can potentially affect participants in Connecticut. The converse is also true. Consequently, it is desirable from a common interest perspective for participants in Connecticut to have access to a forum in Vermont where they can contribute to policy making, and vice versa.

Political fragmentation causes a barrier to effective policy by creating a situation where the diverse set of participants within the watershed are unable to mutually engage each other in an effort to reconcile their interests and find common ground. The desire to overcome fragmentation is evident in the numerous plans developed by participants for managing the Connecticut River Watershed, including the most recent by the Connecticut River Watershed Council (CRWC). These plans advance a holistic vision and prescriptions for the region. However, according to both The Nature Conservancy (TNC) and CRWC, every plan created ends up "sitting on the shelf." This is not surprising given the fragmented arena. Fragmentation contributes to plans being created by a limited number of participants as compared to the watershed's large community to which the prescription is to be applied.

Persistent problem #2: Goal substitution

While common ground exists between the goals of the five organizations visited, all organizations are hindered by issues of goal legitimacy and substitution. As previously identified, each organization has a slightly different vision for what an ideal Connecticut River watershed would look like. These visions are not mutually exclusive. However, the various organizations have set themselves up in a competitive manner to determine whose vision (goals) are "correct" for the region. This competition is manifested in values of power (who can actually effect change), wealth (who can raise more capital), and respect (who is seen as the leading organization).

While common ground exists between the goals of the five organizations visited, all organizations are hindered by issues of goal legitimacy and substitution.

This competitive dynamic is a contributing factor leading to goal substitution (focusing on an intermediate goal often to the detriment of an overriding goal), and is most evident in the relationship between TNC and the CRWC. TNC, an international NGO with substantial monetary resources, entered into the Connecticut River policy arena much later than CRWC, an organization whose sole purpose is to secure the future of the watershed. From the CRWC's perspective, TNC, as an internationally recognized organization, has attempted to wrestle control of the conservation arena and is not attentive to the rich regional history of the watershed. The CRWC sees this as a deprivation of respect for their effectiveness as a conservation organization, a deprivation of power due to their inability to get a seat at the table next to TNC, and a deprivation of wealth due to the competition for conservation funds. As a result, the CRWC spends considerable time and resources trying to increase their monetary base and profile as a conservation organization. In other words, rather than trying to cooperate with TNC on shared goals, the CRWC is focused on developing and meeting indicators that demonstrate their organization's superiority to TNC.

While it is possible for healthy competition to benefit conservation activities, this dynamic contributes to goal substitution by orientating organizations away from high-priority goals, such as their mission statement, and instead narrows the focus to low-priority goals. As a result, organizations such as CRWC measure their success in terms of monetary funds raised, number of donors or members, positive mentions in popular media, and other easily quantifiable attributes that they can compare against those of their perceived competitors, rather than judging their success by improved conservation outcomes.

This type of goal substitution is further evident in the failure and unwillingness of organizations to terminate ineffective conservation programs. Termination is often viewed as a symbolic organizational or conservation failure, rather than a restructuring of the decision process. For example, the USGS claims that it is interested in developing interdisciplinary indicators to better understand the system as a whole, but is resistant to revising the current set of indicators beyond biological or hydraulic data, which portray the agency in favorable terms. There is concern that adding social variables may decrease or threaten their claims of success.

Persistent problem #3: Scientific management paradigm

The perspectives of participants in the Connecticut River system have a significant effect on the quality of management policy, and thus conservation outcomes. Perspectives of participants in the region can be understood through their identity (formulae, doctrine, and symbols), expectations, and demands (Lasswell 1971, table 2). With the exception of the CRJC, all of the organizations visited use an expert-

driven approach, based in biology, in an attempt to achieve successful conservation outcomes.

The perspectives of participants in the Connecticut River system have a significant effect on the quality of management policy, and thus conservation outcomes.

This expert-driven approach is characteristic of scientific management. Scientific management is a paradigm—a specialized myth used to justify certain practices and claims—based in positivism (Brunner 2006). This style of management is well entrenched in popular scientific and policy culture, where reductionism and replication to develop generalizable laws of nature are regarded as the standard method by which people should understand and operate in the world. While attractive for studying isolated technical phenomenon, this management paradigm has proven insufficient to resolve complex policy issues (Brunner et al. 2005), such as the Connecticut River Watershed. The reductionist mentality is prone to overlook or discount critical components of context in a policy setting, often because some factors are not easily quantifiable.

The USFWS is a prime example of how this management paradigm hinders effective conservation in the Connecticut River system. In the development of the Silvio O. Conte Refuge design, this government agency realized that social and political factors are a necessary component in creating an effective reserve. However, the USFWS staff fell back almost entirely on their technical backgrounds to complete the reserve plan, ignoring what they recognized as critical components to be integrated. They justified the exclusion of social components and indicators from their plan (e.g., value dynamics and demands) simply because these factors are "difficult to quantify and measure."

This trend is similarly evident in the other four organizations visited. They tend to frame issues using simplistic, expert-defined problem definitions (whether it be hydraulic, biological, or economic), and, consequently, focus on technical problems at the expense of solving basic constitutive problems. Such a problem definition may be advantageous for one particular organization (for reasons of goal substitution, funding, and the perception of political support); however, it fundamentally excludes legitimate participants, such as non-expert citizens, from the arena.

LOOKING TOWARD THE FUTURE

Based on the trends, conditions, and problems described above, it is possible to envision a number of likely future scenarios for conservation in the Connecticut River watershed.

Based on the trends, conditions, and problems described above, it is possible to envision a number of likely future scenarios for conservation in the Connecticut River watershed.

Business as usual

In this scenario, the most likely of the three, current trends and conditions are carried into the future without significant alteration, and problems of urban sprawl, habitat fragmentation and non-point source pollution gradually but consistently become more chronic in the Connecticut River watershed. Each organization will continue to undertake on-the-ground projects and activities reflecting its perspective of successful resource conservation, without a larger constitutive decision process to streamline efforts, or to integrate organizational strengths and resources for greater impact. Though there will be occasional partnerships and collaborations, the underlying competition for power, wealth and respect will preclude more integrated conservation solutions. The major environmental organizations will continue to focus on intelligence-gathering and the promotion of their institutional doctrines resulting in narrow, expert-defined problem definitions. Without a larger, coordinated effort improving the cumulative social and decision making processes, it is unlikely that the *Business As Usual* scenario will achieve the overarching goal shared by the river's environmental groups: improving the overall health of the Connecticut River Watershed.

Competition and fragmentation

In this scenario, both the cumulative and the individual conservation activities of the river's major environmental groups are hampered by parochialism, competition for scarce economic/funding resources, and by struggles for power and respect. Both the social and the decision processes become less contextual, integrative, and effective on the watershed scale. For example, the current unease between the Connecticut River Watershed Council and The Nature Conservancy grows into a malignant competition. The CRWC then shifts valuable organizational effort from outreach to fundraising, in an effort to replace key funders "stolen" by TNC. TNC finds its ecoregional approach hampered at the local level by suspicious or hostile community leaders who have seen CRWC pushed aside and local contextual issues largely ignored. Or, in another illustrative scenario, the largely successful but geographically-restricted Connecticut River Joint Commissions avoids "exporting" its success stories and templates to groups on the lower river, instead maintaining a narrow focus on its backyard (as currently outlined in the CRJC legislative mandate). Here, the watershed's ability to benefit from local innovation and experimentation, and to integrate conservation solutions at a larger level, is virtually eliminated. The result, in both the short and long-term, is that sprawl, habitat fragmentation, and non-point source pollution along the river increase unabated; and, perhaps as important, community and social justice opportunities are severely hampered by regional and organizational competition.

Collaboration and integration

The final, and most promising, scenario is one in which the leading environmental groups of the Connecticut River find need for and implement a larger, more collaborative and integrated approach to conservation. This may be led by any number of groups: the Connecticut River Watershed Council might acquire the resources or power, The Nature Conservancy might find that sharing or distributing power, respect and wealth to a larger group of stakeholders is more productive than is its current approach. In any case, the major groups engage in a constitutive decision process, which more effectively and contextually identifies problems, describes trends, analyzes conditions, projects developments and creates, ranks, and selects alternatives for achieving the common goal. In this case, the arena and consequently the social process are clarified and improved; solutions are contextual, and failed efforts are instructive but terminated. The relative strengths of the different environmental organizations are harmonized and brought to bear upon the river's biophysical problems, including urban sprawl, habitat fragmentation and non-point source pollution. The overall health of the river improves, and through time, the opportunities for social benefit and justice are created and spread throughout the watershed geography.

RECOMMENDATIONS

In order to encourage movement towards the *collaboration and integration* scenario, three different, but related strategies are proposed: decision seminar, problem orientation workshops, and practice based learning. A common theme of these recommendations is encouraging a problem oriented approach to conservation in the watershed. While these alternatives are oriented towards the participants involved in the Connecticut River Watershed, they also specifically address ways that future students can continue to engage in this case. These recommendations provide the entry points to encourage each of the organizations to work towards a common purpose, especially if they perceive that they will be enriched through this process.

In order to encourage movement towards the collaboration and integration scenario, three different, but related strategies are proposed: decision seminar, problem orientation workshops, and practice based learning.

Decision seminar

It appears that the groups interviewed share a common desired future condition of improving the social and biological conditions of the Connecticut River watershed. Unfortunately, this goal is highly prone to substitution by the five organizations, and there is a lack of agreement on how to achieve this outcome for the watershed. This deficiency in the policy process provides an opportunity for Yale to lend its skill and

knowledge by coordinating a policy clarification and exercise called a decision seminar (Willard and Norchi 1993). A decision seminar is an ongoing, group-based exercise that helps participants problem solve in a policy-oriented, multi-method, and contextual manner (see Burgess and Slonaker 1978, Muth 1987, Willard and Norchi 1993). This seminar helps participants find and maintain a common problem definition: a set of goals, trends, conditions, projections, and range of alternatives.

Muth (1987) lists six operational procedures that are necessary for a decision seminar to occur. First, a dedicated nuclear group of participants is essential to maintain the seminar through time. Second, a permanent local site is necessary to be a symbol for the exercise and to house the material used. Third, audio-visual aids are needed to remind the problem solving group of its progress and its goals. Fourth, outside experts are crucial to increase the knowledge of the participants. Fifth, a detailed record-keeping system is required to document the continual changes in data. Finally, a research system is vital to add to and update the data on which the group relies.

An outside group, such as a future Yale class, could try to organize and coordinate such a seminar. Most of the organizations and individuals involved in the conservation of the Connecticut River watershed see a need for a larger understanding of the problem. The individuals involved in this case are highly motivated and dedicated to this effort. If approached in a manner playing to their core values, all of the institutions involved in this appraisal would likely be willing to participate in such a seminar. This sets the stage for a nuclear group of participants. It is recommended that the students find ways to secure and sustain the other five operational procedures described above, and to create a termination strategy for Yale's involvement as the facilitator of the seminar.

Problem orientation workshop

Organizations pursuing conservation in this watershed often compete and do not address shared goals. One method for finding common ground between the participants would be to organize a workshop centered on problem orientation. In order for the groups to effectively work together in a collaborative fashion, they need to develop a good understanding of their own perspectives as well as the perspectives of the other participants. By exploring the following questions, the workshop participants can attend to the five tasks of problem orientation:

1) What do we want to achieve?
2) How well have we done so far?
3) What has influenced these circumstances?
4) What will happen if things go on as they have?
5) What must we do to achieve what we want?

Organizations pursuing conservation in this watershed often compete and do not address shared goals.

Students from the Yale School of Forestry & Environmental Studies could play an important role in organizing this type of workshop and serving as facilitators. Students could employ a Q-methodology in order to reveal common ground between the participants. In a Q-workshop, participants are asked to generate responses to questions about problem definition, goal clarification and potential strategies for meeting goals and then the participants are asked to rate the degree to which they agree or disagree with the responses (Brown 1980, 1993). An analysis is subsequently performed to place the participants into factor or cluster groups based on their responses.

Potential outcomes of this workshop are greater insights into the similarities and differences between the participants and a better working relationship between the participants. If successful, the workshop could produce a shared problem definition and new opportunities for future collaboration, such as the creation of a "Connecticut River Congress" as suggested by CRWC.

Practice-based learning

In order for large scale conservation efforts to be successful within the Connecticut River watershed it will be necessary for stakeholders to combine efforts and work toward mutually compatible goals. Although all of the organizations involved with conservation in the region have partnerships and programs that have individually been successful, coordination at a larger scale has not occurred. This stems, in part, from the lack of clarified goals among all of the organizations. The creation of a joint initiative provides a unique opportunity to overcome this problem and there are several mechanisms already in place that would help facilitate its creation. For example, the CRJC, the CRWC and the USGS all expressed interest in developing an atlas for the region. Although the CRJC intends to focus only on Vermont and New Hampshire, and the USGS is focused on biophysical elements, their desire for a similar output is a first step in aligning interests. In addition, the Connecticut River Watershed Initiative, being developed by the USGS and researchers at the University of Massachusetts, provides a newly created vehicle for bringing together stakeholders and a diverse set of interests. Although the current focus is on biophysical elements, they have expressed an interest in developing a framework and tools that incorporate other perspectives and values.

Creating a pilot project and using a practice-based approach will enable the organizations in the region to test out different conservation strategies and create new arenas at a smaller scale before trying to translate these approaches into a watershed-based approach. Students from the Yale School of Forestry & Environmental Studies could also play a role in implementing this recommendation. They could highlight best practices in the region and then serve as mentors to the various organizations, helping them to encourage similar practices among their constituents. In doing so, the students would essentially be providing these groups with an entry point for appraisal.

However, conservation work in the Connecticut River watershed tends to be a patchwork of efforts, in which projects are often fragmented with limited functional linkages.

CONCLUSION

All of the organizations appraised in this paper have successfully undertaken conservation activities using a variety of formulae to achieve the overarching goal of maintaining a healthy watershed. However, conservation work in the Connecticut River watershed tends to be a patchwork of efforts, in which projects are often fragmented with limited functional linkages. Under these circumstances, a major concern is that the Connecticut River groups will continue along the *Business As Usual* path. However, it appears that there is much common ground between the organizations surveyed, even if they do not fully recognize it at the moment. While competition can spur innovation, the overriding goal among these organizations is a healthy ecological and social system, not institutional continuity or plaudits. Achieving their common interests can best be accomplished by working toward the *collaboration and integration* scenario. In order to shift the future trajectory of conservation in the watershed, three alternative measures were provided. These measures can assist the organizations in finding common ground, creating a functional network, and transforming the ineffective patchwork approach to a coordinated approach at a larger scale. It is important to recognize, however, that these large scale recommendations complement rather than replace the ongoing watershed conservation strategies and practices. Given the existing social and political conditions, such as home rule and parochialism, a top-down regulatory approach is unlikely to be successful. Each organization has an important role to play in its respective arena. We hope our recommendations will assist in creating a new, large scale arena which embraces a more bottom-up approach. Finally, through the sharing of the common vision, pooling of collective wisdom and experiences, and establishment of a joint initiative, the Connecticut River stakeholders are more likely to find true lasting solutions to the broad set of challenges facing the river system. Our hope is that this report, though limited in research scale and scope, provides the platform for an improved dialogue and concerted actions among players involved in the conservation and management of the Connecticut River watershed.

Achieving their common interests can best be accomplished by working toward the *collaboration and integration* scenario.

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Chapter 5

Water Management on the Wind River Indian Reservation, Wyoming: A Rapid Assessment and Recommendations

Christopher Meaney, Colleen Sullivan, Susan G. Clark[1]

ABSTRACT

Water management policy on the Wind River Indian Reservation (WRIR), Wyoming, home to Shoshone and Northern Arapaho Tribes, is awaiting resolution in the common interest (i.e., in environmental sustainability and human dignity terms). Irrigation water is taken from the Wind River largely for non-Indian agricultural activities. In the past thirty years, there has been growing controversy on who can use water, how much should be used, for what purposes, and who gets to decide. We took on the WRIR water case at the invitation of Native Americans on the WRIR because it is a complex large scale case study that deals directly with challenges to human dignity. We assessed the case during a five-day rapid assessment field trip and through follow up research. The existing water management policy is not supported by a broad-based consensus among all interests, is inefficient, and does not work well in practice for all the people involved. Alternatives to current management exist that might improve matters. We explore nine alternatives, but for brevity, our analysis here evaluates only four in detail. It is recommended, however, that future efforts to improve water management policy consider all nine and any other options that present themselves.

Key words: *Wind River Indian Reservation, water management policy, Native Americans, policy research, Wyoming, common interest, human dignity, sustainability*

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INTRODUCTION

The 2.2 million acre Wind River Indian Reservation (WRIR) in central Wyoming is home to the Shoshone and Northern Arapaho Tribes. Non-native ranchers and other Euro-American immigrants reside on inholdings and adjacent lands. Irrigation water is taken from the Wind River, the only significant river on the reservation, largely for non-Indian agricultural activities. Water use has been adjudicated in the Wyoming court system and before the U.S. Supreme Court, but the appropriate allocation and uses of water remain highly conflicted. Water is managed using the single and multiple use paradigm (Chapter 3, this volume). Over the past thirty years, there has been growing controversy among stakeholders focusing on who can use water, how much should be used, for what purposes, and who gets to decide. The western frontier worldview dominates the regional and local culture and this has major implications for how Indians are treated (Slotkin 1992, Western 2002).

We took on this large scale water management case at the invitation of Native Americans on the WRIR, because it is complex technically and politically, and most importantly, because we see it as a human dignity case. Given the diverse interests of Native Americans, Wyoming agriculturalists and politicians, and other stakeholders, this is an exceeding complex case with no simple short- or long-term resolution easily at hand. O'Gara's book *What You See in Clear Water: Life on the Wind River Reservation* provides a background of this case. In many ways, the issue is less about water and more about a lack of human dignity for Indians. Human dignity is about respect for individuals and equal treatment under law. Achieving the goal of dignity cannot happen unless people live in healthy, sustainable environments (Clark 2002). Nevertheless, most people involved, including observers and the courts, continue to treat the case as only about water and its proper management. We conclude that the WRIR situation is ripe for resolution in the common interest. This paper describes the WRIR water management case, emphasizing the dynamics of social and decision processes at play, analyzes trends and conditions that have brought the issue to its present conflicted state, and offers recommendations for ameliorating some underlying issues in the common interest.

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Policy problem

Beyond the contextual problems as introduced above, the policy problem is that Wyoming water law operates under the prior appropriation doctrine known as "first in time-first in right." This is often referred to as "use it or lose it," wherein, if a water allocation is not used for a defined beneficial purpose within a certain amount of time, the right to use it in the future is forfeited. Water rights are issued by state

officials to those who plan to make "beneficial use of water," a concept that is narrowly defined in terms of agricultural productivity and mining. Water rights obtained under the doctrine of "first in time" conflict with water rights obtained by Native Americans through a formal treaty with the U.S. government, which does not require that water be used in order for those rights to be recognized. The current regulatory structure and water management policy provide little incentive for conservation of water. The "first in time" doctrine and the "use it or lose it" principle conflict directly with the desires of some participants (e.g., Native Americans, conservationists, sportspeople) to leave water in the Wind River for cultural, ecological, and recreational purposes. Accordingly, competing definitions over what constitutes "the most beneficial use of water" lies at the heart of the policy problem.

Euro-American settlers immigrated to the region in large numbers in 1870, and in 1890 Wyoming achieved statehood. The U.S. Bureau of Reclamation developed the first federal irrigation district to distribute water in the area (Fremont County) in 1904. This program today extends along both sides of the reservation's major river, the Big Wind River. The river and associated irrigation systems provide water for farms and ranches in a 335,000-acre zone of the reservation (Massey 2004). This arrangement is highly problematic for some interests. It raises questions about allocation of resources and also larger questions about human dignity. For example, how are constitutive issues of "first in time" to be reconciled with Indian treaty rights? And importantly, how can matters be adjudicated to enhance human dignity for all, especially Indians? These questions have neither been answered nor the policy problem resolved in an enduring way that fully supports human dignity for all.

Theory, methods, and standpoint

This case was researched beginning with a five-day rapid assessment field trip in early November 2005. Rapid assessments are short duration (typically a few days) during which researchers seek "inventory" information around a resource issue (Del Campo and Clark 2009). Often, rapid assessment focuses on ecological issues, but assessments are most complete when they also include social and contextual elements. Our assessment included both human and ecological concerns. We used methods that were a mix of tools from ecology (e.g., direct observation, site visits, GIS, data on water flow), anthropology (e.g., observation, cataloguing of practices), sociology (e.g., interviews, social metrics), economics (e.g., income measures, cost-benefit analysis), and public health (e.g., health statistics). Our approach kept the human dignity concern in mind at all times.

We drew on a comprehensive problem-oriented framework to guide our research (McDougal et al. 1980, Lasswell and McDougal 1992, Chapters 2 and 9, this volume). This approach, in addition to offering an analytic perspective and method, is also a theory about human dignity and sustainability. This approach is systematic, empirical, and problem focused (Clark et al. 2000). The approach required us to focus our research on the social and decision processes at play in the case and to use triangulative methods. Triangulation involves obtaining data from three or more sources and cross-checking it to see if it all focuses on a single conclusion. We used

indices of people's lives (e.g., poverty, unemployment, income, health care) and the status of the environment (e.g., crop yield, soil, in-stream flows). In addition, we drew on indices and standards associated with the overall social and decision processes (e.g., was the decision process comprehensive, timely, open, and so on – see Lasswell 1971). These helped us assess the quality of the decision making process and to apply procedural, substantive, and practical tests of the common interest, as described by Brunner et al. (2002), Brunner and Steelman (2005), and Steelman and DuMond (2009).

This approach, in addition to offering an analytic perspective and method, is also a theory about human dignity and sustainability.

Our methods included mapping of the social process: identifying key stakeholders, their perspectives, situations, values at stake, strategies being used, and outcomes sought. We contacted professionals in the region to gain insight into the case and spoke with people who had experience with water management in the Wind River region. Interviews were pre-arranged by contacting key participants identified during the social process mapping stage. While in Wyoming, we toured much of the WRIR by car and spoke to over thirty people from all sides of the conflict over how water should be used. This included representatives of the federal government, members of both Indian tribes, County Commissioners from two counties, a newspaper editor, elected state officials, individual Indians, ranchers, environmentalists, and citizens. We visited dam sites, irrigation systems, crop and livestock lands, wildlife habitat, rivers, streams, and lakes. After our field trip assessment, we followed up with interviewees to discuss our observations, and continued library research.

Our methods included mapping of the social process: identifying key stakeholders, their perspectives, situations, values at stake, strategies being used, and outcomes sought.

According to Lasswell and McDougal (1992), people tend to behave in ways that they perceive will leave them better off. Because people's goals are motivated by their values, we assessed both goals and values at stake. We were particularly interested in the value dynamics and outcomes of WRIR water management for Native Americans. We recognized that what we observed was more than a result of water management. It reflects a long history of the relationship between native peoples and the dominant culture (Euro-Americans). All natural resource management policy is a normative activity, so our focus on values is essential (see Bell 1970). This contrasts with the conventional approaches that have been applied to this case, and which typically focus on technical, biophysical facts and underattend to the value dynamics involved.

Values encompass "orientations towards what is considered desirable or preferable by social actors" (Zavalloni 1980: 64). Values are socially organized, and are invested

with deep feelings of identification and emotional commitment for individuals. They are basic to developing a collective understanding of the "good" or common interest (McDougal et al. 1980). They are the bedrock on which all claims to water in the WRIR rest. We used Lasswell's (1971) system of values as it recognizes our common shared humanity and our individual and social heritage. Lasswell offers eight broad values that flow from his conception of human dignity and "each one," according to Bell (1997: 180), "is a good candidate for being universal." The functional values are about the shaping (producing) and sharing (enjoying) of power, enlightenment, wealth, well-being, skill, affection, respect, and rectitude (in no order). The WRIR water case clearly involved conflict among participants across all eight values.

The WRIR management policy problem is brought into focus through our descriptions of the decision making functions that make up the WRIR case. We used a decision process model comprised of interrelated functions or activities. Taken together, the person involved acquires relevant information, debates the meaning of the information, decides on a course of action, implements management actions, evaluates consequences, and adapts accordingly.

The observational and analytic standpoint of the authors and five other field trip participants is reflected in the text, impressions, and recommendations that follow. Because our work was based on a rapid appraisal and some follow-up work, we realize that our report could benefit from a longer study, one with more empirical data, and thorough analysis. Although our travel and meetings did not present us with a complete picture of the issue and its context, we feel that useful insights were gained, that our recommendations are practical, and that they serve common interest and human dignity ends.

WIND RIVER WATER MANAGEMENT

Wind River water management policy has a long history. The WRIR was established as a result of three treaties negotiated with Shoshones, the last in 1868, all pre-dating Wyoming statehood, which occurred in 1890. Thus the rights of the Shoshone were established on the property before the federal government created the Territory and then the State of Wyoming. Shoshones claim sovereignty over the WRIR. The reservation, however, is shared with the Northern Arapaho tribe. The Northern Arapaho peoples were moved onto the Shoshone Reservation some years after it was established, against the objections of the Shoshone people. They too, however, side with the Shoshones on how they want the water to be used and who should decide.

Geographic context

The WRIR, once 44 million acres, is now 2.2 million acres and supports about 8,000 individuals, 6,500 of whom are Native Americans (Massey 2004). Agriculturalists, miners, ranchers, recreationalists, retirees, and other people inhabit the region. Reservation lands are bounded on the west and south by the Wind River Range and are characterized by foothills, sagebrush basins, and a few riparian areas (Knight

1994). It is bounded on the north by the Owl Creek Range and opens into the basins and prairies to the east. Once considered to be barren land, the area is now valued for its resources, especially minerals. Given the low levels of rainfall (less than 10 inches annually in some areas) and varying winter snow pack levels, water is typically in short supply, especially given recent demands for agriculture and ranching. The eighth consecutive year of drought was in 2008.

Social context

Many different groups are involved in the WRIR case with diverse interests (values) at stake. Understanding participants, their values, and the way in which they are employed (strategies) allows us to offer recommendations to remedy this policy problem in the common interest. The social context of western Wyoming was described by Taylor and Clark (2005). These authors discuss settlement patterns, statehood and state's rights, federalism, and community dynamics in the region. These features figure prominently in the WRIR water case. A brief description of the major participants follows.

Understanding participants, their values, and the way in which they are employed (strategies) allows us to offer recommendations to remedy this policy problem in the common interest.

Federal government

Through the Department of Interior (DOI), the federal government manages affairs for this area via the Bureau of Indian Affairs (BIA), the Bureau of Reclamation (BOR), and the Fish and Wildlife Service (FWS). Additional intervention and oversight occurs through the federal judicial system. The government and its programs predominantly seek value outcomes of power, wealth, and respect. In most cases the federal government uses all four strategies at its disposal (i.e., diplomatic, ideological, force, and economic means). The outcome of the decision process thus far has been to maintain federal and state authority and control above all else (e.g., an overriding constitutive outcome in this case).

State of Wyoming

The State of Wyoming exercises its interests through the State Water Engineer's Office and indirectly through elected officials, such as County Commissioners. The state shares similar values to those of the federal government regarding the management of water resources and also uses all four strategies. Overall the state's strategies has been to promote wealth, power, and well-being on a state level, especially for non-Indian participants.

Indian tribes

The Eastern Shoshone and Northern Arapaho tribes both live on the WRIR and are sensitive to human dignity concerns as a consequence of a long history of respect, power, and other value deprivations. These deprivations have been well documented (O'Gara 2002). The tribes have traditionally shown a strong "sense of place" about the surrounding natural resources, though these values are diminishing in younger generations. The Indians, like the government, seek value indulgences. The tribes are exploring diplomatic strategies through their tribal liaison officer with the Wyoming state government. Overall, the tribes have lost power, well-being, and other value outcomes since the early 1800s.

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Agricultural sector

In addition to individual farmers and ranchers, the agricultural sector includes the irrigation districts that administer the irrigation system. The Bureau of Reclamation still owns these districts and will not turn them over to local owners until the debt for the system is paid off. Participants in this sector who have gained ownership of these irrigation districts are of European ancestry and are characterized by utilitarian beliefs and a pursuit and maintenance of wealth, well-being, and power. These participants use diplomatic strategies through negotiations and political connections with the state to achieve their outcomes.

Non-governmental organizations (NGOs)

NGOs include the Wind River Alliance (WRA), Wyoming Outdoor Council (WOC), and the Greater Yellowstone Coalition (GYC). These organizations value rectitude, power, and respect for themselves and others. Other than the WRA, few directly address the WRIR water case. However, all are interested in natural resource management and policy in the region. Strategies utilized by these groups include the full range of strategies – public outreach and education, negotiations, and lobbying.

Sportsmen/recreationalists

Sportsmen and recreationalists include individual hunters, fishermen, hikers, campers, and boaters, as well as the groups representing them. These participants value skill, well-being, and rectitude. They have mostly employed diplomatic and economic strategies in support of their values, including recreation.

The arena within which all these participants interact is centralized and under the authority and control of the federal and state governments. Indian relationships with

the federal government and state of Wyoming remain complex, ambiguous, or problematic, thus allowing conservative local interests that favor the status quo to dominate the current arena, as they have throughout the past. If the overriding goal is a fair, effective and practical water management policy in the common interest, our interviews, observations, and analysis of the social process show much value conflict and discontent. The present management policy process strongly favors local agricultural and state interests at the expense of environmental interests and those of Native Americans and their allies.

Analysis

We used empirical indices of the situation to gain insight into the history and conditions, and as a basis for predicting likely future events and processes in this case. We focused on selected indices about people and their lives, the environment, and the management decision process used to decide how resources are used and who decides. We sought indices that could be easily obtained and were in keeping with our rapid assessment.

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People's quality of life indices

People interact through a social process that has consequences that can be measured in terms of social values and indices thereof. We could not find direct indicators of people's lives and water management during our brief visit. With more time, we could have found and detailed these. In the absence of this time and work, we took general social indicators from the literature, such as unemployment, poverty, and health care, as measures of values that people seek. Although not directly tied to water management, the indices that we used do give some insight into the quality of life for people involved. Measuring and understanding these is a way to identify past performance and future opportunities in the decision making process (Clark 2002). We found that there are vast differences in values outcomes for participants on and off the Reservation because of past decision processes. Obtaining data on these value dynamics (and indices thereof) was not easy. For example, according to senior economist David Bullard from the Wyoming Department of Employment and Research Planning, information of the status of people's lives is collected at the county level and is not broken down on an on-reservation versus off-reservation basis (personal communication, 11 November 2005). Thus data for Indian and non-Indian populations in value terms is either nonexistent or difficult to acquire. However, we did find indices of value outcomes—human dignity measures—as described below.

We used a series of indices about people's lives that are a measure of human dignity and the distribution of value outcomes in the region. Poverty statistics provide an index of human dignity. Poverty is clearly a problem on the Reservation. Of Wind

River Indian residents, 67.6 percent fell below the official poverty line in 1987, and 56.7 percent did so in 1998 (Antell et al. 1999). Significant variation in poverty exists between the two tribes. On the WRIR, 62.4 percent of Northern Arapaho families and 49.5 percent of Eastern Shoshone families live below the poverty threshold (Antell et al. 1999). By comparison, the 1990 U.S. census showed that the poverty level for the rural town of Riverton, mostly non-Indians, was 16.5 percent below the poverty line (Bureau of the Census 1990). Current conditions have little changed, and are not good for residents, Indian or not.

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Second, we used employment as an index of human dignity. The 1990 U.S. Census indicates that unemployment of WRIR Indians was 32.4 percent, or four times the national average. In 1998, 38.1 percent of WRIR Indians between 18 and 64 were unemployed (Antell et al. 1999). Job shortages and a poor fit between available human capital and job requirements in economic sectors (e.g., oil/gas drilling, guiding tourists, and service industry) influence these high levels (Massey 2004). In contrast, the Wyoming Department of Employment Research and Planning reports that the unemployment rate in Fremont County, as of March 2008, was only 5.0 percent, down from 6.2 in 2002, and 5.7 in 1992 (Wyoming Labor Force Trends 2008, 2005, Wyoming Department of Employment, Research and Planning 2005). The statewide seasonally adjusted unemployment rate has steadily increased since the 2000 rate of 3.8 percent, to 4.2 percent in 2002, and to the 2008 rate of 5.1 percent (Wyoming Labor Force Trends 2008, Wyoming Department of Employment 2005).

Third, we used income as an index of human dignity. As for income, reports suggest that total household income on the reservation is low, with a median annual income for Indian households of $11,920 (Massey 2004). Twenty-five percent of households have an annual income of less than $4,700, and only the top quartile has an annual income above $21,940. According to the 1990 U.S. Census, median household income for Riverton, Wyoming is $22,641, and according to the 2000 U.S. Census, the same measure showed $32,503 for Fremont County. Relatively speaking, non-Indian households are doing well (Wyoming Department of Employment 2005). Overall, income is low.

Fourth, we used health statistics as an index of human dignity. Health care in general in the region is a widely acknowledged problem. Preliminary efforts to obtain data on health care access for Fremont County revealed numerous problems. A nursing supervisor at the Fremont County Public Health office indicated that access to healthcare for uninsured individuals (an unknown number of people) between the ages of 19 to 64 living off the reservation is "horrible." She stated there are disparities between the levels of service available to Indians versus non-Indians, with Indians getting poorer quality health care. It was noted that overall access to healthcare in the

region is below national standards. Furthermore, the Director of the Indian Health Service (HIS) Wind River Unit indicated that the Unit suffers from financial shortfalls and is experiencing health professional shortages, particularly for nurses and pharmacists. Demand exceeds available services at the two ambulatory health care facilities in Fort Washakie and Arapaho, and about 30 percent of the Wind River Unit IHS user population has no other form of healthcare coverage (Cathy Keene, personal communication, 21 April 2005).

This analysis suggests that values such as skill, wealth, and well-being – indices of human dignity – are not fairly distributed compared to Fremont County as a whole. There are striking differences in levels of poverty, unemployment, and healthcare access on the reservation as compared to off the reservation. This is true for the other values as well (i.e., power, knowledge, respect, affection, and rectitude), again based on our observations and interviews. There are many institutional practices in place that determine these value flows and who experiences the most dignity/indignity. The way water is managed is just one of these institutional practices. It reflects how the water "resource" is allocated and used. Uses are determined through past and existing decision and social processes that allocate sought-after values (e.g., well-being). These processes also show who benefits and who is deprived as a consequence.

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Environmental indices

People interact through a social and decision process that has environmental consequences that can be measured. We used crop yields, irrigation data, and in-stream flows as an index of environmental sustainability. Crop yields were used as a measure of agricultural prosperity, salinization as a measure of environmental degradation, and in-stream flow as an indicator of ecosystem health. These indices integrate many environmental factors and human land management practices.

First, crop yield data is one index of environmental sustainability. Data is hard to interpret due to regional rainfall variation in this semi-arid environment and variation in individual agricultural practices. The environmental situation in Fremont County is not amenable for agriculture unassisted by irrigation. This is especially true for alfalfa, which requires huge volumes of water inputs. The largest alfalfa crop yield in recent history took place in 1991 during a drought year caused by a low snow pack in the mountains, which was only 70% of its mean annual level. During that year, water rights allotments were enforced strictly and farmers used less water more effectively than in years prior (David Skates, personal communication, 4 November 2005). Aside from the bumper crop in 1991, crop yield data shows great variation annually. However, the implication of this example is that good water management can probably improve crop yields while at the same time freeing up water to remain in the river.

Second, land is consistently over-irrigated, causing water-soluble salts to accumulate on the soils, a phenomenon visible throughout the region. This was widely reported to us and visible on the land. Hard indices of the rate and other aspects of salinization and consequences for crop yield were not available. Nevertheless, considerable acreages were white from salt build-up. Most people we spoke with expected this trend to continue.

Third is in-stream flow. In past years, water levels have been consistently low, and miles-long portions of the Wind River have dried up completely. These portions include the area between a Federal diversion dam, where water is removed for irrigation districts, and downstream, where heavily salinized water is returned to the riverbed. There is consensus that the drying is due to water diversion. This has serious ecological and aesthetic implications. Low flow and changes in flow patterns affect riverine organisms adapted to the already narrow range of environmental conditions. The Yellowstone cutthroat (*Oneorhynchus clarki*), a once thriving species in the region, is nearly gone from the Wind River system. David Skates, a United States Fish and Wildlife biologist, indicates that the fish commonly known as the sauger (*Sander sp.*) had declined to approximately 4,000-5,000 individuals in the early 2000's from much higher but unspecified numbers a decade or two ago (personal communication, 11 November 2005). Reduced natural flow in the river impairs water quality because irrigation runoff is typically polluted with nutrient-rich fertilizers and pesticides, causing adverse impacts on agriculture and on the aquatic ecosystem. Instream flow statistics suggest that current practices are not sustainable.

When it comes to projections, this analysis suggests that if current trends and conditions persist, then crop yield, increasing soil salinization, and continuing low in-stream flows will bring about a deteriorating environmental situation. According to David Skates (personal communication, 11 November 2005) and observations of wildlife and agricultural activities, crop yields, despite the variation, will continue to decline for the next 30 years, at which time the ground will be so saline that it will be virtually impossible to farm. As well, low levels of in-stream flow will continue to contribute to the decline of ecological conditions in the river, eliminating valuable habitat for riverine organisms and reducing biodiversity. This projection assumes that the situation remains unchanged from the past. If this turns out to be the case, then an even more conflicted decision and social process can be expected as people's value demands become unmet. In other words, the value demands for human dignity and environmental sustainability will grow. What can be done to aid this situation?

Decision-making process indices

In the Wind River case, the data cited above, our observations, and interviews suggest that all decision functions are problematic in the way they are carried out. Below we briefly offer our observations and conclusions about the management decision process.

First, our research showed that the *intelligence* function is incomplete (Clark 2009). This function ideally seeks information to understand the problem at hand and its context, but not all the information needed for understanding the WRIR water case

is available or it is under-used at present. Our research and the field visit showed little available data on the full problem and its context. Weak intelligence occurs because of limited resources, including lack of official commitments to collect the needed social, environmental, and physical data relevant to the case. An example supporting this conclusion is the removal of several U.S. Geological Survey water gauges used to measure the volume of water diverted for agriculture and the amount remaining for in-stream flow. Thus data formerly available is no longer available. Now no one knows how much water is being diverted for agriculture. Efforts to restore these gauges, even if the expense is borne by a non-governmental organization, have been met with resistance from both irrigators and regulators. Officials claim it is too costly to maintain them. Other examples include the lack of disaggregated data with respect to economic and health indicators between native and non-native peoples.

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Second, the *promotion* of alternatives is inadequate. Individuals and groups typically promote different interpretations of information and courses of action. For example, our research confirmed that Indian participants are left out of key discussions. This occurs because adequate forums, arenas, and situations do not exist in which the different interests can gather to identify and work out differences of facts, perspectives, and values.

Third, the deciding activity, called the *prescription* function, lacks specificity and resources. Our research indicates that the selected or prescribed rules do not serve all participants fairly. The contentious legal history of the issue before the U.S. Supreme Court and in other legal venues reflects the "special interest," not the common interest, focus of this activity (see O'Gara 2002).

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Fourth, *implementation* must work in practice by being contextual, unbiased, and constructive. Our research shows that the past and existing water management programs have limited success in meeting these standards. A number of people that we spoke with claimed that the majority of irrigators use many times the amount of water allocated; however, this is not enforced or even measured precisely by officials.

Fifth, *appraisal* or *evaluation* shows that much of the WRIR management process has been conducted in the courts, and that the litigation process has not effectively addressed all of the issues inherent in the WRIR water management policy decision making process. The appraisal that the courts have put forth does not blend,

Table 1 Alternatives to the Wind River Indian Reservation water management problems

DEGREE OF FEASIBILITY IN REACHING A SOLUTION IN THE COMMON INTEREST	ALTERNATIVE	DESCRIPTION	EVALUATION
HIGH	Improved regional communication	Innovative avenues of communication such as professionally facilitated workshop may bring together influential parties to develop improved water policy.	Unclear if local and state leadership is capable of moving beyond established worldviews.
HIGH	Increased water metering	An effort to pay for appropriate water metering facilities once removed by the USGS may be inexpensive effort providing valuable information to water policy management decision makers.	This effort could be undertaken by the establishment of an area foundation. Collaboration between the local communities, state and federal government would be necessary.
MEDIUM	Irrigations district restructuring	Returning ownership of irrigation districts to local farmers will provide an opportunity to review past district management efforts and result in better management. Identifying and publicizing the financial shortcomings of the current structure may lead to improved regional management.	Unclear how this process would proceed. Relinquishing ownership would require leadership and organization at the local level and buy-in from the federal government.
MEDIUM	Upgrade irrigation infrastructure / assumption of ownership of irrigation infrastructure by Native Americans	Current irrigation infrastructure on the WRIR is inefficient. Upgrades and transfer of infrastructure may result in efficient uses and increased water conservation	Institutional barriers may prevent this alternative. Tribes are unlikely to want to assume responsibility of an ineffective system.
MEDIUM	Substitution of crops and the purchase of unproductive agricultural lands	Replacing current crops will place less stress on the regional ecosystem.	Cultural traditions heavily influence agricultural practices and some are resistant to change. Residents fear that such actions will prevent recreational users from accessing natural resources on lands.
MEDIUM	Innovative agricultural use	Interpretation of a U.S. Supreme Court Decision gives the WRIR a large allotment of water if put to an agricultural use. Uses such as hydroponics farming, landscaping nurseries, and aquaculture may satisfy this definition and be a positive tribal economic effort.	Location and outflow of such a project and return flow to the river will be key factors in factoring non-Indian users. This may heighten conflict, or could potentially induce non-Indian irrigators into more equitable solutions.
LOW	Create new water storage facilities	New water storage would ensure greater water availability	Location, cost, payment, environmental concerns among others make this a less likely option.
LOW	Statutory Change	Changing water laws to reflect a broader definition of beneficial use to include in-stream flow will enhance abilities for the parties involved to develop an improved water management policy.	Past efforts to implement such change have been ineffective. Regional differences and political barriers act as roadblocks.
LOW	Litigation	The sluicing of the Diversion Dam may be a point source emission under the Clean Water Act, potentially opening up further avenues of litigation.	Litigation as a strategy to improve water management policy has proven to be ineffective in the common interest, is cost prohibitive and fails to address competing worldviews.

harmonize, or integrate different interests of the larger Wind River community into an overall common interest program outcome. For example, beginning in the 1970s, Indian participants appealed to the court system to resolve a host of problems, beginning with state courts, and eventually reaching the U.S. Supreme Court. An outcome in the U.S. Supreme Court case that was more or less satisfactory to the Native Americans was remanded back to the Wyoming Superior Court to refine. In this local arena, the local decision favored non-Indian water users in a manner harmful to the tribes, as they saw it. Following this controversial decision, the tribes chose not to go back to the U.S. Supreme Court. They feel that justice has not been served and that costs and time are not worth revisiting the issue in that venue. The claims and counterclaims have not been fully adjudicated as yet.

Finally, *termination* or ending of the existing policy or program has not occurred. As a result, a status quo management policy remains in place. It is unlikely that it will be terminated and/or replaced with more effective means and outcomes given the current context.

In sum, the functioning of the current decision process is problematic. There is little likelihood for change in the foreseeable future. The decision process as presently configured favors dominant, non-Indian water users over Native Americans.

Problem revisited

The policy problem is that water management is contentious and management policy is not in the common interest given the human dignity and environmental sustainability goals. Various human, environmental, and decision making indices support this conclusion. Social interactions have not included all key participants fairly or comprehensively in a timely fashion. As a result, the existing water management policy lacks consensus, is inefficient, and does not work well in practice for all the people involved. Different views of the adequacy of water management are reflected in competing claims (value demands) and prescriptions for policy today. What is to be done? To achieve water management that supports human dignity for all and environmental sustainability, it is essential to use irrigation water in contextually sensitive ways. This is especially true given the diverse participants who want to be included in decision making and their myriad value demands.

As a result, the existing water management policy lacks consensus, is inefficient, and does not work well in practice for all the people involved.

RECOMMENDATIONS

Alternatives do exist that might improve matters. Table 1 presents options to move the entire management policy process towards a common interest outcome. Nine alternatives are presented in total, but for brevity, our analysis evaluates only four in

detail. It is recommended, however, that future efforts to improve water management policy consider all nine and any other options that present themselves.

The four alternatives discussed below are: (1) upgrade irrigation infrastructure and assumption of ownership by Native Americans, (2) make statutory changes in Wyoming water law, (3) substitute crops and purchase agricultural lands from non-Indian irrigators on the reservation and nearby, and (4) improve regional communication among diverse perspectives.

Subsequent to the identification of the nine alternatives and more detailed review of the four alternatives listed above, our analysis indicates that the greatest opportunity for near term improvement would be to improve communication and coordination among federal, state, and tribal agencies while working to increase efficiency of current water use infrastructure (e.g., irrigation ditches). Long-term improvements can come from addressing water laws.

Upgrade infrastructure and assumption of rights

Irrigation infrastructure (e.g., irrigation ditches, headgates, and related facilities) in Fremont County, especially on the WRIR, is highly inefficient (e.g., irrigation ditches) compared to that on non-Indian lands on the reservation or nearby. Infrastructure upgrades may be costly; however, the state of Wyoming has enjoyed a budget surplus for years due to its energy development. A small part of these surpluses, estimated at $1.8 billion in 2005 alone, according to State Senator Robert Peck (personal communication, 12 November 2005), could be channeled into renovation efforts to replace flood irrigation with gated pipes and center pivots. The state could subsidize infrastructure improvements since water conservation is in the public good.

A joint management scheme could, however, address concerns.

Another possibility would be for a tribal governmental agency, such as the Wind River Water Resources Control Board, to assume shared responsibility for Indian irrigation infrastructure, which is now owned and controlled by the Bureau of Indian Affairs (BIA). The federal government, and hence the BIA, currently fails to allocate appropriate funding to the maintenance of the irrigation system despite the fact that water users on the reservation pay for such services. Likewise, the tribes do not want to assume sole responsibility for a dilapidated system and incur the costs of improving infrastructure. A joint management scheme could, however, address concerns.

Statutory change

Changing Wyoming's state water laws to reflect a broader definition of the beneficial use of water to include in-stream flow will enhance the ability for all parties involved to develop an improved water management policy. Other states, such as New Mexico and Oregon, have taken action to recognize in-stream flow as a beneficial use and

have implemented programs to increase the quantities of water allocated for this purpose. New Mexico established a Strategic River Reserve, and through legislation, instructs an intrastate stream commission to manage water and water rights within the strategic water reserve to benefit threatened and endangered species. The state of Wyoming could follow suit and establish a Water Trust Board similar to the commission in New Mexico.

Since residents of Wyoming respond strongly to property rights doctrine and the western frontier myth and regimes, it is possible that they would support a tradable water rights scheme that promotes temporary transfers of water quantities rather than those that must be permanently relinquished. Legal precedent for this alternative exists. In-stream rights have been recognized by Oregon under the 1987 in-stream Water Rights Act that recognized in-stream uses as beneficial and permitted the appropriation and transfer of in-stream water rights.

Crop substitutions and purchase of agricultural lands

Crops that are currently grown in Fremont County such as sugar beets and alfalfa are water intensive. Replacing these crops with others that are less water intensive will place less stress on the regional ecosystem. The economic consequences of such a change are unknown at present.

Purchasing less productive agricultural lands and taking them out of production would prevent ecosystem degradation (e.g., salinization), leave more water in the river, increase water availability per agricultural acre to existing land, and improve water management. This presumes that the beneficial use issue is addressed first. Otherwise someone else would just get access to the water. Organizations, including The Nature Conservancy, have bought farms and ranches, but rather than restoring the land to its natural character, have continued to operate agricultural enterprises using water. While private owners are buying property in the Wind River area, some residents fear that such actions "lock it up" and prevent recreational users from accessing natural resources on lands that previously allowed hunting or fishing.

This alternative ultimately reduces water demand to affect water management but is likely to face resistance from local residents who believe strongly in their property rights and the ability to enjoy their land at its highest and best use. This use may include development that does not promote the common interest.

Improved regional communication

Innovative avenues of communication and professional facilitation may bring together influential parties for improved water policy. Non-centralized facilitation services may be able to restore lines of communication previously broken as a result of long, legal processes. Such an effort, agreed upon by all parties with clearly defined rules and objectives for engaging in talks, may increase understanding in the contentious environment. It is unclear if local and state leadership is capable of moving beyond established state's rights, anti-federalism, and western frontier perspectives. Furthermore, without determination by the parties to reach a common interest goal, this alternative may face setbacks.

CONCLUSION

Given the complex, ongoing nature of this case, there are several options open to improve water management policy, the human dignity of Native American and non-Indian people and cultures, and ecological consequences in the common interest. Any resolution should produce constant pressure towards achieving these policy goals that will offer the greatest net value gains for all people. All decision process activities can be upgraded to approximate higher standards than presently exist (e.g., timeliness, factuality, openness, fairness, and comprehensiveness). This can be partially achieved by improving the social process to increase effective communication among all the present parties as well as through a more comprehensive representation of constituencies in a fully respectful, effective series of forums. As well, improved irrigation systems management (e.g., ditches, headgates, and pivots) could help minimize water use and consequent negative effects on in-stream flows, biodiversity, and recreational losses. In the long-term, Wyoming water laws, and perhaps the entire Western water law of prior appropriation, must be revised. Few, if any, new resources would be required to try these options. A genuine commitment to problem solving will be essential to improving water management policy in the common interest.

Given the complex, ongoing nature of this case, there are several options open to improve water management policy, the human dignity of Native American and non-Indian people and cultures, and ecological consequences in the common interest.

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Chapter 6

Large Scale Conservation in the Greater Yellowstone Ecosystem: A Field Assessment and Recommendations

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ABSTRACT

As graduate researchers in a seminar on large scale conservation, we visited the Greater Yellowstone Ecosystem, which is a large scale landscape, to investigate natural resource management challenges. A rapid assessment provided insight into the issues, participants, perspectives, and values in the social process underway there. We identified obstacles to the achievement of common interest outcomes through interviews, discussions, first-hand observations, and literature reviews rooted in the policy sciences analytic approach. Our observations revealed an inadequate participatory-based decision process that fails to satisfy valid and appropriate interests of diverse participants. We identified positive steps that are being taken in the region, including better management practices for historically marginalized stakeholders and describe examples. We recommend further use of these strategies, with an overall move toward an adaptive governance model of management, in the common interests.

Key words: *Large-scale conservation, Greater Yellowstone Ecosystem, Yellowstone, adaptive governance, scientific management, innovation, prototyping*

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INTRODUCTION

For 140 years Yellowstone National Park has served as a powerful symbol of the importance of protecting nature for the benefit of present and future generations. Today, the park and surrounding region are home to abundant wildlife, alpine flora,

and unique geological features. Some people see the park as a symbol of the greatest idea America ever had, while others see it as a symbol of federal presence in the Greater Yellowstone Ecosystem (GYE), and government intrusion in the lives of locals. Through its role as a symbolic and political landscape, the park and the large scale GYE have become a confluence of wide-ranging and conflicting values, perspectives, and strategies for management and policy. Stakeholders on all sides of the many issues are generally well informed and immensely passionate, and they display an intelligent and caring regard for their interests. In this context, persistent policy problems impede achievement of a common interest-oriented approach to wildlife and resource management (see Vogel 2006).

This paper describes a ten-day field trip in March 2009 taken by nine students enrolled in Professor Susan G. Clark's large scale conservation seminar at the Yale School of Forestry & Environmental Studies. The field trip was a rapid appraisal in the northern GYE from Cooke City to West Yellowstone and Old Faithful to Madison Valley, Montana. We describe the trip and our interactions briefly, analyze them, and offer our perspective and recommendations. We surveyed selected persistent policy problems (e.g., wolf and grizzly bear management). We sought innovative programs to address this kind of problem. We sought examples of efforts that are working on the ground already. These innovative efforts are advancing shared interests common to citizens and officials. As such, they can serve as exemplars for resolving the widespread conflict in the GYE and in other large scale ecosystems.

In this context, persistent policy problems impede achievement of a common interest-oriented approach to wildlife and resource management (see Vogel 2006).

STUDY AREA, METHODS, AND STANDPOINT

In this section we describe the large scale ecosystem that we visited, our observational methods and theoretical foundation, and our standpoint as observers and researchers.

Study area

The GYE is an example of a very high profile large scale ecosystem. The GYE has been described by diverse authors (e.g., Clark and Minta 1994, Schullerly 1997, Ferguson 2003). GYE is a unique biological and geological system. It is irregularly shaped and about 500 km north-south and 250 km wide. It is about 77,000 km^2 or 7,600,000 ha. The Continental Divide bisects it. The Yellowstone Plateau occupies much of Yellowstone National Park at the heart of the greater ecosystem. The region has over 200 geysers and over 10,000 thermal features altogether. The GYE is headwaters to the Yellowstone-Missouri, Green-Colorado, and Snake-Columbia river systems, and contains about 300 bird and 70 mammal species. Overall, the flora and fauna are

relatively intact, but invasive species and beetle kills are changing the biota of the region.

The region has been colonized by Euro-Americans in the last 130 years. A former wilderness of the 1850's has been transformed today into a destination for millions of visitors each year. Much of the greater ecosystem is under federal government ownership as parks, forests, sagebush basins, and wildlife refuges. Challenges facing this large scale ecosystem were summarized by Clark (2008) who surveyed literature from researchers, government agencies, nongovernmental organizations, popular writers, and others. To be sure, there are many concerns about the conservation of natural resources, especially rare species, but at heart are problems with how people interact with one another, how decisions are made, and with leadership (see Clark 2008). We visited parts of the northern GYE encompassing the Lamar Valley in the northeastern section of the park and saw firsthand some of the challenges.

To be sure, there are many concerns about the conservation of natural resources, especially rare species, but at heart are problems with how people interact with one another, how decisions are made, and with leadership (see Clark 2008).

Methods

We chose to go to GYE because it is important globally and often touted as a model large scale conservation system. The team sought to gain insight into the management challenges facing the region through firsthand observations and conversations with relevant officials, experts, and other participants. We used the rapid assessment method, which is increasingly popular and can be implemented with limited resources to great effect (Clark and Ashton 2004). Rapid assessments are generally performed within a short period, from a few days to a few weeks, with the aim of identifying specific problems, determining why these problems exist, and proposing what might be done about them (Grandstaff et al. 1985, Del Campo and Clark 2009). Many rapid assessments focus only on technical and ecological aspects of a problem, whereas others focus more on human components, but often lack adequate problem orientation and a thorough contextual focus (Clark et al. 2000). Rapid assessments that lack contextual approach preclude an integrative or interdisciplinary perspective on the problems, as well as the possibility of formulating practical, justified, and reasonable solutions (Clark et al. 2001). In contrast, we sought to be explicitly and systematically problem-oriented, contextual, and interdisciplinary.

Our team had only a few days for on-site assessment in the geographically vast, ecologically complex, and intricately contested ecosystem. We employed rapid appraisal to gain a broad overview and understanding of issues as circumstances permitted. We took copious notes, many anecdotal. Our rapid assessment consisted primarily of discussions with selected participants in the GYE's key management challenges. We met formally with ten professionals actively working in the GYE and

had informal discussions with tourists, recreationists, local community members, conservation advocates, scientists, and park employees. We spoke with officials and leaders in government and outside government. We also spoke informally with snowmobilers, local business owners, tourist guides, service workers, and local citizens, totaling more than fifty people. From these sources, we were able to parse out distinct and recurring themes and patterns in people's standpoints, management paradigms, problems, conflicts, and possible solutions. Throughout this document, attributions are anonymous out of respect for the participants interviewed.

We followed up with more intense discussions amongst ourselves and literature reviews (see Robbins 2006 for example) over nine months after the field trip. The data from the trip, largely based on participant observation, open-ended interviews, and lectures/presentations, were analyzed using the concepts and framework of the policy sciences, literature, and guest speakers in the seminar knowledgeable with the region (e.g., David Mattson, Mike Gibeau, Murray Rutherford), and from our collective life experiences in other diverse contexts (Lasswell 1971).

Interdisciplinary problem solving relies on mapping problems contextually, that is, examining management and policy issues, including activities (i.e., the decision process) that make them up. We thus mapped the interactive activities or components of the decision process we observed—intelligence (planning), promotion (debating, recommending), prescription (deciding), invocation (initial implementation), application (final implementation), termination (ending or succeeding), and appraisal (evaluation). The content of these activities differed across different substantive issues (e.g., fire management, wolf reintroduction, or grizzly bear recovery). Interdisciplinary problem solving also includes examining organizational cultures and structures, leadership, and many other factors in evidence-based ways.

Interdisciplinary problem solving relies on mapping problems contextually, that is, examining management and policy issues, including activities (i.e., the decision process) that make them up.

We analyzed data from our interviews, conversations, and observations of actual social process and differing perspectives on problems. First, all resource management problems occur within a context, characterized here as the interaction of every individual and organized interest in the arena or social process. Data were obtained on participants and organizations, their perspectives, values, strategies for attaining values, and outcomes.

Next, problem orientation mapping is about procedural rationality and serves as a guide to identifying problems that impede sustainable management. It calls for describing circumstances and problems empirically and exploring remedies to identified problems. We used five critical thinking elements to orient to the problem: (1) clarifying goals and finding measurable indices of them; (2) mapping trends

(historical data on these indices that affect the problem); (3) determining the conditions behind or underlying the trends; (4) projecting likely future conditions if nothing is done and then explicating any problems that arise from our trend and condition analysis. We sought (5) to invent, evaluate, and select possible solutions. In short, we sought through our rapid assessment to find alternatives to "business as usual," so as to improve decision processes currently at play in the GYE in ways that serve the common interest. Finally, we drew on three tests of the common interest to assess the efficacy of present management and policy in the GYE. Our approach included the procedural, substantive, and pragmatic tests (see Steelman and DuMond 2009, Brunner 2002, 2005, Clark 2002). The main aim of our trip was finding innovations that are addressing underlying people and decision making problems. We focus on those in our recommendations section.

Standpoint

Our standpoint during the field trip and in this report was an amalgamation of the perspectives and backgrounds of nine observers. Because our standpoint, collectively and individually, influenced our analysis and recommendations, it is appropriate to discuss it here.

The nine team members possess broad experience in conservation and resource management across diverse contexts from local to international. Our backgrounds include work in conservation advocacy groups, government and private wildlife research, international conservation NGOs, government and contract positions, and extensive technical field research. Most team members are published authors. This grounding in real-world experience enabled the team to gather and analyze data as experienced practitioners with a collective understanding of the realities of complex and sensitive management problems.

The team embarked on the survey of the GYE with a shared regard for clarifying and promoting participants' common interests and a keen interest in conserving the natural environment. We were aware of the range of widely accepted approaches to large-scale conservation, including parks and protected areas, single and multiple use management, ecosystem management, integrated conservation and development, ecoregional planning, transboundary management, and adaptive governance (see Chapter 3, this volume) before the trip. We used the trip to improve our skills as observers, researchers, and analysts (see Chapter 9). We sought to advance our skills in assessing management and policy in a complex, large-scale ecological system. Our recommendations are intended to aid all participants, including policy makers in the GYE and elsewhere, as well as future students of conservation policy and natural resources management.

ASSESSMENT

All problems have a social and a decisional context. Mapping and understanding these is essential to clarifying problems and searching for solutions. This section briefly examines these two contextual elements.

Social process mapping

Broadly speaking, in their daily interactions people seek to maximize human values for themselves—power, wealth, respect, affection, rectitude, skill, enlightenment, and well being (Lasswell 1971). In any social process, individual and organizational participants have value assets and liabilities they seek and use in every interaction (Clark 2002). Diverse problems throughout the GYE can be defined not only in biophysical terms or conditions, but also in terms of actual value deprivations and indulgences, that is, whether the participants get more of what they want or less (Clark and Wallace 2002). Within the GYE, the value position or standing of some participants has eroded through social process. For example, locals feel that respect for their views has declined over the years. Environmentalists feel they are being slighted. And many people, wanting to influence decision making, feel their power has diminished. This has lead to a drawdown of trust and cooperation among participants that may have existed historically (Table 1). In turn, this constrains the ability of social and decision processes to identify enduring solutions to problems. Understanding how values deprivations can be reversed through improved social and decision process is critical to clarifying and securing the common interest (see Kahn 2000, Cromley 2000).

Broadly speaking, in their daily interactions people seek to maximize human values for themselves—power, wealth, respect, affection, rectitude, skill, enlightenment, and well being (Lasswell 1971).

Table 1 A selected overview of the complex social process in the Greater Yellowstone Ecosystem

Participant	Perspectives	Values	Outcomes of past social process
Wildlife conservation groups	Wolves, grizzlies, and other species deserve protected status to enable their numbers to grow beyond park boundaries	Rectitude, power, respect	Lack of respect, some degree of power through litigation, feeling of inadequate rectitude
Ranchers	Wildlife conflicts with ranchers' ability to earn a living and therefore should be kept within park boundaries	Respect, wealth, well-being	Lack of respect, damage to wealth and well-being through continued conflict with wildlife
Government and park managers	Much variation; commonalities include the bureaucratic tendency to embrace the status quo	Power, skill, respect, enlightenment, rectitude	Lack of respect, some enlightenment via scientific research, significant power

In short, participants in the GYE currently lack an effective arena through which they can explore their different perspectives, and relative value indulgences and deprivations, in a realistic problem-oriented, and contextual way. Consequently, special interests clash ceaselessly in the media, politically, and in the courtroom. This lack of an arena only inflames and recycles conflict, escalates the symbol politics of matters at hand, and further precludes working toward common interest outcomes and effects. It is clear that the value demands of diverse stakeholders are being stymied in many ways, with the value of respect being denied or drawn down for most participants. Although some officials and environmentalists do realize the need for a common platform to discuss and identify common interests, they have lacked the authority, applied tools, and the arena that would enable them to move forward.

In short, participants in the GYE currently lack an effective arena through which they can explore their different perspectives, and relative value indulgences and deprivations, in a realistic problem-oriented, and contextual way.

A superficial understanding of differences in demands among stakeholders masks value similarities (e.g., demands for respect). For example, conflict is most visible between the ranching/agricultural community and the federal government (Taylor and Clark 2005). The ranching community feels deprived of power (over their grazing lands and lack of means to voice their views on problems and solutions) and wealth (because of real and perceived restrictions on their management relative to large carnivores such as wolves and bears). This leaves ranchers, like many other participants, feeling disrespected, slighted, and powerless. This is compounded by an increasing number of residents in the GYE who lack a ranching background, combined with increasing tourism and its growing importance to the region's economy, which symbolically threatens the ranchers even more. Additionally, the environmental community feels that its voice remains largely unheard as well, unless they can reach officials via litigation. Weekly newspapers are full of examples across diverse issues (e.g., endangered species, oil and gas development, tourism issues). This widespread feeling of loss of respect and dignity across most sectors complicates social and decision processes and further alienates individual participants and groups.

Additionally, the social process in the GYE has been ineffective at addressing some of the major policy problems because some major stakeholders have been historically excluded from the process. Combined with other historic trends and conditions, conflict with large carnivores, in particular, has become highly symbolic of deeper value dynamics, perspectives, and practices (Clark et al. 2005, Clark 2008). With the spread of wolves and grizzlies throughout the GYE in the few last decades, for example, wildlife-livestock conflict has become one issue that local community members feel they need to address. Some locals fear that change, including accommodation of large carnivores, would lead to sacrificing their way of life, a belief

that has led to conflict over the values of respect, rectitude, power, and wealth. Their views differ from newer residents of the region, who view large carnivores as part of the landscape and are more willing to participate in coexistence initiatives.

Additionally, the social process in the GYE has been ineffective at addressing some of the major policy problems because some major stakeholders have been historically excluded from the process.

Finally, debates over listing and delisting of grizzlies and wolves from Endangered Species Act protection are heavily laden with symbol inflation. This process of large carnivore management has little to do with the animals and their ecology and a lot to do with the threat that legislation, government, and bureaucracy imply or mean in terms of people's shifting value holdings and demands. Strategies employed by many participants so far have been more ideological and coercive—through newspaper articles, letters to the editor, and organizing activist campaigns—than ameliorative and persuasive. These further divide participants and preclude productive discourse. Some attempts have been made to initiate multi-group interaction, but more organized, large-scale, and authoritative efforts are necessary to make a difference (e.g., Primm and Clark 1996, Mattson et al. 2006).

This process of large carnivore management has little to do with the animals and their ecology and a lot to do with the threat that legislation, government, and bureaucracy imply or mean in terms of people's shifting value holdings and demands.

Many participants, including decision makers in the GYE, rely almost entirely on scientific management in formulating management policy and actions, positioning themselves politically, and measuring success of their endeavors. Others seem to be transitioning toward an alternative approach—adaptive governance—and, in some instances actively embracing it explicitly (see Chapters 1, 2, 3, this volume, and examples below).

Decision process mapping

In this section we examine dominant patterns in the overall decision process in the region, as we saw them and as described in the literature (e.g., Clark 2008). Our descriptions focus on the interconnected activities and functions of any decision process: (1) intelligence (planning), (2) promotion (debating, recommending), (3) prescription (deciding), (4) invocation (initial implementation), (5) application (final implementation), (6) termination (ending or succeeding), and (7) appraisal (evaluation). We draw on widely recognized standards for each function as listed in Table 2 and described by Lasswell (1971, Brunner et al. 2005). Other researchers have

arrived at conclusions similar to ours, for example, Cromley's (2000, 2002) examinations of grizzly bear and bison management in the GYE.

Table 2 The decision process in two different management paradigms practiced by participants in the Greater Yellowstone Ecosystem

Decision process phase	Standards	Traditional management	Adaptive governance practitioners
Intelligence (planning)	Dependable Comprehensive Selective Creative Available	Intelligence comes only from positivistic science; not comprehensive, creative, or available	Comprehensive, inclusive, multi-method approach; intelligence may come from community
Promotion (open debate)	Rational Integrative Comprehensive Effective	Goals are viewed as single-target; overly selective (not comprehensive) and fails to integrate multiple valid perspectives	Multi-method, comprehensive function; fosters active debate and open dialogue
Prescription (selection)	Effective Rational Inclusive Forward-looking	Single-authority decision making; not inclusive or forward-looking	Bottom-up selection process ensures inclusivity and effectiveness in terms of expectations
Invocation (enforcement)	Timely Dependable Rational Non-provocative Effective	Central authority enforces prescription; often extremely provocative as participants protest	All participants fully involved in enforcement; ensures rational invocation
Application (Implementation)	Rational Contextual Unbiased Constructive	Only experts are qualified to implement policy; fails to be unbiased; litigation is commonly used	All participants establish a method of mediation to ensure continued community support, is contextual
Appraisal (evaluation)	Dependable Continuing Independent Contextual	Appraisals typically not fully problem-oriented or contextual; focused on single quantitative goals; fails to account for social and historical context	Policies are appraised in light of the perspectives of all valid participants and of the common interest
Termination (exit)	Comprehensive Timely Dependable Ameliorative	Termination rarely occurs because of the permanent nature of government programs	Prompt termination of ineffective or conclusively successful policies, with comprehensive and ameliorative stakeholder input

Intelligence (planning)

In the GYE, scientific managers typically strive to provide data on wildlife populations and ecosystem features, which are used to assess current events and

create future scenarios. Relationships among important variables tend to be tested or examined in a reductionist manner, regardless of differing contexts. However, these data are often incomplete, poorly communicated to the public, and may not be trusted by all stakeholders. Moreover, data are typically used in a partisan, political fashion to defend the status quo. Consequently, the data do not offer a complete picture of the problems at hand in the GYE or their contexts, thus lacking in comprehensiveness and other standards of a high quality decision process (Table 2). This leads to suboptimal decision process outcomes.

In contrast, a growing minority of practitioners uses an alternative approach—adaptive governance—in their planning activities. They focus on studying evolving relationships among people and wildlife in differing contexts as described below and in Brunner (2005). Adaptive governance requires multiple methods and triangulation of data in intelligence gathering, approaches that extend well beyond those traditionally used by resource managers. Both qualitative and quantitative methods are used and integrated. Through this approach, context-specific information about the conservation issue is collected and made available to everyone who is affected or interested by the issue. Disseminating data and research findings to appropriate stakeholders is emphasized. In this way, practitioners satisfy the high standards of the intelligence function (Table 2), including dependability and comprehensiveness. Intelligence experts and citizens are also creative in their methods of finding and managing the facts. For example, in Jackson Hole, Wyoming, a wildlife conservation group is turning to "citizen science" to collect information about wildlife movements.

Adaptive governance requires multiple methods and triangulation of data in intelligence gathering, approaches that extend well beyond those traditionally used by resource managers.

Promotion (open debate)

In the promotion process, participants dedicate themselves to finding solutions to problems as they understand them. Typically, resource managers make policy recommendations that center only on the biological or ecological aspect of the problem at hand. They tend to see goals as single targets, ignoring context in an effort to eliminate uncertainty, and these incomplete problem definitions come to dominate promotion and debate (Brunner 2002).

Often the conclusion is that further scientific research in needed. Restrictions placed on the kind, quality, availability, and use of information produces a promotional process that does not meet recommended standards of a high quality activity (Table 2). This leads to suboptimal decision outcomes.

Ideally, through open dialogue and commitment, communities can develop a policy alternative that is supported by a broad spectrum of participants and likely to be rational, integrative, comprehensive, and effective in the long run.

We did observe some practitioners who were working to promote much more open and active debate about the issues and testing solutions different from those promoted by government officials. Some practitioners do so quietly, working through projects with locals, whereas others do so publicly through the media, community organizing, and political advocacy. Trying to bring together participants in open discussion and to secure common interest outcomes is a feature of adaptive governance (Brunner et al. 2002, 2005). For example, Mattson and colleagues (1999) brought diverse parties together in Bozeman, Montana, in 1999 to find shared interests and common ground in large carnivore conservation. Adaptive governance facilitates more integrative and comprehensive means to address relevant stakeholders' values and considers a wider range of alternatives. In this decision process function, people's values and interests, as well as other contextual considerations, are key. Ideally, through open dialogue and commitment, communities can develop a policy alternative that is supported by a broad spectrum of participants and likely to be rational, integrative, comprehensive, and effective in the long run.

Prescription (selection)

The prescription function is the part of the decision process that creates, selects, and enables rules and norms. Decisions are made and resources are committed. Decision makers have a large role in the prescription function as they determine whether new rules will complement those already established. Scientific managers in the GYE are involved in this part of the process through the creation of management plans, environmental impact statements, and other prescriptive activities, but these efforts usually do not include the full range of stakeholders and are therefore generally not effective at addressing issues of large-scale conservation. Failure to meet the expectations of all participants in decision making or to account for how social factors might influence those outcomes in the future leads to suboptimal outcomes (Table 2). Clearly, attention to people and their perspectives, including their expectations, is key to successful large scale conservation.

People who utilize the adaptive governance framework, in contrast, influence the prescription function by creating an arena for dialogue so that prescriptions will meet people's expectations and not disrupt the community's standards of operation. Community standards include openness, fairness, timeliness, mutual respect, and more. Selection of a policy prescription using the adaptive governance framework integrates policy from both the bottom up and top down (Brunner 2005). Solutions that are based in community initiatives as well as local knowledge confer respect for participants and establish inclusivity.

Invocation (enforcement)

This part of the decision process deals with the initial implementation of the new rules, or putting the new rules into effect, including enforcement (Table 2). For example, in the GYE, rules and regulations are formally promulgated and officials

invoke them through making regulations and citations. Invocators look for violations of the new prescription, and these may be about poaching, off-trail recreation, and other illegal activities. These public order activities are typically visible to the public, especially as they play out in application (e.g., in the courts).

In contrast, adaptive governance seeks to use civic norms as much as possible to establish and invoke new rules, regulations, and policies. Community standards and norms are brought into play as much as possible, thereby reducing the need for official public order invocation. This is community-based conservation work at its best. Bruner et al. (2002, 2005) offer diverse examples of successful community-based conservation in the American West.

Application (implementation)

This function encompasses society's response to a new rule, ideally resolving disputes over how prescriptions will be implemented and under whose authority (Clark 2002). The management system in place in the GYE dictates that these activities emanate from a single source, i.e., the government. Managers view experts as the only individuals who are qualified to implement sound management plans and bureaucracies as necessary agents to enforce plans. Therefore, disputes must be appealed directly to the centralized authority, often through litigation.

Adaptive governance instead places importance in the ability of community participants to voice their concerns about a policy or plan or the way it is to be implemented. This part of the decision process helps to establish a method of mediation so that new policies can be successfully implemented with continued community support. Throughout the implementation of new rules or policies, managers who incorporate adaptive governance create open dialogue between stakeholders—for instance, those involved in grizzly bear and wolf management issues—to allow for successful mediation between individuals or groups who may have doubts about a prescription or policy. The shortcomings of bureaucracies can be balanced by using community-based initiatives to ensure effective, constructive application and to bring people together.

Appraisal (evaluation)

Appraisal is vital for the success of conservation management and policy in seeking open and honest monitoring and evaluation of past actions. Too often, honest, independent appraisal is absent, resulting in policies that do not meet their goals and create rifts between participating groups. Independent appraisals are rare because they take a lot of time and experience to do well. Resources are often not available to support then. In the GYE, we observed little thorough appraisal of past decisions, policies, and actions from sources who are independent. Appraisal should be ongoing and available to anyone.

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Appraisals typically fail to consider fully the context, that is, the interests of local communities, ranchers, hunters, recreationists, and other stakeholder groups, including the management agencies themselves (Clark 1993). This oversight adds to feelings of alienation and marginalization on the part of some participants, engendering hostility toward some policy prescriptions and among individuals and organizations. A clear example of this is the "Aggregation" and "Vision" exercises of the federal government in GYE in the 1980s (see Clark 2008: 123-128). Some stakeholders observe that decisions makers do not have to deal with the consequences and outcomes of their actions in their everyday lives.

In contrast, an adaptive governance approach holds the appraisal function as one of the most important in achieving success. With many previously implemented conservation plans not meeting their goals, appraisal can be difficult to navigate because many policy makers are reluctant to acknowledge their policy "failures." However, dependable, contextual appraisal is necessary in order to adapt policy so that it better meets its goals. Hobbs (2009: 2) says that "accepting failure and learning from it are an integral part of adaptive management."

Termination (exit)

The termination function is the cancellation or adjustment of ineffective or unnecessary policies. Policies that have been judged successful in reaching their goals can be ended, and policies determined to be harmful or ineffective can be replaced by new policies that the community has determined will be more likely to meet the common interest. Polices that are terminated because of their success may be diffused and adapted elsewhere (Brunner 2005).

Official decision processes in the GYE have consistently failed to carry out the termination function according to high standards (e.g., the delisting of grizzly bears is one such example). This has lead to many problems. Many factors account for the fact that failing policy prescriptions are exceedingly difficult to end, not least of which is the tenacity of those who have benefited from the prescription.

In contrast, adaptive governance calls for active independent, timely, comprehensive, and ongoing appraisal as a basis for learning and determining when and how termination should occur. The examples described in our recommendation section below show how active learning can be used in ongoing, actual programs.

Common interest tests

Unless the common interest is set as the primary goal of management and policy, sustainable solutions to problems will be difficult to achieve. The common interest can be defined as an interest that is widely shared within a community of stakeholders and is demanded on behalf of the whole community (Clark 2002). Whether the common interest has been identified and secured in any natural resource decision-making process can be deduced through the application of three partial tests, applying procedural, substantive, and pragmatic criteria (see Steelman and DuMond 2009). Data from the GYE cases that we learned about show that many decision processes fall short in all three tests of the common interest.

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First, the procedural criterion asserts the need for fairness in the decision process by providing the participants with a sense of inclusivity, representation of their interests, balance, opportunities to voice their views, and sound justification for any action taken. Although the traditional management system has aided recovery of species like grizzly bears and wolves, it has made little overall progress toward increasing inclusivity for all participants, especially those historically opposed to agency decisions, except in token, ritualistic ways.

Our appraisal suggested that the existing management framework is weak in maintaining openness, representation, balance, and fairness in granting participation of diverse interests. This precludes opportunities for people to voice their perspectives in meaningful ways in existing, authoritative arenas. For example, we heard from diverse people and interests, including scientists, managers, conservationists, and ranchers, as well as park officials, who recognized that not all groups are being fairly heard at present. The issue is of one of procedural fairness and clearly needs to be rectified.

Second, the substantive criterion tests whether an outcome meets the valid and appropriate expectations of all participants, as supported by data. Again, valid interests are those that are appropriate to the issue at hand (e.g., role of hunters in grizzly bear deaths) and supported by data saying that the issue is important (e.g., too many bears are being killed by hunters). This test determines the validity of the concerns that stakeholders express, inspecting whether claims are made based on broader community goals and evidence (Brunner 2002). It also seeks to determine if people's expectations are valid given the content of the issue, the data, and the process at hand.

Our assessment revealed no data that showed attempts were being made by authorities to determine the validity of concerns expressed by several individuals or groups. In many instances, authorities categorically dismissed claims made by valid participants. The management process in the GYE has been dominated by government agencies, with participation from the other groups being restricted to litigation, grassroots organizing, and commenting at public meetings, in other words, mostly antagonistic strategies. There has not been in-depth analysis of the validity of the concerns raised by stakeholders to test whether the common interest has been met.

Third, the pragmatic criterion calls attention to whether a policy is implemented well, tested to make sure it works, and adapted as needed in a timely fashion. A policy must be responsive and adaptable in achieving common goals as the context changes in order to satisfy the pragmatic test. Decisions must be carried out completely and in a manner consistent with the expectations of the participants in the decision making process (Steelman and DuMond 2009). Congruency between stakeholders'

expectations and their experience with a given policy is key in this test (Brunner 2002). Those community members who approve a policy should experience its application in practice in a manner consistent with their expectations.

Our observations suggest that thus far in the GYE, management decisions have not been carried out in a manner appropriate to meet pragmatic standards. Several stakeholders expressed their dissatisfaction with the manner in which management decisions have been practically carried out in the GYE. Our field notes are full of examples from diverse officials and others who made this point. The kind and degree of adaptation of official policy called for or needed is little evidenced in the cases we examined. Cases exist where management and policy process and outcomes do not approximate common interest standards. In contrast, some people, mostly working outside formal governmental structures, are striving toward a more inclusive, open, participatory system of problem solving and decision making that does meet these standards and pass common interest tests (examples below). These practitioners of adaptive governance seek systematically to use a proven strategy—contextual, multi-method, and inclusive—to address challenges in the region.

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RECOMMENDATIONS

Our rapid appraisal enabled us to gain as deep an understanding as possible of the issues at hand, recognizing that we are outsiders who spent a relatively short time in the arena. Conservation policy decisions within the GYE have clearly had unintended negative effects on community members and resources in some cases. Our recommendations here are designed to encourage common interest outcomes. In order to achieve more successful conservation, stakeholders must be willing to work hard at finding shared interests and building on them (Knight and Clark 1998). This requires creating arenas wherein people can work together to address problems of mutual concern (see Cherney et al. 2009). Finding and creating arenas in which people can explore their concerns in respectful ways is key to improving management in the region.

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Learn from practice-based, prototyping experiences

There are successful prototypes in the GYE and the surrounding region to learn from. It is a matter of harvesting this experience and diffusing useful prototypical elements

to other projects (Brunner and Clark 1997). For example, Glick and Clark (1998) describe the Beaverhead County Partnership, Madison Range Landscape Assessment and Adaptive Management Project, and the Henry's Fork Watershed Council as prototypes. These authors list common elements, including building social capital prior to working closely together, creating an arena for civic dialogue, giving stakeholders a genuine voice, recognizing the shared interests at stake, and focusing on monitoring and evaluation as the principal means to learn and improve.

Two other examples of successful prototyping that we discussed with people come from outside the GYE and offer lessons applicable to the GYE. First is the Blackfoot River system case (Wilson 2006). Seth Wilson and others have been working with the Wildlife Committee of the Blackfoot Challenge near Missoula, Montana, for years (Wilson et al. 2006, 2007, Wilson and Clark 2007). The Blackfoot Challenge is a landowner-based group that coordinates management of the Blackfoot River watershed, its tributaries, and adjacent lands. In 2002 the Wildlife Committee was formed in response to increasing numbers of grizzly bears, wolves, and other predators that were using privately owned valley bottom habitat and creating concerns among residents, many of whom work in the ranching business. While working closely with ranchers and conservation groups, Wilson sought innovative, yet practical, measures to reduce conflicts with bears. He advocates long-term community participation in management of cattle and sheep. He told us that "folks who have been in [a conflicted locality] a while have a lot to offer" and that engaging them directly is essential.

His approach considers local residents as a valuable resource of information about conflicts and trends, and he capitalizes on local insight to create prototype projects adapted to local situations (Wilson et al. 2006). These small-scale projects allow citizens and managers to find out what works in one situation and then adapt and sometimes scale up the prototype to create successful and mutually beneficial outcomes throughout a region. These efforts are combined with the use of GIS and mapping skills to build a creative framework that brings sound intelligence to the forefront and allows for adaptation and self-correction. The work of Wilson and his associates has been highly successful in reducing grizzly bear-livestock conflicts.

Second is a case in Banff National Park, Alberta, where Michael Gibeau of Parks Canada and his colleagues organized grizzly bear management workshops that took place over two years. These were designed to increase the skill level, contextual understanding, and problem-solving capacity of the participants (Rutherford et al. 2008). Importantly, he sought to create opportunities for all involved to increase respect and to shape and share values. Gibeau created a new arena and a new social and decision process that worked at many levels. The workshops helped participants defuse the deeply polarized conflict, develop practical insight and a more comprehensive perspective on the grizzly bear management process, create mutual respect among participants, enhance trust, and increase cooperation directed at practical problem solving. The key to success in this case was improving the problem-solving skills of the participants. These workshops helped people to clarify and secure their common interests concerning several grizzly bear management issues, such as trail use.

These and other examples are a treasure trove of lessons waiting to be harvested and diffused throughout the region. In turn, lessons can be applied to other situations or adapted. This is the practice-based, prototyping process.

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Create new arenas for community-based participation

Participatory, community-based processes hold great promise for producing enduring practices for large scale conservation cases (see McLaughlin et al. 2005, Wilkinson et al. 2007). Action and dialogue should be interwoven so that citizens can make headway in solving practical problems (Wilson and Primm 2004). Workshops and fieldwork may be included as Gibeau and Wilson did in their cases.

Efforts by Steve Primm, who works in the Madison Valley, Montana, on grizzly bear conservation and other issues, provide two more good examples (Primm and Wilson 2004). Primm works with individuals, agencies, and conservation groups through practice-based prototyping, engaging in hands-on projects to facilitate coexistence between carnivores and people (Primm 1996, 2000). He has worked very closely with ranches in the Madison Valley affected by conflicts for over a decade (Wilson and Primm 2005). He believes that it is important to recognize that people's objections to carnivores are legitimate and valid, and that whenever possible local people who know the situation best should design the solution. Primm's approach is based on a formula of long-term community participation, working with locals on their terms, and in settings comfortable and familiar to them. He seeks to determine how conservation goals can be achieved by respecting participants and encouraging them to find common ground (Primm and Clark 1996). This formula is practice-based prototyping, constantly exploring opportunities for concerned people to develop successful processes for turning experience and reason into sound public management and policies (Primm 1996).

Second is the Northern Rockies Conservation Cooperative (NRCC), based in Jackson, Wyoming. This NGO works in the region and beyond, with projects and associates in Canada, Mexico, and other countries (Wilmot 2004a,b, 2005, Wilmot and Dixon 2004a). NRCC has been an organizational home for Seth Wilson and Steve Primm for the past 15 years as well as 20-plus other research associates working on diverse projects. Most use practice-based prototyping to address complex wildlife problems. Avery Anderson (2007) and her colleague Rebecca Watters (2007) worked with the ranching community in the Green River Valley of Wyoming on conflicts with wolves. Elizabeth Deliso (2007) worked on elk management in western Wyoming.

NRCC was founded in 1987 and combines a commitment to human communities with scientific expertise through place-based, adaptive governance approaches. According to its website, "This intersection between ecological science and social context is where NRCC makes its greatest contributions" (www.nrccooperative.org).

Unlike most NGOs in the GYE or elsewhere, NRCC focuses on clarifying and securing the common interest through prototyping. NRCC's goals are accomplished by analyzing complex management and policy problems, bridging science and policy for practical solutions, building trust and facilitating dialogue among diverse people and interests, creating learning networks for conservation practitioners, developing leadership and analytical skills in others, and fostering creative and interdisciplinary approaches to problem solving (Wilmot 2007a). Further, NRCC gives particular attention to improving the decision-making process and to developing conservation prototypes (www.nrccooperative.org; Wilmot 2004a, 2005, Wilmot and Dixon 2004 a,b). One of NRCC's projects is the Greater Yellowstone Conservation Directory (Northern Rockies Conservation Cooperative and Charture Institute 2007). It has helped organize the arena by making people more aware of each other's work in order to avoid duplication, increase collaboration and use scarce resources more efficiently.

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Jason Wilmot, the group's executive director, is a wolverine ecologist. Wolverine conservation in the GYE is another potentially intractable controversy (Wilmot 2007b, 2008). Wilmot works as the field director of the Absaroka Beartooth Wolverine Project, which is a collaborative, large scale conservation effort between Rocky Mountain Research Station, Yellowstone National Park, NRCC, and others. Beyond his research efforts to acquire a better understanding of wolverines and the threats to their survival, he is trying to maintain a dialogue between conservation groups and the federal and state agencies responsible for the species' management. People like Wilmot, who function as "insiders," able to maintain a dialogue with all stakeholders, are well equipped to create an inclusive decision process and arena to improve management and develop stronger links between science and policy.

These people and examples are a few among others in the region. They are proving successful and could be joined or replicated by others.

Adopt the adaptive governance framework in problem solving

Our analysis, based on our experiences as well as literature on adaptive governance, strongly indicates that the situation in the GYE would be significantly improved through use of this more complete and practical framework. Adaptive governance emphasizes adjusting current decision-making processes to actual, on-the-ground situations. It also calls for continually evaluating whether those efforts and policy decisions are effectively moving toward enduring, common interest outcomes. Constant review and learning are keys to successful adaptive governance.

As a flexible framework for policy making, adaptive governance closely evaluates how policies are actually performing and affecting the community on the ground (Brunner et al. 2005). This bottom-up, contextual approach is proving more effective

in achieving conservation gains than the traditional approach of scientific management. The use of scientific research, data, and technology as the foundation for environmental policy often lacks the holistic approach necessary to create sustainable and effective policy. Although science is critical in decision making, it alone is not an adequate basis for sound policy making. Adaptive governance addresses the politics and science simultaneously in pursuit of the common interest (see Brunner et al. 2002).

An important step toward adaptive governance is to accept that the current governing policies are not adequately addressing many issues at hand (Brunner et al. 2005). Managers and policy makers need to realize that instead of using scientific data alone, ideal decisions stem from using scientific knowledge in addition to local and traditional knowledge (Wilkinson et al. 2007). Moreover, decisions need to be community based. This strategy upholds the idea that the common interest is an achievable combination of individual interests of the community.

One of the most important aspects of the adaptive governance approach is its commitment to reviewing management policies, adjusting them, or occasionally abandoning them for better ones. Management and policy can be modified as the context of the issue changes. Managing carnivores and natural resources in the GYE, for example, requires an ability to define what the problems are and to create decision-making processes that are inclusive, constructive, and balanced and that meet the three tests of the common interest. Successful management to date shows this to be true. The governance problems that exist in the GYE can only be addressed if parties are able to meet and work toward common ground solutions.

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CONCLUSION

Our rapid assessment showed that conservation management and policy, as evidenced in the programs we surveyed (e.g., grizzly bear and wolf management, snowmobile use, tourism, and others) and the people we talked with, are fraught with conflicting perspectives and contested problem definitions and are fueled by symbol inflation and politics. The participants whom we interviewed and read about described the need for a new, respect-based approach to management and policy. They recognize that science is essential and must be understood in the broadest context. They feel that a new problem solving, multi-method, contextual approach could help defuse antagonism and gridlock in the many impassioned issues in the GYE today. We recommend a transition to adaptive governance as an overarching paradigmatic framework to address management and policy problems. This could be achieved by using the practice-based, prototyping approach proven to be successful

through field trials, based on a growing number of successful examples carried out by creative, committed, and skilled people in the GYE (Clark 2008).

The promise of practice-based prototyping for identifying and securing common interest outcomes in the GYE lies in the fact that this approach provides a unique platform for creating a process that is more inclusive, capable of harnessing local knowledge and experience, and bridging the divide between science and the practical measures needed for effective conservation. This approach also fosters what is currently missing in the GYE—respect and pursuit of human dignity as an overarching goal. We see that adaptive governance can help participants in the region to work toward a practical, functional, and inclusive process to protect resources and values in this highly complex and symbolically charged, yet beautiful and widely treasured, ecosystem.

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Part III: Education and Leadership

Chapter 7

A Workshop on Large Scale Conservation: An Exercise in Group Problem Solving and Leadership

Tristan Peter-Contesse, Susan G. Clark, and David Mattson[1]

ABSTRACT

Graduate students in a large scale conservation seminar at Yale's School of Forestry & Environmental Studies designed a student-facilitated three day workshop to learn how to conduct a workshop, explore interdisciplinary problem-solving techniques, and find principles for large scale conservation. This paper describes the workshop, methods used, and results of the exercise. This report will help other people using workshops to find principles, methods, and actions for effective conservation. Once goals were set and two students were selected to be co-convenors, the group designed the workshop with the help of the instructor. The workshop began with an introduction, statement of goals, and rules for participation followed by a "mind mapping" exercise, listing of problems in large scale conservation, and an exploration of solutions and needed leadership skills. These exercises clarified principles and practices for large scale conservation and also how to conduct and participate in a problem oriented, contextual, multi-method workshop. First, mind mapping allowed students to describe their perspectives and compare them with those of others. Second, the problem oriented exercise showed shortcomings in the current approach to large scale conservation (i.e., scientific management). Third, options were generated to address these shortcomings. Finally, leadership and personality tests were given and discussed. Some participants found it difficult to move beyond conventional, disciplinary, and positivistic patterns of thought. As this became evident to students, it served as a learning exercise. Participants left the workshop with experience in organizing and leading a workshop, the ability to facilitate group exercises designed to bring a problem focus and contextual clarity to an issue, and specific knowledge of

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leadership types and skills essential for success in large scale conservation and environmental management.

These exercises clarified principles and practices for large scale conservation and also how to conduct and participate in a problem oriented, contextual, multi-method workshop.

Key words: *workshop, group problem solving, mind mapping, problem orientation, leadership traits and skills, personality, large scale conservation, adaptive governance*

INTRODUCTION

Practical conservation requires effective leaders who are able to skillfully integrate diverse information and the often-conflicting perspectives of participants involved. What follows is an account and appraisal of a workshop that introduced graduate students in forestry, environmental science, and environmental management to interdisciplinary problem solving techniques useful in large scale conservation and in other venues. The workshop was designed to facilitate that kind of problem solving and leadership. Leaders today are challenged by unprecedented losses in biodiversity and landscape connectivity, a changing climate, and a lack of arenas and institutions to aid their work. Nevertheless, they are expected to help design strategies and programs, including workshops, that further conservation goals in the common interest.

What follows is an account and appraisal of a workshop that introduced graduate students in forestry, environmental science, and environmental management to interdisciplinary problem solving techniques useful in large scale conservation and in other venues.

The workshop detailed here was held over three weeks (one day per week), at Yale School of Forestry & Environmental Studies (F&ES) in the context of a seminar on "Large scale conservation: Integrating science, management and policy" (Appendix A, this volume). The main goal of the workshop was to articulate a formula that participants could ultimately adapt to problems of large scale conservation, and to explore leadership skills needed in their careers. A subsidiary goal was to gain experience at designing and participating in workshops using a range of methods that can be helpful in group-based problem solving.

The purposes of this paper are to describe a method for conducting interdisciplinary workshops, report on what happened in this particular workshop, describe and analyze the insights gained about large scale conservation that came out of the workshop, and reflect on the workshop and ways to improve it. This account is descriptive and analytic, and also offers recommendations by which participants

might further hone their own problem solving skills for improved future professional performance. Most participants had been in workshops in other settings (see examples of other workshops by Clark et al. 2002, Mattson et al. In Review a,b, Rutherford et al. 2009).

METHODS

Too many large scale conservation efforts have been marked by a lack of skilled leadership and deficient decision processes, according to some observers (see Mattson et al. In Review a, Clark 2008, for example). Some efforts have failed to constructively reconcile the conflicting perspectives, demands, and expectations of participants into successful programs that advance human dignity and environmental sustainability. Much needs to be learned from experience across many cases to find a workable formula, a supporting paradigm, and to achieve tangible gains on the ground—the only place where it really matters (see Chapters 1 and 2, this volume).

The course and workshop described in this volume and in this paper can be used by students to inform better interdisciplinary problem solving in a variety of large scale conservation settings and for that matter, on all kinds of public, professional, and personal challenges.

Currently, there are multiple traditions or approaches to large scale conservation in wide use around the world, including single and multiple use, ecosystem management, and transboundary initiatives (Chapter 3, this volume, e.g., Clark, D. et al. 2009). These were explored in the workshop. For the most part, these approaches address ordinary problems focused on content issues—wherein problems are viewed as being "out there," and in need of technical fixes (Clark 2002). The higher order (and basic) process problems inherent in conservation, such as deficiencies in governance and inadequate constitutive decision process, remain unseen and often unaddressed (Chapter 1, this volume, Clark 2008). *Adaptive governance* is the only formula/doctrine specifically designed to address all problems—ordinary, governance, and constitutive—simultaneously (see Brunner et al. 2005). It draws on an interdisciplinary problem solving approach that is problem oriented, contextual, and multi-method as described by Clark (2002) and others (e.g., Lasswell 1971). The course and workshop described in this volume and in this paper can be used by students to inform better interdisciplinary problem solving in a variety of large scale conservation settings and for that matter, on all kinds of public, professional, and personal challenges.

Goals

The overall goal of this workshop was to carry out a three-part analytic exercise that would improve participants' skill, understanding, and insight related to large scale

conservation and leadership. It introduced participants to workshop techniques for problem solving that are useful in diverse venues. Additionally, it encouraged participants to organize their own thinking on the subject, make an assessment of the best, most practical ways forward, and position them for rapidly learning once on the job. Specific goals of this workshop were to:

(1) gain a hands on workshop experience through analytic activities related to large scale conservation, problem solving, and leadership;

(2) examine perspectives and traditions of large scale conservation through social process mapping, decision process analysis, and problem orientation (focused on rationality and practicality) exercises;

(3) develop a practical guide—formula, and doctrine—for large scale conservation;

(4) clarify participant standpoints (locate one's self in the process)—existentially, by value position, personality-wise, and in terms of leadership characteristics and skills.

Organization and participants

The workshop was convened by two graduate students. Their invitation to participants defined the overall goal as carrying out a three-part analytic exercise that would improve participants' skills, understanding, and insight into problem solving, large scale conservation, and leadership. The workshop spanned three weeks, with three days of exercises each lasting three hours. Day 1 was lead by two student facilitators and focused on a "mind mapping" exercise to help participants clarify their individual standpoints in relation to large scale conservation. Day 2 was led by three other students and focused on identifying problems inhibiting effective conservation and finding potential solutions. Day 3 was lead by David Mattson, a research scholar affiliated with Yale, who focused on leadership attributes and results of personality tests that participants had taken previously. A profile of successful leadership was produced from these exercises. The workshop was terminated with a round-robin discussion reviewing the experience.

Participants were the eighteen students in a large scale conservation seminar (Appendix A, this volume). Most students were in their mid to late 20s. Most had been born and educated in the United States, and had worked in the field of conservation, broadly defined, for between one and five years. Others came to Yale from abroad, including Costa Rica, India, and China, among other countries. Some had worked in the private sector as environmental consultants, for government agencies—such as the U.S. Forest Service—or with non-governmental organizations in the U.S. or internationally. Others had professional experience in fields outside of conservation. Most came to the course with an interest in large scale conservation, and will likely be applying its lessons to conservation problems throughout the world in the future.

Workshop design

The workshop was organized based on the seminar instructor's experience in other workshops (e.g., Clark et al. 1990). Most recently this design was used on polar bear conservation (Clark D. et al. 2009), grizzly bear management (Rutherford et al. 2009), and large scale conservation efforts (Mattson et al. In Review a). Participants were asked to read "The Policy Process: A Practical Guide for Natural Resource Professionals" (Clark 2002: 173-189). This approach emphasizes the use of empirical evidence on the situation at hand, careful and complete orientation to the problem at hand, specifying goals in relation to problems, and attention to social and decision processes (the context) influencing the problem. Participants had been previously introduced to these concepts in the seminar. These concepts do not restrict or exclude any discussion or impose a particular methodology on participants. Instead, they help participants to organize and improve insight into their own professional work and the approaches used by other people, in a truly interdisciplinary manner. They also facilitate a collective "meta" (high order) learning experience across cases and in discussions (Clark 1992, 1993).

Participants were asked to read "The Policy Process: A Practical Guide for Natural Resource Professionals" (Clark 2002: 173-189).

Modeled after Cherney and Vogel (2006), this workshop was set up as an alternative forum to the conventional classroom experience, which often involves discipline-based, bounded outlooks, and traditional professional conferences. Our workshop did not showcase scholarly work and examples as a completed product, or illustrate disciplinary theory as a way to frame problems and seek solutions. Instead the workshop sought cooperation and a shared commitment to resolving problems and skill building with basic foundational concepts. This mode of learning and skill building improved the insight of all participants into their own policy problems and the policy process generally (Chapter 9, this volume). Dismissive criticism, personal attacks, and one-upmanship were not permitted.

Instead, the workshop sought cooperation and a shared commitment to resolving problems and skill building with basic foundational concepts.

As noted by Cherney and Vogel (2006), the interdisciplinary problem solving approach used in the workshop rests on foundational principles:

(1) the importance of people and their perspectives. People are encouraged to engage in self-orientation to make explicit the values and assumptions that bias every person;

(2) an explicit normative stance in maximizing human dignity, the greatest possible participation in the shaping and sharing of policy outcomes, as the central goal of any social process;

(3) the functional, applied value of knowledge as opposed to developing generalized causal relationships;

(4) a stable frame of reference required to develop a coherent understanding of any problem;

(5) focus on problems instead of preconceived solutions or methods;

(6) emphasize practical insights into real-world problems and the invention and evaluation of alternatives to resolve those problems; this is in contrast to generalized theory development or methodological or disciplinary orthodoxy;

(7) emphasize the unique context, the empirical reality, of every problem.

The intent is not to narrow the scope of inquiry, but to continually call attention to what is left out of our evolving understanding of any particular situation. This requires relying on a comprehensive and stable frame of reference.

The workshop began with a welcome by the conveners. They offered an overview of the workshop, a day-by-day agenda, and rules for interaction referred to as a "code of civility." These included: (1) seeking understanding first and then seeking to be understood, (2) disagreeing in a manner that focuses on the issue at hand rather than the individual involved, (3) acting in a fashion that honors the sincerity of all who choose to speak out on an issue, (4) recognizing that we each have personal issues, but some issues are more important to the community as a whole than others, and (5) encouraging participation by all workshop attendees.

RESULTS

A description of each day's goals, activities, rationale, results, discussion and conclusion follow. Additionally, more detail is provided for the methods used in the workshop.

Day 1: Mind mapping

The goal of Day 1 was to provide a structured opportunity for participants to clarify their own standpoint and perspective on what is required for successful large scale conservation. To do this, individuals undertook a facilitated exercise, mind mapping, with the intent of arriving at an agreed-upon formula for large scale conservation. Participants were given a felt pen and large sheet of paper. They were then given half an hour to draw a "mind map" or graphic representation of their conception of large scale conservation, including their own role or location in the process. They were encouraged to use concepts from readings and discussions and insights from guest

speakers (Appendix A, this volume). Following this individual exercise, the group reconvened and each participant was given time to explain his/her mind map to the rest of the group and to field questions from the other participants.

Mind mapping and foundational principles

A mind map is a picture illustration or diagram with images, words or lines and boxes that link together or arrange elements into a central idea (Pressley et al. 1998, Buzan 2000, Farrand et al. 2002). Mind maps are a way for people to represent or visualize their thinking or impressions about ideas, events or tasks. The way that the elements are arranged is often conventionally intuitive, according to the importance of the concepts. Elements are often grouped or connected in various ways. These represent what the author attends to, the main focus of attention, and the relation of elements to the whole. Mind maps are an aid in problem solving, decision making, and communication. Even for simple tasks, mind maps vary dramatically among people.

Mind mapping typically brings out participants' understanding of the context or social process within which people struggle to understand and solve the problem at hand. The workshop participants understood that the social process is the context in which all problems occur and all decisions are made. In any social process, *participants* with subjective *perspectives* interact in *situations* (or arenas) using *base values* (or resources) through various *strategies* to achieve valued *outcomes* that have *effects* in the broader social and decision contexts (Lasswell 1971). These terms or categories can call attention to important aspects of the social context that may have been overlooked. For example, many problem solvers fail to adequately address the role of individuals' perspectives, in part because of difficulties in rigorously studying subjective phenomena (Ascher and Hirschfelder-Ascher 2005). Some people fail to maintain contextual relevance because they neglect empirical outcomes and instead focus on other aspects of the social or decision processes to develop, for example, generalized strategic theories. Workshop participants' mind maps were compared against these standards (e.g., being factual, timely, open, fair) for complete social process understanding relative to standards for problem orientation and decision making (Clark 2002).

Mind mapping typically brings out participants' understanding of the context or social process within which people struggle to understand and solve the problem at hand.

The maps

Results were rich and diverse, reflecting the wide range of perspectives on the ideal formula for large scale conservation and the experience, insight, and skills of participants. Several participants volunteered to explain their mind maps to the workshop, after which facilitators and the group decided that the emphasis should shift from finding a formula to making sure that all participants were included in presentations and discussion. Thus the goal shifted midstream from a knowledge and skill goal to an emphasis on inclusion, a respect and affection goal (Chapter 2, this

volume). This shift in goals reflected the sentiment of workshop facilitators and participants at the time. Many problem solving groups shift goals midstream, which amounts to "goal displacement or goal inversions" (Daft 1983). As a consequence of this shift in goals, facilitators gave each participant extended time to describe his/her mind map to the group. Much of the workshop's first day, then, was devoted to these presentations of how individuals approached the concept of large scale conservation. Mind maps served as the concrete focus for these comparisons and discussions. Figure 1 shows three participant mind maps.

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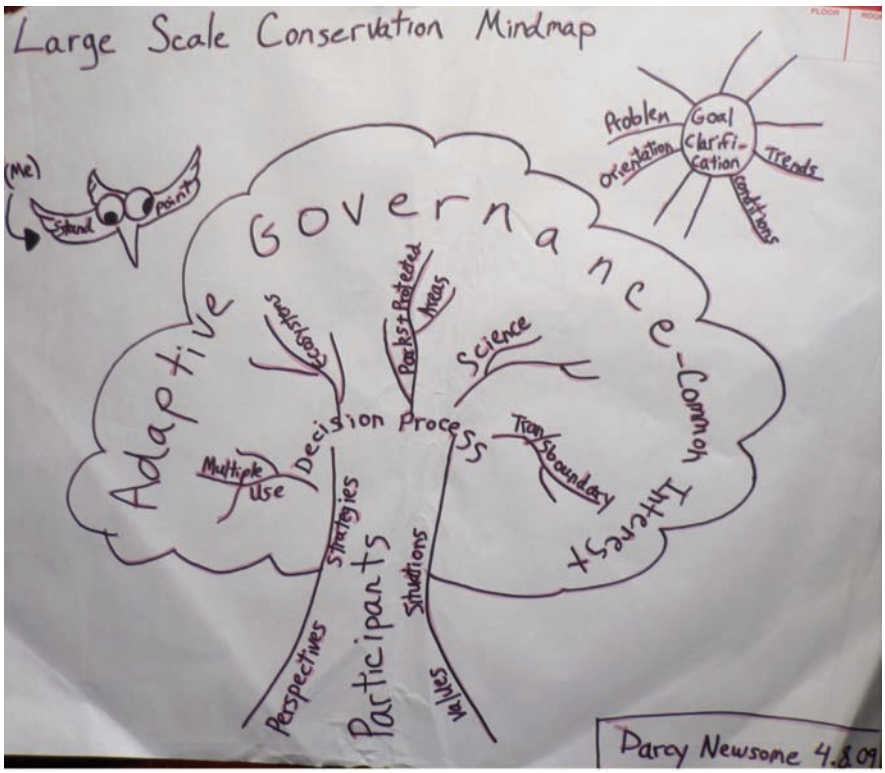
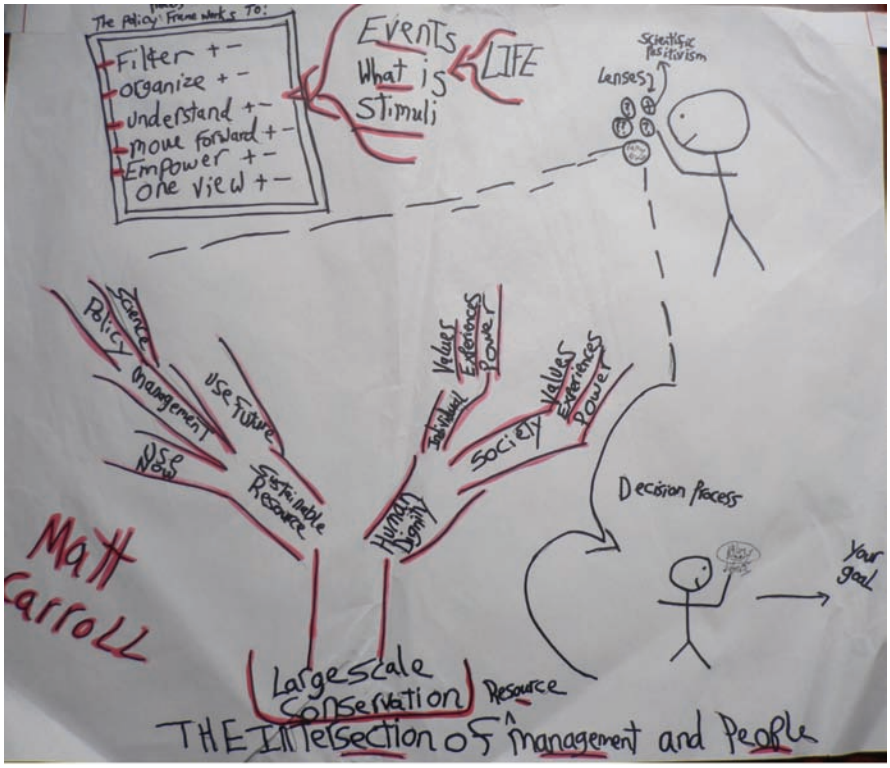
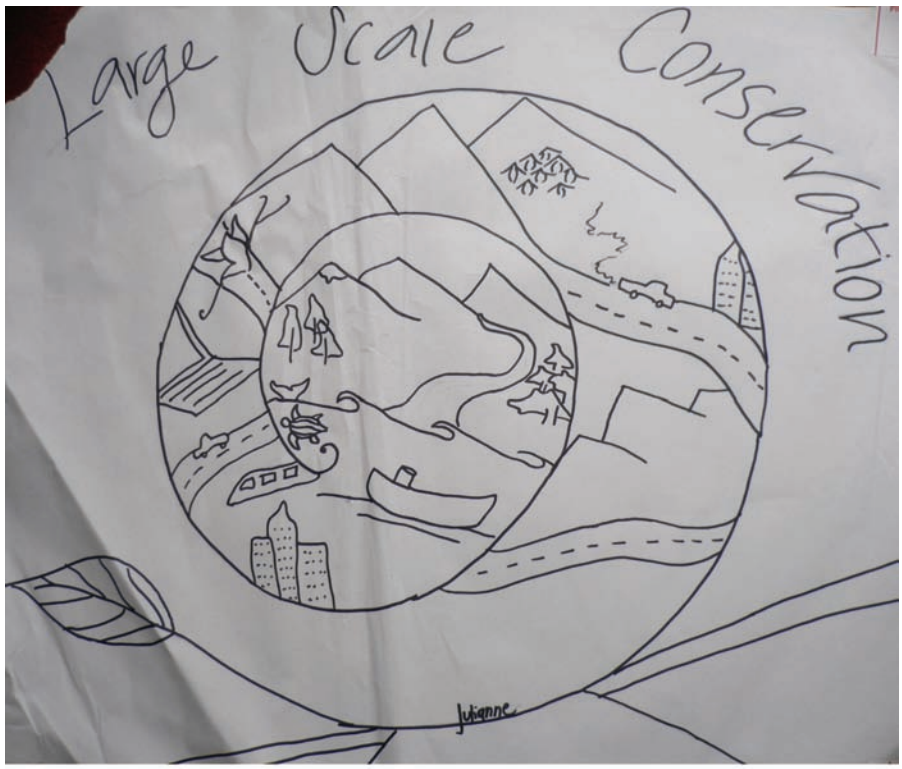
Figure 1 Three representative mind maps from workshop participants. See text for explanation



Mind maps of some participants were entirely visual, incorporating few to no written words. One participant (Figure 1, bottom map) explained that she left out words and kept her drawings as abstract as possible because she wanted her work to be open to interpretation. She wanted it to allow moving "forward" in any specific case in as contextual of a manner as possible. She said that she did not feel that she


The Policy Frame Works To:
Filter +-
organize +-
understand +-
move forward +-
Empower +-
one view +-
Events
What is
Stimuli
LIFE
Lenses
Scientific Positivism
Science
Policy
Management
Use Future
Use
Now
Sustainable Resource
Values Experiences Power
Individual
Society
Values Experiences Power
Human Dignity
Decision Process
Your goal
Matt Carroll
Large Scale Conservation
Resource
THE Intersection of Management and People


Large Scale Conservation
Julianne

could capture large scale conservation in her mind map. Another participant (not included in Figure 1) relied on visual images as metaphors for the social and decision process, including a stream as the "progression" of potential policy solutions and boulders in the stream as filters to refine, re-direct, and/or entirely inhibit the progress of those solutions in implementation.

The content of participants' mind maps reflected the subjective nature of the exercise. One diagram captured the social and decision processes as component parts of a large tree, in which participants made up the trunk and elements of the decision process made up the canopy (Figure 1, top map). A sun in the upper right hand corner represented the concepts of goal clarification and problem orientation, metaphorically shedding light on the social and decision processes depicted by the tree. This participant identified herself as a bird looking down on the tree from above, seeking to capture the notion that any participant can only see one part of a problem at a time.

The content of participants' mind maps reflected the subjective nature of the exercise.

Another participant conceived of and drew large scale conservation as the intersection of research, resource management, and people (Figure 1, middle map). He saw that most ordinary participants in problem solving use the lenses of scientific positivism and other doctrines. This student, seeking to integrate a number of inputs in his mind map, included societal goals and individual values. The decision maker was drawn as a waiter "elevating" values and human dignity in order to move toward a previously identified goal. This mind map conveyed an understanding that problems are not principally about managing resources as things "out there," but about managing the values and expectations of people. This map also demonstrated a focus on human dignity.

Still another mind map (not included in Figure 1) paid attention to all aspects of the interdisciplinary approach, but emphasized that interactions are not necessarily linear. Goal clarification and problem orientation, defined in terms of the common interest and the pursuit of human dignity, were drawn as smaller circles within successively larger circles of social and decision processes. Decision making in this mind map was not the end state of conservation but just one part, albeit an integral one, of a process that involves continuous re-evaluation and a back-and-forth examination of the social process. This participant's formula for success showed an understanding that conservation is not simply about following a pre-defined set of positivistic or scientific management steps toward a goal, but instead involves feedback from diverse inputs all along the way toward successful problem solving.

Evaluation of the workshop process and content

A few participants incorporated most or all aspects of the social and decision processes elements and standards inherent to the seminar and articulated in the

background reading's cases and in guest speaker presentations. Most workshop participants did this implicitly and in a haphazard, incomplete way. Few participants, if any, were fully explicit about these elements and standards or used them to organize their mind maps. Most participants focused almost exclusively on just one process or component/element of the overall interdisciplinary approach (e.g., participants and their rectitude value outlook). These people typically relied on conventional, ordinary language and notions to represent and talk about their views. As a consequence, these mind maps were incomplete when compared against the interdisciplinary elements and standards talked about throughout the seminar. This shortfall perhaps reflects limited experience of participants in actual management efforts. It may also reflect the positivistic mindset from which many students of science and conservation have learned to operate, and how difficult it can be to shed that mindset.

For most participants, the workshop was the first time they had ever been asked to think comprehensively about conservation formulas (and supporting doctrines and symbols), their own standpoint, and problem solving skills. The concepts were new to some students in the beginning of the seminar and as a result they challenged these students' preexisting, more conventional perspectives, including identity, expectations, and demands (e.g., positivistic science was all that is needed for effective large scale conservation). A few participants grasped the problem solving approach and used it in their mind map and discussions, but most participants stayed rooted in their original perspectives derived from past educational and natural resource management experiences. Many participants also focused exclusively on social process elements of large scale conservation, failing to delve into the decision process or objectively reflect on their own standpoint. This situation illustrates how hard it is for many people to think fundamentally and practically about their own experience and standpoint relative to tasks like large scale conservation.

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Participants were diverse and this was evident in both the description of the mind maps as well as the mind maps themselves. Some people had years of experience in the U.S. and in other countries, sometimes under complex field situations. Others came directly from undergraduate programs and lacked "real world" experiences. As a consequence, some participants were quite familiar with conservation problems on-the-ground, whereas others were not. Additionally, some students had the benefit of diverse courses that they drew on in building and talking about their mind maps. Finally, some students – regardless of academic or professional background – were simply more open to reflecting and revising their personal views on large scale conservation paradigms and the policy sciences. The richness of perspectives, experiences, and value outlooks of workshop participants brought out through the

mind mapping served to stimulate discussion, some reflection, and perhaps revision. Participants learned from each other, perhaps most importantly discovering how differently each sees the world.

Time constraints precluded a thorough comparison and discussion of mind maps. If time had been available, the elements and standards of interdisciplinary problem solving could have been explored in some detail relative to the differing mind maps and the overall task of articulating a formula for large scale conservation. Even with time constraints, all participants were able to explain their mind maps to the group, and this affected the direction and outcome of the conversation. As the most vocal participants also tended to be those with significant real-world experience, it is certainly conceivable that a discussion emphasizing their standpoints could have been more focused and ultimately more productive. However, this would have excluded a large number of workshop participants at the outset, potentially affecting their willingness to participate throughout the rest of the workshop. The diversity of views expressed was wide, and learning how each participant approached the issue of large scale conservation helped frame an examination of problems and solutions and decision process on day two.

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Day 2: Problem orientation and decision process

The goal of Day 2 was to explore problems and solutions in large scale conservation. This required knowledge of how decision making actually takes place in cases and also about the recommended decision making activities and associated standards. Guest speakers and cases previously discussed in the seminar helped frame the background for Day 2.

Description of activities and rationale

Three student facilitators guided participants through exercises designed to identify problems inhibiting large scale conservation and find solutions. This was followed by two students' who carried out a problem oriented exercise on their own based on the lists of problems and solutions the group produced. They presented results at the beginning of the third day.

In order to ground participants in a real-world case, students, who had gone on a field trip to the Greater Yellowstone Ecosystem (GYE) over spring break, gave a presentation detailing their experiences and lessons learned from the trip. They began with background on GYE. They also clarified their standpoints as ten females from diverse backgrounds. They then moved on to discuss the participants involved in management of GYE with whom they had spoken. A wide range of doctrines for successful management of GYE's natural resources were apparent among these

managers, including government employees who promote scientific management to NGOs and independent actors who champion *adaptive governance* as the most sound solution to persistent policy conflict.

Following discussion of the GYE case, attention in the workshop turned to exploration of the decision process at the heart of large scale conservation. In an initial attempt at defining the problems in decision process, facilitators passed around sheets of paper and asked all participants to spend five minutes listing problems with large scale conservation. Once five minutes had passed, each participant passed his/her list to the participant to his/her right, who then added new or expanded items to the list. After repeating this process several times, participants passed the sheets to the facilitators for compilation and discussion.

With a list of problems in hand, the next task was to develop a list of solutions. Facilitators oversaw the same process to generate a list of solutions. Ultimately, the group's task was to utilize problem and solution lists to articulate a formula for successful large scale conservation.

Discussion

Workshop participants generated a list of problems with large scale conservation (Table 1). The list is quite conventional, clearly emphasizing that the existing formula for large scale conservation is not working, but not explicitly orienting to the problem through identification and analysis of goals, trends, and conditions.

Workshop participants generated a list of problems with large scale conservation (Table 1).

Table 1 The list of problems workshop participants saw with large scale conservation. No order implied.

Problems with large scale conservation
• Focus on ordinary problems: lack of goal clarification and problem orientation.
• Government special interests: leaders in general have special interests; investment in the status quo.
• Scientific uncertainty, biophysical.
• Conservation discourse – lack of peoples' values and needs incorporated into large scale conservation; lack of incorporating local knowledge; lack of listening.
• Need to build trust between different stakeholders and decision makers in conservation – lack of a framework for how to be truly participatory.
• Lack of stakeholders to be able to clarify a common goal.
• Lack of bridge-building between disciplines; lack of flow of ideas from top-down and bottom-up.

- Recognition of antiquated view of problems that, in reality, have no boundaries. Political boundaries are not ecosystem boundaries.
- Lack of effective leadership: respect-based, visionary leadership; people unwilling to let go of egos; lack of identifying strong leaders.
- Scientific management is an inadequate doctrine for large scale conservation.
- Large scale conservation ends up being more about integrating a bunch of small projects over large landscapes.
- Power hungry people.
- Distrust.
- Lack of a constitutive document for large scale conservation – and language for large scale conservation can be exclusive.
- Lack of funding and resources; budgets and funding that reward quantifiable results in the short-term.
- Many problems have long time scales but results are wanted in the short-term: desire for instant gratification, but also balancing people's short-term needs with long-term goals.
- Lack of appraisal and termination of bad programs.
- Lack of process for defining goals.

Alternatives to the status quo, as conceived by workshop participants, are in Table 2. Workshop participants Emily Alcott and Abigail Adams undertook a problem oriented analysis of the list, noting that participants generally focused on problems related to social and decision processes.

Table 2 The list of solutions workshop participants saw with large scale conservation. No order implied.

Alternatives to improve large scale conservation
• Clarify goals and be flexible to change.
• A need to identify successful, practice-based approaches, reward them, disseminate, and scale up; do not assume bigger is always better.
• Incorporate local knowledge in an effective and genuine discourse.
• Create indices that measure progress towards achieving the common interest; terminate programs that aren't progressing towards that goal.
• Find, support, and reward leaders who are connectors, exhibit problem oriented skills and knowledge, and have conducive open personality types.

Students categorized alternatives into conventional terms, and could be categorized in terms of people, perspectives, situation, values at stake, outcomes sought, and long-term effects. Social process problems were particularly apparent; for example, many of the submitted alternatives revolved around a perception that decisions are being made by people who seek wealth and power (chapter 2, this volume). Generally, it seems that a blending of value outcomes is not in place. Affecting change begins with addressing these kinds of fundamental value issues within the social and decision processes.

Evaluation

The listing exercise fell short of participants' expectations. These students were looking for more insight and practice in using problem orientation. During the workshop participants were eager to articulate the many problems they had observed in cases throughout the semester, but in the process did not describe the underlying context, trends or conditions behind problems. This is a common pitfall in analysis and discussions, as quick identification of problems can often lead seamlessly into an associated list of solutions. Critically, failing to take into consideration the basis of problems in social and decision process terms can lead to solutions that do not address root causes, thus failing ultimately to solve that problem. Our recommendations address this issue below. Unfortunately, day two's discussion of the decision process fell into this trap. Additionally, in some cases statements identified as "problems" might have been more correctly categorized as "trends and conditions." For example, a trend in biodiversity decline is not a problem unless first a goal has been set declaring that biodiversity is to be conserved. A "problem", then, should be conceived of as the difference between a goal or desired state of affairs and trends and conditions.

During the workshop participants were eager to articulate the many problems they had observed in cases throughout the semester, but in the process did not describe the underlying context, trends or conditions behind problems.

As in other parts of the workshop, participants were hampered by a lack of time, which prevented in-depth discussion of problems and solutions. Nevertheless, facilitators oversaw a dialogue that touched on many of the most widespread and persistent problems. Moreover, participants were able to move beyond simply describing problems, and begin to articulate potentially lasting solutions. Following a semester of coursework that covered management approaches to conservation, some of which seemed intractable, much of the value in this particular exercise lay in putting a significant amount of collective thought into the bigger picture—what does it all mean? What are the problems that have come up over and over again, with different people and in different contexts, and how do they inhibit progress toward solutions that protect ecosystems and support human communities as well, ultimately promoting human dignity?

Day 3: Leadership

Day 3 was devoted to an overview of leadership concepts, the examination of participants' perspectives on leadership, and relations of those perspectives to other facets of personality. Goals were: (1) to familiarize participants with conventional leadership frames premised on power and position, (2) introduce a relational paradigm of leadership better suited to large scale conservation, and (3) foster participants' clarification of their own leadership standpoint by elucidating their varied perspectives on "good" leadership and relations between those perspectives and their value orientations and personality traits.

Leadership and foundational principles

Leadership is unequivocally important to successful large scale conservation. Large scale conservation characteristically exhibits high levels of complexity and novelty that in turn require the efforts of people who are able and willing to integrate, innovate, and take risks as a basis for orienting themselves and others to productive courses of action. Because imposed top-down solutions are typically not durable (Acheson 2006, Berkes 2007), the group concluded that leadership in large scale conservation is often better exercised based on persuasive engagement and grounded in respectful relations (see Yukl 1994, Mumford et al. 2000, Zaccaro 2001, Hogan and Kaiser 2005).

Leadership is unequivocally important to successful large scale conservation.

Workshop participants were introduced to a paradigm of situated, relational leadership focused on relationships devoted to the promulgation of social order based on persuasion, civility, self-direction, positive affect, and the related prioritization of respect, inclusive rectitude, enlightenment, and affection. This concept of leadership and its related goals is rooted in the seminal work of Harold Lasswell (Ascher and Hirschfelder-Ascher 2005) and Herbert Kelman (Kelman 2006), and is well suited to the demands of large scale conservation. Situated and dignity-oriented leadership requires on-going and effective standpoint clarification among putative "leaders," and attaches great importance to perspectives of the "led," including their expectations of leaders and their notions of "good" leadership.

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Description of activities

Day 3's activities centered on examining the perspectives of workshop participants regarding "good" leadership, and the roots of these perspectives in participant value

orientations and personality traits. These activities were designed to foster standpoint clarification as well as an increased appreciation for the considerable differences in peoples' perspectives on leadership, the roots of these differences in personality, and, ultimately, the importance of understanding this facet of context to effective professional practice.

We used Q-analysis (Brown 1980) to clarify participants' perspectives on leadership. Participants sorted 44 statements about elements of "good" leadership according to their reckonings of importance. The statements were obtained from surveys of students in three earlier classes with a related topical focus. Participant rankings were statistically analyzed to derive factors representing different more-or-less coherent perspectives. We interpreted these factors as "perspectives" based on the numeric loadings of different statements. Participants were identified with each perspective based on similar numeric scores. We regressed participant scores for each factor against their numerically scored value orientations and personality traits. Participants subjectively scored their own value orientations using a Likert scale and according to two different value schematics (Lasswell and Holmberg 1992, Schwartz 1994). Personality traits were scored according to online versions of the Myers-Briggs Type Indicator (MBTI) and NEO-PI Five Factor Model (Big-5, see Rentfrow et al. 2008).

Leadership and personality results

The results of our workshop activities were complex. Participants consistently scored themselves highest on orientations towards respect and well-being, which are the values most strongly identified with human dignity. Despite common patterns, value orientations differed among participants along four gradients defined by degrees of orientation toward self-transcendence, self-enhancement, conservatism, and openness. Self-transcendence was positively related to the personality traits of Agreeableness and Feeling. The combination of self-enhancement and conservatism was positively related to Concreteness and Extraversion (see Rentfrow et al. 2008). And, the combination of self-enhancement and openness was positively related to Extraversion, Agreeableness, and Abstractness, and negatively related to Neuroticism. Overall, workshop participants were less Neurotic and more Agreeable, Open, and Conscientious than the general population, and exhibited a predominantly rational and moderate orientation toward risk.

The structure of participant perspectives on "good" leadership was multi-faceted but interpretable in terms of defining statements and underlying personality. We defined three "families" of perspectives comprised of eight factors. The "surgent" perspective looked for leaders that were inspirational and self-confident and attached little importance to the ability of leaders to clarify their standpoint or locate themselves in social and decision making processes. This perspective was positively related to participant traits of Toughmindedness and Neuroticism and self-scored orientations toward the values of benevolence and hedonism. The "open and facilitating" perspective looked for leaders who were able to listen and learn, solve problems, balance process and goals, and maintain others' focus, and attached little value to leader self-confidence or charisma. This perspective was positively related to

Feeling and Conscientiousness, and negatively related to Agreeableness and the value of universalism. The "communicative" perspective looked for leaders who communicated well, fostered connections, and were able to listen and learn, and attached little importance to vision, passion, or leader "mapping" skills of any sort. This perspective was positively related to Agreeableness and Spontaneousness. This exercise examined personality in leadership and clarified the attributes of successful leadership, which are context specific.

Discussion and conclusion

Aside from some aspects of mind mapping, this day's activities engaged workshop participants at the most personal level. Depending on the individual, this level of engagement seemed to engender varying degrees of both attraction and discomfort. Standpoint clarification, which was a large part of Day 3's focus, is the most difficult of tasks to attend to (Clark 2001, 2002). It requires confronting some aspects of self that may be uncomfortable, which is also the genesis of personal growth and evolution, as well as a key to enhanced sensitivity to situational contexts. Most people are, for obvious reasons, fascinated by themselves. Translating this "self interest" into improved leadership and professional practice depends on many factors (some noted above), including access to conceptual tools (e.g., problem orientation, goal clarification, standpoint analysis) that offer cogent insights. This day's activities offered participants a coherent and comparative view of their perspectives on leadership, which intersects with many issues central to human affairs, as well as insight into their values, personality, and relations of these factors to how they see and orient to the world. All these factors affect how effective an individual will be in a career (see Mattson et al. In Review a,b) The key to success, the workshop concluded, is for professionals to be attuned to their operating environment, facile at its diagnosis, and adaptive in their behavior.

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EVALUATION

Participant evaluations of the workshop are useful in gauging the utility of such workshops to participants, and in suggesting potential alterations to the focus and agenda of workshops in the future. Anonymous responses to a set of pre-defined and tested questions ensure that participant feedback is as candid as possible, and useful to facilitators in improving workshop design. Evaluation from facilitators, similarly, provides a useful benchmark for assessing the success of a given workshop relative to others that the facilitator has overseen in the past.

On the last day of the workshop, evaluation forms were distributed to participants. Feedback was requested via responses to seven questions, as noted below. About 50

percent of workshop participants returned their evaluations; follow-up with those who had not responded was difficult in part because: (1) evaluations were conducted anonymously and (2) many participants left campus for summer internships and/or full-time jobs soon after the workshop ended. Despite these complications, the response rate achieved yielded a number of insights for potential application in future workshops.

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The first question asked to participants was: *Was the approach we took in the workshop new to you and was it helpful?* For the most part, participants indicated that the approach was indeed a new one, and useful as a framework for trying to make sense of cases in large scale conservation. A smaller subset of respondents noted disappointment that important points were sometimes glossed over in the interest of time, and that differing levels of engagement among participants inhibited elevation of dialogue to a higher level. For example:

> I wish we had more time as I think several important points were glossed over and we were unable to get into deeper analysis and critique of our peers' responses.

The second question asked of participants was: *What are the three take-home lessons of this workshop?* Broadly, many responses to this question addressed the importance of context in large scale conservation; a single formula is simply not possible to develop and apply in all cases, and the differing ways in which people conceive of and attempt to solve problems must be respected and attended to when developing formulas for specific cases. Many participants also felt that the workshop demonstrated the centrality of *people* in issues of large scale conservation, and that working toward adaptive governance as an overarching management framework should be the main goal of conservation efforts.

The third question for participants was: *How will you use this experience?* A number of respondents indicated that they are already using a multidisciplinary framework to inform analyses of material in other courses, and that they expect to further utilize the interdisciplinary framework examined in the course as conservation leaders and professionals in the future. For example:

> I now can read materials, listen to news, presentations, speakers etc with a more attuned ear, pinpointing elements from the policy process and adaptive governance, and using them to evaluate the degree of effectiveness of leaders, organizations and colleagues at addressing and resolving problems. I hope to continue to hone these skills and implement them as a better leader in the future.

The fourth question requested that participants note: *What design and content improvements would be helpful for similar workshops?* A majority of responses noted

the workshop's major shortcoming as simply a lack of time in which to really engage the issues under consideration. The approximately nine hours spent in the workshop—in three blocks, of three hours apiece, spread over three weeks—to many participants was not enough to dig into problems of large scale conservation in a meaningful way. Similarly, a number of participants felt that, given the limited amount of time allotted to the workshop, the focus on large scale conservation in general was too broad and that the workshop would have been more effective if focused on a specific case, or several specific cases. For example:

> The workshop would be improved if the focus were more concrete and specifically focused on a particular natural resource or conservation issue.

The fifth question asked to participants was: *What do you think would be a constructive next step to address issues and problems highlighted in this workshop? And who should be involved?* Some students responded that producing a document either individually or as a group, addressing outcomes of the workshop and lessons learned, would be a useful means of applying the workshop to real world issues of large scale conservation. Several others noted that before moving forward any further, input from a wider range of stakeholders involved in large scale conservation would be desirable. To one participant, the best use of lessons learned is to enter the professional world and put these concepts into practice.

The sixth question asked to participants was: *Would you recommend this or similar workshops to other people? Who? To cover what natural resource topics?* Nearly all participants responded that such workshops would be of great value to professionals involved in large scale natural resource management, with one student even suggesting that such workshops should be mandatory for conservation professionals. Participants saw that the workshop was applicable to many areas outside of large scale conservation, including disaster risk reduction and international development.

To one participant, the best use of lessons learned is to enter the professional world and put these concepts into practice.

The seventh and final question asked to participants was: *How have you used (or can you see yourself using) concepts, information, or contacts acquired in this workshop in your work?* One participant responded that he/she had already used the policy sciences framework to inform the design of an upcoming summer research project, whereas others plan to rely on the concepts of common interest, adaptive governance, and others in future professional careers.

RECOMMENDATIONS

The first recommendation is that the productivity of future workshops could be significantly enhanced if all participants simply had more experience: with on-the-

ground conservation in particular, and with life outside of academia in general. In a workshop specifically intended to improve the practice of large scale conservation "out there," better grounding in life experience could ease the conceptual leap from background theory—relied on throughout the workshop—to the real world, where practitioners must translate that knowledge into more effective programs and practices. Participants in this workshop with less life experience certainly were not at fault for this; rather, it was simply a reflection of the stage they were at in their academic and professional careers. For these students and indeed all workshop participants, greater facility with analytic tools, such as mind mapping and problem orientation, could likely have contributed to an overall higher level conversation on concepts and tools, and how to apply them to real-world experience.

Second, as noted in a number of student evaluations, participants needed more guided examination of actual cases rather than, or in addition to, a high-level overview of large scale conservation. A detailed examination of one or more specific cases could have eased the transition from theory to practice, illuminating elements of doctrine and formula and leading to the development of foresight about ordinary, governance, and constitutive problems and solutions on-the-ground. Students had considered case material throughout the semester, but could have benefitted from a closer examination of this material in context of a focused workshop. Particularly for students with minimal experience outside the classroom, case studies can help with the comprehension of otherwise abstract concepts and provide standards against which other cases can be judged. This recommendation seems especially applicable for workshops that are somewhat limited by time constraints, as this one was.

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A corollary to this recommendation, in the context of this workshop being held as part of a larger seminar for graduate students in environmental management, is that participants would have benefited from having taken one or several other courses in the policy sciences before participating in an in-depth workshop. "Species and Ecosystem Conservation: An Interdisciplinary Approach" and "Foundations of Natural Resources Policy and Management" are two courses offered at the Yale School of Forestry & Environmental Studies that could have provided students with a better grounding in interdisciplinary concepts and their application to conservation in practice. To foster a more productive dialogue, future workshops may require participants to have taken one or more foundational courses.

Third, in general, workshop participants need to think more rigorously about foundational concepts of leadership and practice-oriented skills. Much discussion failed to move very far beyond conventional descriptions of problems with the large scale conservation paradigm, and potential solutions to those problems. More active

engagement with background material for the course in general and the workshop specifically, along with participants who had taken one or more foundational courses in interdisciplinarity, could have improved the dialogue and outcomes throughout the workshop.

CONCLUSION

The three-session workshop provided participants with practical concepts and skills about problem solving in conservation. Participants did conclude that the current formula (i.e., scientific management) is not working well. As a solution, workshop participants noted that the formula most likely able to affect the kind of constructive change that is sought in large scale conservation is that of *adaptive governance*, as described by Brunner et al. (2005) and Clark (2008). *Adaptive governance* explicitly recognizes that all conservation problems rest within a specific context, and seeks to integrate scientific and other types of knowledge into policies to advance the common interest through open decision making structures. This approach pays close attention to the social process and ultimately arrives at outcomes that seek to advance human dignity and sustainability. Ultimately, reform of conservation practices is possible by changing knowledge/skill interactions in the decision making process, the people involved, the structures used, and the arena/environment in which people interact. In the end, adaptive governance as the preferred formula seeks to advance human dignity and sustainability, which workshop participants supported as the overriding goal for large scale conservation.

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Chapter 8

Best Practices: The Concept, An Assessment, and Recommendations

Aaron Hohl and Susan G. Clark[1]

ABSTRACT

The *Best Practice* (BP) concept is an important tool for improving environmental and conservation management practices. Our objective in this paper is to facilitate the development and use of more effective BPs in large scale conservation. BPs are ultimately about improving the decision making process. Although many BP innovators focus exclusively on substantive improvements, they can be used to spur both substantive and procedural improvements. Adopting practical models of decision making, innovation, and diffusion processes can enhance the utility of BPs and facilitate more rapid improvements. Most BPs rely on rules of evidence and inference derived from positivism; however, broadening the epistemological foundation of BPs to include post-positivistic methods that attend to contextual factors can enhance the utility of BP prescriptions. Prototyping is a context-sensitive learning strategy that may be the most practical means of rapidly testing, adapting and diffusing new BPs successfully.

Key words: *Best practices, best management practices, innovation, decision making process, environment*

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INTRODUCTION

Best practices (BPs) are prescriptions for improving (on) the status quo. They are used to communicate potential practices for improving management or policy outcomes. Although BPs have been used since the beginning of the human skill revolution millennia ago, recognition of their potential utility is increasing in many sectors of society. The popularization of BPs in business is widely attributed to the book *In Search of Excellence* (Peters and Waterman 1982). However, the concept has numerous

antecedents and is currently being used in diverse fields (e.g., engineering, medicine, government). For example, since the late 1970s, state and federal agencies have formulated *best management practices* (BMPs) for forestry and agriculture to address non-point pollution sources. BPs typically represent an expert opinion, based on a mental model of how the system works and how to enhance outcomes given a person's goals/objectives. The utility of BPs turns on many contextual factors, including how the problem is defined, the innovativeness of originators and promoters, as well as a host of diffusion and restrictive forces and factors.

Best practices (BPs) are prescriptions for improving (on) the status quo.

We feel that the full potential of BPs to spur incremental improvements in large scale conservation projects, as well as in environmental management practice more generally, is not currently being realized. Our aim is to facilitate the development and use of more effective BPs in large scale conservation. We offer a problem oriented description of the BP concept, introduce a typology for classifying BPs, illustrate the role of BPs in the decision process, and recommend ways that BPs might enhance policy and management outcomes. Our argument in brief is:

- First, a better understanding of the conceptual basis of BPs, including their substantive/procedural focus and their epistemological foundation, will allow people to be more contextual in their use of BPs.
- Second, a familiarity with the complete decision process will facilitate formulation and use of superior BPs.
- Finally, knowledge of the innovation and prototyping processes will expedite spread of superior, context sensitive BPs to a wide audience for use. This approach opens up new opportunities for future advances in large scale conservation projects.

We feel that the full potential of BPs to spur incremental improvements in large scale conservation projects, as well as in environmental management practice more generally, is not currently being realized.

BEST PRACTICES: THE CONCEPT

The goal of people who promote and use BPs is to obtain superior outcomes in their realm of practice by using the best available standards and methods. BPs are commonly identified by surveying existing practices in a field (e.g., in benchmarking exercises, Jenkins and Hine 2003), developed based on a theoretical construct of the

system under management (e.g., as has been done using modeling exercises, Boyd 2005), or originated by identifying successful prototypes (Brunner and Clark 1997). Although the use of the superlative "best" suggests a prescription imbued with finality and immutability, BPs are actually provisional statements reflecting the current state of the art. In fact, the term *best available practice* more accurately reflects the impermanent and evolutionary nature of BPs.

Given the varied origins of BPs, the range of substantive and procedural applications, and the contexts in which BPs are prescribed and used, it is not surprising that diverse epistemological standpoints are relied upon in the formulation of BPs. While the dominant epistemology in environmental management is positivism, other epistemologies (particularly post-positivism) are also in wide use. For example, the Conservation Measures Partnership (2007) has developed a strategic planning process (Open Standard for the Practice of Conservation) which leads participants through a consensual, rather than positivistic, process for developing conceptual models of and solutions to large scale conservation problems. Similarly, although the BP development process is often carried out using scientific principles derived from empirical studies, other methods (e.g., prototyping) are required when the system is poorly known.

Most BPs represent the judgment of experts on how to improve upon the status quo with respect to some (often implicit) suite of values. Ideally goals and objectives have been clearly articulated prior to arriving at a BP prescription. Lack of clear goals and objectives can be an impediment to deriving BPs. Without clear objectives, it is difficult to identify the most important (driving) variables in the system, provide guidance on how to use knowledge about those variables to enact management improvements, or evaluate the effectiveness of a BP. For example, in Pennsylvania those who view wildlife primarily in terms of game species (e.g., the Pennsylvania Game Commission) and those who use a broader definition of wildlife (e.g., Pennsylvania Bureau of Forestry) have developed competing prescriptions for managing public forests for wildlife. The goal of one agency is to maintain a stable whitetail deer population, while the other agency would like to see the whitetail deer population decline in the expectation that the neo-tropical migrant bird population would increase.

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Efforts to identify BPs are always subject to human foibles, including inappropriate, self-interested simplifications, as well as disciplinary and epistemological biases. Such simplifications and biases can be especially problematic in the complex, poorly understood systems with which large scale conservation practice is concerned. Although experts must rely on previously developed expertise, new systems may differ from familiar systems in unexpected ways and even familiar

systems may periodically experience abrupt shifts that make past research outdated (Hilborn et al. 1995). In such cases, "assumption drag" may prevent BP prescriptions from catching up with current conditions or the context on-the-ground (Ascher 1978). These and other problems limit the utility of BPs.

History

Attempts to identify, collect, and disseminate BPs have a history going back to antiquity and the search for BPs has played a major role in development of human civilization (Bunch 2004). For example, the Edwin Smith Papyrus, written in Egypt about 1,700 B.C. is a compilation of 48 case histories arranged by anatomic region of the human body. Each case describes a patient's symptoms, offers a diagnosis, and prescribes treatment (i.e., offers a best practice prescription). Although it is the oldest surgical text known, textual evidence suggests that the papyrus may be based on an earlier text written between 3,000 and 2,500 B.C. (Stiefel et al. 2006). Early Greek physicians built upon Egyptian practice to produce new BPs. The *Corpus Hippocraticum*, which gathered works attributed to the Greek physician Hippocrates, was complied during the third century B.C. for the library at Alexandria. Despite the rudimentary investigative methods available to the Greeks, Hippocrates' writings describe treatment methods still in use today. Panourias el al. (2005: 181) wrote that "trepanation, or trephination, which is still one of the most popular procedures in neurosurgery, is mentioned extensively in this treatise [*On wounds in the head*], together with its clinical indications, technique, and outcome." Both the Edwin Smith Papyrus and the *Corpus Hippocraticum* were attempts by medical practitioners to identify and use best practices based on the methods, and knowledge of the era.

Close empirical observation by practitioners has often been sufficient to arrive at a BP in the absence of scientific explanation. For example, when Louis Pasteur applied germ theory to the beer brewing process in his *Etudes sur la Bièr* (1876), brewing practice "underwent no revolution, for the best practice in brewing was already in line with Pasteur's teachings" (Sigsworth 1965: 549). Brewers had already adopted methods that prevented introducing germs into beer, even though the concept of germs was unfamiliar to them. It is notable that, "Works upon brewing most in use by brewers [in Great Britain during the late 19th century] provided much theoretically-based advice which was doubtless wrong, but they also contained much practical wisdom gained by empirical observation, for which the late nineteenth century provided scientific explanation" (Sigsworth 1965: 549). As this example illustrates, BPs can be clarified and can stimulate progress in applied fields, even in the absence of scientifically grounded explanation (Stokes 1997).

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Environmental professionals in the United States have been engaged in identifying, adapting and applying BPs since Gifford Pinchot pioneered the field of American forestry in the 1890s. Regarding a trip to Europe at the beginning of his career, Pinchot observed in his autobiography (1972: 19) that, "Nothing could have been more useful to a lot of foresters in the egg than this tour through some of the best-managed forests on earth. Even if we were not able to see everything we looked at, at least we built up some mental picture of what a forest under good management actually looked like—a standard against which to check our future work." He recognized, however, that even the best forestry practices of Europe could not be indiscriminately applied in the United States—the social and biological context was too different. Accordingly, his management of the Biltmore Estate in North Carolina, an endeavor that marked "the first example of practical forest management in the United States" (48), served as a prototype by which to identify BPs appropriate to the American context.

Pinchot adeptly combined both substantive and procedural elements. He not only developed and applied substantive prescriptions about how best to manage forests, but also transformed the process by which decisions about forest management were made in the U.S. Lessons learned at Biltmore were disseminated not only by Pinchot, who went on to become the first chief of the U.S. Forest Service, but also by others who worked the estate. Though Pinchot himself took some aspects of social context into account in the development and application of forestry BPs, the importance of accounting for social context in forestry practice has been a longstanding subject of debate (e.g., Behan 1966, Luckert 2006). This is reflective of a tendency to be overly reliant on positivism in developing and evaluating BPs.

Conditions

Many factors determine whether BPs are used or rejected and how BPs are first clarified, diffused, and adapted. The most basic among these factors are the people involved, their perspectives, the values at play (e.g., power, knowledge, skill, respect), and strategies they use (e.g., diplomatic, educational, economic, coercive). It is beyond the scope of this chapter to look at these conditioning factors in detail. However, one case in which these factors were documented was in the endangered black-footed ferret (*Musela nigripes*) recovery effort in the American West (Clark 1997). The search for BPs played a significant role in setting new standards for field surveys and population monitoring, capture and handing techniques, habitat mapping and management location of transplant/recovery sites, captive breeding, and program organization and decision making. In turn, substantively oriented BPs stimulated subsequent advances in recovery efforts. Because value dynamics were little attended to, however, progress was less rapid than it might otherwise have been. Specifically, the Wyoming Game and Fish Department's desire to maintain the appearance of authority and control made it slow to adopt the recommendations of outside experts on how best to conserve the remaining ferrets.

Projections

The term BP is increasingly being employed in diverse fields and disciplines. For example, in medical literature the term is linked with *evidence based practice*, an attempt to incorporate the best available evidence into up-to-date treatment prescriptions. Searches of databases of academic journals show the rising frequency with which the term *BP* is used by biological and social scientists (Table 1). We expect that BPs will continue to proliferate and BPs will take on greater importance in coming years. As access to the Internet expands, it will become easier to diffuse and harder to restrict BPs (e.g., The Together Foundation 2008). Furthermore, calls for transparency and accountability on the part of businesses, government, and individuals will encourage practitioners and decision makers to adhere to explicitly defined standards of practice, including those that call for openness and creativity. Examples include the use of generally accepted accounting principles (GAAP) for financial reporting and the requirement by the two major forest certification systems in the United States that forest managers comply with "Best Management Practices" (SFI 2004, FSC 2006). An ongoing challenge will be to find superior BPs and to balance the desirability of explicit standards with the need to be contextual, flexible, an innovative. A major limitation of traditional scientific management has been applying a pre-defined "single best way" instead of more contextually sensitive solutions.

The term BP is increasingly being employed in diverse fields and disciplines.

Table 1 Number of references by year to "best practice" in three academic databases

Year	Agricola	Medline	Sociological Abstracts
<1980	2	2	1
1980-1989	2	10	5
1990-1999	29	583	48
2000-2005	59	1997	144
2005-2009	126	2675	198
Total	218	5267	396

ANALYSIS: ANATOMY OF A BEST PRACTICES CASE

Successful intervention in large scale environmental systems requires adequate models of the natural systems involved, as well as the human systems in terms of the social and decision processes at play. Additionally, it is useful to understand the epistemological standpoint and biases of those who develop, seek, and use BPs. Assumptions about what constitutes appropriate epistemological rigor are embedded

in the methodologies and professional norms people use to develop, apply, and evaluate BPs. Often these assumptions are not fully conscious or explicit. A lack of clarity about the epistemological standpoint and focus of attention of a BP will limit one's ability to learn from experience and improve BPs. In this section, we illustrate how articulating one's epistemological standpoint and adopting interdisciplinary models relative to a BP can contribute to the effective development and use of BPs.

Successful intervention in large scale environmental systems requires adequate models of the natural systems involved, as well as the human systems in terms of the social and decision processes at play.

A typology for BPs

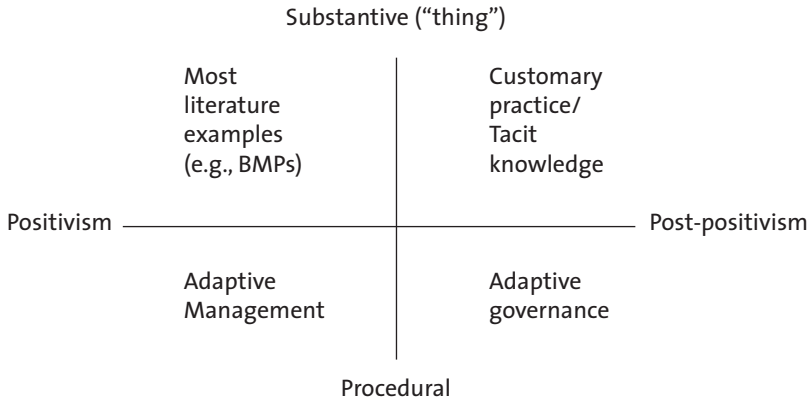
Specific BPs can be arrayed along two axes (Figure 1). A particular BP can be arrayed relative to other BPs using this typology. The first axis relates to the focus of attention of people creating the BPs and whether the target for improvement is largely substantive (e.g., trees, species, watersheds) or procedural (e.g., decision making, social process). The second axis relates to the epistemological standpoints in use. The two major epistemological standpoints held by scientists and managers today are positivism and post-positivism.

Customary management practices, though usually not described by their users as BPs, often serve as substantive BPs rooted in a pre-positivistic epistemology. The use of fire as a forest and wildlife management tool by native American and early European settlers is an historical example. Explicitly articulated BP prescriptions in natural resource management typically have been concerned with substantive rather than procedural issues. For people who have been thoroughly socialized into their respective disciplines, the appropriate goals of BPs may seem so obvious that they hardly need to be stated. For example, substantive goals are usually taken as a given by developers of forestry Best Management Practices for water quality (commonly referred to as BMPs): the goal of BMPs is understood to be reducing water pollution to a level compatible with previously determined water quality goals. However, most BMP developers do not expect BMPs to completely eliminate non-point source pollution, though this may not be clear to all BMP user groups (e.g., town wetlands commissioners). BMPs were developed by states in response to the goals set in the federal Clean Water Act. One of those goals—the nation's water bodies should receive zero discharges of pollutants by 1985—may have been infeasible and inappropriate. However, in the absence of clearly articulated goals, the lack of agreement on appropriate goals may not have been readily apparent until late in the decision process.

While most BPs in environmental management are substantively oriented, procedurally focused BPs do exist. Adaptive management as articulated by authors such as Walters (Walters 1986, Walters and Holling 1990) is a procedurally focused BP used by natural resource practitioners in which the target of improvement is the

decision process itself. In this view, adaptive management is basically a prescription for using monitoring and evaluation techniques to learn and incorporate current best knowledge into decision making. In a discussion of the way in which adaptive management could be applied to ecosystem management, Rauscher (1999) noted that "we should devote as much creative attention to devising good ecosystem management decision processes as we do in assuring the quality of the decisions themselves." It should be noted that other practitioners of adaptive management subscribe to a more post-positivistic epistemology (Lee 1993).

Figure 1 A typology of professional's focus of attention/targets in the BP process along a "substantive vs. process" axis and along a "positivism vs. post-positivism epistemological" axis. Different professionals employ different standpoints along these axes in their BP work.



In this view, adaptive management is basically a prescription for using monitoring and evaluation techniques to learn and incorporate current best knowledge into decision making.

Both BMPs and adaptive management are examples of Best Practices rooted in positivism. According to the positivist tradition in science, hypotheses are predictions derived from theory that can be falsified using carefully constructed and controlled, usually reductionistic, experiments. Strict positivists assume that they are unbiased, neutral observers; that their senses are reliable windows on the world; and that through careful, systematic observation they can know the world precisely and accurately hold that empirical evidence gives them an unbiased and objective view of the natural world that is free from the context in which the person learns about the world. Positivists often fail to recognize the importance of social facts that are mediated by social consensus rather than reflections of an objective reality. Consequently, positivists tend to see content and not fully appreciate process.

Complying with positivism requires that BPs be based on either empirical research results or scientifically (positivistically) deduced principles. Deriving scientifically

defensible BPs is easier in some areas of environmental management than others. For example, the efficacy of checking hoses and fittings on machinery to avoid chemical spills on a logging site is unlikely to be contested. By contrast, formulating uncontested BPs for large scale conservation is more difficult for at least two reasons. First, it can be difficult to agree upon appropriate substantive goals (What level of protection is appropriate? At what economic cost? What ecosystem functions or services should be taken into account?). In fact, a strictly scientific (positivistic) endeavor, which strives to be value-neutral, cannot move from projection to prescription, which is unavoidably value-laden (Pouyat 1999). Second, best practices for large scale conservation cannot be easily reduced to a few scientifically derived rules of thumb because interactions between social, economic, and environmental conditions are complex and not fully understood. In fact, because ecological theories tend to be context specific, multi-causal, and probabilistic (Pickett et al. 1994), reductionism has proven difficult to apply in ecology, let alone large scale conservation. Additionally, the basic hypothesis of reductionism—that everything obeys the same basic set of laws—does not logically entail a constructionist hypothesis—that we can reconstruct any system, even the universe, if we know the fundamental laws. Consequently, it becomes difficult to transform data derived from a given reductionistic experiment into generalizable BP prescriptions, when interactions between multiple biophysical and social variables are taken into account.

In contrast to positivism, post-positivistic epistemology holds that our understanding of reality is socially constructed (e.g., Berger and Luckmann 1966). Post-positivists assume that the "self" or "personality" does not stand completely apart from the rest of the real world and that our understanding of the world is thus a combination of "objective" and "subjective" constructs. Whereas an objective world "out there" exists, we can only understand it based on subjective mental models that are developed in dialogue with other people in our society. This epistemology implies that the most effective way to improve our understanding of the operation of the world "out there" is to use multiple methods to triangulate on a more robust mental model of reality. Such triangulation will necessarily take into account not only biophysical facts, but also social facts. Consequently, a post-positivistic epistemology is better equipped to deal with values. Furthermore, a post-positivist professional may formally and frequently use the positivistic method, but not the reverse. By granting a legitimate role to post-positivistic epistemology, BP developers can acknowledge their biases without undermining their rationality. Adaptive governance is an example of best practice for natural resource management that is rooted in post-positivistic epistemology and procedurally focused (Brunner et al. 2005).

Adaptive governance is an example of best practice for natural resource management that is rooted in post-positivistic epistemology and procedurally focused (Brunner et al. 2005).

Evaluating BPs

Because most BPs target substantive rather than procedural improvements, the importance of having a functional model of the decision process is often overlooked. While substantive BPs can have a key role in improving environmental outcomes, technically inclined people ignore the decision process at their peril. Since all BPs are interventions in decision making, it is important to have a logically inclusive and comprehensive model of the decision making process. One such model includes six phases (Brewer and deLeon 1983, Table 2). Using such a model can facilitate evaluations of a BP's effectiveness. Evaluation is often a complex and always a critical task. Since BPs frequently involve applying current knowledge in new, partly unknown situations, ex ante specification of the conditions under which an intervention will work will necessarily be incomplete. Repeated failures may highlight an inadequate understanding of context, an incomplete decision process, or perhaps an inability to learn from experience. Consequently, it is important to know whether a BP succeeded or failed because of how it was applied (i.e., the application in the field did not closely follow the prescription) or because it was applied in inappropriate contexts (i.e., the intervention did not work under the particular field conditions in which it was applied). The first type of failure may reveal weaknesses in the mental model used to understand the social process whereas the second type of failure may reveal weaknesses in the model used to understand the biophysical system.

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Table 2 A functional decision process models (Brewer and deLeon 1983)

Phase	Description
Initiation	Potential problem first recognized.
Estimation	Contours of the problem and possible alternative solutions explored.
Selection	A course of action or a plan is decided upon and a prescription is promulgated.
Implementation	A program for work in the field is designed and carried out.
Evaluation	Monitoring and appraisal undertaken to determine if goals are being met.
Termination	Ends the current process and replaces it with another one or some other management effort.

Developing more effective BPs requires adequate evaluation of current BPs. Evaluations should (1) address both substantive and procedural goals, (2) determine whether goals were achieved and why/why not, and (3) determine who is responsible

and accountable for success/failures. Lack of agreement on substantive goals early on can lead people to reach different conclusions when evaluating BMP efficacy. For example, after reviewing the scientific literature on streamside management zones, Castelle et al. (1994) concluded that wetland and stream buffers should be at least 15-30 m wide. However, most states recommend minimum buffer lengths less than this range (Blinn and Kilgore 2001). Castelle et al. (1994: 878) lamented that, "wetland buffer policies have often been established with significant regard for political acceptability but with little consideration of scientific data." In contrast, Ice (2004) estimated that BMPs reduce water quality impacts from 80-99% and considered them to be highly effective. What is not immediately clear is that the basis for comparison—hence the management target—is different. Castelle et al. designated watersheds that have not been harvested as their controls (basis of comparison) whereas Ice designated watersheds that have been harvested without the implementation of BMPs as his controls. Ice concluded that BMPs are effective because management that complies with BMPs is much better environmentally than what was done in the past. Someone using the work of Castelle and others might conclude that current BMPs are not good enough because they do not offer as much protection as not harvesting at all would offer. In this case, as in many large scale conservation cases, a realistic baseline that takes social context into account has not been agreed upon. Consequently, potential progress is hindered.

As in many debates about BPs in environmental management, there is an underlying procedural dimension that has not been explicitly evaluated. Just as different formulations of substantive goals for BMP programs can compete, so too can formulations of procedural goals. If BMPs are seen as a way of restoring the chemical, physical, and biological integrity of the nation's water to pristine, pre-Columbian conditions (a substantive goal), then efficacy should be judged based on a comparison of current stream conditions to a hypothetical, pre-Columbian baseline, perhaps. On the other hand, if compliance with BMPs is seen solely as a means of maintaining one's social license to carry out forestry operations (a more procedural goal), then efficacy should be judged in terms of whether the public continues to grant the company a license, irrespective of the actual impacts on water quality. Whereas few participants in the social process are likely to adhere to either of the two extreme positions presented above, an analysis of BMP efficacy should take into account both procedural and substantive goals, regardless. In fact, a rational decision process needs to be in place before a substantive goal can be set.

Adopting a flexible epistemology can be important in developing and evaluating BPs. Once a goal has been articulated, BP methods can be employed instrumentally to achieve that substantive goal. However, developing and deploying a BP using a narrow epistemology is likely to miss critical components of the context essential to the success of the BP. For example, getting ranchers to adopt management techniques that help to minimize negative interactions between large carnivores and livestock may be more successfully accomplished by appealing to their conservation ethic rather than relying on legislative remedies. Because management contexts vary, a BP process that is effective in one system may not work in another system in which the

suite of participants and their goals differ. This fact calls attention to the need to be contextual. For example, community based natural resource management has been promoted as a method for pursuing biological conservation and more equitable economic development. In a comparison of five cases in Kenya, Nepal, and the U.S., Kellert et al. (2000) found that community natural resource management efforts in the U.S. were more effective at meeting these goals. They attributed this to contextual factors including stronger legal support for community based management, and a more organizationally developed and financially supported infrastructure. Evaluating a BP using a narrow epistemology will likely overlook key details that explain why it is successful or unsuccessful in a particular context.

Adopting a flexible epistemology can be important in developing and evaluating BPs.

Learning

Ideally, the search for BPs should engender a continuous, active process of appraising outcomes followed either by termination or modification of the old prescription and implementation of a new one. An unresolved issue in many processes designed to generate BPs is how to identify and incorporate the best available data. Typically, an attempt is made to match the current situation with past situations that are similar. In this section we introduce four methods by which learning can be enhanced—experiments, correlations/statistical analyses, prototypes, and case studies. The utility of a given learning method will vary with context and the order of presentation does not necessarily reflect their relative utility. Furthermore, use of one method does not preclude use of another method.

Ideally, the search for BPs should engender a continuous, active process of appraising outcomes followed either by termination or modification of the old prescription and implementation of a new one.

Experiments

Randomized controlled experiments, which rely on the epistemology of positivism, are a good way to document tight causal connections. For example, the role of phosphorus in lake eutrophication was demonstrated using a series of whole lake fertilization experiments (Schindler 1977). Experiments are invaluable when it is possible to control for all relevant variables. However, the difficulty of constructing well designed, yet relevant experiments in large scale ecosystems is highlighted by numerous critiques of ecological experiments (e.g., Hairston 1989, Hurlbert 1984, Peterman 1990). Even when experiments can be designed, sufficient resources often do not exist to conduct all the experiments needed to control for all relevant biophysical and social variables.

Correlations and other statistical analyses

Often BP prescriptions require using data gathered through non-experimental methods. Correlations and other statistical analyses can be used to discern trends and possible relationships in data without actually experimentally intervening in the system under management. Island biogeography (MacArthur and Wilson 1967), which underlies many BPs in large scale conservation reserve design, is based on a series of correlations between the size and shape of islands and the number of species present. Statistical analyses can also provide information in cases in which direct experimentation is uneconomical, unethical, or otherwise infeasible. For example, benchmarking of environmental performance is an inexpensive technique to identify BPs for industry. Two important caveats exist when using statistical studies to develop BP prescriptions in large scale ecosystem. First, correlation cannot be equated with causation. Second, users must take care to avoid what epidemiologists term the "ecological fallacy"—inferring individual level effects based on population level measurements. Whereas statistical procedures used in quantitative research, including both experiments and studies of correlations, can be used to deduce the properties of the larger population to which a sample belongs, they cannot be used to deduce the properties of a sample from the characteristics of the population.

Cases

In contrast to the quantitative evidence derived from controlled experiments and correlations, case-based evidence is often qualitative and derived from actual practice and experience. For example, Clark (2008) uses case study research based on more than 3\0 years of local experience to diagnose problem of leadership in Greater Yellowstone. A disadvantage of case studies is that there is less agreement on appropriate standards of evidence (e.g., there is no equivalent of a statistical p-value). However, good case research goes beyond the anecdotal and can complement quantitatively based learning. Hypotheses can be formulated and tested, strength of evidence evaluated, and conclusions or lessons learned applied to new situations (Cashore et al. 2004). Whereas experimental or correlation methods are unlikely to account for all of the relevant contextual variables in complex human-environmental systems, case studies allow one to analyze situations in which there are more variables of interest than quantitative data points and triangulate on rational conclusions (Yin 2003).

Prototypes

Prototypes are small-scale trials used in actual management situations as a basis for learning. For example, starting in 1999 the U.S. Forest service started a pilot project to study whether stewardship contracting could be used to address forest stewardship needs through collaboration with local communities. Because they are designed as learning opportunities, the users of prototypes should not expect all prototypes to meet substantive or procedural goals for the system under management. Rather, the goal of the prototype is to generate knowledge so that future interventions will more successfully meet substantive and procedural goals. Some of the challenges to

carrying out successful prototypes include: (1) accounting for the level of risk involved in learning, (2) producing useable results given the relatively high amount of variability in ecological and human systems, and (3) developing interventions that are potentially reversible.

Prototypes are small-scale trials used in actual management situations as a basis for learning.

RECOMMENDATIONS

In this section we offer recommendations that will allow BPs to contribute more effectively to improving outcomes in large scale conservation. In brief these recommendations are (1) understand the role of BPs in the decision process, (2) broaden the search for BPs by using different epistemologies and taking into account the potential to make both make both substantive and procedural improvements in the process of environmental decision making, and (3) diffuse BPs to a wide audience of potential new users by understanding that the BP innovation and prototyping process must overcome restrictive pressures. We expand on these recommendations below.

Decision process improvements

One of the most important tools for successful intervention in a complex system is an adequate mental model of that system. A better mental model is one that allows practitioners to understand and effectively intervene in the system. Substantively focused models rooted in the natural sciences can be used to describe how the biophysical system works and whether it is likely to respond to an intervention. Such models are important in the formation of BPs, however, a successful practitioner will also need to be aware of procedural models if they are to generate BPs that are maximally practical and feasible. Procedurally focused models can be used to bring the social and decision processes into focus. They can be used to determine whether the human social system is likely to be amenable to BP intervention. Full models of the decision process, which combine substantive and process focus, can be used to capture how the decision process actually works (descriptive models) or ought to work (normative models) and how BPs can improve the process and outcomes. Professionals should use a realistic, functional model of the decision process as part of their efforts to come up with and diffuse new BPs. While not the only possible model, the decision process model by Brewer and deLeon (1983) is one that we and other people have found practical. Understanding and seeing that BPs can be part of any management decision process will facilitate improved environmental management.

Each phase of the decision process—initiation, estimation, selection, implementation, evaluation and termination—will involve different participants in different arenas. Environmental problems arise out of conflicting human values rather than

the state of the world, per se. Any attempt to solve a problem without taking into account the human element is unlikely to succeed (Hilborn et al. 1995). Yet the social dimensions of environmental problems are often under-attended to in BP development processes. Consequently, the initiation and estimation phases can be improved by taking into consideration both biophysical and social systems simultaneously. In complex large scale conservation efforts, it may be impossible for all participants to agree upon a common formulation of the problem before action is taken. In such cases, the selected BP prescription may represent a compromise designed to address one of a number of competing formulations of the problem. Those who seek new BPs (e.g., stakeholders), those who develop them (e.g., scientists, managers, innovators), and those expected to implement them (e.g., managers) need to work together throughout the process. BPs tailored in this way will have an increased chance of being implemented as intended. Ongoing independent appraisal of BPs is necessary. However, when there are competing formulations of the problem to be addressed, it may be difficult to find consensus on the evaluation of a BP's efficacy. Finally, it is important to develop a termination plan for programs that have achieved their goals or that clearly cannot achieve their goals.

Understanding and seeing that BPs can be part of any management decision process will facilitate improved environmental management.

Targets of best practices

Those who seek, develop, and use BPs should have a clear understanding of their own standpoint and focus of attention. As noted above, people very much matter in the BP process, including the innovator(s) of BPs. Because most environmental professionals were trained as positivists, most BPs focus on substantive improvements. However, BPs can be used for process improvements too.

At present, the legitimacy of BPs tends to be judged using a positivistic epistemology. However, rigorously vetted quantitative data sought by positivists is not always available in environmental management problems that face practitioners of large scale conservation. Post-positivism is better suited to identifying problems and offering BP solutions in complex contexts. Reductionistic analyses could then be used to confirm the efficacy of the identified BPs. However, studies suggest that successful practitioners do not rely on purely reductionistic methods (Schon 1983). Consequently, we suggest that the case study method be used in the generation of BP prescriptions even when positivistic data are available and used. Once prescriptions have been generated, prototyping exercises can be used in implementation and learning.

We feel that a dual focus on both substantive and process improvements, and the simultaneous use of both positivistic and pre-and post-positivistic epistemologies offers the greatest likelihood that BPs can be found and diffused successfully. To limit

oneself to a narrow focus of attention and a single epistemology is to be less than fully problem oriented, contextual, and multi-method. Furthermore, it is less likely to lead to the identification and diffusion of the best practices that are available.

We feel that a dual focus on both substantive and process improvements, and the simultaneous use of both positivistic and pre-and post-positivistic epistemologies offers the greatest likelihood that BPs can be found and diffused successfully.

Diffusion process improvements

Widespread use of specific BPs requires identifying better solutions to the problems facing people and getting these likely solutions adopted, even in the face of resistance. A familiarity with the process by which innovations are diffused and adopted will expedite the diffusion of effective, context sensitive BPs to a wider audience for use. Rogers' (1995) conceptual model of the adoption process in innovation looks at the diffusion half of the equation (restriction is the other half). Innovations are diffused through a sequence—awareness, interest, evaluation, trial, and adoption. Although more recent authors have highlighted the fluid nature of the process (Van de Ven et al. 1999), we feel that Rogers' model has heuristic value for those interested in diffusing BPs. Innovation can be restricted and fail to be accepted at any of the five stages. For example, the practice can be discontinued (terminated) after being partially adopted, either because of dissatisfaction with the outcomes of the practice or because of the adoption of an even newer practice judged to give superior outcomes or for other reasons. An innovation will not be adopted if a person is ignorant of the innovation, is aware of the innovation but unwilling to adopt it, or is aware of the innovation but unable to adopt it. Awareness of an innovation depends on the characteristics of the innovator, the social system, the available modes of communication, and the time since the innovation was first implemented. People attempting to identify and promulgate BPs should look not only to academic sources for information on BPs, but should also actively harvest their own experiences and that of other people to find lessons and new BPs (Brunner et al. 2002).

A number of characteristics will make an innovation more likely to be accepted and, consequently, more rapidly diffused. The innovation should be: readily observable, and potentially reversible (i.e., it can be tested), compatible with existing values, easy to understand and use, *and* apparently better than current practice. Whereas there is a long history and large body of literature on how to diffuse substantive innovations, the diffusion of procedural innovations has not been as extensively studied. Because process targeted BPs tend to be more complex, less visible, and require changes in norms and standard operating procedures among people and institutions, they are slower to diffuse and more likely to be restricted or only partially adopted. The case study methodology can help to identify and document the substantive BPs. However, other methods can be used during too to understand the adoption process. For example, field trips, workshops, and other arenas can be developed to encourage

dialogue between those who have developed or used the BP and people interested in adopting it. Small-scale prototypes can allow potential users to evaluate a BP on a trial basis without committing extensive resources to the practice.

CONCLUSION

The *Best Practice* concept is an important tool for improving environmental management and the practice of large scale conservation. BPs are provisional prescriptions for improvement that reflect relevant experts' best judgments and mental models. BPs are ultimately about improving the decision making process and its real world effects. Although many BP innovators focus exclusively on substantive improvements, BPs can be used to spur both substantive and procedural improvements. Adopting practical models of decision making, innovation, and diffusion processes can enhance the utility of BPs and facilitate more rapid improvements. Although most BPs rely on rules of evidence and inference derived from positivism, broadening the epistemological foundation of BPs to include post-positivistic methods that attend to contextual factors can enhance the utility of BP prescriptions. Prototyping is a context-sensitive learning strategy that may be the most practical means of rapidly testing, adapting and diffusing new BPs successfully.

The *Best Practice* concept is an important tool for improving environmental management and the practice of large scale conservation.

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Chapter 9

Learning Interdisciplinary Problem Solving and Leadership Skills: A Comparison of Four Designs

Susan G. Clark and Richard L. Wallace[1]

ABSTRACT

We describe four venues for teaching interdisciplinary methods and skills: classroom, workshops, field trips, and applied appraisals. Interdisciplinary method and skill are essential for successful leadership and conservation at all scales in today's complex, dynamic world. Formal university courses that systematically teach the method and skills and their application through cases are very helpful. Workshops are an excellent way to introduce interdisciplinarity to working professionals, who can make connections between concepts and their own experience. Field trips are ideal vehicles to help participants develop problem-solving skills without the real life costs of being wrong, although they are not conducive to systematic teaching of interdisciplinary method. Similarly, applied appraisals can help real life participants to identify their role and influence in the social and decision processes in which they are involved, but are not designed for systematic exploration of the methods or skills. Learning interdisciplinarity is easy for some people, but difficult for others. Many professional and institutional incentives work against learning interdisciplinarity and applying it in practice. Nevertheless, many former students and professionals in these four designs have told us, and have demonstrated through their professional work and experiences, that interdisciplinarity has been invaluable to them.

Interdisciplinary method and skill are essential for successful leadership and conservation at all scales in today's complex, dynamic world.

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Key words: *Interdisciplinary, problem-solving, leadership, skills, education, policy, common interest, policy sciences*

INTRODUCTION

Those who are skilled in interdisciplinary method offer a mix of expertise, analysis, sponsorship, authority, leadership, process management, and decision-making experience to help address important problems (e.g., large scale conservation, Chrislip and Larson 1994, Ryan 2001). They have a highly sought after "value added" skill set that is sometimes also called the policy sciences. We use the terms policy sciences and interdisciplinarity interchangeably. This interdisciplinary skill set is an explicit, systematic package of problem solving, contextual operations, an analytic habit, and critical mindset as described below (see Clark 2002). This skill goes far beyond disciplinary and multidisciplinary approaches, or merely possessing an aspiration, desire, or predisposition to be interdisciplinary or even a sense of one's self as an "interdisciplinarian."

Those who are skilled in interdisciplinary method offer a mix of expertise, analysis, sponsorship, authority, leadership, process management, and decision-making experience to help address important problems.

Furthermore, interdisciplinarity is unlike views held by conventional problem solvers (e.g., disciplinarians, multidisciplinarians, positivists and post-positivists). In contrast, effective interdisciplinary problem solvers exercise skills in critical thinking and judgment, integrating diverse knowledge and experience in unique contexts, large and small, in order to influence and improve policy-making. Individuals can learn interdisciplinary skills in university programs, on their own, on the job, through workshops or other specialized training, or in some other way. No matter how they learn the skills, skilled interdisciplinary problem solvers ensure that decision processes are appropriately managed, technical credibility is achieved, and problem-solving groups are enabled to produce reliable and persuasive decisions that are supported by a broad audience and work in practice. Brunner et al. (2002, 2005) use interdisciplinarity in this sense in their treatment of adaptive governance in natural resource conservation (see Chapters 1, 2, 3, this volume). This is how enduring solutions to large scale conservation and other problems come about.

Effective leaders show good timing, respond to clear needs, and may or may not be highly visible to the public. They inspire commitment and action, lead in problem solving, encourage broad-based involvement, and sustain hope and participation. Chief among their skills is helping to clarify goals, map events and social interactions, identify the underlying conditions that drive these events, project future outcomes, and select practical alternatives. Leaders understand the value demands and identities of potential followers, and use this knowledge to fully engage and meet the needs of participants. In

short, they raise people and themselves to a higher level of motivation by empowering others and providing a new sense of perspective and energy. Finally, effective leadership includes promoting and safeguarding the process of deliberation in the common interest.

In this chapter we review our 40+ years' combined experience in teaching, learning, and applying the method of interdisciplinarity in diverse applied and academic settings, focusing largely on environmental studies, science, and management and policy problems. We examine the goals and challenges of our teaching, describe four complementary pedagogic designs (i.e., classrooms, workshops, field trips, and applied appraisals) that we have used, and offer recommendations to more effectively teach, learn, and apply the method.

EDUCATIONAL GOALS AND AN INTRODUCTION

Harold D. Lasswell conceptualized the interdisciplinary method and characterized a skill set more than 60 years ago (Lasswell and McDougal 1943). Lasswell (1971 and earlier) called this skill set the policy sciences. He had a pragmatic view of the way the method should be used: a skilled problem solver must be problem oriented and analyze social and historic contexts in order to understand policy processes, which are actually political/value phenomena. His analytic framework, a logical and comprehensive model, touches on the key parameters in social and decision processes. The method offers a way to see problems and solutions that are practical, macroscopic as well as microscopic, and sometimes radical, and they offer an overriding goal for policy making—human dignity in healthy environments for all people (McDougal et al. 1980, Lasswell and McDougal 1992).

The interdisciplinary method, developed by Lasswell and colleagues last century, offers an analytic framework, a set of concepts, and a vocabulary that can help people solve problems (see Lasswell 1971, Lasswell and McDougal 1992, Clark 2002). Teaching the method and fostering these problem-solving skills is challenging. It is sometimes hard to coach people in the "pragmatic and heuristic attitudes" embodied in the interdisciplinary method and to focus them on better understanding policy problems and solutions in the context of serving common interests (Marvick 1977: 66). The challenges are, first, to encourage people to examine contexts thoroughly and to base their learning and action on evidence (as time and resources permit), and, second, to clarify for them the paramount significance of their own standpoints and perspectives in directing their inquiry of problems and solutions. Learning and applying these skills present an easy reach for some people, yet can be beyond the grasp of others. Command of the method and skills is influenced by students' predispositions and preparedness, their focus of attention (e.g., "boundedness"), the dominance of conventional (i.e., technical, positivistic) outlooks and traditional disciplines, the difficulties of clarifying their standpoint, the challenges of integrating knowledge and action, experience levels, and confusion about the nature and significance of interdisciplinarity and problem-solving. However, our experience has shown that most people can improve their problem-solving through even a little exposure to

interdisciplinarity. Using parts (e.g., contextual mapping, problem orientation, decision process appraisal, standpoint clarification) selectively can be invaluable.

The interdisciplinary approach focuses on structuring problems and finding solutions. It is also a way to address problems of meaning (Brunner 1997a,b,c). It is particularly useful for large scale, seemingly intractable problems, but useful at all scales. The method helps people develop skills in critical thinking, observation, management, and technical matters (summarized by Arnspiger 1961, Muth and Bolland 1983, and others). The analytic framework can be represented as in Figures 1 and 2 (see page 180, and the skills can be described as in Table 1 (see page 182).

The interdisciplinary approach focuses on structuring problems and finding solutions.

Teaching goals

We teach interdisciplinarity in formal classes, workshops, field trips, and applied appraisals (see Patton 1997). Our broad teaching goal is to help students, professionals, government authorities, and advocates, through the rigorous application of interdisciplinarity's skills and perhaps new ways of thinking, to become leaders in real-life problem-solving contexts, to equip them with a method and skill set to address problems, regardless of the form they take or their personal or geopolitical location. We have developed our educational goals specifically in arenas for conserving, managing, and sustaining natural resources and allied social and policy arenas.

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Thus our work is in keeping with Lasswell's later work, in which, in Marvick's (1977: 4) understanding, Lasswell was preoccupied with pedagogic questions, such as how to "equip a cadre of modern intellectuals so they can significantly help to cushion the shocks in store for humankind, as a world of cosmic complexities comes inexorably into being." For Lasswell, these shocks and complexities involved problems in modernity, democracy, and economy, as well as personal freedom and social justice. Degradation of the biosphere, climate change, globalization, and security issues (both national and international) might also be added to this list, as described, for example, by Dahl (1998), Turner et al. (1990), Sandler (1997), National Research Council (1999), Harper (2001), and Brezinski (2007). These forces, factors, and accelerating rates of change could lead to horrendous social disruptions,

psychological stress, and irrational or maladaptive behavior that could threaten public and civic order everywhere (see Muth et al. 1990). Interdisciplinarity was invented to help people meet these kinds of policy problems—small and large, personal and global.

The goals of students are diverse. (For the purposes of our discussion here, we will use the term "students" to include not only college and university students, but also participants in workshops and field trips from government, advocacy, and professional backgrounds.) Graduate students in the Yale School of Forestry and Environmental Studies program, where Clark teaches, for example, come from a highly selective and self-selected professional and admissions process in the School. About one-third of the students are international, and come from several dozen countries. As a group they present a diverse profile not easy to summarize. At the risk of oversimplifying their perspectives, we have observed that on entering the school many students believe that improving policy for managing natural resources means learning positivistic science through a specific discipline (such as economics, political science, or biology), presenting objective findings to decision makers and the public, and trusting that policy will automatically be improved as a consequence (see Pielke 2007). They see their basic job in graduate school as acquiring scientific knowledge (positivism and facts) and skills in, for example, communication, cost-benefit analysis, conflict resolution, geographic information systems, computers, public relations, or some other set of disciplinary methods—a mix that they assume will provide them with a complete tool kit for effective professional leadership. Their views, however, often change over their university careers, especially those who take courses in interdisciplinary studies, including the policy sciences. This is evidenced in what they say, how they write, and how they conduct their work.

Wallace teaches interdisciplinarity as part of his curriculum at Ursinus College where the student population is much more homogenous than Yale's. As well they are younger and tend to enter the academic realm with less of a bias toward positivistic or disciplinary problem-solving strategies. However, the explicitly interdisciplinary critical method and thinking approach of interdisciplinarity is a new experience for them too, and the (anecdotally observed) cognitive changes that occur during their education show that they accept the tenets of interdisciplinarity's problem-solving tools. They perceive how interdisciplinarity works, and they leave their undergraduate years with an understanding of the importance of its goals and skills.

Workshop and applied appraisal participants, however, are quite different from university students. Participants are between 30 and 60 years old and have positions with nongovernmental organizations, state and federal agencies, and appointed or elected jobs. A few are retired from business, law, or some other profession. Most have between a decade and several decades' experience on the job after college or graduate school. They are often mired in the details and complexity of everyday work and have little time to reflect, clarify their standpoint, or stand back from the blizzard of daily minutiae in order to gain an overview of the social and decision processes of which they are a part. Many are solidly conventional, but many are also open to hearing about and learning interdisciplinarity.

This diversity of motivation, knowledge, and experience has prepared many students to engage themselves with interdisciplinarity. Some students are strongly predisposed to shift from conventional to a more self-reflective understanding of themselves, problem-solving, and their world. Nonetheless, there are educational challenges that must be met.

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Educational challenges

First among the challenges in teaching and learning interdisciplinarity is the fact that students do not yet share a "stable frame of reference" (e.g., the policy sciences analytic framework). People come with diverse backgrounds, disciplinary knowledge, and expectations. Some are quite experienced and seem predisposed to appreciate interdisciplinarity, and may even have invented a partial set of equivalencies on their own. The concepts and terms come easily to these individuals. Most students, however, are not prepared to engage interdisciplinarity fully or directly in the beginning. Some resistance is expressed. By the end of their educational experience, however, most are receptive to interdisciplinarity and knowledgeable about what is required of them to apply the method skillfully. Regardless of their initial receptivity, most students pick up interdisciplinarity's ideas selectively when first exposed to them. For instance, the concept of problem orientation appeals to some people, whereas others seem to "get a handle" on it through an understanding of social process, and for some the notion of decision process gives them access to the whole. In an instance, based on his professional experience, one individual was at first taken by the termination function and through his exploration of that category subsequently came to embrace interdisciplinarity. This was because, as an agency professional, he was charged with closing down a successful captive breeding center for rare species. In the face of much resistance to his assigned task, he learned how to think about the task, proceed in a humane, ethical way, recognize and reward the good faith contributions of employees, and smooth a transition that worked for everyone involved. Resources and personnel were used elsewhere to great conservation advantage.

A second challenge is overcoming "convention." Many students are decidedly "bounded" because of their restriction to ordinary, everyday concepts, language, and method. Many, perhaps most, students come with a conviction, based on their educational and personal experience, that solving problems means carrying out positivistic, disciplinary operations (e.g., cost-benefit analyses, ecological surveys, social assessments, legal analyses, statistical calculations, see Schön 1983, Brunner and Ascher 1992, Morcol 2001).

Students' bounded focus of attention, and thus their problem-solving efforts, are generally limited to selected situational factors and specific biophysical entities (e.g. soils,

water, plants, animals, atmosphere), the people present ("politics"), or organizational "imperatives" (e.g., authority relations, structures, values). When adopting a problem-orientation, for example, students tend to describe and analyze trends and conditions in ecological variables while neglecting to clarify goals, make projections in social and decision process, or devise workable, context-specific alternatives. In all cases, they overlook the importance of clarifying their own standpoint.

Typically, many students believe that improving decision making is a matter of increasing the amount of scientific (factual) information available to the decision process. According to Pielke (2007) and others, this "linear science-to-policy" model, in which scientific information always feeds into policy decisions, has been shown to be misleading in practice. The other misleading model students typically possess is the "public deficit" view, in which the public is seen as ignorant or lacking in knowledge, and the job of the problem solver is to generate information to give the people. Both models seek to upgrade the substantive rationality in policy making. In mapping social process, students tend to focus on people, organizations, and the "personalities" and "politics" of the situation while failing to explore systematically the full range of perspectives, the base and scope values at play, participants' strategies, short- and long-term outcomes and effects on value institutions, or other factors.

Typically, many students believe that improving decision making is a matter of increasing the amount of scientific (factual) information available to the decision process.

When it comes to decision process, students tend to focus on formal laws, positivistic science, advocacy, and the courts, while paying less attention to the value shaping and sharing process and the interrelated functions and standards that constitute a complete decision process. They pay attention to different functions of the decision process to varying degrees, usually overlooking some altogether and ignoring the recommended standards of quality decision making. They often express the notion that poor decision making results from too much "politics" and too little "science." In short, some students conventional, bounded outlook predisposes them to understand the policy process in selective and misleading ways. They thus fail to perceive the blind spots and omissions that impede their own comprehensive understanding of policy process (e.g., large scale conservation), including their own standpoint biases.

In describing their goals, many students claim that they want to gain skills in how to translate ideas into solutions, empower people, strategize, and encourage constructive technical and social change. They want to be holistic in their approach and keep the "big picture" in mind. They envision themselves bringing together coalitions of people to solve problems collectively and hope to learn integrative skills. Highly optimistic, smart, sociable, and articulate, they have a sense of purpose and are dedicated workers. They often strive to develop good ideas, learn to listen, maintain open minds, pay attention to context, and become self-reliant. They seek to be

inclusive of diversity, realizing that there are lots of ways to achieve good conservation outcomes and that they must thus be flexible, experimental, and "learning" oriented. They understand the importance of cooperation, and they find ways to work together by talking with people, setting good examples, mobilizing others to solve problems, and gaining broad support. They seek applications in a wide variety of terrestrial, aquatic, and marine situations all over the world. Many are highly skilled in positivistic science and the disciplines, GIS, and computers. Their experience is also broad, including the Peace Corps, the United Nations, governments across the globe, high-profile as well as small-scale NGOs, and a multitude of national and international projects in rural and urban communities. Few aspire to be leaders in the command-and-control mode of simply telling followers what to do. They strive to understand the needs and interests of people. Finally, they want hands-on experience and want to do the needed work on the ground themselves. In many ways they are seeking interdisciplinarity and the skills it fosters, but often do not know it.

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Many students, including participants in workshops and fieldtrips, show a conventional understanding of themselves and their world in the beginning. They accept the received set of ordinary, everyday conditions surrounding them as commonsense, normal, and natural, which leads them to see complex social and decision process problems in conventional terms too, for example, merely as conflict among personalities, as interpersonal and inter-group politics, as institutional territoriality, or as funding limitations. In contrast, an interdisciplinary approach introduces a functional understanding of the problems that arise from social process, decision process, competing myths, differing problem definitions, values and institutions, and other dynamics of social relations. The interdisciplinary framework that we use serves as a "stable frame of reference" that permits users to see and analyze any social and decision process at the level of functional relationships.

A third challenge is that students find it difficult to clarify their standpoints and integrate what they know into a judgment for which they are willing to accept responsibility. They tend to assume at first that they are more or less objective, neutral, and operating in ways that serve the common interest, and some are surprised to discover their own biases. This disconnect between the personal theories of action that people espouse and those they implement is common (Argyris 1993). Many students find it difficult to confront their own epistemology, cognitive status, disciplinary prejudices, and conventional notions about policy processes, other people, values, and politics. It is, in fact, possibly the most difficult part of learning interdisciplinarity. They are also typically unable to articulate how they understand what problems are and how to solve them and to integrate knowledge for decision purposes (see Schön 1983). Interdisciplinarity courses, workshops, field trips, and

applied appraisals all ask people to learn a new way of thinking and a new view of themselves as individuals, problem solvers, and leaders. When students are asked to think differently, they are really being asked to *be* different. Some students are open, flexible, predisposed, and more than ready to "shift gears" and embrace interdisciplinarity. Others resist for many reasons, some of which we have described above.

Finally, there is confusion about what interdisciplinarity is. In the university setting, students are bombarded with models, theories, and methods, and they often assume that interdisciplinarity is just one among many more or less equally valid or useful competing theories, approaches, or paradigms about the world. In addition, many partial "equivalencies" of interdisciplinarity have been invented in the various disciplines, and the authors of each of these promote their approaches as new or revolutionary. Students have no basis intellectually or experientially to compare the theoretical coherence or practical utility of various constructs, old or new. This is confusing to some students, who may lose their way or orientation, but after they gain enough knowledge of interdisciplinarity they often come to see that this approach systematizes their understanding of problems and contexts, gives them a way to understand all the other models, theories, and methods, opens up the possibility for them to understand their own standpoint, and provides them with a more practical way to address problems of concern.

These challenges are similar to those described by Brunner and Ascher (1992), Brunner (1997a, b,c), Clark et al. (2000b), Clark et al. (2002), and many others. Brunner (1997a: 219-221) observed that (1) students "misunderstand interdisciplinarity as merely one of many parallel approaches to public policy," (2) "were concerned that their intellectual control depended upon a choice among partial approaches," and (3) "often presumed that theory in the social sciences was inadequate for policy purposes." His students requested that his seminar provide (1) "more examples of knowledge application in interdisciplinarity," (2) "more emphasis on knowledge integration," and (3) "more explicit attention to self-orientation in the policy areas selected for individual term papers" (p. 222-23). Our students make the same requests. These challenges are more or less remedial with appropriate instruction and experience.

Educational designs

Interdisciplinarity can be taught, learned, and applied through diverse designs. Semester-long classes offer the most time to learn interdisciplinarity more formally and to conduct case applications. Short workshops combine theory and cases focused on specific problems and skills. Field trips are more "hands-on" experiences that bring students into direct contact with problems, the people involved, and their situations. They are more salient in personal terms. Applied appraisals can take many forms, varying from a single day of discussion to a series of meetings over time in which an explicit exploration of methods is possible and excellent command of the method and skills is required. Although the goals and challenges in teaching and learning interdisciplinarity are similar across all four venues, each has unique features. There are other ways, of course, to learn (e.g., from reading and experience on one's own or

discussion with others who are already skilled). We focus on these four approaches here based on our experience with them and because they have utility.

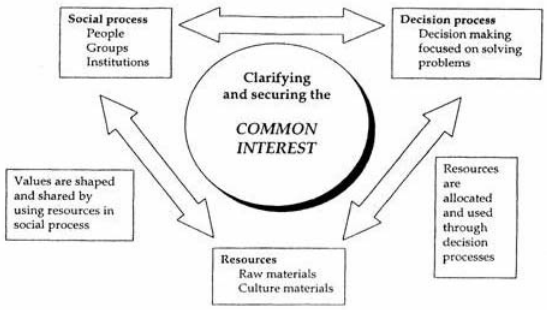
Interdisciplinarity can be taught, learned, and applied through diverse designs.

Basic content design

No matter what the educational setting, in all cases we try to teach the interdisciplinary framework in one way or another (Figures 1 and 2). Our means vary depending on the audience, time, and educational design. In the classroom we can address the method, concepts, vocabulary, and the framework's elements in sequence, whereas in workshops, field trips, or applied appraisals we tend to focus on "problems" first and bring in social and decision process considerations as the problem is explored. We emphasize standpoint clarification in all cases.

No matter what the educational setting, in all cases we try to teach the interdisciplinary framework in one way or another (Figures 1 and 2).

Figure 1 A generalized view of the natural resource management policy process. People carry out decision processes in order to allocate and use resources, which affects how values are shaped and shared in society. The process is the means by which people clarify and secure their common interests



Source: Clark 2002: 15

Figure 2 The principal dimensions, categories, and terms of interdisciplinary approach to problem-solving organized into a framework

Source: Clark 2002: 10

We generally begin by describing the challenges that confront professionals in the complex context in which the students are working or will work. If possible, we offer an overview of social science theory about individuals in society (i.e., social process) and then list, describe, and illustrate the categories of problem orientation, social process mapping, and decision process mapping, along with values, the maximization postulate, and the principle of contextuality (only in applied appraisal does this step sometimes become implicit, or "coded," depending on the background and preparedness of the students). Regardless of the context, it is essential to present all this material in light of the overriding goal of human dignity. We employ problem orientation to define problems and help students to clarify their standpoints, examine methods available to map, analyze, and present results, and examine human rights and common interests. The manner in which we cover this material varies, depending on the context, from a methodological and explicit exploration in a semester-long class to an applied appraisal's more limited opportunity to identify the relevance of human dignity, values, and common interest in a narrow context.

In all our educational designs we focus on the concept of human dignity and common interest. We emphasize that human dignity begins with individual people. Individuals are valuable in themselves; they are not means for some other end (e.g., labor/economics). Dignity concerns both the individual (an identity with patterns of loyalty and desire for respect and well-being) and society (the community collective in which individuals live). According to Kelman (1977: 48-49), human dignity is about the individual in a community context, wherein the person is "part of an interconnected network of individuals who care for each other, who recognize each other's individuality, and who respect each other's right." It is also about the basic notion that individuals are entitled to live their own lives around their own goals and values, and whether they are capable of making free choices.

[1] Basic values are power, wealth, enlightenment, skill, respect, affection, well-being, and rectitude.

In all our educational designs we focus on the concept of human dignity and common interest.

We stress that a common interest is one that is widely shared and embraced by people in a community, and that a common interest is at stake in most cases because people with their special interests are interacting in a community. Common interests are difficult to clarify and secure in advance or in the abstract. There is no single formula for deciding a common interest in any or all situations. There are, however, three tests—procedural, substantive, and practical—that can be used to help us make informed judgments about common interest processes and outcomes in specific contexts useful to appraise social and decision process (Brunner et al. 2005). For example, it is known that voluntary approaches to community problem-solving serve common interests better than coercive approaches. We try to assess whether programs are inclusive and allow for responsible participation, whether they take into consideration valid and appropriate concerns of the participants, and whether they uphold the expectations of those who participated in good faith. This approach

increases our capacity to appraise policy processes and improve them to better serve the common interest.

One way that we introduce interdisciplinary problem-solving concepts is as a basic four-part set of skills (critical thinking, observation, management, and technical matters; see Table 1) that can be represented with questions, analytic categories, and operations (Table 2). *Critical thinking* involves carrying out the five intellectual tasks of problem orientation. *Observation* and *management* focus on what to observe, research, and manage. *Technical* skills include qualitative and quantitative expertise in the natural and social sciences that provide professionals with distinctive tools for addressing problems, especially those requiring a procedural disciplinary focus. These skills target social and decision processes and the observer/researcher/manager (i.e., the analyst). Mapping social and decision processes in any policy problem will typically suggest productive lines of investigation and alert students to aspects of the political landscape that can help in solving problems.

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Table 1 Skills essential for interdisciplinary problem-solving (after Lasswell and McDougal 1943).

Skill	Description
1. Skills of Thought (Critical Thinking)	
Goal-Thinking	Normative standpoint. Value clarification.[1] Basic values of democracy and how to relate them operationally to people and concrete situations.
Trend-Thinking	Historic standpoint. Past trends appraised according to the degree of goal attainment and the distribution of basic values.
Scientific-Thinking	Scientific standpoint. Identification of variables that condition the democratic value variables.
Future-Thinking	Projective standpoint. Creative thinking about future probabilities appraised according to the degree of goal attainment and the distribution of basic values.
Alternative-Thinking	Practical standpoint. Invention, evaluation, and application of alternatives or solutions to overcome problems and achieve goal.
2. Skills of Observation	
Extensive Procedures	Professional observes a particular situation for a brief time and uses simple methods, such as rapid assessments, brief surveys, and cursory reports of a situation.
Intensive Procedures	Professional observes a particular situation for a long time and uses complex methods, such as individual behavioral studies, population or community studies, and detailed ecological and human studies of historical or current situations.

3. Skills of Management	
Primary Relations	Persons with whom a professional deals individually.
Public Relations	Persons with whom a professional deals as members of a larger group (e.g., the public, students, bureaucrats).
4. Skills of Technicality	The distinctive skills of the professional, such as evolutionary and ecological theory, qualitative and quantitative methods, statistical and computer skills, theoretical and applied social skills, including social process or context mapping and communication skills, both written and oral.

Table 2 Interdisciplinarity can be taught as a four-part set of skills for effective problem-solving. These are listed in the first row, followed by a set of questions, and then by the operations and/or categories to be researched and managed and examples of methods that might be used. These concepts and terms are described in Lasswell (1971).

Critical thinking	**For both:**		**Technical concerns**
	Observation	**Management**	
How to be both procedurally and substantively rational?	What to observe and research?	What to manage?	What disciplinary-based tools are needed?
Tasks in problem orientation	Social process – context		Theory/methods/tools
Goals (value task)	A. Others		Knowledge system positivism post-positivism
Trends (historical task)	Participants experts authorities special interests "unknowledgeable" nonhuman life forms		Discipline(s) anthropology ecology economics history literature political Science philosophy psychology sociology others
Conditions (science task)			
Projections (futuring task)			
Alternative (practical task)	Perspectives identity expectations demands myths		Interdisciplinary
	Situations (arenas) ecology (space/time) institutions crises		Theories evolution relativity others
	Base Values well-being, power, wealth, affection, skill, respect, rectitude, enlightenment		Qualitative, quantitative open-ended surveys questionnaires sampling mathematics statistics others
	Strategies educational diplomatic economic force		Technology microscopes remote sensing computers GIS others
	Outcome-Decision Process intelligence – planning promotion – debating prescription – deciding invocation – enforcing application – admin. appraisal – evaluating termination – ending		Methods cases

	Effects – Decision Process innovations – practices diffusion – restriction B. Self (Clarify Standpoint) Role(s) tasks factors orientation lens (social process, decision process, values)	correlations experiments prototypes

Interdisciplinarity can be taught as a four-part set of skills for effective problem-solving.

Active learning design

In all educational settings, we use an active, cooperative learning approach (Cooper et al. 1990). "Active learning" engages students in activities other than listening to lectures and taking notes. There is less emphasis on transmission of information to passive recipients and more emphasis on students' development of understanding, skills, and self-awareness. This approach helps motivate them to become more engaged with the subject and gives them immediate feedback from the instructor and classmates. Employing active learning requires flexibility in ways to achieve individual and cooperative learning (Herreid 1998) and integrating academic learning with on-the-job application (Batchelder and Root 1994, Banner and Cannon 1997). Abundant research shows the benefits of active learning. For example, student concentration declines during lectures after 15 minutes by about 25 percent. The AAC Task Group on General Education (1988) found that active learning encourages students to hear, understand, interpret, and integrate ideas better. Astin (1985) noted that students learn by becoming involved, which active learning accomplishes more effectively. Chickering and Gamson (1987) concluded that students learn best when they are required to talk about a subject, write about it, and apply it. Finally, the Study Group on the Conditions of Excellence in American Higher Education (1984) stated that active modes of teaching should be used wherever possible, since they require students to take greater responsibility for learning.

In all educational settings, we use an active, cooperative learning approach.

Among the different levels of cognitive activity involved in education (Perry 1985), active learning in particular requires a "high order" of thinking (e.g., analysis, synthesis, and evaluation) very similar to interdisciplinarity. Understanding and applying interdisciplinarity also requires a high order of thought, a special kind of "disciplined rationality" that depends on memory, comprehension, application-analysis synthesis, and evaluation (Sheppard and Gilbert 1991).

We employ a variety of active learning methods. In the classroom, we give students questions, short exercises such as "mind mapping," critiques of newspaper and other articles, and videos. We also use guest speakers to relate how they have used interdisciplinarity and to demonstrate specific applications. As part of this, we ask students to describe an example of one of the value categories, or we ask groups of three or four to come to an agreement on a definition of a value or indices of how well it is shaped and shared in particular situations. Such questions lead to productive discussions and standpoint clarification. We often focus on the respect value. We also have students read short news articles, analyze them on the spot (e.g., for the values involved), report to the class, and discuss them. The two page "Policy Forum" articles from *Science* magazine are useful for analysis and may be discussed in the subsequent session. In-depth discussion leaves students with much greater retention of information, more problem-solving skills, and higher motivation than lectures (Hyman 1980, McKeachie et al. 1987, Cross 1999). Student involvement in the learning exercises means, however, that we cannot cover as much lecture material as we might otherwise present. We keep class sizes between five and twenty-five students. Active learning is best accomplished in smaller classes. In fact, it has been shown that most learning takes place in small groups (Tiberius 1990).

Good teachers, according to Wilen and Clegg (1986), try to phrase questions clearly, ask questions that are primarily academic, yet practical, and pose a lot of questions at low cognitive levels as well as at higher levels. This combination seems to produce effective learning. Some students volunteer answers readily, but we try to balance their participation by inviting responses from those who seldom volunteer. At first, we ask simple questions that encourage a high percentage of correct responses from students and help with incorrect responses. We acknowledge correct responses promptly, and encourage exploration of responses that miss the mark. We often probe student responses to get more complete responses and to gain insight into how they arrived at their answers. Any student resistance to active learning must be overcome; for example, shy students require more encouragement. Some of our international students, in fact, come from educational settings in which they have never entered into open classroom discussions or given presentations before their classmates.

Student presentations, either individually or in small groups, permit each student to make a unique contribution, to learn and share complex material (often from multiple sources), and to exercise skills in evaluation, application, analysis, synthesis, conflict resolution, and presentation (Bonwell and Eison 1991). Group efforts provide experience in team building and collective problem-solving, participation by all members, interdependence, status equalization, involvement, and listening (Jacques 1991, Westberg and Jason 1996). In addition to oral presentations, our students are required to write substantial analytic papers (see Chapters 4, 5, 6, this volume).

Courses, workshops, field trips, and applied appraisals

Interdisciplinarity represents a new way of thinking, analyzing, and understanding problems for many students, and mastering these needed skills makes new demands on them. In all cases, we try to tailor classroom experiences, workshops, and field trips

to students' foci of attention, backgrounds, and perspectives at the time they begin, but move well beyond those by the end of the exercise. We describe interdisciplinarity as a tool for integrated problem-solving in real world contexts requiring particular skills. All students are expected to engage themselves with the materials and with each other, and to participate actively throughout the semester, workshop, or field trip. We encourage them to assess and discuss their evolving understanding of interdisciplinarity, the policy process, and their applications. Analytic case studies keep their learning grounded and relevant to their interests. We spend considerable one-on-one time with most students and groups. No two classes, workshops, or field trips are identical, and, in fact, they often vary considerably. We feel that a mix of the four designs best allows students to learn and apply new methods and skills to the practice of conservation.

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Courses

One of the best and easiest ways to teach and learn interdisciplinarity is through a formal college or university course that systematically illustrates interdisciplinary skills and their application. A semester allows time to develop the concepts and methods and demonstrate their application, and gives students a chance to analyze and present a case of their own using the analytic framework, either individually or as part of a team. Using interdisciplinarity's framework and skills goes far beyond conventional examination of cases, which are commonly part of more traditional courses too. Selected supporting materials (e.g., readings, exercises, videos, guest speakers) aid the instructional task. We regularly offer three graduate courses (SGC) and one undergraduate seminar (RLW) that teach interdisciplinarity overtly, and our other courses include aspects of interdisciplinarity. We have taught many courses over the last 25 years that illustrate what is involved.

Using interdisciplinarity's framework and skills goes far beyond conventional examination of cases, which are commonly part of more traditional courses too.

First is "Species and Ecosystem Conservation: An Interdisciplinary Approach." This course is designed as a full introduction to the policy sciences. We have found that students' initial interest is as much about biological conservation as it is about applying interdisciplinary problem-solving to the problems of declining species and ecosystem loss and their restoration, conservation, and sustainability. We spend considerable time in problem orientation, examining goals, trends, conditions, projections, and

alternatives. This class, which Professor Clark has taught more than fifteen times since 1990, reaching over 300 students, is an opportunity for students to integrate their course of graduate study with their experience and interests and to develop a broad range of key problem-solving skills for their future conservation work.

Second is "Foundations of Natural Resource Policy and Management," which Professor Clark has co-taught at various times with Andrew Willard, a research fellow formerly at the Yale Law School, and with David Mattson, of the U.S. Geological Service. Team teaching greatly strengthens this course. In Clark, Willard, and Christina Cromley's (2000) book of the same title, which is based on their experience teaching this course, the authors describe the course's background and format and their view of natural resources, introduce interdisciplinarity, give their own and student evaluations of the course, and list the topics that students have researched and presented (Clark et al. 2000b). A valuable outline for researching and writing on any topic is given. Students can use the outline to see how the interdisciplinary method and framework are woven into a format that is easily communicable to lay audiences. This course focuses explicitly and systematically on interdisciplinarity as a basis for investigating ways to improve any policy process and to clarify what sustainability of natural resource policy and management means in practice. The notion of sustainability is illuminated by the interdisciplinarity theory central to the course. The purposes of the seminar are, first, to introduce students to comprehensive and integrated methods for thinking about and proposing solutions to problems in natural resource policy and management and, second, to help students gain greater control over these methods by applying them to particular problems and writing and lecturing about their case studies. The course is limited to 18 students. This course has been offered fifteen times and has served about 200 students. In some semesters there have been international students from as many as 10 different countries.

Third is "Advanced Environmental Policy Analysis," an upper-level undergraduate seminar designed to serve students who have a particular interest in the application of social theory to environmental problem-solving. Professor Wallace has taught this course six times at two institutions over the past ten years, most recently at Ursinus College. At Ursinus the course serves students interested in spending a semester focused intently on developing critical thinking skills in preparation for graduate study or a policy-oriented professional position. Most of the students enrolled in the class are environmental studies majors. The environmental studies major at Ursinus is explicitly designed to help students develop analytical skills by introducing and applying aspects of interdisciplinarity in varying contexts beginning in the freshman year. By the time they take the advanced seminar, they have had substantive experience with base and scope values and problem orientation and are prepared to spend a semester working with interdisciplinarity's central theory. In this seminar students engage in a systematic exploration of interdisciplinarity's main themes and frameworks, using Clark (2002), primary interdisciplinarity literature, and many case studies in the literature, current news, and film. As with the "Foundations" course, above, this advanced seminar is designed to help students gain a stronger grasp of critical thinking skills by explicitly using and reflecting on the use of social theory in

practice. By the end of the semester, if the course goals have been met, the students have a heightened sense of self-awareness that allows them both to identify their standpoint in any social process and to analyze the behavior of other participants using analytic tools of interdisciplinarity. In a sense, the course is run as an exercise in self-reflection as well as a social theory seminar, simultaneously challenging the students to learn about themselves and about the theory and methods of interdisciplinarity.

All three of these courses receive strong, positive evaluations from the students who take them. They typically say the course was demanding and rewarding. Student comments reflect the challenges of the work required of them. One of the positive attributes of these courses is that they are unlike any other courses, or any other approaches to theory and method, offered in students' respective programs. They stand in sharp contrast to other conventional courses. While some student feedback reflects frustration with the approaches and demands of the courses, making it clear that interdisciplinarity is not for everyone, generally the evaluations show that the courses are highly valuable to students. In short, the student demand is for exercises that help them to develop their thinking and problem-solving skills, and students recommend these courses to their peers. It is common to hear from students years after they took one of these courses, reflecting on the value of the experience. Their work, reports, and papers attest to their command of the method and skills.

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Workshops

One way to help people develop problem-solving skills in large scale conservation, for example, with potentially long-lasting benefits is through workshops for working professionals (Hanna 1994, Braus and Monroe 1994, Clark et al. 2002, Mattson et al. 2006). Workshops can meet the growing need for more effective performance, helping professionals move beyond narrow, technical outlooks by articulating and strengthening new ways to synthesize information, think critically and creatively, and solve public policy problems (Sullivan 1995).

Dr. Clark has carried out twenty workshops on natural resource issues in the Greater Yellowstone Ecosystem (in Jackson, Wyoming; Bozeman, Montana; and Denver, Colorado), three in Banff National Park with regional Parks Canada staff, and one in New Haven, Connecticut, on wetlands conservation with officials from town, state, and federal government levels, universities, and advocates. Professor Clark also led workshops with government professionals in Australia over a five-year period in the 1990s, the purpose of which was to introduce agency personnel (in most cases) to interdisciplinarity. Based on the Yale courses described above, the workshops consisted of lectures, readings, case analyses, presentations, and discussions, although, of course, the content was greatly shortened and the focus was on specific issues of concern to the attendees. Typically taught over a few days, the workshops usually

targeted specific audiences and particular problems, or they were designed to teach policy analytic method and skills to professionals or students, usually under the rubric of "interdisciplinary problem-solving" or "better outcomes for conservation problem-solving" (Clark et al. 2002). Among the North American workshops, themes included problem-solving, strategic planning, governance and natural resource management, endangered and special management species (e.g., grizzly bears, wolves, mountain lions), and ecosystem conservation. These workshops were one to two days long and followed a schedule similar to that for the earlier Australian workshops (see Clark et al. 2002).

Workshops require that instructors or leaders undertake considerable preparation in advance—working with participants, developing shared expectations, and discussing content and methods. Typically, for example, Professor Clark met with all the participants in advance to build relationships, preview what would be covered, and familiarize herself with the issues or problems that participants wanted to address in the workshop. Standard adult education techniques were used, such as two-way, communication and asking participants for their advice and clarification on technical and other matters. Attendees were treated as equals, as professionals in different lines of work. Because many of the management issues covered in these workshops were highly contentious, Dr. Clark tried to establish and maintain low conflict and mutual respect within the workshop setting. Conversations were deliberate, organized, and analytic. Discussions were open and free-ranging as experienced participants typically raised many questions and offered rich examples from their work. The policy sciences were used more or less explicitly and offered a perspective on problems and solutions, typically a functional one, to help illustrate the concepts and terms and their utility in understanding and solving actual management problems. These workshops gave attendees a stable frame of reference, a language to use to talk about problems in sophisticated ways, and practice at analysis much like students in the classroom situation receive.

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In our experience, workshops seemed to be more successful when they lasted three to four days, yet most professionals cannot take much time off work, nor are they inclined to read very much in preparation for the workshops. Workshops of at least two days give attendees time to reflect overnight and time to get acquainted in case they choose to work together in the future. The multi-day workshop gives attendees time to assimilate the concepts and discussions much better than a single-day workshop. Workshops can build social capital and have the added advantage of bringing together professionals who might not otherwise interact or whose only contact may have been at volatile public meetings where they were on opposite sides of an issue.

Most of Dr. Clark's workshops begin with an introduction and overview of interdisciplinarity in somewhat conventional terms, keeping remarks brief and mixing conventional concepts and language with the new words and ideas. Students are then divided into teams to give them hands-on experience in analyzing cases and reporting to the group for critique and discussion. Teams pick cases in which they are currently involved. We then revisit the concepts and elaborate on them through analysis and discussion of the case presentations, summarizing as we go along and making comparisons across the cases about problem orientation tasks, social process mapping, decision process appraisal, standpoint clarification, and integration and judgments. The effectiveness of workshops is increased when they are followed up with additional workshops, continuing discussions as informal opportunities arise, and distribution of additional readings. Workshop effectiveness also increases with the experience level and inclination for reflection of participants. The workshop attendees have included county commissioners and planning staff, regional leaders in nongovernmental advocacy groups, and city, county, state, and federal government officials. In the Australian workshops, attendees had all worked from seven to thirty-five years. Most of these people quickly made connections between the interdisciplinary concepts and terms and their own extensive experience. This contrasted dramatically with graduate or undergraduate students, many of whom have limited experience in which to ground their learning of interdisciplinarity.

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The workshops always end with an appraisal from the participants. Feedback is typically positive and substantive. A number of key points have surfaced from workshops on two continents. First, attendees generally want more repetitions of case analyses and applications to give them more exposure to interdisciplinarity's methods and more experience in their use. Second, they recommend more discussion of the concepts and categories of the policy sciences framework. They are often curious about why certain concepts that make up interdisciplinarity are included and others that they consider of importance are not. They are interested in commanding the terms and language to express themselves better in communicating with others who are knowledgeable about interdisciplinarity and to lay people. They express a need for more agency support for improved problem-solving, indicating that there is little support on the job for interdisciplinary-like analysis. About one typical workshop, participants said, "There is a more structured way to think about problems." "I will use [the workshop] to improve my participation and leadership skills as a professional with a federal agency," and "I will certainly share the information with colleagues." "Yes, it was extremely helpful and new." Participants typically want more practical applications, more diverse participation, fewer readings, more discussion of

concepts (such as human dignity and common interest), more cases, and follow-up applied workshops. They want to tackle existing conservation problems as well as those looming on the horizon, and they want to get more of the actual players in real issues in the room and use this approach with them. Overall, there appears to be a huge latent demand among professionals for use of the policy sciences to help solve diverse, real-world problems, particularly those related to large scale conservation.

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Field trips

Field trips are ideal vehicles to help participants develop interdisciplinary problem-solving skills. However, in this format the policy sciences are not presented to attendees in a comprehensive, systematic way. Instead, the field trip is used to "bring out" interdisciplinarity and its utility in actual practice. This is more challenging in some ways, as students are not urged to move beyond conventional thinking in the forceful, guided way that they are in the classroom.

Clark and Ashton (1999) described the benefits of field trips that prepare students to be broad-based, practical problem solvers. When field trips are part of a course, they put students on the front line in contact with diverse professionals and others involved in management or affected by a problem in situations that are often laden with competition and conflict. Students meet the actual people who are affected by a problem, those responsible for creating it, and those who hope to resolve it. In one field trip to Ecuador, for example, students met with an older blind man and his grandson begging on village streets, saw women trying to wash clothes in a muddy, six-inch-wide stream next to a road in the high Andes, and talked with a young man who recently lost both arms in an agricultural accident who was begging for food. These experiences dramatically and practically brought home to the students, in very personal ways, the human dimensions and costs of policy and management decisions. Through field trips students can learn what is involved in on-the-ground management, compare their classroom learning with the workings of real cases, hone their integrative abilities, and develop insight and judgment without the real-life costs of being wrong. They give students the opportunity to exercise their skills in critical thinking, observation, management, and technical matters. Students can apply, discuss, and integrate all their previous education and practice into a concentrated synthesis in the field (Clark and Ashton 2004).

To synthesize both biological and social knowledge into an integrated picture of a conservation challenge, its context, and its resolution requires a genuinely interdisciplinary approach.

Field trips are typically scheduled visits to one or more field sites to examine a specific problem or set of problems. The trips that we have led have lasted one to sixteen days; some included repeated site visits over the course of a semester. For example, as part of a semester-long Yale class on "Rapid Assessments in Forest Conservation for Diversity and Productivity," colleague Mark Ashton and Susan Clark led several two-week, graduate-level field trips to South and Central America. One trip looked at management of the buffer zone of the La Amistad Biosphere Reserve in Costa Rica (Clark et al. 2003), another examined management policy of the Condor Bioreserve in the high Andes of Ecuador (Clark et al. 2004), and others have examined issues in Panama, Costa Rica, and Ecuador (e.g., Clark et al. 2003, 2006, 2009). This course, which focused on identifying and addressing real management and policy problems in practical and effective ways, centered on the field trip and included pre-trip preparation and post-trip assessment and report writing. All reports and publications were shared with people at the field site and in the region. To synthesize both biological and social knowledge into an integrated picture of a conservation challenge, its context, and its resolution requires a genuinely interdisciplinary approach.

Attendees of the 1998 field trip to the Panama Canal watershed, for example, consisted of seventeen master's degree candidates who had diverse undergraduate backgrounds and work experiences (see Ashton et al. 1999, Clark and Ashton 1999). Three were from countries in Central America and one was from Indonesia, four American students had Peace Corps experience, and other students also had various field experiences. Half of them spoke Spanish. The goal of the field trips was to help our hosts address their conservation problems. Pre-trip preparation included gathering knowledge and understanding values about the field trip site. During the field trip itself, we visited numerous sites and interviewed key people in the communities, nongovernmental organizations, and government officials. Contacts were made with a broad range of participants, from high-level government officials and various professionals in nongovernmental organizations, to peasants and indigenous people engaged in subsistence living in the canal's watershed. Some of these people assured us that current policy arrangements for the watershed were just fine, whereas others told us of the severe deprivations they suffered under current policy. Seeing and experiencing for ourselves and contrasting the conflicting stories people told us was a powerful experience at multiple levels, from intellectual to emotional. The policy sciences gave us a way to examine analytically the people and their perspectives (identities, expectations, demands), the values at stake for each of them, their strategies, and the outcomes they each sought, as well as to clarify our own standpoint. We were also able to appraise the ongoing decision process through which these people participated to achieve what was of importance to them (e.g., well-being, power, skills, respect). Round-table meetings were held in the evenings after long days in the field to review and integrate our experiences. After the field trip the students were required to evaluate and discuss their experiences as a team and as a class, to write papers, and to make presentations to the class. Most of their written papers, which demonstrated their level of comprehension and skills, were later published in peer-reviewed journals (e.g., Clark et al. 2009).

In another example, Dr. Wallace spent the spring 2003 semester with the students in his advanced seminar traveling frequently to the site of a nearby riparian restoration project, and interacting with the principal participants, including two local research and conservation organizations, the county planning commission, the county conservation district, and the government of the local municipality. Up to that time, the restoration project had been a purely technical venture, consisting of ecological restoration and monitoring. As a result of the policy science students' involvement, they became the de facto social science experts in the project and were asked to tackle what the municipality considered to be negative public perceptions of the project. The students developed and wrote a "public outreach plan" for the project that they subsequently implemented with the local municipality and other organizations. At the end of the semester the students wrote and discussed an appraisal of the experience, explicitly addressing the role that interdisciplinarity played in their experience. Two of the students then decided to remain involved in the project for an additional year, in which they were given leadership status by all the other participants and orchestrated both the social and technical aspects of the project in an interdisciplinary, problem-oriented fashion.

Field trips typically produce a lot of interaction and feedback during the site visit, analysis, and write-up. Students, instructors, and local participants have judged the concentrated experience of field trips of this design to be extremely valuable. However, students are less able to grasp and use interdisciplinarity in this format than in the classroom experiences or the workshops described above. Many students remain firmly rooted in convention and even those that show the inclination to become immersed in interdisciplinarity are impeded by the workload and time constraints of the field trip format. This was true even for Professor Wallace's advanced interdisciplinary seminar students in 2003, when such substantive involvement in field-based activities detracted from the process of learning the theory.

Applied appraisals

Appraisal has much in common with the workshop approach described above, except that it is typically undertaken as a discussion or collaboration between the person conducting the appraisal and the people who are providing the information that is being appraised. Applied appraisals share the workshop format's focus on issues of concern to the participants, the targeting of specific audiences and problems, and the promotion of better outcomes for conservation problem-solving (Clark et al. 2002). They are also designed to encourage self-reflection, self-awareness, and a greater degree of understanding of the participants' place in an active and ongoing social process. Applied appraisals are not academic exercises; they are designed to provide information on social and decision processes for the purposes of improving or better illuminating those processes. They are conducted in response to conditions that require attention or correction. In practice they combine, like the advanced undergraduate seminar described above, a demand on the participants to undertake applied learning about a policy issue with a challenge to be reflective and introspective in their approach to appraising their professional practice.

Applied appraisals are not academic exercises; they are designed to provide information on social and decision processes for the purposes of improving or better illuminating those processes.

We have conducted many applied appraisals during our careers as analysts of social and decision processes in many large scale conservation arenas (e.g., Wilson and Clark 2007). Dr. Wallace has designed and carried out a number of applied appraisals in recent years that combine a systematic, empirical approach to program evaluation with the reflective approach described above (e.g., Wallace 2003). In these appraisals, Professor Wallace contacts participants in specific programs to seek their participation in the appraisal, describes the appraisal process to them, and then either travels to meet with them at their place of work or holds conversations with them by phone. Most of the appraisals have been in the form of one-on-one conversations. The conversations are based on a directed (but not fixed-response) survey questionnaire that is designed simultaneously to ask the subject to consider specific program or policy issues while also triggering an internal (i.e., psychological) evaluative process. These conversations are designed as supportive engagements, in which the interviewer and the subject interact collegially. As with other approaches to teaching interdisciplinarity, this approach is not for everyone, and a small number of intended participants are put off by the style and design of the appraisal. This is a very small number indeed, however: only two out of ninety participants in one such appraisal (Wallace 2003) were reticent when faced with the applied appraisal experience, and all 100 participants interviewed in a more recent study were open to the experience.

The use of interdisciplinarity in these appraisals is implicit. There is no attempt to teach or promote an explicit understanding of interdisciplinarity as described in the literature or as used in the courses, workshops, or field trips. Rather, the approach is to seek a narrower goal concomitant with the program or policy-related evaluative goals. The interdisciplinary goal is to help the participants in the appraisal become more aware of their observational standpoint in the social or decision process of which they are a part and more aware of their relationship to the processes at hand. If this is accomplished, it results in a greater empowerment for those participants in that process. Follow-up to these appraisals has been only anecdotal but has included responses that highlight the benefits of the method. Comments from program and policy participants in these appraisals included descriptions of the process as "totally cathartic" and "unlike any experience in my professional life." Other participants have noted that "no one has ever asked me to think about my work in this way" and "no one has ever asked me questions like this before." Another anecdotal measure of success was that as these and other participants became engaged in the process, conversations that were initially designed, by the length of the questionnaire, to take 60 to 90 minutes, sometimes took several hours or continued on subsequent days. From their initiation as interviewer-driven evaluative conversations, they became experiences driven by their subjects' buy-in to the applied appraisal process.

Experience and reflections

Our goal has been to create a "transformative" experience for students in learning the basic skills of the policy sciences and applying it to problems of natural resource management. Our thinking on what constitutes such an experience has changed over time. In Poncelet's (2001) description of theory on personal transformation through interaction, for instance, he noted that problem-solving experiences—such as courses, workshops, and field trips—can and do lead to personal transformation. Transformation might be explained as coming about in predisposed students through a combination of high quality interaction and reflection. It includes an extra-personal level (involving changes in understanding and relating to things beyond the self) and an intra-personal level (involving changes to one's own conceptualizations). In their discussion of cognitive psychology and epistemology, Maturana and Varela (1987: 231) describe this as a basic change in the "organization and coherence in daily life of this ongoing flow of reflections that we call consciousness and that we associate with our identity."

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Clearly, introduction to interdisciplinarity is transformative for some people. We have observed many examples over the years that demonstrate this. Most recently, one mid-career professional said to us, "The whole policy science 'renaissance' (if you will) was a bit like a light going on in my brain. It seems to be a missing piece of what I've been trying to do. I'm looking forward to developing a deeper understanding of its frameworks and approaches."

Clearly, introduction to interdisciplinarity is transformative for some people.

Our students have gone on to publish peer-reviewed book chapters and articles. For example, the students in our rapid assessment course/field trip in 2005 went to Podocarpus National Park in Ecuador. David Cherney and his fellow students co-authored "Understanding Patterns of Human Interactions and Decision Making: An Initial Map of Podocarpus National Park, Ecuador," recently published in the *Journal of Sustainable Forestry* (Cherney et al. 2009). They noted that successful conservation is as much about people and how they make decisions as it is about flora and fauna. Just as practitioners can understand systematically the biophysical patterns and processes of a natural resource issue, so too are there systematic methods to understand patterns of human interactions and processes of decision making that affect these issues. Understanding these patterns and processes can reveal more effective interventions to improve management and policy. Their paper demonstrates a skillful use of

interdisciplinarity to accomplish that end. The students went on to suggest actions through community-based initiatives to help improve arenas and decision making.

A second example is students in special projects courses. Rebecca Watters and Avery Anderson (In Review) went to western Wyoming (specifically, the Wind River Indian Reservation with the Eastern Shoshone and the Northern Arapaho tribes and the ranching community of the Upper Green River basin) to study the highly contentious issue of wolf management. They wrote "Wolves in Wyoming: The Quest for Common Ground in Native American and Ranching Communities," a book chapter in a forthcoming book on large carnivore conservation. As the wolf population grows, these human communities face important choices about how to manage the controversial species. The authors offered many practical recommendations to improve matters, all working with local people.

A third example is Doug Clark and his colleagues (2008) in Canada who researched and wrote "Polar Bear Conservation in Canada: Defining the Policy Problems," a paper in the journal *Arctic*. They concluded that the decision process in polar bear management did not sufficiently foster identification and securing of common interests among participants who express multiple competing perspectives in an arena that has been increasingly fragmented and symbolically charged. The fundamental challenge for polar bear conservation in Canada is to design the decision process so that it can constructively reconcile the various perspectives, demands, and expectations of stakeholders. These authors offered ways to do just that. We have scores of other examples demonstrating students' command of interdisciplinarity in applications in Africa, Asia, Australia, Europe, and North and South America in diverse cases, on various problems, and in complex settings.

In our experience, about twenty percent of students undergo some kind of transformation once they are exposed to interdisciplinarity, as evidenced in their own evaluations. This occurs in young students at the undergraduate level, those who come directly from undergraduate studies into their graduate work, in more experienced students who have Peace Corps or several years of work behind them, and in returning older students. Comments indicate that some of them underwent significant changes as a result of their investigations using interdisciplinarity in cases of interest to them. We took their comments at face value. Here is a sample of comments made after grades were turned in:

- "For those new to interdisciplinarity, this course will change the way you approach problems."
- "The framework on which the course is based dramatically changes and improves students' understanding of the social process."
- "Interdisciplinarity provide an amazing framework for looking at all kinds of problems and because of this course I am familiar with them and comfortable using the framework."
- Fantastic course—learned an incredible amount—big influence on my thesis work."

- "Interdisciplinarity give me a new outlook on problems and conflicts, as well as equip me with the skills and the tools to deal with any type of conflict...not just environmental but in my personal life as well . . . it was invaluable!!!"
- "It has helped me in all my other classes."
- "The class was one of, if not the, best course I have taken."
- "Only true interdisciplinary experience in the School—helps to put the other stuff (especially science) into perspective."

Many similar statements have appeared in our course evaluations over the years that we have taught interdisciplinarity, and from students and others from workshops months or even years after the experience. Transformations were also evident in the changes that some students made in their professional careers once they left school and in the nature of the research and professional work that some undertook after their schooling.

Improving education

To bring about these transformational experiences with a higher frequency and permanence, much more systematic attention must paid to how the policy sciences are taught, whether in the classroom, workshops, in field trips, and applied appraisals. Three avenues to bring about improvements are new teaching materials, novel educational designs, and continuing opportunities to develop skills and build community. The following recommendations are general, but all three could improve experiences.

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Teaching materials

One of the biggest challenges to teaching and learning interdisciplinarity is a lack of easily accessible readings and teaching materials. Many of us began teaching interdisciplinarity by drawing on the original works of Lasswell and others, but despite his prolific output, students typically find his writing dense, stylistically difficult, and out of date (see Eulau 1958, 1969, Marvick 1977, Muth et al. 1990). Lasswell himself noted that there is a practical problem in explaining and using the policy sciences (Lasswell and McDougal 1992). A number of other authors have written books that are valuable teaching aids, including V. Clyde Arnspiger, *Personality in Social Process: Values and Strategies of Individuals in a Free Society* (1961). *Foundations of Policy Analysis* (1983), by Garry Brewer and Peter deLeon, is invaluable but could be updated. The works of William Ascher and his colleagues, for example, *Natural Resource Policymaking in Developing Countries* (1990), should stimulate similar works that are explicitly in the interdisciplinary tradition. *Finding*

Common Ground: Governance and Natural Resources in the American West (2002), and *Adaptive Governance: Integrating Science, Policy, and Decision Making* (2005), both by Ronald Brunner and colleagues, are also valuable sources.

Much of Professor Clark's time in recent years has been devoted to writing and compiling materials that will be useful for teaching (e.g., Clark 2002, Clark et al. 2005). For example, Professor Wallace is one of many policy scientists who now uses Clark (2002) as a text in interdisciplinary classes at either the undergraduate or graduate level. Dr. Clark is also considering writing a small handbook for citizens and advocates engaged in natural resource and democratic issues. Other policy scientists are no doubt writing or considering writing new teaching materials, which are needed in the natural resource field, as well as international development, biodiversity conservation, health, global change, and other fields. Many more case studies are needed.

Finally, the journal *Policy Sciences*, the Society for the Policy Sciences' new web site (www.policysciences.org), and the recent publication of syllabi and other educational materials are all helpful. The journal contains articles that Professors Clark and Wallace use in their courses. Updated compendia to original materials, like that of Marvick (1977), and compilations of selected readings that are well introduced and explained would be very helpful in adequately introducing Lasswell's writings and keying them to current events. More theory and case books are needed for general and specific audiences. These should integrate readings, current events, and skill building. Interactive experiences, such as workbooks and videos that demonstrate connections between the interdisciplinary concepts and actual cases are also needed.

Educational designs

In addition to well-planned and thoughtfully designed courses, workshops, and field trips, other designs or formats might also be effective in interdisciplinary education. Prototypes—a particularly learning-focused exercise—could be developed by instructors and students for given problems. Small-scale decision seminars might be set up to address specific issues (see Muth and Bolland 1983, Burgess and Slonaker 1978). The "chartroom," developed as a group project, should be fully explored as a teaching tool (Lasswell 1971). New case materials (short pieces that look at public policy problems in interdisciplinary terms) are needed for general and technical audiences. Interdisciplinarity already provides a wealth of important teaching materials, but a new section explicitly devoted to teaching could be especially useful. Videotapes of the society's meetings, special presentations commissioned from society members, mock decision seminars, and similar documentation of interdisciplinarity at work might also prove to be extraordinarily helpful. Finally, personal testimonials about the value of interdisciplinarity in actual problem-solving might be more persuasive than instructors' promotional efforts in convincing prospective students to study this approach.

We also need more mid- to long-term evaluation of the benefits or drawbacks of existing curricula. Perhaps the Society of Policy Scientists could survey graduates from programs around the country from the last few years with the goal of revealing

patterns in teaching, learning, and applying interdisciplinarity. For example, we know that some interdisciplinary courses attract significant numbers of students who go on to join the society, use interdisciplinarity in their work, continue developing their knowledge and skills, and design, develop, and teach courses of their own. Detailing and profiling these patterns might help us design better educational experiences. We need to compare, upgrade, and diffuse successful designs constantly.

In addition to well-planned and thoughtfully designed courses, workshops, and field trips, other designs or formats might also be effective in interdisciplinary education.

Continuing opportunities

Participants in college and university classes, workshops, field trips, and applied appraisals in interdisciplinarity need to be supported though continuing contact. The establishment of the Society of Policy Scientists and its web site are important steps in building a community. The society's interest in comparing teaching approaches and results, listing syllabi on the web site, and publishing collections of cases and experiences such as those in this special issue of the journal are additional milestones in advancing teaching of interdisciplinarity.

Participants in college and university classes, workshops, field trips, and applied appraisals in interdisciplinarity need to be supported though continuing contact.

Other opportunities might be created for people to increase their interdisciplinary knowledge and skills. The society's summer workshop is one way, as are continuing, short, refresher courses (even self-administered). The society might also want to design teaching modules that would facilitate teaching interdisciplinarity outside the usual settings of the university or professional meetings. Casebooks might be developed as well as workbooks that people could take home as a reference source. Continuing workshop experiences (one or two per year over a two to three year period) for professionals would help to reinforce their initial learning, although more attention to their employing organizations is needed to build lasting institutional support. It is also important to find and recruit new individuals to the society and invite new people to attend appropriate educational experiences.

CONCLUSION

It is clear that interdisciplinarity can facilitate an orderly, problem-oriented inquiry into complex large scale conservation problem settings, and others as well. It is equally clear that it can be taught and used in courses, workshops, field trips, and appraisals to good effect. In a few days to several months, students can gain insight

and skill in critical thinking, observation, management, and technical maters. The interdisciplinary approach, based on our first-hand experience over many years and across diverse settings in several continents, does help professionals, analysts, managers, politicians, decision makers, advocates, the public, and students (as they look ahead to their careers) to take active, informed, and responsible leadership roles in solving policy problems. People in our courses and other educational designs are coming to recognize the severe limitations and practical hazards of being locked into narrow, conventional methodological perspectives, institutional settings, cultural contexts, or professional viewpoints. There is a growing awareness on the part of students that we must understand contexts of time and place and the growing demand from all segments of society for people to be more rational, practical, and humane in their dealings with public policy—characteristics that interdisciplinarity can help them achieve. In short, the skill set that interdisciplinarity encourages is practical.

In short, the skill set that interdisciplinarity encourages is practical.

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Conclusions

Chapter 10

Large Scale Conservation in the Common Interest: Conclusions and Recommendations

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INTRODUCTION

All large scale conservation projects have context specific goals for both biophysical and social targets. However, we have argued that there are three fundamental goals that should be addressed by all large scale conservation projects. First, participants should strive to find solutions that are in the common interest. Common interest outcomes are the only ones likely to by sustained by the community. This is always a difficult task since it requires integrating and accommodating mutually dependent interests that grow out of diverse and complex personal and cultural histories. While it will not be possible to accommodate the interests of all participants in all cases, more enduring solutions are likely to be found if all participants are dealt with respectfully, fairly, and the validity of appropriate multiple interests is addressed. Second, participants should seek solutions that are both biophysically and socially sustainable. Whereas sustainability has proven difficult to define precisely, we have argued that sustainable solutions should maintain the potential of a system to persist or improve its functioning and the human benefits derived from that system over time. Finally, and most importantly, we believe that there can be no higher goal than human dignity. Large scale conservation cannot be achieved without sustainable, healthy societies grounded in human dignity for all people.

However, we have argued that there are three fundamental goals that should be addressed by all large scale conservation projects.

We described the major types of large scale conservation—parks and protected areas, ecosystem management, integrated conservation and development, ecoregional planning, transboundary conservation, and adaptive governance. Factors driving the adoption of these approaches include a rapidly growing appreciation on the part of many world citizens that we are not living sustainably, that we must transition as quickly as possible towards sustainability, and that we must redouble our efforts to achieve human dignity for all. Another conditioning factor is that needed systems of governance and institutions to support this transition are being organized at local (e.g., community-based) to global scales (e.g., focus on global change). Finally, leadership to accelerate these constitutive trends and conditions is evident, but in short supply at present. We concluded that, with the exception of adaptive governance, all the above approaches to large scale conservation are just modern variations on single and multiple use management, and remain guided by the doctrine of positivism and scientific management. We need to transition to effective, contextual learning approaches (e.g., adaptive governance) guided by skilled, democratic leaders and enlightened citizenry.

The case studies in this volume illustrate that the fundamental challenge in developing and implementing projects that not only achieve large scale conservation objectives but also support a commonwealth of human dignity is to move beyond traditional approaches rooted solely in scientific management and adopt approaches that take into account social and decision processes through which values are developed and allocated. The complexity of our social systems becomes more apparent when the target of conservation involves multiple land owners, crosses jurisdictional boundaries, or involves large, diverse communities of interest (e.g., the world community). Consequently, in addition to the biophysical complexities that manifest when conservation projects are scaled up (e.g., metapopulations, successional dynamics, interrelationships between different ecosystems), scaling up conservation projects also reinforces the need to take human social and decision processes explicitly and systematically into account. Again, this fact argues for a flexible interdisciplinary approach.

The complexity of our social systems becomes more apparent when the target of conservation involves multiple land owners, crosses jurisdictional boundaries, or involves large, diverse communities of interest (e.g., the world community).

In order to address this fundamental challenge, students and practitioners need a conceptual model and analytic framework for understanding problems in particular cases. The legacy of the Enlightenment has been the rise of the modern university and a profusion of disciplines that specialize in narrow fields of inquiry, but lack an integrative framework to move beyond disciplinary boundaries. To be sure, disciplinary specialization has yielded many benefits not only in the field of conservation but also in the overall human enterprise. For example, knowledge of

behavioral ecology has lead to the successful reintroduction and subsequent maintenance of wolves in the Yellowstone ecosystem. Advances in remote sensing technology have enhanced our understanding of the scale and consequences of deforestation. Social survey methods have resulted in a better understanding of the societal values placed on ecosystems. Environmental economics is allowing us to calculate the economic value of ecosystem services. And yet, problems in large scale conservation persist and grow because whatever the disciplines used, each suffers from blind spots that cause important contextual aspects of the situation to be overlooked and therefore not integrated into the picture as a whole or into a solution. In cases in which disciplinary scientists work strictly within disciplinary or even multidisciplinary frameworks, partial solutions are advanced that, and in retrospect, often prove themselves to have missed key contextual elements.

Our recommended strategy to address this overall challenge is to adopt an interdisciplinary model, such as the one presented in Part I, for understanding problems and as used in adaptive governance. This model was described based on watching successful problem solvers address complex messy problems. The model requires analyzing not only the biophysical/resource component of conservation problems, but also the human value and social dynamics and institutional processes at play, at the same time. Practitioners who use this model will have a better understanding of the problems that arise in large scale conservation projects and what to do about them in rational, political, and moral ways.

Our recommended strategy to address this overall challenge is to adopt an interdisciplinary model, such as the one presented in Part I, for understanding problems and as used in adaptive governance.

This model is what allowed the authors to identify the problems described in the cases presented in Part II. These three rapid appraisals were informed by an interdisciplinary approach. First, Cherney et al. (Chapter 4) analyzed the goals, values, symbols, and decision making trends among participants in the Connecticut River Watershed. Their analysis identified several key challenges that included a fragmented decision-making arena, a lack of goal clarity, and narrow problems definitions bounded by the doctrine of scientific management. Second, Meany et al. (Chapter 5) used the interdisciplinary framework to understand the social and decision process challenges faced by participants in sharing water resources on the Wind River Indian Reservation in Wyoming. After collecting a detailed inventory of social and decision process indicators, four alternatives were offered to help participants shift the policy process towards common interest outcomes.

Finally, Newsome et al. (Chapter 6) described the Greater Yellowstone Ecosystem where researchers directly observed and appraised social and decision processes related to the management and policy of this complex, large ecosystem. They were interested in harvesting the lessons of experience. They found a pervasive lack of

respect felt by many people in the arena, regardless of the issue at hand. They identified obstacles to the achievement of a common interest outcome. And they attributed problems to an overreliance on the single and multiple use paradigm based on scientific management and its modern incarnations (e.g., ecosystem management, bioregional planning, transboundary approach). The authors focused specifically on improving the functions of decision making and offer three recommendations to learn from and improve current patterns of decision making–first, learn from ongoing practice-based, prototyping experiences, second, create new arenas for community-based participation, and third, use the adaptive governance framework to problem solving.

Once problems have been identified, the next step is to take concrete actions to solve the problem as recommended in the three cases in Part II. Traditionally trained resource managers tend to frame issues as technical problems and consequently undervalue the importance of process and governance dimensions. This often prevents them from articulating the common interest let alone finding and implementing common interest solutions. Practitioners working within an already defined system (e.g., single and multiple use management) have trouble recognizing when it is possible and sometime necessary to change the norms and rules for making decisions. Consequently, they focus their efforts on dealing with technical issues when attention should be focused on constitutive issues.

Part III illustrates several educational tools for interdisciplinary problem solving that will help practitioners move more successfully toward solving conservation problems in the common interest. For example, Chapter 8 details an experience in using workshops for integrated problem solving. Chapter 9 explains how to identify, adapt, and disseminate best practices. And Chapter 10 offers diverse methods for teaching interdisciplinary problem solving and the leadership skills that are necessary to adroitly and successfully integrate disparate interests into common interest solutions. The focus in Part III is on practical education and real world solutions.

In closing, we hope the challenges presented by large scale conservation will lead participants towards an intense disciplinary, problem oriented, contextual, and multimethod approach in the common interest. This approach to large scale conservation explicitly attends to social and decision processes, is premised on the belief that common interest solutions should be sought, and prioritizes sustainable human dignity for people in healthy environments over other considerations. Adopting an adaptive governance approach will lead to durable solutions that are sustainable both environmentally and socially.

Appendices

A. The Yale Seminar on Large Scale Conservation

B. Making Conservation More Effective: A Guide for Decision Making

C. Worksheets for Appraising and Improving Large Scale Conservation

Appendix A

The Yale Seminar on Large Scale Conservation

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This volume addresses the environmental and human dimensions of large scale conservation problems. It is based on a graduate seminar offered at the Yale School of Forestry & Environmental Studies. The seminar and this volume promote a problem-oriented and interdisciplinary approach to the study and practice of large scale conservation. This appendix provides details about the seminar including the rationale and organization of the course, selected case studies by students, a description of guest presentations, student evaluations of the course and finally some general comments about benefits from five years of teaching the seminar.

The seminar and this volume promote a problem-oriented and interdisciplinary approach to the study and practice of large scale conservation.

THE SEMINAR

In the Yale seminar "Large Scale Conservation: Integrating Science, Management, and Policy in the Common Interest," we first gain an overview of the different approaches, their history, and content. As the semester progresses, we hear from diverse guest speakers involved in actual cases using one or more of these approaches, examine cases in the literature, and visit large scale initiatives and make assessments, as feasible. This is supported by readings, exercises, and much discussion. Throughout we are seeking a workable formula, a supporting doctrine, and appropriate symbols to represent these.

Background

Collectively, large scale conservation efforts are a response to the growing awareness that many environmental problems can only be understood and addressed at large scales and in more basic ways (e.g., governance and constitutive changes). These initiatives can be considered *practice-based prototypes* or *innovations* to meet the goal of sustainability in terrestrial, aquatic, and marine arenas. As these innovations are applied, we can learn from them through appraisal of all aspects of their operations, both content and process dimensions. Methods and standards for such appraisals exist and can be applied to any large scale effort.

Many large scale conservation efforts are ambitious in scope. Some are mere extensions of business as usual only at bigger geographic, scientific, and bureaucratic scales. Each case is "large" on spatial, temporal, and complexity scales. Efforts are being undertaken or proposed at subnational, national, and international levels. Although each "formula" for large scale conservation shows a central tendency in approach, variation and overlap exist among the many models. This reflects the fact that initiatives are being developed in many different contexts, rest on very different beliefs (e.g., doctrine), and are represented symbolically for diverse promotional reasons. Each approach emphasizes somewhat different goals and methods, and engages different communities of practitioners, decision makers, and publics. Functionally, each initiative seeks to change or maintain value-institutions in their respective societies. Ideally, their goal is to improve human dignity for all people in healthy environments, but often this is not the case. Sometimes goals are much narrower and technical. Large scale conservation efforts stress different conventional outcomes, ranging from nature preservation and biodiversity conservation to poverty relief and rural development.

People and organizations use diverse "formulae," based on different conceptions and standards. These include different mixes of the biological and/or social science disciplines, epistemologies (positivism or post-positivism), operating assumptions and means, typically in a multidisciplinary fashion. Few use a genuine interdisciplinary approach, despite rhetoric to the contrary. To be fully interdisciplinary requires critical thinking, problem solving, observation, management, and technical skills (see Clark and Wallace this volume). Finally, the success of any large scale efforts varies according to the standards of appraisal. Being clear on evaluative standards is essential to close feedback loops and actively learn at individual, organizational, and policy levels. The key to improving and learning is monitoring and finding lessons that can be adapted and applied in a never-ending process that upgrades management policy (this sequence is *prototyping* at its best). The thing to be upgraded in each case is the decision making process involved in large scale conservation. Therefore, knowing about decision making and its context is key to understanding formulas and improving on them practically.

Few use a genuine interdisciplinary approach, despite rhetoric to the contrary.

Seminar

This seminar examines the conceptual, contextual, and practical basis for diverse efforts, compares and contrasts formulae, doctrine, and symbols being used (e.g., in science, management, policy), explores themes and skills (critical thinking, problem solving, decision making, organization, leadership, monitoring, learning, innovation), and surveys cases from three arenas (terrestrial, aquatic, and marine) for lessons. The seminar is genuinely interdisciplinary in an explicit, systematic sense (see Clark 2002).

The course is a mixed seminar and practicum. It takes a problem-oriented, contextual, and multi-method approach that offers students conceptual, practical, and professional benefits. It includes readings, lectures, discussions, workshops, exercises, guest speakers, individual and small-group assignments, workshop, papers, presentations, and a field trip. Extensive student participation is required throughout. It draws on a literature about professionalism, leadership, and effectiveness, including but not limited to:

Schon, D. A. 1987. Implications for improving professional education. Pp. 303-326 in *Educating the reflective practitioner: Toward a new design for teaching and learning in the professions.* San Francisco, CA: Jossey Bass.

McCroskey, J., and S. D. Einbinder, eds. 1998. *Universities and communities: Remaking professional and interprofessional education for the next century.* Westport, CT: Praeger.

Organization

The seminar is organized around specific goals, requirements, prerequisites, enrollment concerns, students, case studies, guest speakers, and as a capstone course. Students meet once or twice weekly with each other for discussion and with guest speakers. Readings for each week's discussion are essential. High interest, thought, and engagement with the topics are expected from all participants. A field trip is carried out most years, providing students with the opportunity to apply their knowledge and skills to a large scale conservation case. The seminar focuses on finding a formula that would be effective in practice, along with supporting grounding and philosophic basis.

Goals

The seminar has scientific, analytic, and professional goals. First, students develop their broad scientific knowledge and the conceptual and practical tools and standards necessary to understand the management of natural resources, people, and policy process at large scales. Second, students develop their critical thinking and analytic skills so that they can analyze and articulate the formula being used in any initiative, critique its theoretical/conceptual basis and mode of application, and offer ways to improve it—conceptually, organizationally, and practically. Third, students develop their career skills of integrating scientific, management, and policy tasks that are

essential for becoming an effective professional today. The seminar's most exciting possibility is the leadership potential for those who will enter the work world armed with the ability to orient themselves quickly to a given program or initiative, make well-grounded assessments about the effectiveness of its approach and operation, and help with new approaches and practices that will increase the program's and their co-workers' chances for success.

Requirements

Attend class. Read assignments. Engage the subjects, guests, and your fellow students actively and constructively. Engage in critical thinking at all times. Grades are based on (1) participation in all class exercises and discussion (20%), (2) a paper/book reports (oral and written, 2 page (20%), (3) a 20+ paper and presentation on a topic of your choice (40%), and (4) a personal journal with at least 20 substantial entries (20%). In 2009 the class also carried out a workshop over nine hours. Other years, different designs were used. Requirements were altered so as to best fit with students' unique requirements. Each year the class also contributes to an annotated bibliography on large scale conservation.

Prerequisites

The more courses and experiences a student has, the better. A background in ecology, conservation biology, social ecology, economics, and policy sciences and related areas is desirable. Extensive and diverse work experience (local to international) is also desirable.

Enrollment

The seminar was limited to 16 students and restricted to second year students, mid-career students, or those with permission of the instructor to accommodate those that have had substantial prior work experience or academic training in the area or because of other constraints can only take the course at this time.

Students

Approximately 100 students have enrolled in the seminar over six years. They came from over 25 countries. Many graduates have gone on to work in organizations that are active in developing integrated science, management, and policy at large scales. This trend is expected to grow in the future. In order to be successful in their careers, students need a way to sort through the myriad approaches and learn to lead future initiatives. One key to sustainability is to accelerate progress toward that goal and that requires a special kind of strategic leadership and professionalism. That is why leadership skills, critical thinking, and problem solving are stressed in this seminar.

Approximately 100 students have enrolled in the seminar over six years. They came from over 25 countries.

Guest speakers

In 2009, we heard from David Mattson (USGS, Yale, MIT) on scientific management vs. adaptive governance, Tanya Rosen (Yale) on grizzly bear management in Greater Yellowstone, Mike Gibeau (Parks Canada) on the evolution of his professional career in support of adaptive governance. Murray Rutherford (Simon Fraser, BC) talked about ecosystem management but is in favor of adaptive governance. Keeley Maxwell (Yale) spoke about the social context of parks and protected areas. Catherine Picard (Yale) addressed the symbols, formulas and doctrine that underpin transboundary conservation. Conrad Reining and Alice Chamberlin (Wildlands Project) told us of their eco- or bioregional planning efforts. David Cherney (Univ. Colorado) spoke on science for policy and policy for science and supported adaptive governance. Toddi Steelman (NC State University) spoke directly to adaptive governance based on her book and studies, and David Mattson spoke again on leadership (see attachment below). I spoke on large scale conservation efforts in support of elk management, and on other subjects.

Capstone course

The seminar is a capstone course. A capstone course should meet certain criteria, if it is to adequately substitute for a master's project as the culminating independent work, including: (1) course should involve the synthesis and application of knowledge gained in previous courses, and should generally involve integration of material and perspectives from different disciplines; (2) the bulk of the work of the course should be a project (individual or group) that is focused on the application of knowledge to the solution of a specific, real-world problem; (3) there should be a balance in the course between the clinical experience of dealing with a specific case study and the learning of generalizable principles; and, (4) the project should result in a substantial, professional-quality, implementable document.

Student cases

Students typically conduct an appraisal of a large scale case in which they are interested or have been involved. A list of student cases from 2004 to 2009 is provided below. Examples are drawn from an array of large scale conservation approaches including: ecosystem management, terrestrial and marine, transboundary, and integrated conservation and development efforts. Additional examples of single and multiple use and parks, protected areas and adaptive governance can be found in Chapters 4-6 of this volume as well as Brunner et al. (2002, 2005).

Examples are drawn from an array of large scale conservation approaches including: ecosystem management, terrestrial and marine, transboundary, and integrated conservation and development efforts.

2004 Student Titles

Andriamihaja, Misa. The Yellowstone to Yukon Initiative: Comments Following the Y2Y Workshop.

Cherney, David. Preparation to Understand Large Scale Conservation in the Field: A case of pronghorn migration in the Greater Yellowstone Ecosystem

Dempsey, Heather. Conflict in the Klamath River Basin, Oregon.

Egan, Elizabeth, and Petruska, Elizabeth. The Future of the Northern Forest: An Assessment of Large-Scale Conservation Efforts in the Northern Forest Region.

Kurauchi, Yuko. Review of the Case: Transboundary Approach of IUCN Asia in Mekong River Basin.

Malcolm, Trent. Functional Analysis of the Millennium Ecosystem Assessment.

McIntosh, Alex. National Audubon Society, National Park Service and The Wildlife Conservation Society: Using the Policy Process to Evaluate Summer 2004 Internship Opportunities

Cahusac, Cesar Moran. The Machu Picchu Historical Sanctuary: An International Tourism Icon in Peril?

Mortimer, Kim. Ecoregional Planning, The Nature Conservancy and a Case Study in Southern Florida.

Van Gorp, Alison. New Models of Governance: An Analysis of Envision Utah.

Mortimer, Kimberlee. Private Property and Water Policy: The Influence of Tradition on the Lake Okeechobee Basin.

2005 Student Titles

Franco, Oscar. Designing a Conservation Plan for the Huanacabamba Conservation Landscape, Northern Peru.

Lam, Hugo Sergio. Rethinking Bosawas, Nicaragua: Balancing Sustainable Livelihoods with Conservation.

2006 Student Titles

Albietz, Jessica, and Avery Anderson. An ecosystem approach to watershed management: a prescriptive paper for participatory water management in the Makira Forest Area, Madagascar.

Campbell, Richard. Transboundary protected areas: a dual mandate in the Carpathians.

Clark, Gordon. "Conservation in the 21st century:" The Governance Approach and the Story of the Great Bear Rainforestry.

Enuoh, Oliver. Appraising Integrated Conservation and Development Initiatives in Cross River National Park, South Eastern Nigeria.

Gudbrandsson, Gudmundur. The Debate on Hydropower Development in the Thorsaver Nature Reserve in Iceland.

Marriott, Susan. Large Marine Ecosystems: A Paradigm Shift Toward Success in the Gulf of Guinea.

Middleton, Arthur. Single- and Multiple-use Natural Resource Management: A History of American Conservation.

Muruetagoiena, Tamara. Transboundary Conservation in the European Union.

Nordgren, Jim. Bio-Regional Planning in Metropolitan New York.

Picard, Catherine. The Promise and Peril of Transboundary Conservation: An Appraisal of The Great Limpopo Transfrontier Park.

Sanborn, Rebecca. Ecoregional Planning and the Green Infrastructure Approach.

Watters, Rebecca. Parks and Protected Areas in Evolution: Mongolia and the Creation of a Protected Areas System.

Westrum, Justin. Integrated Conservation and Development in Kerinci-Seblat National Park, Indonesia.

Zarella, Christina. Ecosystem Management: Science, Society, Politics and the Idaho Wolf Reintroduction.

2007 Student Titles

Gordon, Bella. When a Protected Area is 80% Private Land: Creating Sustainable Livelihoods and Rational Resource Use in the Tepesomoto Reserve and La Botija Protected Area.

Holmes, Patrick. Social and Decision Processes in Free-Market Environmentalism: The Case of the Defenders of Wildlife Predator Compensation Program.

Knowles, Lucas. A New Direction for Alaska's Salmon Fishery Management.

Moberg, Tara. Adaptive Governance: 15 Mile Reach Case Study: Ordinary, Governance and Constitutive Problems Identified through Implementing the Prescription.

Oden, Matthew. Greenland: A Large Scale Resource and Global Change.

Parisa, Zachary. Forest Management in Armenia.

Group project: Northern Continental Divide Ecosystem of the US and Canada: Grizzly Bear Management Analysis.

2009 Student Titles

Adams, Abigail. Yellowstone to Yukon Initiative (Y2Y): Making Connections, Naturally.

Alcott, Emily. The Appalachian Mountain Club and the Maine Woods Initiative.

Anderson, Christa. Livestock Predation in Northern Tanzania as Viewed by a Local NGO.

Blom, Benjamin. The Nicaragua and Honduras Corazon Transboundary Biosphere Reserve Project.

Burns, David. The Heart of Borneo Initiative: An Appraisal.

Caligiuri, Peter. Conservation, Community Forests and the Skyline Forest: A Central Oregon Case Study.

Carroll, Matthew. Wildland Fires and Communities.

Hoyle, Jennifer. Ecosystem Management of The Great Bear Rainforest: The Legend of the Spirit Bear Meets the Myth of Scientific Management.

Hughes, Kathy. Algonquin to Adirondack.

Hummon, Lisa. Case Study on the Mexican Wolf Reintroduction for Large Scale Conservation: A Paradigms Workshop.

Kamal, Sristi. Project Tiger: India.

Newsome, Darcy. The Mustangs of America's Frontier: Symbolism and the Pioneer Myth Confounding the Common Interest.

Peter-Contesse, Tristan. Northeast Shelf Ecosystem.

Rosen, Tatjana. Large-scale conservation in the Pamirian Knot: The proposed Transboundary Protected Area Agreement.

Siegal, Jessica. Case Study: Mesoamerican Biological Corridor- Formula, Doctrine and Symbols.

Wynn-Grant, Rae. Terrestrial Ecoregions: WWF's Approach to Large Scale Conservation.

Benefits of the seminar

Among the many benefits of this seminar is the opportunity for participants to get to know one another though an examination of the challenges of large-scale conservation (i.e., mixed ordinary, governance, and constitutive challenges), and exploration of management options. The guest speakers, readings, weekly assignments, discussions, projects, field trip, and workshop all provided valuable materials for discussion and debate. More specifically, participants examined approaches to large scale conservation using the research categories of myths or paradigms, formulas, doctrines (e.g. views of nature/human interactions, program/policy organization), and the symbols to represent people, nature, and efforts. We saw that NGOs, governments, and citizens use one or some combination of these categories to justify, organize, and implement large scale conservation efforts. These researchable categories are fundamental to understanding large scale conservation and were new to some of participants. Another benefit of the seminar is that it provided an opportunity for participants to practice and apply their analytic skills to a case study. The ability to identify and analyze formulae, doctrines, symbols, and related phenomena are vital to successful leadership and the career of any conservation professional.

Appendix B

Making Conservation More Effective: A Guide for Decision Making

Susan G. Clark, Catherine Picard, Aaron Hohl[1]

This appendix provides a comprehensive series of questions that can help people think constructively about organizing and making decisions in any large scale conservation program. The questions are designed to help everyone carry out successful programs, whether they are new programs that are being set up, or existing ones that are facing conflict or undergoing review.

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This appendix provides a comprehensive series of questions that can help people think constructively about organizing and making decisions in any large scale conservation program.

Answering these questions may appear to be an academic or theoretical exercise, but the questions are systematically presented to help people be as rational and practical in their work as possible. There are no single, correct answers. The purpose of this exercise is to encourage people to be deliberate, systematic, and thorough in examining themselves, the structure and functioning of a program, and the process of decision making. This exercise is applicable to a broad range of cases, and these questions are appropriate for scientists, managers, decision makers, citizens, researchers, investigative reporters, ranchers, advocates, and anyone else affected in any way by a management program. Discussing and comparing the diverse answers that result is a good way to begin building trust so that participants can delve into the causes and conditions of their problems and, ultimately, explore alternatives in a creative and inclusive way. This exercise can help people find ways to identify common interests, clarify their goals, and track progress toward achieving those goals. It can also help them make the kinds of adjustments needed to make the program more successful.

We encourage users of this guide to modify or adapt the questions to fit their particular situation. You can refer back to the text to help you think about and use these questions.

I. How well is the overall conservation program working?

(1) How would you characterize an ideal large scale conservation program? What features would it have? Be specific.

(2) How does the current program function? Describe its strengths and weaknesses.

(3) What are the differences between 1 and 2? Again, be specific.

(4) Explain the differences. In other words, what factors are causing or contributing to differences between the ideal program and the actual program? Such factors might include a lack of clear or realistic goals, competing estimations of the problem, an insufficient program structure for a large scale effort, weak leadership, lack of skills on the part of the professionals involved, the wrong equipment, or too few resources. Try to explain the program's functioning in terms of the people involved, the decision-making process, and similar "systems" variables.

(5) Identify possible means that participants could use to minimize these differences or address the problems that you have identified. That is, how can you, as a group, move the current effort toward the ideal and close the gap between how the program currently operates and how it should operate? Be creative. Don't settle on the first idea that comes to mind, but let the group spend a long time fully discussing and evaluating lots of ideas. To answer this question, you need to refer to #4 above. The suggested alternatives should be geared specifically to the variables or problems (e.g., changes goals, decision-making process, leaders, or some other variable). Evaluate each suggestion realistically. Explicitly, how will each alternative solve the program's problems?

(6) Which of the suggestions or alternatives developed under #5 above are most promising? Ask which problems will be solved by which suggested change. Will the proposed changes improve the program, or might they create other, unintended consequences? How will you measure progress if you implement the suggestions?

How does the current program function? Describe its strengths and weaknesses.

II. How are people, groups, and organizations interacting with one another within the existing program?

Get data on these matters; do not rely on casual opinion. Informed observation is important in answering all these questions.

(1) Who are the key participants (individuals and organizations, official or unofficial) in the program? Who is not participating? Who should be involved? What is preventing people or organizations from participating?

(2) What are the perspectives, goals, assumptions, expectations and values of participants in the program? Getting information to answer this question can be difficult, but it is important.

(3) In what situations or settings do participants interact (science, management, media, courts, other)? Is there a way to change the patterns of interaction for the better? How do participants manage their interaction across a large and dispersed landscape (if relevant)?

(4) What strategies do participants favor or use to get their way? In an open democracy, persuasive strategies are more sustainable and often more effective than coercive ones. Education, diplomacy, and economics can all be used persuasively. Sometimes coercion seems justified, but it is often destructive in the long run.

(5) What are the short-term outcomes and long-term effects of these interactions on the people involved in the program, the management institutions and decision-making processes, and public perceptions? Finally what the short term outcomes and long term effects for wildlife, humans and large scale ecosystems? These are important questions: it is possible for example to save carnivores across a large scale ecosystem in the short term, but doing so may alienate the public, make institutions more rigid and defensive, or create other problems so that long-term conservation becomes impossible.

III. How well are decisions being made?

This set of questions clarifies the standards that we use for making judgments about the adequacy of the program and each of the human, decision, and technical matters involved. Is your program comprehensive, yet targeted? Is it creative in finding facts? Is it open to everyone who has something to contribute? Is it realistic and rational (does it meet standards of procedural rationality)? Is it integrative? Is it effective – that is, does it work in practice? Is it timely? Is it constructive, unbiased, and independent of special interests? Is it economical? Is it flexible? Is it responsible and honest, and does it have a reputation for honesty? In what ways does your program meet these standards, and where does it fall short? Where are the data to support your evaluation?

This set of questions clarifies the standards that we use for making judgments about the adequacy of the program and each of the human, decision, and technical matters involved.

(1) Describe an ideal example of people gathering, processing, and sharing information. Does the current program this ideal? In what ways have research and the transfer and application of information been ideal? In what ways have they not? Is information being collected on all the relevant components of the large conservation program and from all affected people? (2) Is data collection balanced and diverse (for example quantitative and qualitative)?

(3) How open is the discussion about the meaning or relevance of information? By what standards are meaning and relevance judged? Which participants (official or unofficial) urge which courses of action, based on what information, for what purposes? Are people keeping common interests in the forefront, or are special interests trying to subvert the process of collecting, analyzing, and interpreting information?

(4) Are the guidelines, policies, or plans that result from the preceding research and debate adequate to conserve and manage species across a large landscape? Are they efficient, effective, and equitable? What is guideline, or plan for a conservation program? Does the current program approximate the ideal?

(5) What are some ways to implement both national legislative policies and more local management plans and guidelines across a large landscape? What are the features of an organization ideally suited to carry out this implementation? In what ways have the agencies that are currently implementing programs and management activities performed well? In what ways have they not?

(6) What would be the best ways to appraise or evaluate implementation of the program as well as the entire decision-making process that led up to implementation? In what ways has appraisal of the program been done well? In what ways has it not been done well?

(7) Has the present approach to large scale conservation led to success? By what standards do you define success? What factors should be considered in judging if large scale systems are well managed, if affected people have been treated fairly, if institutions have been strengthened and trust in them increased? How should policies and related management be changed as needed? What should happen in terms of policy and management after the present policy ends to ensure future conservation and long-term coexistence? Why?

This set of questions clarifies the standards that we use for making judgments about the adequacy of the program and each of the human, decision, and technical matters involved.

IV. What is your own standpoint?

We all have different personalities, values, philosophies, education, experiences, and loyalties that give each of us a unique standpoint or viewing angel on the world and the program of interest. There is no such thing as a truly "neutral" or objective" person or organization, although most of us aspire to be as bias-free as possible. How we see people and explain their behavior (including our own), how we go about solving problems, and how we find personal and professional meaning in our lives are all directly affected by our standpoints. Being aware of your own and others' standpoints is essential to good analysis and problem solving. Knowing the answers to these questions may tell you about unconscious biases that you or others have.

(1) What roles do you and other people play in the conservation program? Are you a scientist, a technician, manager, advocated, advisor, decision maker, scholar, facilitator, observer, analyst, or concerned citizen, or do you play another role?

(2) What problem-solving tasks do you carry out when performing your roles?

(3) Do you help set goals, determine trends, analyze the conditions that underlie that trends, project trends into the future, or invent and evaluate alternatives?

(4) What factors shape how you carry out you role and tasks—culture, personal interests, personality type, disciplinary training, organizational affiliation, and previous experience?

(5) Which roles or problem-solving approaches are you attracted to large scale conservation in the first place? Which approaches or roles are you not interested in? Why?

How we see people and explain their behavior (including our own), how we go about solving problems, and how we find personal and professional meaning in our lives are all directly affected by our standpoints.

Some final thoughts

Our shared interest is in finding more effective and sustainable ways for conducting large scale conservation–whether it is international transboundary peace park, an ecosystem management plan or a community watershed taskforce. This task will likely continue to be a problematic if past trends continue without any substantive or procedural changes. One conclusion seems obvious: if we—the extended community of people concerned about large scale conservation—persist in our old perspectives and practices, unproductive conflict will remain with us. Improving programs and processes will require that people and institutions shift gears conceptually and practically.

We perceive three possible outcomes in any large scale conservation effort. In the win-lose situation, a "solution" is found when the most powerful side wins at the expense of the losers. This seems to be the way that large scale conservation typically unfolds. In the compromise situation, contenders are clear about what they stand to gain or lose, and they work out a deal that minimizes deprivations. Compromise is, for example, part of most carnivore programs in Greater Yellowstone Ecosystem today. Integrative, win-win solutions are achieved when a new framework of cooperation is devised and adopted. Integrated solutions go well beyond winner versus loser, or patchwork quilt compromises. They involve genuine innovation that redefines the context and offers participants the possibility of satisfying their underlying demands without threatening participants' values and expectations. New perspectives and practices will emerge from integrated solutions.

Integrative, win-win solutions are achieved when a new framework of cooperation is devised and adopted.

Appendix C

Worksheets for Appraising and Improving Large Scale Conservation

Susan G. Clark, Catherine Picard, Darcy Newsome, Aaron Hohl[1]

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Worksheet 1: A Comparison of Formula, Symbols, Doctrine

Paradigm (Framework, Worldview, Myth)	Single/ Multiple Use Approach	Parks & Protected Areas Approach	Ecosystem Manage. Approach	Integrated Conserv. & Develop. Approach	Bio(Eco-)-Regional Planning Approach	Trans-Boundary Approach	Governance Approach
Formula (Operation Guidelines—"How To?"							
Symbols (Representa-Tions, "Y2Y," GIS Maps, Logos, Tee Shirts, Etc"							
Doctrine (Underlying Beliefs, Assumptions About World, People, Nature, Etc)							

What is the formula, recipe or guide being used?

1. ***Formula*** is the recipe, rules, guidelines, or program for being successful. Describe in terms of steps, methods, details how to be successful. The formula may not be well articulated and/or it may lie buried in the history and operations of the effort. Detail and cite examples.

2. ***Symbols*** are the popular manifestations of the formula. These include stories, actions (deeds), words, uniforms, logos, flags and the like. What symbols are used in the case? For example, "Y2Y" is a symbol of the

Yellowstone to Yukon initiative. What do they symbolize? List, detail, and cite examples.

3. ***Doctrines*** are the basic premises, beliefs, assumptions or philosophies that are described in abstract terms to support the formula. Doctrine functions to shape and continually reaffirm the perspectives of people, organizations, society as they carry out their lives and work. The doctrine is sometimes hard to find or see and describe.

Worksheet 2: Problem Orientation

	Ordinary Problems	Governance Problems	Constitutive problems
Single and Multiple Use			
Parks & Protected Areas			
Ecosystem Management			
Integrated Conservation & Development			
Ecoregional Planning			
Transboundary Conservation			
Adaptive Governance			

Ordinary problems: These are easily observed, quantifiable, technical problems that are observed on a day-to-day basis. Examples include poaching, habitat fragmentation, lack or excessive bureaucracy.

Governance problems: These are problems related to the decision process. Examples include the data collection and dissemination, participation in the debate about preferred alternatives, the selection of policy, implementation (including the use of sanctions), evaluation and termination of a policy or project.

Constitutive problems: These underlying problems have to do with the rules for making the rules. For example who gets to make decisions and set policy and why? Constitutive problems can be difficult to identify because they buried deep in doctrine and norms, but they can be seen by observing long-term patterns in decision making.

Worksheet 3: Approaches to Large-Scale Conservation Relative to Content and Process Dimensions

	Content (biophysical features)	Social process	Decision process
Single and Multiple Use			
Parks & Protected Areas			
Ecosystem Management			
Integrated Conservation & Development			
Ecoregional Planning			
Transboundary Conservation			
Adaptive Governance			

WORKSHEET 4: PROBLEM ORIENTATION

Goals: *What outcomes are sought?*

Content (substance):

Procedure (process):

Problem(s): *What stands in the way of achieving goals?*

1. Situation (content or biophysical problems)?
2. Human (social process problems)?
3. Decision making (decision process problems)?

Overall problem definition? Describe/spell out clearly, realistically

Trends *(historic standpoint): What has happened In terms of problems 1, 2, 3 above?*

Conditions *(scientific standpoint): Why? Explanation in terms of problems 1, 2, 3 above.*

Projections *(futuring standpoint): What is likely to happen in terms of problems 1, 2, 3 above?*

Alternatives *(Options/recommendations) (practical standpoint): What can be done about problems given trends, conditions, and projections?*

Remember that solutions come about by changing conditions that affect future trends.

Option #1: Status Quo—do nothing
Option #2: Some change in conditions? Detail.
Option #3: Something other than two above? Detail.

Justify your selected option.

WORKSHEET 5: CONCEPTUAL OUTLINE FOR A CASE STUDY: DECISION PROCESS

This outline views a decision process as a means for clarifying and securing a community's common interest. There are many factors that hinder finding the common interest in large scale conservation including, but not limited to pluralistic interests, special interests, bounded rationality, ideology, incomplete and distorted information, and situations that are open to internal and external surprises. Some decision process fails to realize the common interest just as some programs fail to achieve their goals. This outline for appraising conservation programs and finding ways to improve them was modified from a general outline prepared by Professor Ronald D. Brunner, Center of Public Policy Research, University of Colorado, Boulder, Colorado 80309 and successfully used in a wide variety of program appraisals.

I. Introduction

A. Focus. Describe the case and its significance.

B. Purpose. Clarify the purpose(s) of your study (e.g., practical, theoretical, and/or comparative).

C. Overview of what follows in body of paper.

D. Your standpoint and methods

II. Policy (decision) appraisal

A. Goals. What are the policy goals that are openly proclaimed? These formal goals are usually the best working approximation to the common interest and the easiest for us to use and defend.

B. Persistent problem(s). Problems are discrepancies between goals and actual trends in outcomes. Problems exist over time despite promises to correct them.

C. Diagnosis. Malfunction in decision process (any or all functions) are likely to be among the formal and effective factors responsible for persistent problems. Identify them so that they can be addressed.

III. Decision process appraisal

A. Map the decision process. What are the typical outcomes of each function? How are outcomes typically arrived?

B. Identify malfunctions. Look at each decision function for malfunctions.

C. Diagnosis. What factors are formally or effectively responsible for any significant malfunctions – participants, perspectives, situations, values, strategies, outcomes, and effects?

IV. Correcting the process

A. Strategy. Who should intervene in the process, when where, how, and for what specific purposes in order to improve the policy / program's outcomes through improvements in the decision process?

B. Explanations. Why is the recommended strategy expected to work if implemented? This is a case-specific theory to guide the reform effort.

C. Requirements. What resources are required to implement the strategy?

V. Conclusions

A. Contribution. Review what this case study has added to knowledge and/or practice in the conservation area.

B. Significance. Consider the significance of the results in broader political and social context.

Biosketches of Authors

Emily Alcott is a Master of Environmental Management Candidate at the Yale School of Forestry & Environmental Studies. Her interests include water resource management, soil conservation, and the policy sciences. She has experience in water quality research, watershed restoration, and environmental education.

David Cherney is a doctoral student at the University of Colorado at Boulder's Center for Science and Technology Policy Research and is a research associate with the Northern Rockies Conservation Cooperative in Jackson, WY. He holds a Master of Environmental Management degree from Yale University and a bachelor's degree in environment, economics, and politics from Claremont McKenna College. He serves on the executive council for the Society of Policy Scientists and on the program committee for the Society of Conservation Biology's Social Science Working Group. His dissertation research focuses on conservation non-governmental organizations in greater Yellowstone.

Susan G. Clark is Joseph F. Cullman 3rd Professor (adjunct) of Wildlife Ecology and Policy Sciences in Forestry & Environmental Studies and Fellow in the Institution for Social and Policy Studies at Yale. Her interests include interdisciplinary problem solving, decision making, governance, policy process, leadership, conservation biology, organization theory and management, natural resources policy, and the policy sciences. She has experience in the NGO community, academia, and field, nationally, and internationally. She wrote *Ensuring Greater Yellowstone's Future: Choices for Leaders and Citizens* (Yale Press) in 2008. Current work is on large carnivore conservation (e.g., polar bear/native people coexistence in Canada) and other projects.

Aaron Hohl is a recent PhD graduate of the Yale School of Forestry & Environmental Studies. His dissertation, Decision Support Systems and Monitoring for Sustainable Forestry (2009), analyzed social and biophysical dimensions of forest sustainability. His research interests include ecological modeling, forest landscape management, decision support systems, and interdisciplinary problem solving. He currently lives in northern California, where he is a lecturer at Humbolt State University.

Jennifer Hoyle is a candidate for a Master of Environmental Management degree at the Yale School of Forestry & Environmental Studies. Her current coursework

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Sristi Kamal is a graduate in Zoology and holds a post-graduate degree in Environmental Studies. She is currently working with ATREE (Ashoka Trust for Research in Ecology and Environment) in Darjeeling, India. Her interests include biodiversity conservation, natural resource management, and enhancement of livelihoods and ecological services for local communities in protected areas. She has worked with NGOs in India and has experience working in the field. She wrote a paper on Vertebrate Fauna of Kanjia Lake, Orissa, based on her field work, which was published in a national journal of India in 2009. She is currently working on community empowerment and monitoring impacts of human intervention on biodiversity in the Eastern Himalayas.

Yuko Kurauchi is currently Programme Officer of the United Nations Development Programme Drylands Development Center (UNDP/DDC). Prior to her appointment with UNDP/DDC, she served as a consultant to the World Bank Kenya Country Office. She has also worked as Project Officer at the World Resources Institute. She holds a Master of Environmental Management from the Yale School of Forestry & Environmental Studies and a B.A. in International Relations from the International Christian University, Japan.

David Mattson is a Research Wildlife Biologist and Station Leader with the USGS Southwest Biological Science Center, Lecturer and Visiting Scientist at the Yale School of Forestry & Environmental Studies, and Western Field Director of the MIT-USGS Science Impact Collaborative. He has studied large carnivores for the last 30 years, focused on puma ecology and human-puma interactions in Arizona and behavioral ecology of grizzly bears in the Yellowstone ecosystem of Wyoming, Montana, and Idaho. His interest range across leadership issues, organization design and behavior, and policy matters.

Alex McIntosh is Director of Corporate Citizenship for Nestlé Waters North America (NWNA). In creating this role and through initiatives completed to date, he acts as a catalyst to imbed corporate citizenship strategy into NWNA's operations, particularly: 1) environmental sustainability; 2) community & stakeholder engagement; and 3) reporting & transparency. Prior to Nestlé Waters, he helped lead conservation efforts at a field office of The Nature Conservancy, and published a field guide to birds. Alex earned his B.A. from Duke, and a master's degree from the Yale School of Forestry & Environmental Studies. Alex and his partner designed and live in a green condominium in Connecticut.

Christopher Meaney is currently a Marine Habitat Resource Specialist with the National Oceanic and Atmospheric Administration's National Marine Fisheries Service. His efforts focus on the implementation of the essential fish habitat provisions of the Magnuson-Stevens Fishery Conservation and Management Act, integrating impacts of climate change into habitat protection policies, aquaculture policy, and approaches to ecosystem based management. Over the course of his career, he has worked closely with government and non-government organizations on issues associated with both land-based and coastal and marine natural resource management, policy, and governance issues. He has a Bachelor of Science from the University of New Hampshire, and a Master of Environmental Management from the Yale School of Forestry & Environmental Studies, and was named a John A. Knauss Marine Policy Fellow in 2007.

Arthur Middleton is a PhD student in the Cooperative Fish and Wildlife Research Unit and the Program in Ecology at the University of Wyoming. He is currently conducting research on elk population and behavior dynamics and elk-wolf interactions in northwest Wyoming. Currently his focus is on large mammal ecology and predator-prey interactions, and he also maintains interests in relationships among ecological science, management, and conservation policy. He graduated in 2007 from the Yale School of Forestry & Environmental Studies with a Master of Environmental Management, and previously worked as a raptor biologist and falconer.

Kim Mortimer received her bachelor's degree in Visual Arts and Environmental Studies from Eckerd College in 2002 and her master degree in Environmental Management from the Yale School of Forestry & Environmental Studies in 2004. She also attended the Ecumenical Water Network–School on Water in Geneva, Switzerland in 2008. Her research focuses on the value of water as both a resource and human right from the religious and private lands perspectives, exploring how these values influence water policy decisions. She currently works for the Florida Fish and Wildlife Conservation Commission as a Regional Coordinator of private lands conservation in southwest Florida.

Darcy Newsome earned her Master of Environmental Management from the Yale School of Forestry & Environmental Studies in May 2009. Her work has included nonprofit conservation work as well as federal contracting. She has written on conservation-related topics including the need for a broader base of the conservation movement, as well as on programs to protect open spaces by targeting growth into urban centers. Her original research and analysis have influenced conservation and land use policy decisions at the local and state level. Her interests include large scale conservation, smart growth, and land use.

Tristan Peter-Contesse earned his Master of Environmental Management from the Yale School of Forestry & Environmental Studies in May 2009. He is currently an ORISE Fellow with the Environmental Protection Agency in Washington, DC. His interests include collaborative conservation, interdisciplinary approaches to

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Catherine Picard is a doctoral candidate at the Yale School of Forestry & Environmental Studies. Her research is focused on transboundary and large scale conservation in sub Saharan Africa. Her dissertation is an appraisal of the design, implementation and impact of the Selous Niassa Wildlife Corridor located on the Tanzanian-Mozambique border. Prior to Yale, she spent five years with the John D. and Catherine T. MacArthur Foundation, and has lived and worked in Rwanda, Senegal, Swaziland, Namibia and South Africa. She has a B.S. from the University of California at Berkeley, and a M.S. from the University of Michigan, Ann Arbor.

Tatjana (Tanya) Rosen is a Research Associate with the Northern Rockies Conservation Cooperative and IUCN Policy Adviser. She has worked since 2006 with the USGS Interagency Grizzly Bear Study Team on bear projects in Yellowstone and Grand Teton National Parks. She is also an international lawyer with experience in multilateral negotiations and editor of International Bear News. Her interests include the social ecology of carnivore conservation and transboundary management. Her latest article is on Transboundary Management of Large Carnivores in Europe (*Conservation Letters* 2009).

Jessica Siegal is completing the final year of her Master degree in Environmental Management at the Yale School of Forestry & Environmental Studies. Her academic focus is sustainable agriculture and local food systems, with an emphasis on farmland conservation and small-farm economics. Prior to attending Yale, she worked for the Rainforest Alliance, an international conservation organization, as their major gifts officer. Rainforest Alliance develops and promotes best management practices for sustainable agriculture, forestry and tourism in over 60 countries. She holds a bachelors degree in political science from Boston University.

Colleen Sullivan is a 2008 graduate of the Yale School of Forestry & Environmental Studies and has a B.S. in Environmental Studies from the University of Vermont, School of Natural Resources. After college, she spent five years teaching ecological concepts at a variety of environmental education facilities. While at Yale, she learned to use an interdisciplinary approach to manage conservation issues. Her work included a stint as a Tropical Resources Institute Fellow, researching institutional strategic alliances for conservation in the Galapagos Islands. She also worked locally with groups including the Urban Resources Initiative and produced, "Invasive Plants in Beaver Ponds Park, New Haven, Connecticut: Origins, Impacts, and Management Options."

Richard L. Wallace is associate professor and chair of the Environmental Studies Program at Ursinus College, where he teaches interdisciplinary courses on problem solving, biodiversity conservation, and food systems. He is a former staff member of the U.S. Marine Mammal Commission, where he analyzed species and habitat

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Rae Wynn-Grant is a 2010 Candidate for the Master of Environmental Science at the Yale School of Forestry & Environmental Studies. Her focus areas are wildlife ecology, East African wildlife management, human-wildlife conflict, and community based natural resource management. She has work experience in the government sector as well as with NGOs and plans to continue a career in addressing human-wildlife conflict globally.