Essays

Developing Policy-Oriented Curricula for Conservation Biology: Professional and Leadership Education in the Public Interest

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Abstract: *Some conservation biologists question the ability of current university curricula to prepare students to meet the needs of the profession in solving real-life conservation problems or to integrate the goals of conservation biology with other societal goals. The gist of the criticism is that curricula tend to emphasize narrow, technical proficiency at the expense of more integrative, "policy-oriented" problem solving. Conservation biologists' work should be relevant to policy, and I argue that professional participation could become more effective through a broader educational curriculum. Such curricula should teach students three things: (1) an understanding of how the policy-making system works and how human value interactions constitute the core of professional work, (2) mastery of skills in critical thinking and development of an interdisciplinary, "procedural rationality" for analyzing problems and evaluating potential solutions, and (3) development of influence and responsibility within policy systems. Seminars, case studies, and field trips are among the tools that can develop these skills in students. Finally, the education committee of the Society for Conservation Biology has great potential to improve the quality and relevance of professional education.*

Desarrollo de Planes de Estudio con Orientación Política para la Biología de la Conservación: Educación Profesional y de Liderazgo para Beneficio del Público

Resumen: *Algunos biólogos conservacionistas cuestionan la capacidad de los programas de estudio universitarios actuales de preparar estudiantes que llenen los requisitos necesarios de la profesión para resolver problemas reales de conservación o para integrar las metas de la conservación biológica con otras metas de la sociedad. La esencia de estas críticas es que los programas de estudio tienden a enfatizar una destreza técnica estrecha a costo de una más integradora, orientada a la solución de problemas con orientación política. El trabajo de los biólogos conservacionistas debería ser de relevancia política, y yo argumento que la participación profesional podría ser más efectiva mediante un programa de estudios educativo más amplio. Este programa debería enseñar a los estudiantes tres cosas: (1) el entendimiento de cómo funciona el sistema del quehacer político y como las interacciones de los valores humanos constituyen el meollo del trabajo profesional, (2) el manejo de técnicas de pensamiento crítico y desarrollo de una "racionalidad procesal" interdisciplinaria para analizar problemas y evaluar soluciones potenciales, y (3) el desarrollo de influencia y responsabilidad dentro de los sistemas políticos. Entre las herramientas que pueden ayudar a que los programas desarrollen estas habilidades en los estudiantes se encuentran seminarios, casos de estudio y viajes al campo. Finalmente, el comité de educación de la Society for Conservation Biology tiene un potencial grande para mejorar la calidad y relevancia de la educación profesional.*

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Paper submitted January 4, 1999; revised manuscript accepted June 21, 2000

Introduction

A strategic concern for conservation biology is the quality of education of its future professionals. In the face of rapid environmental change and cumulative crises such as human population growth, over-consumption of resources, and loss of biodiversity, our profession is one of the few that society can engage to advise responsibly and reliably on the conservation of biological processes and resources. We must be able to provide advice that is principled, practical, and in harmony with other key societal goals, among the most fundamental of which are human dignity and democracy.

Conservation biologists, whether in the field or classroom, need to consider fully their professional relationship to the society in which they live and the kind of governance their work promotes. Most of us live in democratic societies and at some level seek to promote democratic values and practices. Indeed, demands for democracy and improved material conditions are growing worldwide (e.g., United Nations Universal Declaration of Human Rights; McDougal 1992–1993). Ideally, our profession promotes a democratic world rich in human and biological diversity at healthy and sustainable levels.

Our ability to move toward sustainable conservation depends on the health of our governance processes (Cortner & Moote 1998). The recent surge in community-based and public participatory approaches to conservation are evidence of society's intense desire to share in the process of shaping conservation policy. This is consistent with Dahl's (1994) conception of democracy, which is participatory, representative, and deliberative. Orr (1992:2) confirms that "sustainability, citizenship, and real democracy are linked."

The policy problem for society, including conservation biologists, is twofold: first, to create a workable process for balancing sustainable environments with sustainable societies; second, to ensure that this process produces substantive outcomes. Conservation biologists must also understand the interplay of their own and other peoples' values in policy processes if they expect to be effective in promoting biodiversity conservation in the context of democratic society. Consequently, because higher education is largely the task of colleges and universities, we need university curricula that recognize the scope and context of conservation problems, fully prepare professionals to carry out policy-oriented activities, and develop both leadership and lifetime learning.

I reviewed criticisms of existing curricula and, by way of clarifying aims for new university programs, describe the practice of contemporary conservation biology. I suggest some knowledge and skills that students must acquire, and I describe educational opportunities in the classroom and beyond.

Appraisal of the Problem

Many practitioners have spoken out for more comprehensive and relevant conservation biology curricula. Noss (1997:1267) noted that, "with few exceptions, universities fail to train graduate students for problem-solving outside academia, largely because the professors themselves have no experience elsewhere. I see no evidence that these problems have lessened in the 10 years since I received my Ph.D." He concluded that "the university [is] ill-prepared to train students for the current job market." Meffe (1998:259) believed Noss to be "on target and the problem to be serious." He traced "serious deficiencies in academia's response to the biodiversity crisis" to "the narrow visions of university departments and the disciplines they represent" (p. 259). Boersma (1998:1) stressed that "one of the most pressing needs is influencing the policy process." Jacobson and McDuff (1998:263) concluded that essential skills in policy process, social sciences, or communications, which are not viewed as part of our professional identity, largely go unaddressed. Scientists and managers alike have reiterated the need to expand our training and understanding of the human dimensions of natural resources management, yet educators typically ignore these pleas.... We may, in fact, be training *idiot savants*—individuals skilled in certain areas (in this case, the technical biological aspects of conservation)—but largely inept in other aspects of the field." Another criticism comes from Jope (1994:925), who decided that "for far too long we have accepted a paradigm that is proving a hindrance to our ability to conserve the biodiversity of the Earth." Other authors have also called for better education and professional effectiveness, among them Romm (1984), Clark (1997), and Lidicker (1998).

Although the criticisms are diverse, they commonly speak to weaknesses in skills such as integrative, interdisciplinary, problem solving for real-life situations. Many in higher education do not understand what needs to be taught, what skills are necessary, what should be integrated and how, and for what outcomes. Despite all the discussion within academia, there is little explicit, systematic effort to relate the structures, philosophy, and methods of conservation biology curricula to the major conservation policy problems of the United States and the world.

Regardless of the focus of these criticisms, the language employed, or their recommendations, critics are calling for a more interdisciplinary, "policy-oriented" conservation biology curriculum. Such a curriculum would focus attention on solving problems at the interface between humans and the natural world (Clark 1992). Policy-oriented education—and thus policy-oriented professional practice—is likely to create more practical, problem-focused, contextually relevant, and genuinely interdisciplinary conservation solutions.

Many current curricula in conservation biology are based on concepts, methods, epistemology, and pedagogical means that do not serve pressing contemporary needs. They represent too narrow a conception of the goals, role, and nature of the profession, focusing on technical aspects of population and community ecology, genetics, and a range of secondary topics such as population viability assessments and park and reserve management. Although these secondary foci are intended to be relevant, they often fail to come to grips with dynamic social values, institutional contexts, and actual, ongoing policy processes.

Without explicit reference to the larger social context of which it is a part, the teaching of conservation biology is incomplete. Rather than recognizing social objectives such as democracy and sustainability, curricula are defined predominantly in disciplinary or theoretical terms, sometimes with high-level abstractions. Recent curricula tend to "technologize" education in terms of scientific positivism, quantification, predictive methods, hardware, and science-based programs (e.g., Murphy 1990), rather than clearly articulate a body of interdisciplinary theory and how to use it. The current focus on statistics, computers, and geographic information systems are examples. These are important tools, but they do not necessarily focus the profession on the ultimate causes of biodiversity loss, which are nearly always related to humans.

In exploring science and social responsibility, Brunner and Ascher (1992) noted that science is often carried out acontextually and that larger questions about society, democracy, or other institutions receive comparatively little attention. From the technical-rationalist viewpoint, science is seen only as a prerequisite to policy (e.g., Schön 1983; Lubchenco 1998). Under traditional assumptions, students are encouraged to avoid politics, policy, or value discussions because these "corrupt" objective science and professionalism. As a result, students may fail to see alternative, innovative, and, in many cases, more effective means of solving problems. On the job, practitioners are left to their own devices to invent, interpret, and intervene in ways they feel are constructive. Without training, some practitioners evolve their own idiosyncratic understanding of policy situations, their own vocabulary, and methods that work more or less in individual contexts; most do not.

A growing number of universities are directing their curricula toward policy, but instruction is often vague, amorphous, and based on scientific positivism and simplistic, conventional notions that all that is needed is good science and ethical politicians to put it to good use. Teaching often consists of inadequate admonitions to students to integrate the biological and social sciences, appreciate the "human dimensions" in policy-relevant ways, or blur confining disciplinary boundaries. Curriculum review is too often limited to whether it is appropriate or best to have individual versus group projects, small versus large courses, broad versus specialized training, field versus laboratory experiences, or biological versus social education. These are not basic discussions. The question of how to escape the inadequacies of present curricula has not received the introspection and deliberation it deserves. If conservation biology education is to serve the needs of a free and environmentally secure society, it must provide purposeful, efficient, and systematic training in policy making, including the formulation, implementation, and appraisal of all sorts of policies, programs, and practices.

How Professionals Influence Policy

Conservation biologists in academia, resource management agencies, research facilities, nonprofits, environmental organizations, and business organizations carry out diverse tasks in conserving biodiversity for the public good. As in other professions, scientific and conservation activities overlap and interact with those of public policymakers. No conservation biologist can escape being part of *policy making*, which may be defined simply "as the making of important decisions which affect the distribution of values" in society (Lasswell & McDougal 1992:1269). *Value* simply denotes an object of human desire, and the "distribution of values" notion is key: it signifies who gets what in society (good or bad), whose goals and ideals are achieved and whose are denied, who is "indulged" and who "deprived," which values (and associated institutions) are promoted and which are devalued, and what means are used to reach these outcomes. Even conservation biologists who argue that policy is of no concern to them are advocating a policy, however unconsciously. They are promoting the status quo in current value distributions and institutions, and their unwillingness to participate means that their values (presumably, to protect the natural world) will likely be regarded as irrelevant by the rest of society.

Professionals currently figure into the conservation policy-making process in many ways. Although many people understand policy making to be limited to those activities that take place in the U.S. Congress or at high levels within agencies, it actually includes activities leading up to and following from authoritative government decisions (see Ascher & Healy 1990; Clark et al. 2000). Among opportunities to influence policy are the following professional activities, which, of course, constitute only a partial list: conducting research (basic and applied); writing and publishing technical articles, monographs, and books on species, ecosystems, and conservation subjects; lecturing to professional audiences and making public presentations on matters of professional and civic interest; teaching short courses, in-service training programs, and formal university courses; participat-

ing in professional organizations and societies; preparing, reading, commenting on, and reinterpreting agency (and others) decisions and documents (e.g., environmental impact statements); advising organizations, such as nongovernmental conservation groups, or serving on boards and formal advisory bodies; consulting or negotiating with allies and adversaries; bringing out (or concealing) facts or policies that decisionmakers need; and serving as ordinary or expert witnesses.

Conservation biology practitioners are members of what we might call an elite skill group**.** Their influence on policy processes is measured not in terms of a few high-profile, important decisions, but in the cumulative effect of daily activities and ordinary interactions in which facts and opinions are delivered, considered, and acted upon. The work of conservation biologists is truly important to society for the development, implementation, evaluation, and evolution of public policy—in other words, for clarifying and securing the public interest.

Conservation biologists need to have the knowledge, skills, and civic-mindedness to serve society in ways that count. They should learn what other informed people think, the historic trends of their time, the long-term interests of those they are associated with, and the available means to serve those interests (e.g., Scott 1998). They should develop habits of questioning what they think they know, seeking help with knowledge they lack, and thinking in innovative ways. This does not mean abandoning positivistic science and technical matters, only adding to them and putting them in a larger social perspective. Conservation biologists ought to be leaders in offering a comprehensive and corrective perspective to society, one that is rooted soundly in the disciplined exercise of appropriate skills.

The major contours of contemporary practice for the foreseeable future seem clearly visible (e.g., declining biodiversity). Global trends in human populations, social behavior, and "demands" for values seem clear, too (McDougal et al. 1988; Turner et al. 1995). Effective practice will require conservation biologists to assimilate knowledge that is directly useful in conservation policy and, equally important, knowledge of the policy process itself. That is, they should have skills to be both substantively and procedurally rational, politically practical, and morally justified.

Knowledge and Skills that Students Need

A new focus in university curricula is needed, one directed toward helping students become leaders in developing and implementing conservation policy for the public good. The task is to identify the essentials of an adequate education in conservation biology and the best configuration of coursework and experiences to ensure appropriate outcomes in terms of knowledge, skill, and public interest. Although some universities excel at this task and some professionals are moving on their own toward a policy orientation without formal education, this shift could be more efficient and effective if it were taught explicitly and systematically. The overriding goal is to integrate the ecological and social sciences to make conservation biology a more effective tool of change. Conservation biology applied in a democratic society must be consistent with democratic principles. This should not be taken naively to mean that the whole human social process in any given case can be fully understood or that society will ever achieve harmonious consensus on democratic, conservation, or any other values. Nevertheless, it is definitely possible and vitally important to teach conservation biology students to be knowledgeable, effective, willing, and responsible policy participants (Ascher & Healy 1990; Lasswell & McDougal 1992; Clark 1997).

Three specific bodies of knowledge would contribute to making conservation biology education more policy-oriented. First, students should have rigorous training in the study of human interactions (including those involving conservation)—not as unfathomable, random, and inherently bad political machinations, but as transactions in values. Second, students should be trained and experienced in democratic discourse and deliberation so that they can participate effectively, responsibly, and reliably in public proceedings. Finally, they should have finely honed critical thinking skills, allowing them to analyze problems and recommend alternative solutions in ways that are rational and comprehensive yet sensitive to context. Organizing conservation biology curricula around these three principles of values, skills, and influence would produce practitioners who are better equipped to solve pressing conservation problems.

Understanding Human Interactions

However science and conservation are understood, they are human activities and as such are part of the human social process. Conservation biology texts and curricula should teach systematic theory about social processes and how to bring about constructive change. To make sense of the social process, students need systematic and rigorous study of the *participants* in any policy situation, their *perspectives* (how they identify themselves and what they expect from the policy situation), and their *values* as manifested by their behavior (their demands). Students need to be capable of analyzing *situations* (biogeographic settings, institutions, crises) in which participants act and the *strategies* they use to achieve their goals. Finally, it is important that they be able to assess the *outcomes* and *effects* of policy decisions in terms of value distributions. This deceptively simple set of social-process categories, which can lead students to a comprehensive exploration of the human context of

any conservation problem, is derived from the policy sciences as developed by Lasswell and Kaplan (1950). This integrative field, which draws on anthropology, political science, jurisprudence, sociology, and other disciplines of human behavior, has much to offer the field of conservation biology.

Because all human interactions and transactions (in other words, all policy processes) are manifestations of people striving to satisfy their values, the study of values is a good starting point. The set of values recognized by the policy sciences is brief yet comprehensive. It is generally agreed that people act in accordance with only eight basic categories of values—power, wealth, enlightenment, skill, respect, rectitude, well being, and affection—as acknowledged in many international and national constitutions and other documents of social import (Lasswell & McDougal 1992; Meffe 1997). The major objective of a free society is the achievement and protection of a balanced combination of these values.

Students in conservation biology programs should be able to abstract and articulate the values served by their professional activities, whether they include endangered species recovery, preserve design, construction of interpretative trails, or any other activities. They should be able to make high-level generalizations about how these practices harmonize with other societal goals. It is important that students be able to clarify their own values and perspective relative to the entire social process of which they are part—not an easy task because each individual, group, or society has multiple values, many of which may conflict. Curricula should encourage students to contemplate how well conservation biology doctrine and practices affect the attainment of all eight values and what kinds of structures and practices exist or can be made to affect value distributions. Students should be familiar with several "discursive designs"—such as mediation, facilitation, and problem solving (i.e., representative and deliberative designs), for instance—that are most likely to bring out good public participation and sustainable conservation. Curricula should create individuals who are capable of meaningful dialogue, of clarifying the values at stake in any situation, and solving problems—skills central to participation in the policy process (Dryzek 1990; White 1995).

Because conservation is a process of decision making, students need to understand the functions and needs of the decision process: *intelligence* (information gathering or planning), *promotion* (open debate), *prescription* (selection of a policy), *invocation* (enforcing the policy), *application* (administration), *appraisal* (evaluation), and *termination* (ending one policy and moving to a new one) (Clark & Brunner 1996). As students examine complex and difficult case studies, they must be able to apply accepted standards to assess whether each function of the decision process is carried out well and what requirements still need to be met. Courses on decision making in conservation biology, for example, could focus on determining which individuals and agencies make the important decisions; identifying the outcomes and effects of decision processes; assessing how well decision functions are carried out and how they could be improved in specific cases; clarifying which institutions in society have power, how they use it, and which formal or informal controls keep their use of power responsible; examining the mechanisms of formal authority and effective control within organizations; and developing ways to give more people access to and skill in interpreting the data necessary for decisions that promote democracy.

Courses on conservation biology and sustainable community development, for example, might be a good forum in which to bring together all these major values and variables. The frame of reference would be the interrelationship among the theory, practices, and structures of conservation biology and use of resources by human communities. Issues of natural resource management, population control, regional planning, and regional ecosystems are particularly urgent (e.g., Lafferty & Eckerberg 1998; Warburton 1998). Addressing these issues in regional ecosystems is especially necessary (e.g., Brunner & Clark 1997). Students should be clear about the patterns of life facilitated by sustainable community-development projects. A basic question is how community development and use of natural resource practices can be harnessed to improve the democratic process, and vice versa.

Developing Professional Skills

Perhaps the most important variable that determines whether a student will mature into a successful conservation biologist is skill, or the ability to find or create and take advantage of opportunities to attain goals effectively. A substantive command of the scientific and technical components of conservation biology and rigorous scientific methods is, of course, required. But because the policy milieu of conservation problems falls largely outside the domain of scientifically answerable questions, an adequate education must also provide experiences that stimulate students to think creatively about about policy processes.

Critical thinking is derived from an individual's cognition, epistemology, and framework for problem solving (Lasswell 1971; Goldman 1986). Cognition involves sensing and knowing, which are functions of anatomy, physiology, psychology, and sociology. Epistemology deals with how we know things, which is both an individual and a cultural product evidenced through language and social communications. Because people and cultures vary, there are many different individual and social epistemologies and cognitive styles in currency, but unless a person's knowledge is structured in a framework shared

with other members of society, there is little basis for communication, let alone cooperative problem solving. Some frameworks, are superior to others as heuristic devices, however, and these can be described, taught, and applied (Clark et al. 2000). Students need to master an effective critical thinking framework and be able to apply their skills of thought to resolving policy problems.

Thinking about policy processes differs qualitatively from scientific thinking. Clarifying and securing the common interest in a complex situation—sorting through people's values and how to satisfy them—is a different kind of problem from the biophysical problems typically addressed by conservation biology. Policy problems are rarely amenable to experimental testing with control groups as called for by positivistic science. Traditional science and its accompanying epistemology (i.e., positivism) and cognitive style are ill suited to answering questions about why so much conflict has crystallized around the Endangered Species Act or how to conserve fisheries on Georges Bank, for example. Science can contribute to the policy process by determining matters of fact, clarifying historic trends and conditions, and making projections about them. But policy thinking demands a conceptualization that is broader than positivistic science, although equally rational and empirical.

To address policy problems practically, students—as developing professionals and practitioners in the field of conservation biology—need to learn a procedurally rational, problem-solving strategy. Such an analytical approach, entailing five "intellectual tasks," has been described by Lasswell (1971) and Clark (2001), and has been applied to the practice of conservation (e.g., Arsanjani 1981; Clark et al. 1996).

The first task in developing procedural rationality about policy matters is to clarify the goals and values of the people involved in or affected by the problem and its solution. This is essential to understanding the nature and scope of the problem and to devising and assessing possible solutions despite the difficulty of sorting out multiple values and perspectives. Students must clarify their own values, interests, and stakes in the situation as well as others'. What values does conservation biology stand for? What values is it compatible with? What values does it conflict with, and can they be reconciled? To be effective in policy making, students must develop a broad perspective on human values.

The second task is to describe the trends that have led to the current situation or the history of the problem with respect to the participants' goals. This requires empirical data not only about ecological events but also about social, economic, and political history. For example, increases in human land uses as well as habitat loss may be a key trend in the disappearance of a species. If trends are moving away from the goal, then a problem exists. The practical task for the student is to identify the discrepancies between existing situations and people's preferred goals and to think creatively about how to change the trends to maximize the likelihood that the future will better approximate the goals.

Third, students must learn to analyze the conditions under which the observed trends evolved. To determine causes and influences, scientific thinking is usually brought to bear to explain the factors and forces that created or enabled the problem. Students should be familiar with up-to-date methods for deriving facts systematically, and in recent decades both social and ecological methods have become more systematic, technical, and exhaustive. If the participants in a policy situation can manage or change the conditions under which existing trends have developed, then they can increase the likelihood of influencing future outcomes. In this broader context, science seeks to promote human freedom by bringing more factors more reliably into account when decisions are made (Brunner & Ascher 1992).

The fourth task is for students to project trends and conditions into the future. Creativity is needed, along with scientific knowledge, to make realistic, probabilistic projections about whether future events are likely to move toward the preferred goals. Many techniques can be used, especially modeling; simple models as well as sophisticated computer simulations can graphically display what is known about trends and conditions and possible interrelationships and scenarios. If modeled trends are deemed accurate, then the policy participants have a good basis for deciding on a course of action.

The final task that students must undertake is to invent, evaluate, and select alternatives to bring future trends more in line with goals. Changes may be made in policies, programs, or perspectives and students must decide which changes are compatible with the attainment of a healthy, sustainable environment for all and which improve prospects for the actualization of human dignity. How can the institutions of modern society—education, agriculture, business, government, the justice system, and many others—be fine-tuned to be consistent with the goal of dignity and sustainability for all?

Seeing problems as discrepancies between current conditions and people's goals, analyzing past and future trends in the problem and conditions, and devising and evaluating alternative solutions to bring trends in line with goals will enable students to think comprehensively, rigorously, and iteratively about conservation policy problems. Along with a more comprehensive understanding of social process, values, and decision making, this framework of five tasks and standards for their fulfillment provide critical, rational analysis for the solution of complex problems.

Influencing Policy

As students move into the professional world as conservation biologists, they should not only be beneficiaries of the values that society decides on, but they should

also contribute to shaping those values. Highly developed analytical and technical skills and a robust understanding of the policy process bring with them a responsibility to participate. Influence belongs to those who are skilled in the manipulation of symbols (both word and deed, focused on community cohesion, meaning, and adaptation) and in the management of goods and services (the flow of materials and processes). Despite the many negative associations of "influence" in our political system, conservation biologists cannot build healthy, sustainable societies and environments without it.

Universities should teach students how to serve society's common interests, how to influence policy explicitly, systematically, and responsibly, and where and how to intervene in policy systems. Attention should be paid to those with maximum political influence (e.g., heads of organizations or key opinion leaders) and representative influence (e.g., public). Students should be challenged to appraise whether and how the current ideas and practices of conservation biology are influencing and persuading law makers and other leaders. In other words, students should develop skills in presenting conservation biology information in a form that is usable by policy makers.

As they become practitioners, students must be prepared to work with public officials, administrators, business executives, village chiefs, negotiators, citizens, and other responsible persons. Students must learn several ways to achieve agreement or acquiescence in mixed social settings to improve conservation. As they engage themselves in broader issues than those requiring their distinctive technical skills, they will be forced to operate as equals with people who use other skills and what Lasswell and McDougal (1992:1339) call "general policy skills." In such settings, a traditional university education may confer advantage, but it may also insulate or prevent students from learning or practicing other modes of thinking, knowing, and communicating (see also Majone 1989; Parsons 1995). Success in actual situations depends on being able to deal with real-life, factual information, including differences among people. Scientific thinking seldom accounts for cultural frames of reference, beliefs, or individual motivations that play a major role in problem solving at the group or societal level. Thus, students should begin by being explicit about their own frames of reference—their values, why they hold them, how to justify them, and how to act on them. Good habits of thinking, writing, and speaking and use of a policy framework for thought and action can help produce the insight, awareness, and objectivity that are great advantages in diverse social settings. A good curriculum should give students experience in such hands-on, manipulative activities as well as intellectual ones (Brunner 1997*a*, 1997*b*, 1997*c*).

As they learn to influence conservation policy, students will be called upon to work with people, as individuals or as groups, and such interactions should always be guided by values of dignity and worth of the individual. Basic information about human personality and group psychology will be essential for students to observe and communicate reliably with others; estimate responses of the public leaders, and those influential in media and public opinion, and decide what to do to improve conservation. Study of organization and management as well as public relations skills could also supplement conservation biology curricula. For example, it is valuable to know the characteristics of different kinds of organizations, the kinds of tasks for which they are best suited, and the functions of management and leadership. Regarding methods, for instance, many procedures exist to sample people's predispositions and attitudes, such as scientific polling surveys, prolonged interviews, and content analysis of the media. Different media and different contents reach different group's attention, for instance, and media analysis can indicate who controls the media and which values are being promoted, how, and for whose benefit. These and related fields of study have much to offer conservation biology students in terms of practical methods, standards of reliable knowledge, and useful knowledge.

Suggestions for Improving Conservation Biology Education

A growing number of conservation biology leaders are speaking out about the lack of explicit, systematic, policy-smart curricula. Current curricula tend to put too much emphasis on positivism and technical proficiency and not enough on problem-focused analysis, contextuality, and genuinely interdisciplinary methods. In effect, there is not enough emphasis on meeting the demands of actual, professional problem solving. The relationship of conservation biology to other societal goals, such as sustaining democracy, needs to be clarified.

Corroborating the need for a policy orientation in professional practice is the commitment of the Society for Conservation Biology to improving public policy development, education, and practice and the group's desire to provide policy-oriented services. The organization's articles and bylaws explicitly recognize that its principal aim is to supply society with key intelligence about the history, and current and future status of biodiversity and to recommend policy interventions that will lead to improved conservation (Society for Conservation Biology 1987; Soulé 1987). The society claims that it will accomplish this by conducting research; disseminating results to the media, public, and private institutions; encouraging interdisciplinary exchanges on social, economic, and political issues; promoting biodiversity; educating people on the issues; exchanging and applying information; and advancing and articulating the society's position on matters of public policy.

Conservation biology curricula need to be upgraded and expanded if we want students to become successful leaders and practitioners in biodiversity conservation. In the classroom and beyond, in seminars, in-service workshops, case studies, field trips, field work, and internships, new guiding principles should be sought to direct curricula. A growing number of professionals are proposing new views and new university courses that articulate social values, provide criteria for development of arguments, and identify variables in social processes that affect conservation outcomes (e.g., Romm 1984; Jacobson & McDuff 1998).

The classroom probably will remain the site of most pedagogy, and thus it is up to professors to make the classroom experience a powerful opportunity for transmitting technical, leadership, and policy skills and stimulating creativity and innovation. Seminars offer a great opportunity for small groups of students and professors to undertake creative exercises and research problems. Interdepartmental seminars and in-service workshops can be particularly productive in improving professional performance. Case studies can help students develop their skills without actual professional costs. Using context-sensitive methods, they can explore situations that mimic real life (and future career circumstances) and practice solving conservation problems. Field trips, preferably of several day's duration, are also invaluable in immersing students and instructors in contexts of real-world problems, people, and consequences. Students must interact with people whose interests, values, and desires may differ dramatically from their own. Field work and internships involving real conservation biology problems, especially in team settings, can be especially educational. A good education should also provide students with opportunities to interact with decision makers, people affected by conservation problems or proposed solutions, and interest groups.

The education committee of the Society for Conservation Biology, established in 1999, is also likely to have a strong influence in shaping university curricula in the field. Charged with promoting conservation biology principles among the public, biologists, and managers, the committee is currently focusing on seven domains: elementary and secondary education, undergraduate education, graduate education, short courses and workshops, conservation literacy, society publications and meetings, and inter-society relations (S. Trombulak, personal communication). Among the ongoing projects of this "very active committee, with lots of energy and enthusiasm," according to its chair, are a survey and assessment of undergraduate programs, a regular "education column" in the society's newsletter, organization of a roundtable discussion on education for the 2000 annual meeting, and initial efforts "to articulate the components of conservation literacy" (S. Trombulak, personal communication).

A key task of the committee should also be to establish and maintain a comprehensive overview of professional practice. This might require a continuing audit and assessment of needs—from all branches of the profession and from regional to international levels—and recommendations on how curricula and other educational opportunities could best meet these needs and what conditions are necessary to maintain high-quality learning experiences. The committee, which may become a standing committee of the society, seems well on its way to serving as a valuable forum in which experienced as well as new practitioners can share views, meet with experts from related disciplines (e.g., education, critical thinking, policy sciences), and increase their awareness of educational problems and likely solutions.

The Society for Conservation Biology could possibly also serve as a granting organization to assist universities, individual scholars, and other organizations in curriculum development, including those seeking innovation and those who do not fit into generally accepted patterns of teaching or problem solving. Fellowships might be offered for careers in policy research, teaching, and education improvement. The education committee in particular could undertake studies of the requirements of policy-relevant professional practice. It could also encourage federal and state governments to improve the conservation biology education of agency personnel. Another task of the committee might be training of qualified personnel and undertaking or promoting educational experiments or prototypes. Training opportunities could be established to help teachers and scholars increase their command of new techniques. The society and the committee should also pursue leadership development.

The challenge of making conservation biology most effective is clear. Few human enterprises serve the public interest more than conserving our irreplaceable biological heritage. But time is running out for species, ecosystems, and natural processes, and our profession bears a critical responsibility to overcome this dire global problem. We need to develop leaders in the field who are not only competent scientists but are also able to understand conservation problems in their social contexts, analyze diverse ecological and social variables, and intervene in practical, humane ways to solve problems. The acquisition and maturation of such abilities depends on enlarging the scope of professional education at colleges and universities and in the working world. To be successful, conservation must embrace not only biological sciences.

Acknowledgments

D. Casey, M. Rutherford, R. Wallace, G. Meffe, S. Humphrey, R. Noss, D. Iverson, and three anonymous re-

viewers critically examined the manuscript. I thank P. Pister for finding background materials. This project was supported by the Northern Rockies Conservation Cooperative and Yale University.

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