

FORUM

Practicing Natural Resource Management with a Policy Orientation

TIM W. CLARK

Northern Rockies Conservation Cooperative

P.O. Box 2705

Jackson, Wyoming 83001, USA

and

School of Forestry and Environmental Studies

Yale University

New Haven, Connecticut 06511, USA

ABSTRACT / All natural resource managers want to contribute to successful conservation programs. Having and applying an explicit policy orientation is indispensable. The policy sciences are described and a case is made that, if natural

resource managers utilize this set of conceptual and applied tools in their natural resource work, their effectiveness could be enhanced. The policy sciences offer a contextual, problem-oriented, and multimethod approach to meeting complex problems. Two kinds of knowledge are needed to solve problems—substantive knowledge about the resource and process knowledge about the decision and policy processes used to derive courses of management action. The interplay of science, analysis, and politics are examined. The wildlife management community is used to illustrate many points, including the important role implementation plays in the overall policy process.

All natural resource management professionals want to contribute to successful conservation efforts. This article is about enhancing effectiveness, the hallmark of professionalism (Thomas 1986). The paper explores the development and application of an explicit policy orientation for the profession. I draw on the wildlife management profession (wildlifers) to illustrate points. In so doing, I review some literature that shows a growing recognition that a policy orientation is urgently needed. I examine the role of wildlifers in the policy process, focusing on the implementation phase. I introduce the policy sciences from which a policy orientation can be explicitly derived, and I discuss the role of science, analysis, and politics in the policy process. A policy orientation could be taught to all natural resource managers as part of established university programs.

Knowledge and the Policy Process

Since Leopold's (1933) *Game Management*, the wildlife profession has developed numerous conceptual (e.g., population and community ecology theory) and applied (e.g., radiotelemetry, computers) tools. This trend is expected to continue. As a result, wildlifers possess considerable information about wildlife—its behavior, habitats, populations, community relationships—and how to manage it. This information is directly useful in decision and policy-making processes for conservation. But how well is this knowledge used in these processes?

KEY WORDS: Policy orientation; Natural resource management; Policy sciences; Policy process

Many professionals have experienced situations in which their data about wildlife and needed conservation measures were, to their consternation, discounted or ignored in decision and policy processes. Consequently, failure to use that information led to poorly performing policies and programs in which wildlife suffered. Clearly, problems can exist in how other people use (or do not use) wildlife data in these processes (see Yaffee 1982). As Brunner (1987, p. 1) observed: "To the extent that data are underutilized or misused, these resources are wasted and opportunities for better-informed policy decisions are foregone." More disconcerting, though, for many wildlife professionals is Nathan's (1985, p. 423) observation that "analysis is less important than values and beliefs as a basis for policy-making." If this is true, how can wildlife professionals use their knowledge most effectively in decision and policy processes?

In seeking to answer this question, other questions are raised. First, how much do wildlife professionals know about the policy process and how to participate in it effectively? As with any profession as diverse and as large as the wildlife profession, individual knowledge of these processes varies from considerable to nil. Second, concerning those individuals with little understanding of the process: do they unknowingly contribute to the misuse or underuse of their knowledge by their lack of understanding of the complexities and subtleties of these processes? Several wildlife professionals have indicated that, even though the profession is good at getting technical information, they are not—profession-wide—insightful and skilled in the policy process that determines the future of wildlife (e.g., Heinz and

Youmans 1985, Thomas 1986). This article suggests that the wildlife profession could significantly improve use of its knowledge in the policy process if it possessed and applied an explicit policy orientation.

Developing a Policy Orientation

Perceptions and Needs

A growing number of wildlife professionals have described the need for a policy orientation for the profession. In most cases, though, they have not used the term "policy orientation" in making their cases. Greenwalt (1981) said that he developed what can now be termed a "policy orientation" the hard way, over years of experience. (University programs are now available to teach a policy orientation.) Romm (1984, p. 15) emphasized that wildlife professionals need education that will enable them to operate as well in the public forum of the wildlife policy process "as in the forest, field and stream." Thomas (1986, p. 30) asserted that "No natural resource manager can be truly effective over the long term, without mastery of biopolitics." He defined this biopolitics as the "biological and political skills to achieve goals and objectives in an acceptable manner while considering prevailing circumstances, and legal and ethical constraints." Heinz and Youmans (1985, p. 13) observed that most problems besetting effective wildlife conservation are political "and will continue to be because of conflicting human values." Carr (1987, p. 80) argued that good conservation biologists should be "willing to use their training and analytical skills beyond the confines of biology, reaching out to examine the cultural or sociological factors that bear on the survival of their favorite species." Hales (1987, p. 81), in discussing the type of wildlife conservationists that will likely be most successful, noted that the "trained, analytical" approach of the biologist, or any other disciplinarian, often seems to lead to fragmented problem definitions, and unimaginative solutions, the success of which, over time, is not particularly impressive." He went on to say that "Equally important is 'political' wisdom and knowledge, i.e., the ability to make the 'political' system work." Finally, Clark and Kellert (1988, p. 7) concluded that "an explicit understanding of the policy process is basic to the work of wildlife conservation, its science, management, administration, and public service." These authors and others have clearly recognized an urgent need for an explicit, applied policy orientation for wildlife and conservation biology professionals.

Policy Orientation

Simply put, "policy orientation" means having knowledge (or intelligence) that is directly useful in the

policy process, but in addition, having knowledge of the process itself. An example of knowledge in the policy process is knowing about a deer herd's status, consequences of various harvest options, and economic returns derivable from management options. Such knowledge may meet intelligence needs in the policy process in establishing hunting regulations. A typical question about the intelligence needs in this policy process might be: How reliable are the data about the demographics of the deer herd or hunter demands? To provide reliable intelligence requires extensive information in the wildlife management sciences, natural resource economics, and other disciplines. The wildlife management profession is ever striving to improve knowledge in the policy process.

Insight into policy allows a person to understand the overall process by mapping its interactive dynamics, thereby suggesting options to participate effectively (i.e., How well are the decision and policy processes themselves working with the intelligence provided them?). To answer this question, a person must be simultaneously knowledgeable about the wildlife management sciences, several social sciences, and the policy sciences. This is what the authors cited above meant when they called for improved wildlife conservation.

The term policy orientation was coined by Harold D. Lasswell (1951), the originator of the policy sciences. Like logic, a policy orientation cuts across all disciplines. It is a fundamental way of thinking and acting differently from the reductionistic, positivistic traditions of modern science (Clark In Press).

Lasswell's (1951, p. 3) original description was:

A policy orientation has been developing that cuts across the existing specializations. The orientation is two-fold. In part it is directed toward the policy process, and in part toward the intelligence needs of policy. The first task, which is the development of a science of policy forming and execution, uses the methods of social and psychological inquiry. The second task, which is the improving of the concrete contents of the information and the interpretation available to policymakers, typically goes outside the boundaries of social science and psychology."

Acquiring and balancing these two kinds of knowledge are seldom simple for an individual, but most of Lasswell's thinking and writing were aimed at this goal of integration and synthesis of knowledge. It seems intuitively obvious that if an adequate number of wildlife management professionals possessed and effectively applied a policy orientation, improvements in wildlife conservation could be expected.

Having a policy orientation is not the same thing as being an accomplished planner or administrator (Weimer and Vining 1989). There are many differences both in the content of knowledge held by practitioners

and, importantly, in the underlying epistemology. Planners and administrators are traditionally scientific positivists, whereas a policy scientist is a postpositivist (see below, Clark *In Press*). However, having a policy orientation can significantly improve the planning and administrative professions as it can the wildlife profession. Fortunately, several developing university programs in planning and administration are leaning towards a policy orientation.

Wildlife Professionals in the Policy Process

Wildlife professionals are collectively major participants in the wildlife policy process. This fact is often underappreciated. Wildlife professionals most often view themselves as attuned more to animals than people, scientifically rather than socially oriented, technically interested in wildlife populations and habitat rather than decision or policy processes, more skilled in the biological sciences than the social sciences, action-oriented rather than contemplative and preferring to be outdoors rather than indoors. Conventional wisdom has it that policy is made by legislators, commissioners, or top-level administrators, and that wildlife professionals have little, if any, part in this process. Wildlifers are seen to fill only a technical role and not one actively involved in the policy process. In short, these views are part and parcel of the profession's identity. Professional norms tell them who they are, what their role is, and set limits for thought and action (Clark 1988). University training and much of later work life in the agencies and elsewhere reinforce these normative perspectives.

In contrast, what would a policy-oriented view tell wildlife professionals about their role? It would give a view of them as participants vitally involved in streams of decision making and actions that determine collectively what really happens to wildlife. It would tell them that having and applying explicit knowledge of these processes is essential to professional effectiveness. Wildlifers seldom view themselves this way, partly because of the strong views provided by the profession's traditional norms. Like any profession, wildlife conservation possesses specialized language and thought which impose their own categories on the world of experience and serve as a lens through which wildlifers view themselves and the world and act upon them. Like all frameworks of thought and action, this one may hide perspectives and possibilities through the system's basic design, its fundamental propositions, and its intellectual, sociological, and political organization. These statements may be at sharp odds with prevailing traditional ideas about the profession's norms and scope of acceptable practice, but conventional norms and ideas, if enforced too

strongly, can resist needed critical insight and moral reflection on the profession's strengths and weaknesses (Clark 1988).

The Policy Process

Most wildlife professionals, especially those working for government agencies, implement policy, that is, they work to achieve "objectives set forth in prior decisions" (Van Meter and Van Horn 1975, p. 447). Policy, most simply defined, "is a broad strategic statement of intent to accomplish aims" (Brewer and deLeon 1983, p. 30). Policies are solutions formulated to solve problems and, of course, must be successfully implemented. Wildlife policies include the National Forest Management Act, Federal Land Management Act, and Endangered Species Act. These federal policies are not the end of the policy process; in fact, they are near the beginning. Programs must be established, administered, and many other decisions made in order to carry out stated aims. Brewer (1973, 1983) and Brewer and deLeon (1983) recognize six phases in the policy process: initiation, estimation, selection, implementation, evaluation, and termination (Table 1). Real policy is often made in the implementation phase, the place where the majority of governmental wildlifers and many university-associated professionals are most active.

We are most interested in the implementation phase, the execution of the selected policy option. To understand how decisions are carried out in implementation requires detailed knowledge of governmental bureaucracies (see Warwick 1975, Weimer and Vining 1989). For example, an agency's bureaucratic culture and structure very much affect what, how, and when things happen. Yaffee (1982) illustrated this well in his examination of implementation of the Endangered Species Act. Sometimes what is intended by policy formulators and what actually happens are significantly different. Agency incentive systems with bureaucratically fixed rules, roles, regulations, and standard operating procedures very much influence implementation. Thus, agency incentive systems and operating procedures are often key objects of study in policy evaluations and, later, of manipulation by policy scientists and policy designers for improved performance. To evaluate and improve implementation, a person must know about the processes of implementation as well as its intent.

Policy Implementation

Examination of implementation in more detail shows that, until recently, implementation, a complex process, was not considered a separate policy phase (see Pressman and Wildavsky 1973, Bardach 1977, Radin 1977, Rein and Rabinovitz 1978, Romm 1984, Clark

Table 1. Possible benefits from each phase of the policy process^a

Phase in the policy process	Possible benefits
Initiation/ invention	Creative thinking about a problem Prototypical design Crude hypothesis testing Preliminary investigation of concepts or claims
Estimation	Scientific examination of likely impacts and outcomes of a set of plausible options Normative/evaluative examination of likely human impacts of plausible options Development of outlines of a complex program Thorough evaluation of concepts or claims Establishment of a first approximation of performance indicators Detailed estimation of critical parameters
Selection	Focusing debate on the actual issues Allowance for cleaner, less hedged, or compromised options to be selected Choice among program designs Reduction of uncertainty about various options
Implementation	Development of specific, difficult pieces of a program Development of a complex program giving due respect to existing institutional and incentive structures Minimization of implementation costs Establishment of performance expectations based on estimates of critical parameters for selected option Reduction in unexpected and unwanted surprises from program implementation
Evaluation	Comparison of estimated performance levels with those actually attained Reconciliation of expected institutional responses with those actually observed
Termination	Predetermination of whether the problem is chronic, recurring, or resolvable Generation of information about new problems, some of which may require experimental treatment

^aFrom Brewer (1973, p. 153).

and Kellert 1988, Clark and Harvey 1988, Kellert and Clark 1991). Numerous studies of policy implementation since the late 1960s give us a more modern view of the policy process. The older, classical view was formed between the early 1900s and late 1930s. That model assumed that "implementation was a technical, non-political activity that proceeded in response to directives from the top" (Nakamura and Silkwood 1980, p. 18), that the direction provided by top-level policy makers was concise and neutral, and that implementers carried out orders in an automatic fashion. Studies over the last two decades have shown that the assumptions of the classical model are erroneous. Nevertheless, there is abundant evidence that this older view is still deeply entrenched in many agencies' cultures today. In contrast to the classical view, Pressman and Wildavsky (1973) found that implementers are key actors, Van Meter and Van Horn (1975) noted that psychological and human factors significantly influence implementation, Bardach (1977) analyzed "games" played by implementers that subvert, frustrate, and impede policies, Radin (1977) described "political intrigue" present in some cases, and Rein and Rabinovitz (1978) investigated the sometimes competing set of legal, bureaucratic, and consensual imperatives. As a result of these and other studies, the policy process is seen today as a "fluid and reciprocal series of interrelationships between different groups of actors rather than a straight-line 'classical' hierarchy that points directly from the top to the bottom" (Nakamura and Silkwood 1980, p. 19). The policy is now viewed as complex, with no clear beginnings or end points.

Policy scientists, those people who study these decision and policy processes, have clearly documented that the implementation process can be dramatically affected by personal, political, and organizational forces. This is well illustrated by Yaffee (1982), who found that there is a big difference between the way the Endangered Species Act is implemented in theory and the way it is implemented in practice. In theory, technically sophisticated, neutral, and objective professionals effectively and efficiently protect species and their critical habitats. In practice, Yaffee found that much administrative discretion is exercised, scientific decisions are negotiated, and many forces and pressures both internal and external to the US Fish and Wildlife Service and other agencies shape implementation. Many of these forces and pressures at play in determining the path implementation takes are not scientifically based. Decisions are made by balancing legal requirements or technical considerations and the need for political consensus. Yaffee (1982, pp. 70–71) found that agency deci-

sions are really based on a “mix of science, art, and politics and that individual attitudes, values, and professional norms weigh significantly in the process.” Negotiation often takes place in the many decisions about endangered species management, because no absolute basis for decisions exists. Scientific decisions are usually made as a response to political controversy (e.g., snail darter and Tellico dam; Plater 1982). Negotiation is clearly visible in interagency consultation, where other resource demands compete with endangered species. Among forces internal to the agencies that shape implementation are: resource constraints, conflicting organizational goals, norms of biologists and managers, agency hierarchies, agency ideology and culture, scientific and bureaucratic conservatism, and internal advocates. Among forces external to the agencies that shape implementation are: uneven popularity of the issue, constituency groups, conflicting interests, the media, the legislature, and the judiciary. More recent discussion and examples of some of these forces at work in implementing the Endangered Species Act are presented by Yaffee (1988), the General Accounting Office (1988), and others. In short, how the Endangered Species Act is actually implemented is the real policy in action. Policy is effectively made by the people who implement it. This is true for wildlife policy as well as policy in other arenas.

Implementers do play a major role in the policy process. It is imperative that wildlife professionals understand their role in the decision and policy processes and possess both the conceptual and practical tools to participate effectively. Otherwise, all they can do is fall back on opinion, choose sides, and enter the process in narrow partisan ways. Some professionals may find this parochial style of participation exciting, but it does little to promote rational, systematic wildlife policies. In the end, wildlife suffers.

The Policy Sciences

Many people are interested in improving decisions and policies through scientific inquiry. The policy sciences offer a way to do just that—they offer ways to improve programs and policies. As noted by Brunner (1988 personal communication):

Most preventable program and policy mistakes stem from failure to ask the right questions or to appreciate the answers. Typically, some critical part of the context is misconstrued or it is overlooked altogether. In either case, the mistakes become apparent only in retrospect—after commitments have been made and the results turn out to differ from those expected. For a variety of reasons such mistakes cannot be entirely avoided, but they can be minimized through the

systematic use of adequate conceptual tools. Such tools are designed to help you perceive more of the relevant context, and to help you understand the details within that context reliably.”

According to Tribe (1973), these problem-solving tools “attempt to apply systematic, common sense reasoning to the structuring of complex decision situations” (p. 68), “broaden the role of logic and empirical inquiry” (p. 75), and include “devices for organizing thought in rational ways—methods for sorting out issues and objectively clarifying the empirical relationships among alternative actions and their likely consequences” (p. 75).

The premise of the policy sciences is that there is often a significant gap between the limited effectiveness of many policies and existing knowledge available to improve the policy process (Emy 1976) and that, unless much more focused attention is given to designing and participating in the policy process, it is likely that this gap will remain. Neither wildlife professionals nor society can allow this to happen. A strong case can be made for wildlife professionals to learn about the policy sciences because the policy sciences offer “a way of thinking which is practicable in the real world” (Hogwood and Gunn 1986, p. 270).

These practical tools, contributed by a wide variety of social sciences, have been organized under a branch of knowledge called the policy sciences. This term,

is not to be taken as a synonym for any expression now in current use among scholars. It is not another way of talking about the ‘social sciences’ as a whole, or of the ‘social and psychological sciences.’ Nor are the ‘policy sciences’ identical with ‘applied social sciences’ or ‘applied social and psychological sciences’ . . . Nor are the ‘policy sciences’ to be thought of as largely identical with what is studied by the ‘political scientist’ [Lasswell 1951, p. 5].

The policy sciences have a distinctive frame of reference. As described above, they look at how knowledge is used in the decision and policy processes by examining how well these processes themselves are working. They draw on many relevant disciplines, including philosophy, history, economics, political sciences, law, sociology, psychology, and the biological and physical sciences (Brewer and deLeon 1983). The policy sciences are “logically and methodologically” a distinctive enterprise, a primary form of inquiry similar to science, with practical applications (Reynolds 1975, p. 18, Clark In Press). They are practically useful because they seek to augment, by “scientific decision methods and the behavioral sciences, the process that humans use in making judgments and taking decisions” (Quade 1970, p. 1).

Most wildlife professionals have no formal experience with the policy sciences, but in some cases some individuals have evolved rough equivalencies to some policy sciences concepts after years of experience. Nevertheless, learning explicitly about the policy sciences' problem-solving approach in university programs can save the professional the time and pain of learning these tools the hard way, by trial and error, over years of professional practice. Currently, though, neither university wildlife programs nor in-service agency training programs teach the policy sciences tools explicitly or systematically, although in some universities there is a growing convergence between the ecological and policy sciences (Brewer 1987).

Learning how to apply the policy sciences tools "is not easy—but it does pay off in practical results—more reliable estimates of when, where, and how to intervene and participate in the policy process effectively, under time and other resource constraints" (Brunner 1987, p. 1). If wildlife professionals could gain reliable knowledge in wildlife science and biology as encouraged by Romesburg (1981), and at the same time gain more reliable knowledge of the decision, policy, and social processes that use their technical knowledge, as suggested by Clark and Kellert (1988), Kellert and Clark (1991), and Clark (In Press), they could enhance profession-wide effectiveness.

Origin of the Policy Sciences

The original conception of the policy sciences' problem-solving tools was developed by Harold D. Lasswell and his colleagues in the second quarter of this century, but only written about extensively since World War II. The policy sciences provide decision, policy, and social process models essential to problem solving, including ways to map a problem and its context. These tools recognize the practical limits of peoples' objectivity and rationality because of analytical tools and time and resource constraints. The policy sciences' conceptual framework "can be used as a guide to a person's attention to minimize those limits" (Brunner 1987, p. 1). Failing to use these tools is unnecessarily to accept blinders to thought and action—something wildlife professionals can ill afford.

The policy sciences use very few terms in their models of social, policy, and decision processes. These few terms are relatively simple, but are still descriptively powerful enough to capture the dynamic complexity inherent in the models and the processes themselves (Brunner 1987). These few terms are used to help people understand these complex processes, not just to promote jargon. The policy sciences allow use of other terms or "essential equivalents" for their terms, "if the

fundamental ideas the language conveys are not obscured or lost" (Brewer and deLeon 1983, p. 23). The few terms of policy scientists are useful because they are already in wide use and because they convey some meaning as a basis for additional discussion about the complex intricacies they represent (e.g., implementation).

Conceptual Tools of the Policy Sciences

This conceptual framework for problem solving was laid out by Lasswell (1970, 1971) and elaborated and discussed by Brewer (1974), deLeon (1981), Brewer and deLeon (1983), Torgerson (1985), Brunner (1982, 1984, 1987), and others, and is introduced in more detail below. These tools are not a simple recipe that produces instant, error-free results. Instead, like science in the service of wildlife conservation and management, neither its content nor its operation can be adequately captured in a few pages. Thus, readers are referred to Lasswell and the other authors cited in this article for more complete descriptions.

In solving any complex problem, the distinctive outlook of the policy sciences calls for: (1) contextual analysis, (2) problem orientation, and (3) synthesis of technique (Lasswell 1971, p. 3). All three activities are interactive and so must be carried out simultaneously in all six phases (Table 1). This represents a postpositivistic style of problem-solving (Clark In Press) quite different from the positivistic, experimental science as commonly practiced by the physical and biological sciences. Contextual analysis allows a person to make sense of a large, complex, and often bewildering array of potential information. Events make sense only if we understand how they are all interrelated. The largest picture possible of a problem and problem setting is called the social process map by policy scientists. Developing this map produces an explicit conception of the entire policy process and the whole social process. If the social process map is systematically constructed, it identifies the entire context of the values of individuals and institutions and it identifies each one's expectations (Lasswell 1971). Contextual analysis is a broad and in-depth identification and examination of all the factors that bear directly or indirectly on the problem at hand. It prevents a narrow, fragmented, problem-blind conception of the problem and its context, which causes the failures discussed by Brunner above and documented in the wildlife arena by Clark and Harvey (1988).

Contextual mapping of the social process requires knowledge about participants, their perspectives, the situation, their base values and demands, their strategies of action, and the effects of all these elements on each other and on the decision and policy processes

(Lasswell 1970, p. 7, Table 1). A complete contextual map must recognize base values of individuals and groups: power, enlightenment, wealth, well-being, skill, affection, respect, and rectitude. All individuals and groups seek to maximize one or more of these values in any problem setting. All these elements and functions are part of contextual mapping and orientation to any problem needing attention.

A contextual map of any problem is an essential preliminary to detailed examination of specific problems. The analysis of the context does not supply answers to the problem but, according to Lasswell (1971, p. 39), it does "provide a guide to the explanations that are necessary if specific issues are to be creatively dealt with." As Lasswell (1971, p. 36) observed: "The world about us is much richer in meaning than we consciously see," and Torgerson (1985, p. 250) noted that "the whole aim of [contextual mapping] is to make the obvious inescapable." Contextual mapping is indispensable to define the problem, gain its meaning, find possible solutions, and locate oneself and others in the overall process. Knowing the context of problems "creates a condition in which the potential for enlightened action is enhanced" (Torgerson 1985, p. 246). Policy scientists who have taught and used this conceptual framework have described many benefits of contextual analysis and mapping the social process.

The policy sciences' principle of contextual analysis stands in sharp contrast to the narrow conceptions often promoted by technocratic and bureaucratic perspectives (see Dery 1984). Lasswell (1971, p. 4) noted that "unless the salient features of the all-inclusive whole are discerned, details will be incorrectly located." If contextual analysis is constrained by narrow professional or bureaucratic perspectives, for example, errors and failures are likely. The process of contextual analysis can "remove the ideological blinders from our eyes" (Lasswell 1971, p. 220). Finally, the policy sciences analysis can reduce or eliminate constraints on rationality and the spectrum of action possible. As Brunner (1987, pp. 10–11) observes:

The process of contextual mapping and problem-solving is never complete. There are in principle always more observations and interpretations to be made. Inquiry is terminated by time or other resource constraints, or by a judgment that a problem-solving map is enough. . . . From a procedural standpoint, a good map is the result of systematic explorations and iterations through the context and the conceptual framework. . . . It has no obvious holes. . . . From a practical standpoint, the test is whether the map stimulates creative insight into the possibilities for more rational action in the situation, and whether those insights turn out to be realistic and acted upon.

The second element in problem-solving, problem orientation, demands that five tasks be conducted (Lass-

well 1970, p. 11) for any problem to be understood and addressed. Brunner (1988 personal communication) has arranged and described these distinguishable but interrelated tasks:

1. Description of trends in the problem, including analysis of both context and process (historical standpoint)
2. Explanation of trends (scientific standpoint)
3. Projection of trends (projective standpoint)
4. Evaluation of trends and projection (normative standpoint)
5. Intervention, evaluation, and selection of alternatives that might solve problems (operational standpoint)

This sequence of standpoints or tasks is somewhat arbitrary but, as Brunner notes, description is first and alternatives are last. "Many inquiries fail because they assume what has already happened in a rush to get on with explanations, projections, or evaluations" (Brunner 1988 personal communication). These five standpoints are the principal problem-orienting frame of reference of the policy scientist. The details of all problems take meaning in relation to their context, so the five tasks "furnish an agenda for allowing the context to emerge" for attention (Lasswell 1971, p. 39). For adequate problem orientation, and contextual mapping too, a perceptual interchange between a view of the whole image and specific details is essential. The decision and social process analyses must be kept relevant, and these can be clarified by carrying out the five tasks. These five tasks help a person to construct and clarify preferences, trends, and scientific analyses relative to the problem under examination. These are all necessary to solve problems effectively (Brewer and deLeon 1983).

The third element in problem solving focuses on the methods used in contextual analysis and problem orientation. To examine any problem—for example, grizzly bear (*Ursus arctos*) management in Yellowstone National Park—not only are content methods needed to get a fix on the bear population and its habitat, but procedural methods are also needed to look at how problems come to be understood and oriented to, and how their contexts are viewed and dealt with. Two classes of methods are required. First, a wide variety of traditional wildlife techniques are required—mark/recapture population estimates, habitat measures, telemetry and computer analysis, for instance. Second, a wide variety of techniques to analyze the decision, policy, and social processes themselves are also needed. These might include simple observation, questionnaires, and qualitative and quantitative assessments of written ma-

terials, for example. All these methods, ideally, result in a comprehensive and comprehensible understanding of grizzly bear management. Such an understanding is much larger than the view possible using only the wildlife biology paradigm (e.g., Salwasser 1987) and traditional professional norms. A multimethod approach—or synthesis of techniques—helps gain multiple perspectives on the problem and its context. Some methods place emphasis on the content of what is thought by decision makers in problem-solving operations, and other methods place emphasis on procedure in a sequence of attention (Lasswell 1970, p. 12). Too much focus on either content or procedure can lead to error. The vigorous interplay of content and procedural methods should occur throughout any problem-solving exercise. Wildlife biologists most often focus on content.

The policy sciences' problem-solving framework can significantly help wildlife professionals. Conventional problem-solving techniques by government and private organizations "often fail to examine the policy process as a whole; it may not be perceived that in many instances disappointing outcomes are the result of poorly designed and mal-coordinated" programs and the inability to use the kinds of problem-solving tools the policy sciences offer (Lasswell 1971, p. 76). This may explain the course the 1981–1986 endangered black-footed ferret (*Mustela nigripes*) program took (Carr 1986, May 1986, Clark and Westrum 1987, Clark and Harvey 1988). Unfortunately, because the policy sciences are not currently used, it is not possible to point out examples of how they have actually helped solve wildlife problems. Many wildlife cases could benefit from the systematic use of the policy sciences' problem-solving tools (e.g., wolves, *Canis lupis*; Tilt and others 1987).

The policy sciences' conceptual tools may be employed with varying degrees of sophistication, as contexts are mapped, problems oriented to, and multiple methods are integrated. The purpose of policy sciences' inquiry is "to enable the policy analyst and hopefully the decision maker, to find his way in the complexities of the total situation in which he operates" (Lasswell 1971, p. 67). Problem contexts are usually dealt with implicitly by most people; the policy scientists' conceptual framework offers a way to make them explicit. Problems and their contexts must be "consciously recognized, discovered, and judged" and then scrutinized and refined (Torgerson 1985, p. 248) to minimize problem-solving failures. The only other alternative is uncritical adherence to conventional notions. Conservation of our natural resources can ill afford that type of management.

The policy sciences' orientation is not widely used in natural resource management, but two exceptions stand out. First, Brewer (1986) suggested how the inev-

itable problems of analyzing, interpreting, and synthesizing vast quantities of scientific and human knowledge relevant to sustainable development of the biosphere could be managed. In another instance, Weaver (1987) studied the termination phase of the policy process and used the delisting of wolves under the Endangered Species Act as an example.

Science, Analysis, and Politics

All complex wildlife problems involve a mix of science, analysis, and politics (see Brewer 1984). These are three distinctive activities, "although the press of difficult problems typically compels their uneasy interaction" (Brewer 1981, p. 269). All too often the forced association of science, analysis, and politics is unpleasant and may not produce the desired outcome for wildlife [see Simberloff's (1987) review of the case of the spotted owl, *Strix occidentalis*]. It is thus important to understand each of these three activities and their interaction.

Science in its purest form prizes reliable observation and measurement as the prime means to explain phenomena, explanations which in turn enable valid predictions in comparable circumstances (Brewer 1984). Recent papers by Romesburg (1981) and Gill (1986), for example, address the role of science in wildlife conservation. Romesburg (1981) notes that science is carried out through inductive, retroductive, and hypothetico-deductive means, and argues strongly that we need more hypothetico-deductive, true experiment science as basis for reliable wildlife knowledge. Gill (1986) encourages more scientific research and more use of results in decision making by agency administrators and politicians.

Analysis is differently motivated and focuses on problems and the generation of potential solutions through systematic procedures of adduction and inference: facts, evidence, and arguments are supplemented by judgments about what possible interventions mean and portend, and for whom (Brewer 1984). Much of wildlife policy, especially at higher administrative levels in the agencies, is based on analyses of varying quality (see: Yaffee 1982, 1988, Sax and Keiter 1987).

Politics is both process and means. As process, its key elements are conflict, habit and precedent, ideology, and rationality (insofar as the process seeks solutions to problems) (Brewer 1984). As means, politics works to maintain social stability and emotional satisfaction among diverse groups and clashing interests, primarily by making decisions about allocation and distribution. The strong visible role of US senators and congressmen in the ongoing Yellowstone National Park wolf reintroduction debate clearly shows the role politics can have on wildlife programs and policy (Askins 1987).

Strong tension often marks the intersection of science, analysis, and politics in the wildlife arena, as elsewhere. A key aspect in the interaction of these three is not whether a person or group should use information, but rather what facts mean in the broader context of their generation and use (see Latour 1987). For example, data showing a declining trend in black-footed ferret numbers in the summer of 1985 was viewed as fact needing immediate management intervention by one group, and it was discounted as a natural fluctuation in the population by another group (see Weinberg 1986). Today the wild ferret population is extinct. The meaning of data and facts are context-specific. The use of politics, in such cases, does not help to provide clear statements of purpose or goals or set explicit priorities for their attainment; in short, it does not further conservation. In the ferret case, the species suffered because of the dominance of politics in decision making.

Because policy analysis, conducted broadly, often includes study of the interaction of science, analysis, and politics in a given problem-oriented case, it rarely acquires the consistency of interpretation found in scientific work (see Brewer 1984, Brewer and deLeon 1983, Weimer and Vining 1989). Correct answers are exceptional, and solutions derived through political process are seldom, if ever, readily proved right or best.

The policy sciences can aid wildlife professionals in and out of government in sorting through the mix of science, analysis, and politics involved in important conservation policies and programs. However, wildlife professionals must understand how the policy sciences are science and how they can help. The policy sciences are scientific in that they are rational, systematic, empirical, and sometimes use "quasi" experiments (Reynolds 1975). Brunner (1982, 1987) examined their underlying philosophy in the postpositivist tradition, unlike the physical and biological sciences, which are in the positivist tradition. For a more complete contrast of positivist and postpositivist knowledge systems, see Brunner (1982, 1987). The policy sciences understand problems and their contexts as unique, whereas the traditional sciences seek universal laws. Epistemologically, according to Reynolds (1975), in order for the policy sciences to have reliable knowledge: (1) the methods and products of the policy sciences must be objective "to the extent and in the same ways" that science and engineering are; (2) "the conclusions of policy sciences must rest ultimately upon facts and . . . it is incumbent on the policy scientist to be able to indicate what empirical findings would mandate the rejection of his conclusions;" and (3) the "conclusions must be susceptible for public demonstration and communication" (Reynolds 1975, p. 5).

Wildlife Policy Making

Wildlife policy, including the implementation phase most wildlifers contribute to, is complex. Because of this, many problems impede good policy. We must understand these problems.

First, by usual scientific standards, policy making as outlined in the Brewer and deLeon (1983) model (Table 1) is only a partly rational process. Decisions and analyses are nearly always imperfect because the events they deal with are complex. Wildlife problems are intricate and changeable, and they often mean very different things to the different people and organizations involved. Neither the problems, the settings in which they occur, nor possible solutions stand still (Brewer 1984). They evolve naturally and in response to efforts to understand and master them. Our solutions to wildlife problems will never be able to solve all problems adequately.

Second, time and space intrude to make solutions less than perfect (Brewer 1984). Wildlife policy is rooted in the past, where descriptive knowledge exists of historic events and processes, but it is aimed toward the future, where such knowledge does not exist yet. Rather, when considering the future, one finds individuals' imaginings, hopes, fears, and preferences seldom in close harmony with one another. This makes policy a highly competitive activity, sometimes laden with conflict. Other problems arise because some policy is cast in terms so broad (e.g., national standards and goals for wildlife conservation) that those responsible for its execution in actual settings may have no idea of what to do or how to do it.

Third, among other problems impeding creation and use of better policy are the complexity of the systems involved, human perception and values, and profound uncertainties about the future (Brewer 1984). These are seldom aligned with one another.

How is one to proceed, then, in understanding and improving wildlife programs and policy? Several guides were laid out by Brewer (1984). First, one needs to identify and locate the general cast of characters: the producers and consumers of programs and policy information. Next, basic differences in kinds of information or knowledge about wildlife (that is, science, rationality, or the lack of it) involved in the decision, social, and policy processes must be ascertained and attended to. Lastly, some sense of the process itself is also needed, as is a list of questions a person or group might raise in assessing or doing decision and policy research and inquiry, as basis for subsequent action. The policy sciences' tools introduced here can help wildlife professionals to understand and participate most effectively in the complex policy-making process.

Conclusions

How can the policy sciences help wildlife professionals develop a policy orientation and improve their effectiveness? Romm (1984, p. 17) answered: "The wildlife professional who possesses policy knowledge and skills can often exert the capacity to improve a situation by understanding its historical background and its contemporary dynamics and by applying strategies with a conceptual basis for predicting and assessing their long-term consequences." The policy sciences approach to problem-solving is summed by Tribe (1973, p. 107), who noted that it is

a subtler, more holistic, and more complex style of problem-solving, undoubtedly involving several iterations between problem-formation and problem-solution and relying at each stage on the careful articulation of a wide range of interrelated values and constraints through the development of several distinct 'perspectives' on a given problem.

The policy sciences offer concepts and tools helpful for solving complex wildlife conservation problems, "explaining" them, finding solutions, and deriving "lessons."

Wildlife professionals knowledgeable and skilled in the policy sciences' problem-solving framework can contribute to wildlife conservation in fundamental ways. They can help responsible decision makers by examining how well or poorly programs and policies are operating, and they can guide attention to the "effective and formal factors responsible for results" (Lasswell 1971, p. 76). This role was described by Lasswell (1971, p. 40):

To some extent we are all blind and no doubt will remain so. But there are degrees of impairment, and so far as decision outcomes are concerned, it is the responsibility of the policy scientist to assist in the reduction of impairment.

A wildlife professional with a policy sciences orientation can serve as: (1) an integrator of knowledge and action, (2) a specialist in getting all the rationality out of individuals and groups that they are capable of, and (3) a mediator between people who are knowledge specialists and those who are committed to administration. They are integrators, mediators, and go-betweens in knowledge and action.

As professionals, wildlifers need to explore beyond the usual limits imposed by their discipline for tools to increase their profession-wide effectiveness. This requires that traditional frames of references must yield to broader conceptions, as described in this article. Finally:

If the field of wildlife science is to contribute fully and adequately to the critical societal decisions affecting the future abundance and well-

being of our nation's fauna and flora, then it seems essential that young wildlife professionals be sufficiently educated in the complexity, subtleties, and techniques of the policy process [Clark and Kellert 1988].

My comments here were designed to encourage this.

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