CHAPT 3

The Politics of Ecosystem Management

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Chapter 3

A Paradigm Shift?

In many ways, ecosystem management is dramatically different from traditional, sustained-yield resource management, with its focus on utilitarian values. (See table 3.1 for comparison.) Traditional resource management is pragmatic, seeing in nature a collection of resources that can be manipulated and harvested, with humans in control. Ecosystem management, on the other hand, views nature with some reverence and respect for the awesome complexity with which its components are interwoven. Protection of ecosystem attributes and functions, particularly biodiversity, is critical. Ecosystem management involves preserving intrinsic values or natural conditions of the ecosystem; commodities are secondary by-products, much like interest on capital. Unlike traditional resource management, you do not begin by enumerating outputs. The first priority is conserving ecological sustainability; levels of commodity and amenity outputs are adjusted to meet that goal. Science is viewed as highly uncertain, evolving, and multidisciplinary, with no claim on truth or best answers. Ecosystem management is necessarily flexible and adaptive, no longer rigidly following centralized protocols. Furthermore, where decision making was the sole province of resource management professionals, under ecosystem management it is a public, politicized, shared-ownership endeavor, where different interests and values are openly addressed. Some have suggested that these differences amount to no less than a radical revision of professional perspectives, values, and management practices[1]—in other words, a paradigm shift.

Paradigms and Paradigm Shifts

A *paradigm* is a framework of understanding or perspective shared by members of a profession or discipline. In his classic work, *The Structure of Scientific*

Table 3.1 Traditional Resource Management versus Ecosystem Management

	Traditional Management	*Ecosystem Management*
Nature	A collection of resources to be dominated and mastered.	Complex, ever-changing, interrelated systems. No domination required.
Ethics	Compartmentalized; interrelationships marginal.	Holistic; interrelationships important.
Science and Models	Deterministic, linear, static, approaching steady-state equilibrium.	Stochastic, nonlinear, dynamic: variable-rate dynamics with temporary equilibria upset periodically by chaotic moments that set the stage for the next temporary equilibrium.
	Robust, well-defined theory; discrete data and highly predictable outcomes.	Embryonic, beginnings of theory, theory and practice intertwined, interrelated data, and unreliable outcomes. "Expect to be surprised."
	Maps, linear optimization, monetized cost-benefit analysis; quantitative.	Geographic Information Systems (GIS), relational databases, nonlinear simulation (time and space dependent), quantitative and qualitative evaluation for social, economic, and political aspects.
Management and Organization	Centralized; rigid, little focus on incentives or innovation.	Decentralized, interrelated teams; adaptive; flexible; much focus on incentives and innovation and shared learning.
	Hierarchical, top-down bureaucracies.	Adaptive, bottoms-up, open, cooperative.
Planning	Comprehensive, rational.	Interrelated, chaotic, looking for order in chaos. Imaginative.
Decision making	Rigid, chain of command, authoritarian; heavy reliance on experts/professionals' opinions.	Deliberated: all stakeholders' opinions count.
	Science provides "the answer."	Science provides information. Science alone cannot provide answers.
		Adapted to context of problem, interrelated to other problems; considers externalities.
Participation	Influence, money.	Discursive, deliberative.
Leadership	Authoritarian: leaders designated.	Situational: leaders arise from the community when needed.

Source: Adapted from Iverson, An ecosystems approach to management.

Revolutions, Thomas Kuhn describes the dominant paradigm within a science discipline as the set of values, theories, methodologies, tools, and techniques that is sanctioned and utilized by the professional community. The accepted paradigm structures the questions deemed worthy of scientific attention and defines the processes by which those questions are examined. Because the paradigm is widely accepted, it results in consistent actions. However, this unquestioned acceptance can also lead scientists to prematurely reject new information that contradicts the accepted paradigm.[2]

Although Kuhn explicitly applied his theory to the natural sciences, it has since been widely adopted by other disciplines, including the social sciences and the humanities. From the broader perspective of the social sciences, a paradigm is

> a world view, a general perspective, a way of breaking down the complexity of the real world. As such, paradigms are deeply embedded in the socialization of adherents and practitioners telling them what is important, what is legitimate, what is reasonable. Paradigms are normative; they tell the practitioner what to do without the necessity of long existential or epistemological considerations.[3]

According to this broader view, a paradigm is "a view of the world—a *Weltanschauung*—that reflects our most basic beliefs and assumptions about the human condition."[4] Again the normative—even sanctified—nature of the paradigm typically causes its adherents to reject or discount new information or values that do not fit within it.[5]

A paradigm *shift* occurs only when a significant body of knowledge or information accumulates that is contradictory to, or unexplained by, the accepted paradigm. When a critical mass of contradictory information has accumulated, a "revolution" occurs within the discipline. The established paradigm is rejected, new schools of thought proliferate, and from them a new paradigm emerges that accounts for deviations from the old paradigm. Paradigm shifts are dramatic events, as the accepted world view within a discipline is shattered and a new one adopted. According to Kuhn, more than just the discipline is affected: the way in which its practitioners perceive the universe will undergo a fundamental change after a paradigm shift.[6]

In terms of attitudes toward the environment and natural resources, a transition from viewing nature as a set of resources to be managed for human use to a belief that maintaining ecological sustainability is paramount could be viewed as a paradigm shift. Yet as the following sections show, even as the

emerging theory of ecosystem management is becoming more clearly delineated, increasingly it is criticized.

Definitions of Ecosystem Management

As ecosystem management has become more widely endorsed, fairly consistent definitions of the term have emerged (see box 3.1). Most proponents of ecosystem management agree that its ultimate purpose is sustainability, both ecological and socioeconomic. The overall goal of ecosystem management is sustaining ecological attributes and functions into perpetuity, thereby ensuring that future societies enjoy the same ecosystem values that we do today.[7]

Proponents of ecosystem management consider social and ecological sustainability interdependent, in that the sustainability of human communities depends on the sustainability of the ecosystems in which they live. Many ecological scientists further maintain that just as the future of human populations depends on maintenance of ecological sustainability, ecological sustainability depends on human behavior. Human beings are considered integral parts of the ecosystems that they inhabit and use, because humans are both affected by, and affect, ecosystem functions.[8]

Principles of Ecosystem Management

As the ecosystem management concept has been debated and honed by researchers, resource managers, scholars, and citizens, four basic themes have emerged to characterize it: (1) socially defined goals and objectives; (2) holistic, integrated science; (3) adaptable institutions; and (4) collaborative decision making. These broad themes, or principles of ecosystem management, reflect the overall goal of ecological and socioeconomic sustainability and are accepted by most ecosystem management scholars and practitioners. As becomes clear in the discussion that follows, these principles of ecosystem management are not discrete—there is considerable overlap among them.

Socially Defined Goals and Objectives

Although it can be argued that the goals and objectives of resource management have always been socially defined, ecosystem management makes this explicit. This reflects a recognition that many scientific concepts, including the definition of an ecosystem and criteria for a healthy ecosystem, are essentially value judgments.[9] For example, successional theory, which dominated the field of ecology for years, places a bias on climax communities as being the optimal and best ecological condition, thus placing less value on systems in

Box 3.1: Definitions of *Ecosystem Management*

"Ecosystem management involves regulating internal ecosystem structure and function, plus inputs and outputs, to achieve socially desirable conditions."

—Darryll Johnson and James Agee,
National Park Service scientists, 1988.[1]

"Ecosystem management focuses on the conditions of the [ecosystem], with the goals of maintaining soil productivity, gene conservation, biodiversity, landscape patterns, and the array of ecological processes."

—Society of American Foresters Task Force
on Long-Term Forest Health and Productivity, 1992.[2]

"The primary goal of ecosystem management is to conserve, restore, and maintain the ecological integrity, productivity, and biological diversity of public lands. . . . The overriding objective of ecosystem management is to ensure the ecological sustainability of the land."

—Bureau of Land Management, 1994.[3]

"The approach is characterized by synthesis or integrated knowledge, a holistic perspective interrelating systems at different levels of integration, and actions that are ecological, anticipatory, and ethical in respect to other systems of Nature."

—George Francis, professor of environment
and resource studies, 1993.[4]

"Ecosystem management integrates scientific knowledge of ecological relationships within a complex sociopolitical and values framework toward the general goal of protecting native ecosystem integrity over the long term."

—Ed Grumbine, conservation biologist, 1994.[5]

"The goal of the ecosystem approach is to restore and sustain the health, productivity, and biological diversity of ecosystems and the overall quality of life through a natural resource management approach that is fully integrated with social and economic goals."

—Interagency Ecosystem Management Task Force, 1995.[6]

"Ecosystem management is management driven by explicit goals, executed by policies, protocols, and practices, and made adaptable by monitoring and research based on our best understanding of the ecological interactions and processes necessary to sustain ecosystem composition, structure, and function. . . . Sustainability must be the primary objective, and levels of commodity and amenity provisions adjusted to meet that goal."

—Ecological Society of America, 1996.[7]

1. Johnson and Agee, "Introduction to ecosystem management," p. 7.
2. Society of American Foresters, *Task Force Report on Sustaining Long-Term Forest Health and Productivity*, p. xv.
3. U.S. Department of the Interior Bureau of Land Management, *Ecosystem Management in the BLM*, pp. 2, 3.
4. Francis, "Ecosystem management," p. 331.
5. Grumbine, "What is ecosystem management?," p. 31.
6. Interagency Ecosystem Management Task Force, *The Ecosystem Approach*, p. 3.
7. Christensen et al., "The report of the Ecological Society of America Committee on the Scientific Basis for Ecosystem Management," pp. 665, 682.

earlier stages. Similarly, the recent popularity of returning ecosystems to "pre-European settlement conditions" is based in social values more than evolutionary ecology.[10] Desired ecological conditions, including "ecological sustainability," are socially defined concepts, as are desired ecosystem outputs, such as biodiversity, recreational opportunities, and forage. In fact, it is *necessary* that society define its goals, if ecosystem management is to be effective. Management prescriptions will depend on what society wants from a specific ecosystem.[11]

Ecosystem management theorists warn, however, that humans are dependent on the ecosystems in which they live, and therefore societies need to protect crucial ecological processes for their very survival. According to ecosystem management theory, unless humans decide to maintain healthy ecosystems and adjust their behavior accordingly, ecological sustainability will not be attained. Moreover, intergenerational equity, the obligation of current generations to future generations, requires that critical ecological services be sustained.[12] Thus, while ecosystem management explicitly recognizes that social goals and objectives play a central role in framing management direction, it also presumes that humans will decide to make protection of ecological processes their overriding social objective.

Holistic, Integrated Science

In ecosystem management, there are no externalities.[13] (Externalities are environmental effects that are not factored into economic analysis and decision making.) Instead, downstream and long-term effects of changes in any ecosystem component are taken into account. Ecosystems are recognized as open, changing, complex systems made up of social, political, economic, biological, and physical components. The ecosystem management concept is synthetic, opposing "the classical idea that the world can be analyzed as separate, independent parts,"[14] and focusing instead on processes—the interrelationships among ecosystem components. Taking an "ecosystem perspective" means looking at ecological, social, and economic processes and recognizing "that a process may be the result of many interactions and that an action can cause numerous interactions to reverberate throughout a system."[15]

Science for ecosystem management takes a broad perspective, recognizing the interconnectedness of ecosystem variables across large spatial and long temporal ranges. For instance, research in conservation biology and landscape ecology has redefined the scale of management for biodiversity from hundreds to thousands of acres, by showing that parks and other nature preserves are too small and fragmented—isolated "islands" of wilderness within a sea of land developed for agricultural and urban uses—to support large megafauna

and allow genetic exchange.[16] Ecologists now speak of the need to take entire bioregions into account when managing to sustain the biological diversity considered critical to ecological sustainability. Similarly, ecosystem managers must understand long-term ecological change (on the order of centuries) to be able to predict ecological behavior and ensure delivery of desired products.[17]

Yet managing for sustainability will also require an understanding of some very small-scale ecosystem functions. Regardless of the specific outcomes desired, biodiversity and ecosystem structures and processes, such as nutrient cycling and resilience from disturbance, must be maintained to ensure future desired uses of the ecosystem are not compromised.[18] In terms of the biological sciences alone, "Ecosystem management depends on research performed at all levels of organization, from investigations of the morphology, physiology, and behavior of individual organisms, through studies of the structure and dynamics of populations and communities, to analysis of patterns and processes at the level of ecosystems and landscapes."[19] Ecosystem management will rely on information from a similar cross section of physical and social sciences. For instance, social needs and institutions and the dynamics within and among them will have to be understood, from the level of local communities to the national and even global levels. Ultimately, variables occurring on many different scales and at vastly varying rates must be addressed.

The range and breadth of factors that contribute to ecosystem functioning indicate a need for an interdisciplinary approach to research and management that fully integrates an ecosystem's social and physical components. Natural scientists, for instance, need to recognize the importance of context and incorporate qualitative data as well as quantitative data into their research. To effectively manage for ecological sustainability, the complexities of social and political interactions with an ecosystem must be understood. Scientists and managers from several different disciplines need to work together to understand, to the best of their abilities, all of the factors influencing, and influenced by, all of the component parts and functions of an ecosystem.

Adaptable Institutions

The complex and dynamic nature of ecological and social systems means there can be no explicit guidelines or management prescriptions for ecosystem management; uncertainty will always be inherent to it.[20] In order to operate under such conditions of uncertainty, ecosystem management institutions themselves must be "characterized by an emphasis on the interrelatedness, hierarchical complexity, dynamism, openness, and creativity of systems to be man-

aged."[21] In other words, institutions such as organizations, laws, policies, and management practices need to be flexible, in order that they may rapidly adapt to changes in social values, ecological conditions, political pressures, available data, and knowledge.[22] Considerable emphasis is put on the value of decentralized decision-making arrangements to avoid the rigidities of highly centralized institutional arrangements with inflexible prescriptions.

In order to adjust management prescriptions as new information becomes available, adaptable institutions treat management as a learning process in which decisions are continuously revisited and revised, never final. This implies that resource managers, instead of simply following rulebooks and standardized procedures, have the capacity to identify and adapt to new knowledge, including changing public attitudes, and learn lessons from new research and on-the-ground management experiences.[23] Well-developed learning capacities are thus another key component of ecosystem management.

Adaptive management has been offered as one way to address the staggering information requirements of ecosystem management while allowing management to move forward in the face of uncertainty. In essence, adaptive management involves repeatedly monitoring the outcomes of alternative management practices, either in the field or through simulation modeling, and making adjustments based on what is learned. Adaptive management utilizes scientists, resource managers, policy makers, interest groups, and citizens to collectively identify management problems and to set initial management goals. The proposed means of achieving these goals, such as management prescriptions, are treated as working hypotheses. The importance of hypothesis testing through experimentation lies in its ability to rapidly produce information that can be used to review and revise management decisions. By treating their management prescriptions as research hypotheses, resource managers can continuously monitor and modify decisions and practices as needed.[24] The iterative nature of hypothesis testing offers continual refinement of social understandings of ecological responses to management.[25]

Collaborative Decision Making

Ecosystem management means management across ecological, political, generational, and ownership boundaries. Clearly, when management units are defined ecologically rather than politically, greater coordination among local landowners and between private landowners and natural resource management agencies is required. Management decisions must be made collectively by all parties because in most cases no single entity has jurisdiction over all aspects of an ecosystem. Combined with the need for interdisciplinary science discussed previously, this suggests that ecosystem management requires the acquiescence,

if not active support, of a broad cross section of society. The need to integrate the knowledge and values of a broad array of organizations and individuals implies a need to blend organizational and community (i.e., public and private) planning through collaboration among resource owners, managers, and users. From a purely practical standpoint, if any ecosystem residents or users consider their needs unmet by an ecosystem management plan, they are liable to resist or block its implementation.

Collaborative decision making is also important for reasons of equity. Ecosystem management requires a delicate balancing of complex social values and legal mandates with the need to maintain ecological sustainability. Ultimately, in a democratic society, the public must decide what value to place on each issue surrounding an ecological approach. Recognizing the diversity of opinion among social values and concerns, ecosystem management proponents advocate open communication and collaborative decision making, including, but not exclusive to, technical experts. As one scholar puts it:

> This promising paradigm can only be instituted as a general guide to management if conservation biologists, restorationists, and environmental managers reduce their isolation and participate in a public dialogue. Likewise, philosophers, anthropologists, humanists, economists and citizens must join the search for appropriate public values.[26]

Thus, under ecosystem management, the roles of scientists and managers are redefined from expert to educator, public relations specialist, technical advisor, or some combination of these. Correspondingly, the role of the citizen also includes resource management, for under ecosystem management, all citizens take responsibility for achieving ecological sustainability.

Criticisms of Ecosystem Management

Along with fledgling efforts to implement ecosystem management have come questions of its feasibility and criticisms from those who find it untenable on moral, philosophical, legal, and logical grounds.

It's Fuzzy, Ambiguous, and Untested

Among researchers, there is little consensus on new terminology, conceptual categories, and classifications for use in discussing ecosystem management. While many agree that it is important to maintain ecological sustainability, integrity, productivity, and biological diversity, there is no agreement on what

this means exactly in terms of management outcomes. A prominent forest ecologist, for example, advocates (1) "preventing the degradation of the productive capacity of our lands and waters—no *net loss* of productivity; and (2) preventing accelerated loss of genetic diversity (including species), recognizing that evolutionary processes will result in changes—no *accelerated* loss of genetic potential."[27] Another leading scientist, a conservation biologist, goes further, requiring that ecosystem management "maintain viable populations of *all* native species in situ [and] represent, within protected areas, *all* native ecosystem types *across their natural range of variation*."[28] Without clear conceptions of the desired future condition of the ecosystem or the management objectives to be achieved, ecosystem management is said to be too susceptible to subjective judgment, bias, and personal policy preferences.[29] Because there are no agreed-on definitions for terms such as *sustainability*, *ecosystem integrity*, or *ecosystem health*, critics argue ecosystem management lacks a scientific basis. Other terms, like *ecosystem management* and *watershed management*, are often used interchangeably, sometimes resulting in confusion.[30] Thus, it is not surprising that ecosystem management has been criticized as an ambiguous, "fuzzy" concept, providing a muddled basis for policy and with limited ability to provide operational directives. Absent performance standards to determine when policy or management goals have been achieved, ecosystem management is not considered operationally useful.[31]

Moreover, critics claim that ecosystem management is the creation of individuals sitting behind computers rather than those engaged in practical field operations. Consequently, it is argued, many of the concepts of ecosystem management have not been adequately tested, and knowledge based on years of professional experience is being prematurely and cavalierly discarded.[32]

Finally, critics object to the ecosystem being the focus for analysis, arguing that since an ecosystem can be anything one defines it to be, it is unsuitable for spatially-based decisions and not useful as either a biological or a policy concept.[33] Ecosystems are also criticized because their boundaries cannot be matched to existing institutional jurisdictions. For some, the fact that an ecosystem can be defined at different scales makes it impractical as a management unit. Some consider the watershed a more tenable unit of analysis because it is geographically recognizable and its boundaries can be used as a basis for organizing community participation and governance institutions.[34]

It's Legally and Politically Untenable

Other critics consider the legal and political barriers to ecosystem management to be insurmountable. While planning on an ecosystem basis has been upheld by at least one court, it is argued that ecosystem management nonethe-

less has no explicit basis in existing law.[35] Moreover, some legislation, such as the Sherman Anti-Trust Act, which would likely interpret cooperation on the level envisioned by ecosystem management to be a form of collusion among industrial landowners, is seen as inimical to ecosystem management.[36] Considerable opposition rests on the claim that ecosystem-scale management will result in unwarranted intrusions on the rights of private property owners. Supreme Court cases such as *Lucas v. South Carolina Coastal Commission* and *Dolan v. City of Tigard*, which upheld the rights of property owners over the right of the state to regulate for environmental protection, are thus seen to cast doubt on the constitutionality of ecosystem management.[37]

With no identifiable constituency, ecosystem management is further said to be resting on politically shaky ground. Whereas organized groups who benefitted from the agencies' outputs could be counted on historically to support agency budget requests, such constituencies are expected to show little inclination to support ecosystem management politically.[38] Moreover, the collaborative nature of decision making called for in ecosystem management is seen to bear little resemblance to American representative democracy, in which elected officials and powerful interests make decisions for the majority.[39] The emphasis on the collective is also argued to devalue the individual and individual freedoms.[40]

Finally, critics argue, asking for a fundamental reframing of how humans work with nature is infeasible and defies common sense.[41] Worldwide, nations are organized around the concept of developing resources, maximizing economic returns, and increasing human consumption. In their official capacities, nations exhibit a lack of commitment to the principles that define ecological perspectives. Unless nations reconfigure their priorities, the sovereign claims of nations to pursue their economic destinies by turning nature into exploitable resources—claims that severely limit ecosystem management—are likely to be honored.[42]

It's Old Wine in New Bottles

Ecosystem management is perceived by some as an attempt by natural resource experts to recapture the ground they have lost since extensive public participation was institutionalized in the 1970s. From this perspective, the central role of science in ecosystem management is seen as a way to put scientists back in the pivotal decision-making role, reasserting the primacy of technocratic utilitarianism.[43] Critics challenge that only scientists will be able to determine how ecosystems function and assess actual and desired ecosystem conditions; only scientists will be able to determine the criteria of sustainability; and ultimately, only scientists will remain involved.[44] According to these critics,

ecosystem management is nothing new; it's just a strategy for shoring up the politics of expertise extant in the traditional paradigm. The name *ecosystem management* itself has also been criticized because, it is argued, including *management* as a descriptor implies nothing new or different from past practices.[45] Yet others say it is a way to disguise destructive practices with new environmental labeling and that it may even preclude setting aside wilderness "cores," a central concept in conservation biology.[46]

Ironically, those explicitly advocating that professional experts do indeed need to recapture lost ground are also among the most vocal critics of ecosystem management. In the case of forestry, for example, the argument is made that instead of shifting to ecosystem management, "U.S. forest management must be given back to trained and experienced foresters; they are best qualified to scientifically manage our most important renewable natural resource."[47] According to a recent president of the Society of American Foresters,

> the profession must focus on the establishment, protection, growth, and harvesting of commercial crops of timber. This does not mean that other products and benefits should be ignored. It simply means that timber comes first. It keeps us in line with the natural order of things.[48]

Closely aligned with this position is the argument that ecosystem management is simply a new device for environmentalists to attack the essence of professional resource management with "pseudoscience" and emotionalism.

It's a Form of Cooptation

All sides of the debate over ecosystem management distrust one another. Agencies, environmental interest groups, and commodity interest groups have been fighting one another for decades in courts, through the media, and on the ground and are highly suspicious of calls to lay down their lawsuits and cooperate. Ecosystem management is thus seen as an implausible lifeboat that agencies have assembled to rescue themselves from the state of perpetual conflict in which they find themselves.[49]

Some critics consider ecosystem management an environmentalist plot to turn all public lands into nature preserves and expand environmental regulation of private land. They are concerned that ecosystem management is a disguise for efforts to give preservation primacy and that it signals the end of production or output-oriented management.[50] In 1994, the conservative Cato Institute likened ecosystem management to "a federal land grab" and labeled

it a "train wreck in the making."[51] Ecosystem management is seen as a form of political correctness to shield agencies from having to deal head-on with a public that wants to consume high, but produce low.[52] At the other end of the spectrum are those who consider ecosystem management a kind of industrial imperialism, a classic case of cooptation of the resource management agencies and environmental interests by commodity groups, and an empty promise that we can have our cake (ecological sustainability) and eat it too (development).

In a related criticism, representatives of national environmental interests charge that the site-specific nature of ecosystem management translates to "anything goes." They further claim the emphasis on involvement by "communities of place" or "resource dependent communities" typically translates to increased influence by commodity interests, to the detriment of national environmental interests. In 1996, an official of the Sierra Club warned, "Industry thinks its odds are better in these forums. . . . It believes it can dominate them over time and relieve itself of the burden of tough national rules. It has ways to generate pressures in communities where it is strong, which it doesn't have at the national level."[53] Industry's support of collaborative forums is seen as a strategy to use vague concepts such as community and lifestyle to preserve the status quo of industrial subsidies and privilege.[54] Rural community groups retort that neglecting to involve local communities in identification of conditions and trends and in decision making "perpetuates the opportunity for interest groups to create narrow definitions of community well-being or economic health."[55]

It's Contradictory

Proponents of ecosystem management increasingly recognize that there is no formula or set of prescriptions for adopting an ecosystem approach. The site-specific characteristics of ground-level management are seen as critical elements that respect variations in biophysical, social, and economic characteristics of different geographic areas. Each ecosystem has unique problems that reflect its own conditions. The hydrologic conditions of the eastern United States, for example, differ from those of the arid and semi-arid West; the old-growth forests of the Northwest involve different social and ecological relationships than the pine forests of the Southeast. Nonetheless, ecosystem management will necessarily require more widespread agreement about the central principles and performance standards that undergird this management philosophy.

In this search for more explicit parameters, however, contradictions in the central tenets of ecosystem management become apparent. Calls for better use

of ecosystem science in decision making, for example, elicit cries of "biological imperialism," reflecting the concern that basing decisions on ecological requirements in effect runs roughshod over the principle that humans and their wants and needs are also a part of ecosystems. Further, the need to address resource management on broad temporal and spatial scales and to integrate data collection and monitoring may conflict with the concept that ecosystem management needs to be tailored to local ecological, social, economic, and political conditions. Finally, while ecosystem management calls for more attention to social goals and objectives, it assumes that humans won't choose to sustain higher levels of outputs at the expense of sustaining ecological services. It appears to preclude the goal, "we should use as much as we can get now," and the alternative moral position that the current generation does not have a specific obligation to future generations.[56]

A Revolution in Natural Resource Management?

With an overriding goal of ecological sustainability—to be achieved using socially defined goals and objectives, holistic and integrated science, collaborative decision making, and adaptable institutions—ecosystem management is a marked departure from multiple-use–sustained-yield. Indeed, ecosystem management differs from traditional resource management so much that several observers have called it a new resource management paradigm.

Yet others question whether ecosystem management is much different than resource management as practiced today. Resource management, it is argued, has always been about sustainability, and the job of the future is simply to "refine the ecologically based management principals of our early professional history so we can continually improve our stewardship of the land."[57] Undeniably some of the "new" ecosystem management concepts have been around for quite a long time, and some of the "old" sustained-yield premises are quite current.

The view that ecosystem management is business as usual stems in part from a common use of the term *ecosystem management*, favored by most natural resource management agencies, in which the primary goal is sustaining all *desired human uses* of ecosystems. Thus, ecosystem management becomes "a resource management system designed to maintain or enhance ecosystem health and productivity while producing essential commodities and other values to meet human needs and desires within the limits of socially, biologically, and economically acceptable risk."[58] The focus is still on products; sustaining ecosystems is viewed as a constraint to management, rather than its

primary goal. We view this "sustain-all-uses" approach to ecosystem management as an attempt to fit the principles of ecosystem management into the prevailing multiple-use–sustained-yield paradigm, with ecological sustainability taking its place as another in a growing litany of multiple uses. Thus, according to one proponent: "the incremental fitting of multiple uses into ecosystems according to their ability to support the uses—the traditional approach to forest management—is the way an ecosystem management approach must be carried out."[59] This adaption of the ecosystem management concept represents a significant incremental change to sustained-yield natural resource management, but it is not a paradigm shift.

It would be premature to declare ecosystem management, as it has been laid out here, the new resource management paradigm, for there is still no consensus on the way in which the natural resource management community sees the world. The numerous criticisms of ecosystem management and attempts to mold it to fit the prevailing natural resource management paradigm suggest it may be in what Kuhn called a "preparadigm stage." In the preparadigm stage of a scientific revolution, the traditional paradigm is under significant and increasing attack, but no new paradigm has been universally accepted by the professional community. While substantial information has been accumulated regarding ecological processes and the political dysfunction of the traditional paradigm, the values, theories, methodologies, and tools of the old paradigm have not yet been discarded.

Clearly, there are a number of major philosophical and institutional hurdles to be addressed and overcome before ecosystem management can be fully accepted and implemented as a new paradigm. Adopting the ecosystem management paradigm would mean rejecting traditional resource management policies and practices in favor of policies and practices selected primarily for the purpose of sustaining ecosystem health. These new policies and practices may well require strict limits on the social and economic uses of resources and sacrifices of short-term socioeconomic gains.[60] There are more than semantic changes that have to be made before ecosystem management—managing for ecological sustainability—can be realized on the ground in more than a few experimental plots.

Initial studies have suggested that implementing ecosystem management will require extensive social and political changes, ranging from redefinition of the values that define relationships among humans and nature, professions and citizens, and government and citizens to the creation, reform, or even dismantling of traditional resource management institutions, such as agencies and laws.[61] The following chapters examine the policy and potential problems

posed by a shift to ecosystem management and the philosophical, social, and governance changes that may be required to resolve them.

Notes

1. See, for example, Marsh, "Conservation planning under the ESA"; Brooks and Grant, "New approaches to forest management"; Kessler et al., "New perspectives for sustainable natural resources management"; Knight and Bates, *A New Century for Natural Resources Management*; and Norton, "A new paradigm for environmental management."

2. Kuhn, *The Structure of Scientific Revolutions.*

3. Patton, *Alternative Evaluation Research Paradigm*, p. 5, cited in Lincoln, "Introduction," p. 29.

4. Lincoln, "Introduction," p. 29.

5. Patton, *Alternative Evaluation Research Paradigm*, cited in Lincoln, "Introduction," p. 29.

6. Kuhn, *The Structure of Scientific Revolutions.*

7. Christensen et al., "The report of the Ecological Society of America Committee on the Scientific Basis for Ecosystem Management," p. 668; Franklin, "The fundamentals of ecosystem management with applications in the Pacific Northwest"; More, "Forestry's fuzzy concepts"; Pastor, "Ecosystem management, ecological risk, and public policy," p. 286; and World Commission on Environment and Development, *Our Common Future.* For further discussion of the general themes of sustainability, see Social Science Research Group, *Principles of Sustainability.* That report distilled six common themes from the literature on sustainability: (1) maintain ecological functions, conditions, and/or biodiversity; (2) evaluate and adapt social processes and governance functions; (3) adapt to change; (4) integrate ecological, cultural, and economic systems; (5) ensure intergenerational equity; and (6) accept ambiguity of the concept of sustainability.

8. Gordon, "Ecosystem management"; Christensen et al., "The report of the Ecological Society of America Committee on the Scientific Basis for Ecosystem Management"; Grumbine, "What is ecosystem management?"; and Costanza et al., "Goals, agenda, and policy recommendations for ecological economics."

9. Caldwell, "Implementing an ecosystems approach"; Kennedy and Thomas, "Managing natural resources as social value"; Norton, "A new paradigm for environmental management"; and Bird, "The social construction of nature."

10. Westoby et al., "Opportunistic management for rangelands not at equilibrium"; Floyd and Frost, "Measuring management objectives with condition classes"; Smith, "An evaluation of the range condition concept"; and Sedjo, "Toward an operational approach to public forest management," p. 26.

11. Christensen et al., "The report of the Ecological Society of America Committee on the Scientific Basis for Ecosystem Management"; and Norton, "A new paradigm for environmental management."

12. Christensen et al., "The report of the Ecological Society of America Committee on the Scientific Basis for Ecosystem Management." On intergenerational equity see Weiss, "Our rights and obligations to future generations for the environment."

13. Gordon, "Ecosystem management," p. 18.