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# Reflections on “What is Ecosystem Management?”

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**Abstract:** *I review 10 dominant themes of ecosystem management described in the paper “What is Ecosystem Management?” (Grumbine 1994a) based on feedback received from managers actively implementing ecosystem management projects in the field. My emphasis is on practical advice from working professionals for working professionals. Key points include the importance of managing for ecological integrity, the need for social as well as scientific data, suggestions for implementing cooperation strategies and conservation partnerships, a pragmatic definition of adaptive management, and first steps toward changing the structure of natural resource organizations. As ecosystem management evolves, the pressure for change within traditional resource management agencies appears to be reaching a critical point.*

Reflexiones sobre “¿Que es el Manejo de Ecosistemas?”

**Resumen:** *Revisé ten temas dominantes de manejo de ecosistemas descritos en el documento “¿Que es el manejo de ecosistemas?” (Grumbine 1994a) basado en la retroalimentación recibida de manejadores que activamente implementan proyectos de manejo de ecosistemas en el campo. Mi énfasis es en el consejo práctico de profesionistas que trabajan hacia profesionistas que trabajan. Recomendaciones clave incluyen la importancia de manejar para la integridad ecológica, la necesidad de datos sociales, así como científicos, sugerencias para la implementación de estrategias de cooperación y conservación compartida, una definición de manejo adaptable y los primeros pasos hacia el cambio de las estructuras organizacionales de los recursos naturales. Así como el manejo de los ecosistemas cambia, la presión de cambio dentro de las agencias tradicionales de manejo de recursos aparentemente está alcanzando una masa crítica.*

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## Introduction

In late 1993 in an attempt to consolidate discussion over the ecosystem management (EM) concept, I surveyed a broad range of literature and wrote a review paper (Grumbine 1994a) called, “What is Ecosystem Management?” The heart of my analysis was the distillation from the literature of 10 dominant EM themes: hierarchical context, ecological boundaries, ecological integrity, data collection, monitoring, adaptive management, interagency cooperation, organizational change, humans embedded in nature, and values.

Since the early to mid-1990s, most federal agencies with resource responsibilities have officially adopted EM as a new framework within which to practice manage-

ment. Although not all agency definitions are equivalent, it appears that EM is set to carry the day on U.S. public lands. It remains to be seen, of course, whether new policies on paper can be implemented successfully on the ground.

The academic and professional literature on EM has also grown rapidly, and EM projects are being implemented all around the country. Agency practitioners are beginning to receive feedback, recognize what succeeds and what fails, and disseminate results through formal and informal networks.

My purpose in writing “What is Ecosystem Management?” was to highlight an emerging framework of ideas and first principles that practitioners could use as working guidelines to be tested. In this paper I briefly revisit each of the 10 EM themes and make additional comments based on my experience speaking with agency managers over the last several years and on recent litera-

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ture on EM. I do not provide an exhaustive account of current developments. Instead, I highlight, *especially for professionals working in the field*, some of the pragmatic lessons and ongoing dilemmas emerging from initial attempts to put EM into practice.

### **Buzzwords, Goals, and Problem Definition**

In 1993 EM was perceived by many as a buzzword, a concept whose definition was slippery, imprecise. In 1996, after numerous papers and policy documents, many thousands of hours of discussion, and significant first attempts at implementation, EM still is often perceived as such. There are at least four reasons for this perception. First, a profound politics of definition surrounds all new concepts. Defining any term is a political act, an act of power. New concepts are often viewed as threats to the status quo. Defining any term automatically sets up a series of political questions to be negotiated. Which new goals are to replace traditional goals? Whose arguments are legitimate? Which (of many) experts will be called upon for opinions? Some of these struggles over definition were implied in my 1994 paper when I described how most agencies portrayed EM as evolving directly out of traditional resource management, whereas many nonagency observers saw EM as reversing that tradition.

In addition, part of the fuzziness of EM results from many people wanting to contain the concept within a scientific definition. But a quick glance at the 10 themes shows that, though necessary, the scientific aspects of EM are not sufficient for complete definition or successful implementation. Scientific data will not help managers deal with funding constraints, bureaucratic behavior, agency cultures, or media representations.

A second reason that EM is difficult to grasp has to do with goals changing from resource extraction to ecosystems protection. Ecosystem management demands a new kind of thinking about ecological systems and biodiversity (Grumbine 1992; Noss & Cooperrider 1994). But, as noted, the science behind protection of biodiversity from genes to landscapes is only part of the richness of EM. A practitioner must not only understand multiscale perspectives from the natural sciences, he or she must also be able to step back and view specific problems in political, social, and economic contexts. Attempts to understand management problems in larger contexts are radical because so many social myths and assumptions are challenged by doing so. Some of the tacit assumptions—to name but a few—upon which management of public lands in the U.S. has been based include Earth as a resource for humans, competition over cooperation, control in place of adaptation, viewing all problems as soluble, and viewing nature as stable or balanced (Knight & Bates 1995). Ecosystem management chal-

lenges all of these assumptions, and that is why it is revolutionary. As Yager and Muller (in press) put it, “most people are so used to thinking about the public lands on a statute by statute, resource by resource, program by program basis, that it is difficult for them to adjust to. . . ecosystem management.”

Demand for contextual thinking skills leads to a third reason that EM appears to be a slippery concept. Contextual thinking is difficult; it takes time to learn how to do it well. Questioning cultural assumptions is challenging. The managers in the field who are working hard to implement EM know these things firsthand. A U.S. Fish and Wildlife Service manager remarked at the conclusion of a seminar that “All this talk about EM doesn’t mean a damn thing until we can somehow control our population growth.” Others have observed that worldwide economic policies designed to open markets, increase profits, and stimulate production and consumption through transnational corporations (e.g., the General Agreement on Tariffs and Trade and the North American Free Trade Agreement) also undermine EM (Gould et al. 1995). Given that no single person or agency can resolve these larger issues, of course EM seems a chimera.

A final reason that EM is difficult to pin down is that few people know how to define problems well. An extensive literature exists in the policy sciences on how to capture the complexities behind defining problems (see Clark [1993] for an overview and Hardesty [1994] for a successful application). But if one compares these guidelines with how most agencies have proceeded to define EM, one is struck by significant gaps between them. In short, most definitions of EM are fuzzy because they are incomplete.

How do new EM goals compare with traditional resource management goals? A straightforward approach to this question is to distinguish between resources and sources. Traditional resource management has focused on resources; Merriam-Webster’s (1986) dictionary defines resources as “computable wealth” gained from nature. EM posits that we need to protect sources—the ecosystems that produce resources. This distinction can also be explored in relation to the goal that most managers have been taught to focus on: management production outputs. Traditional resource management has been concerned primarily with producing goods and services for humans (Knight & Bates 1995). EM is also concerned with this, but only if production can be attained with ecosystems remaining healthy—by maintaining native biodiversity, ecosystem structure and function, and so forth. To use a banking analogy, traditional approaches have been living off nature’s capital, whereas EM is an attempt to live off nature’s interest. Or, as the Ecological Society of America’s Committee on the Scientific Basis for Ecosystem Management (Christensen et al. 1996) concluded, “Sustainability [must be] a precondition for management rather than an afterthought.”

## The Ten Dominant Themes of Ecosystem Management

Many managers and academics believe the 10 themes described in "What is Ecosystem Management" remain useful as a framework for specific applications of EM. No major additions or subtractions have been proposed, though much new information has come to light. The following comments are meant to update understanding of the themes, based primarily on direct feedback I have received from many federal and some state-level managers across the country. I have chosen comments that elucidate each theme, and I provide information gained from managers working at initial implementation of EM projects.

### (1) HIERARCHICAL CONTEXT

The theme of hierarchical context might better be labeled contextual or big-picture thinking. Aldo Leopold (1949) was alluding to contextual thinking in the title of his essay "Thinking Like A Mountain." Systems thinking not only refers to conceptions of biodiversity; it embeds science in policy, politics, and cultural adaptation as well.

Few professionals have been taught to view problems in multidimensional contexts. Yet a consequence of an increasingly interdependent world is problems with multiple causes that sometimes shift unpredictably. These kinds of problems cannot often be solved by the mindset and methods of traditional resource management. Policy analyst Ron Brunner (1994:13) says it well: "... we do not know enough to design centralized, comprehensive, long-term plans that will actually solve pressing problems. . . This is a consequence of the increasing complexity of modern society, relative to our ability to understand it." Systems problems require systems thinkers who can work across disciplines and be imaginative and integrative, flexible and adaptive. We need managers who are passionate about interdependent as well as independent thinking.

Contextual thinking requires new learning. Many managers are already learning about EM through trial and error, but more can be discovered (with less frustration) by striving to place new learning in context. Two useful resources for managers are Donald Michael's (1995) excellent paper on learning for resource managers and Donald Schon's (1983) book, *The Reflective Practitioner*.

### (2) ECOLOGICAL BOUNDARIES

Contextual thinking expands one's perspective about administrative and political boundaries. Legal scholar Eric Freyfogle (1996:175) has observed that boundaries are influential not because they distinguish between public and private land but in how they "constrain our thinking." Boundaries are not important because of which side of the fence you are on. Freyfogle points out

that traditionally, responsibilities have ended at borders. Managers today are realizing through EM that responsibilities begin at boundaries. Often, the first step in EM work is to bring all interested parties together to define common problems and boundaries of concern. This task is often difficult; it helps to remember that most boundaries are artificial, only as real as we want them to be and only for "so long as we agree to accept them as real" (Freyfogle 1996:176).

### (3) ECOLOGICAL INTEGRITY

Boundaries for sustainable human use of nature are best marked with this theme foremost in mind. Ecological integrity includes maintaining viable populations of native species, representation of ecosystem types across their natural range of variation, maintaining ecological processes, management over the long term, and accommodating human use within the above constraints (Noss 1992; Grumbine 1994a). Some people conclude that ecological integrity trumps other (human) goals. This argument is an artifact of narrow problem definition, lack of contextual thinking, and our propensity to separate ourselves from nature. Over time there simply is no way to sustain humans without sustaining ecosystems. Even if one believes in *Homo sapien's* right to choose which elements of diversity to diminish, we are in no position to make these choices. Scientific data gaps concerning keystone species and other critical elements of ecosystem structure and function will not be closed soon.

### (4) DATA COLLECTION

Some managers complain that they cannot protect ecological integrity without sufficient scientific data on viable populations, disturbance regimes, and so forth. But regardless of data gaps—and there are many—usually enough information is available to begin to resolve regional and local issues if managers can get access to it. This leads to several suggestions. First, managers must cultivate a working relationship with the research staff of their agency (or neighboring agencies) as well as with academics from nearby universities. Tim Mersmann and his colleagues (1993) on the Ouachita National Forest in Arkansas discuss how much progress was made toward implementing an EM project when researchers and managers actually met each other and worked together directly. Second, managers must remember that there are significant barriers to staff interchange. These include physical separation (offices in different towns), research goals (knowledge) in conflict with management goals (products), and more. It is not just a simple matter of researchers supplying managers with data: "[Managers] are limited by their need to continue producing expected services and . . . [often] do not have the expertise to rigorously design and analyze complex data" (Mersmann et al. 1993:15).

There is a larger context from which to view data collection. In the 1994 paper I focused on scientific data collection, but this is too narrow. Managers also need social data to help them do their jobs, but these data have been discounted or simply not collected by many natural resource agencies. Yet studies confirm that nonbiological data are often more important than scientific information in solving management problems (Grumbine 1994b). Third, even as managers strive to find and use the best available scientific information, they must keep in mind that biology does not always affect policy as much as one might assume. Two examples illustrate this point. The recent creation of the National Biological Survey (now Service), with the goal of closing data gaps regarding biodiversity, has been a political football from the beginning because of social concerns (e.g., private property issues), not scientific issues. And in the greater Yellowstone ecosystem, The Nature Conservancy has attempted for several years to construct a natural heritage database for the region in collaboration with the U.S. Forest Service and National Park Service. No doubt such information would help the agencies do their jobs better, but, because of interagency politics, no partnership appears to be forthcoming. The overall lesson is that people will support the use of scientific data only after they become ready to learn.

#### (5) MONITORING

There is the science behind data collection (gathering primary information) and there is the science behind testing data against management activities or experiments (monitoring). Because traditional resource management primarily concentrated on output, little interest was shown in designing monitoring programs to determine if production goals were sustainable.

Designing an efficient monitoring system is relatively straightforward. An excellent source of information on this is chapter 9 and associated references in Noss and Cooperrider (1994). (A valuable philosophical treatment is Shrader-Frechette and McCoy 1993.) Funding a monitoring program poses the biggest hurdle. The main question to keep in mind is, how may one get the most useful learning from the least investment?

#### (6) INTERAGENCY COOPERATION

The key theme of interagency cooperation is best understood simply as cooperation—among all parties to management problems and as both mindset and standard operating procedure.

It is no secret that competition has characterized agency interactions (Grumbine 1991). The difference between competition and cooperation is analogous to the distinction between war and peace. Many managers, tired of fighting battles, have taken cooperation to heart, revealed by the emphasis on public-private partnerships

as the basis for numerous EM pilot projects. What has been learned so far?

According to Frances Westley (1995), there are two critical issues in fostering cooperation. First, all potential partners must share in defining the problem. It does not matter what the specific problem is; if some stakeholders are left out, the chance for success is reduced significantly. The second issue in cooperation is sharing power. Everyone who has experience with the cooperative process has noted that the work is not easy, but few are insightful enough to recognize unequal power distribution as a major problem. Potential partners never come to the table equal in power. The trick is to make power imbalances explicit and to facilitate equitable power sharing as much as possible. Because professionals are not often trained to either of these tasks, partnership work is challenging. Westley (1995:409) makes this clear: "The tendency is toward strong demands for equality from those less powerful and little concern for equality on the part of the powerful."

Why get involved with power? First, experience shows that, the greater the power imbalance in any group, the less chance there is for success. Second, all professionals are embedded in a full range of relationships based on power; everyone is already involved. The role of management professionals in general should be to increase the visibility of the issues and to facilitate awareness of them.

Here are some specific suggestions to assist in negotiating cooperation. Learn to question claims of objectivity: every person in a partnership has something to gain and lose. Partnerships need leadership, but the role of facilitator works better than a traditional chairperson role. Professionals will always be perceived as experts by most partners. Yet the expert role is often counterproductive; let people know the limits of your knowledge. Policy analyst Kai Lee (personal communication) has remarked: "The less managers assume about mapping [problems], the more citizens will be involved in constructing them." Encourage interpersonal communication skills: learn how to listen and give constructive feedback. Based on observation from managers in the field, these basic skills are not trivial. Assuming basic scientific competency, communication and facilitation skills are the most important skills for an ecosystem manager to have.

Be aware that partnerships can become unwieldy if the number of participants is too high. If this is a problem, large groups must break into subgroups. Cooperation often means steady involvement over the long term; true sustainability is intergenerational. Groups need to find short-term rewards to remain productive. For most partnerships, trust building has been found to be more important than information processing. Trust takes time. The most successful cooperative ventures construct work timelines that match well with the problems to be resolved. Some valuable sources of information on cooperation and partnerships are provided by Management In-

stitute for Environment and Business (1993), McNeely (1995), and, in general, Gunderson et al. (1995).

Finally, I have noticed a tendency in some partnerships to focus on the social issues surrounding EM projects, and to discount key goals such as protection of ecological integrity. After all, partnerships are intensely social, and cooperation, negotiation, and compromise are linked and form the basis for democratic action. But discounting nature's role in any partnership is dangerous. More specifically, humans only have so much room within which to negotiate what constitutes a viable population, a healthy and functioning ecosystem, or a habitable Earth.

#### (7) HUMANS EMBEDDED IN NATURE

Americans have a long cultural tradition of viewing themselves apart from nature. Ecosystem management runs counter to this tradition. It is obvious from the current biodiversity crisis that we act upon nature just as nature acts upon us. In EM work the dawning realization is that the terms "humans" and "nature" are mostly conveniences of communication. Nevertheless, it will take people a long time to evolve lifeways and cultural practices that embody this new perspective (Cronon 1995; Soulé & Lease 1995).

#### (8) ADAPTIVE MANAGEMENT

"What is Ecosystem Management?" described adaptive management in terms of science, in which management is conducted as a "continuous experiment where incorporating the results of previous actions allows managers to remain flexible and adapt to uncertainty" (Grumbine 1994a:31). Both recent theoretical (Gunderson et al. 1995) and practical experience with EM have contributed to a more precise understanding of adaptive management, which focuses on increasing new learning instead of increasing power, interest, and control. What does this provocative statement mean for managers?

Consider the central goal of traditional resource management. Holling (1995) characterizes this as controlling the variability of ecosystems so that a steady flow of goods and services can be produced for humans. Management activities (fire suppression, clearcutting, etc.) have been designed to reduce surprise. Output measurements such as recreational visitor days, allowable sale quantities, and animal unit months, indicate how we attempt to smooth out the uneven "bumps" in ecosystems. Ecosystems, however, are not machines. Recent theories in ecological and conservation biology instead suggest that natural systems are dynamic, require variability for long-term functioning, and operate across multiple spatiotemporal scales (Pickett & Ostfeld 1995). Yet changing management to reflect these insights is risky because new learning challenges the status quo. This is a major reason why resource managers tradition-

ally have not often been rewarded for flexibility, openness, and their willingness to experiment, monitor, and adapt.

The adaptive management challenge is to make practitioners more responsive to change, to institutionalize new learning. Adaptive learners hunt for a broad range of feedback instead of one correct answer. In practice, an adaptive approach to EM suggests the following:

- Because ecological and social systems are complex, problems always have multiple causes. Policies or decisions that rely on only one variable or a single partner should be avoided (Holling 1995).
- Systems problems are not often amenable to quick fix solutions and should be avoided.
- A Chinese proverb states, "In action, watch the timing." There are certain periods when systems are susceptible to influence; managers need to know where they are in the cycle of change so that their effectiveness may be enhanced (Holling [1995] provides a useful discussion).
- There is no substitute for reliable monitoring to help determine the success and failure of management actions (Noss & Cooperrider 1994).
- Multiple, modest experiments (prototypes) will likely yield more new learning about a problem than one general design applied widely (Brunner 1994). A prototype should focus on a specific problem and should be testable with only a few years of data (at most). If it is successful it can be replicated. If not, the prototype can be terminated without great cost.
- Decentralized partnerships between management and citizen working on small-scale prototypes appear to yield higher rates of learning than centralized approaches (Brunner 1994).

#### (9) ORGANIZATIONAL CHANGE

Managers everywhere are making an important discovery: to implement EM successfully diverse institutional structures must change. There are three reasons that this cannot be avoided. First, as described earlier, when general management goals evolve (from producing resources toward protecting sources), organizations will also be transformed. There is a link between what organizations do and how they do it. Second, bureaucracies are by definition less adaptive to change. Resource agencies have been structured not so much to be responsive to new learning, but to maintain control over resources, information, and people (Clarke & McCool 1985; Gruber 1987). Third, if new ecological theory describes a nature less stable, nonlinear, and full of surprise, and if we have constructed management agencies based on a balanced, linear, and predictable image of nature, then there is a gap between how we choose to work with nature and the properties of ecosystems. New scientific theories ex-

ert tremendous pressure for change on traditional organizational structures.

What would an adaptive agency look like? Several excellent reviews address this question, including those by Westrum (1994), Westley (1995), Clark and Reading (1994), and Clark (1992). Westrum (1994) compared information flow in a bureaucracy to that within an adaptive organization. He discovered that bureaucracies compartmentalize information into disciplinary channels, discount those who are adept at sharing information widely (messengers), neglect bridge building, and often consider new ideas as potential threats. Adaptive organizations construct networks for information sharing, train and encourage messengers, reward bridge builders, and welcome new learning.

Westley (1995) notes gaps between top-level decision makers, mid-level managers charged with information transfer, and bottom-level field implementors. Westley points out that in hierarchies information is simply not rich enough in meaning to compel action by the time it filters down to the field. To solve these problems Westley suggests creating horizontal information flows based on informal, face-to-face contact. Studies from private business reveal that this is how people actually communicate (Brown & Duguid 1991). She also advocates sharing of decision making and less-specialized job descriptions. Westley cautions against isolating top management from field staff and maintaining incentives designed to reward star individuals and star resources, such as timber in the U.S. Forest Service and cattle in the U.S. Bureau of Land Management.

Some agencies appear willing to experiment with these recommendations for change. The U.S. Fish and Wildlife Service is discussing moving toward a more adaptive organizational structure. Some managers within the agency are calling for more bottom-up planning and responsibility, new job performance incentives, rewards for risk taking, and a greater emphasis on partnerships and teamwork. The National Education and Training Center of the U.S. Fish and Wildlife Service is providing workshops for employees on understanding the ecosystem approach, teamwork skills, and more (Henne 1995). The Bureau of Land Management also has an active training program. Florida's Department of Environmental Protection (1995) action plan for implementing EM is the most comprehensive strategy for organizational change that I have yet seen. Specific recommendations include

- overall reorganization based on EM themes (as presented in this paper)
- staff training in understanding EM, teamwork and communication skills, consensus building, and public outreach;
- employee incentives to do EM outreach to the public;
- staff training across disciplines and program boundaries;

- creation of stewardship programs to reward cooperation between the department and private landowners;
- independent audit and evaluation programs to monitor success and failure.

Resource professionals everywhere are waking up to the fact that they are not so much a technical elite as they are facilitators in a large-scale societal conversation about conservation. Roles in adaptive organizations will be varied and may include educator, mediator, technician, public-relations specialist, scientist, or a combination of these and other skills. The key new understanding is that people in a multiplicity of overlapping roles must be supported by organizations as flexible as these complex tasks require. It is difficult to encourage adaptive learners in an inflexible, institutional environment.

#### (10) VALUES

William Burch, longtime faculty member at the Yale School of Forestry and Environmental Studies, summarized his experience with three central "laws" of resource management (Tim Clark, personal communication):

- All resource allocation decisions are matters of political struggle rather than technical facts.
- Resource management decisions are about use; therefore they are decisions about manipulating human behavior rather than physical things.
- Resource managers, when confronted with social value decisions, will seek to convert them into technical decisions.

People make commitments based on values as much if not more so than on facts and logic. As managers learn to accept the role of human values explicitly, the success of ecosystem management will become more likely. Human behavior, however, like ecosystem behavior, is complex and unpredictable. There is a large gap in American environmental values between what sustaining ecosystems requires and what people desire. Burch's second "law" suggests that managers have a role in helping the public to understand that resource management is as much about negotiating what people want from nature as it is about how to cut trees and stock fisheries. Managers cannot change the biological basis of sustainability, but they can influence human behavior to some as yet unknown degree.

## Conclusion

In July 1995 the U.S. Congress passed a law mandating extensive timber salvage and old-growth sales from public forests, including unprotected roadless areas. The act also suspended all pertinent environmental laws, barring activists from due legal process. Some observers use this

act to prove that without a legal basis ecosystem management cannot survive infancy. The problem, of course, runs deeper than a single act of Congress. As law professor Robert Keiter (1994:911) has mentioned, the entire legal system, "based as it is upon politically defined boundaries, private property rights, a consumptive ethic, and single-resource management . . . runs counter to basic precepts of biodiversity conservation." Managers are not responsible for changing the bases for law in the U.S. Practitioners are responsible only for modeling their values of what is good for the land and the human community and to be open to new learning.

From what I have learned from managers in the early stages of implementing EM, there is great energy for change at the grassroots throughout the profession. Quick political fixes and the ensuing negative ecological feedback will likely only increase the pressure for progressive change at this stage in the evolution of EM. There are now too many managers committed to EM to allow a hostile Congress, administration, or wise-use movement to easily derail them. And for those who do not support change toward ecosystem management, the question is, "What is the sustainable alternative?"

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