Ecosystem Management:

Paradigms and Prattle, People and Prizes

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Introduction

To make sense of ecosystem management, there are at least four elements that need to be understood. The first is the **paradigm**. A paradigm is the basic world view upon which an action or philosophy rests. In a sentence, the history of paradigms in fisheries management is full of fits and starts, beginning in the last century with an *agricultural vision*, leading to replenishment *stocking*, modified by *habitat and recruitment management*, codified into *scientific management*, reinvented as *adaptive management*, and pollinated with business management to create *management by objectives* and *total quality management* (Bottom, 1996).

The second element is **prattle**. Prattle is the noise that surrounds the ebb and flow of debates over paradigms. From a distance, most prattle is just that, meaningless drivel comprised of undefined words. But some prattle masks what turns out to be a paradigm shift, so it should not be dismissed out of hand. You have to be careful; one person's prattle is another's enlightened vision.

The third element is **people**. Policy analysis in fisheries management draws from both values and science. Science, ecological information, tends to place constraints on options; values, of course, are human constructs and they tend to create mutually exclusive policy alternatives. The debate over the proper management paradigm is often a debate over values or at least a debate over priorities and preferences. Values (and priorities) are important; they are the substance of, pejoratively, "politics" and, supportively, "democracy." Society, at least ours, finds it difficult to debate values; it is much easier to debate science as a surrogate of values and priorities.

Finally, and definitely not least important, are the **prizes.** All management decisions create winners and losers. Many times we think of "global" optimization when it is the distribution of benefits and costs that is most important -- who wins and who loses. This distributional question is critical and we should not try to conceal its importance.

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How difficult can current management and policy problems be? Pretty difficult. They have several general characteristics:

(1) fundamental public and private values and priorities are in dispute, resulting in partially or wholly mutually exclusive decision alternatives;

(2) there is substantial and intense political pressure to make rapid and significant changes in public policy in spite of disputes over values and priorities and the presence of mutually exclusive decision alternatives;

(3) public and private stakes are high, with substantial costs and substantial risks of adverse effects (some also irreversible ecologically) to some groups regardless of which option is selected (think of the Endangered Species Act);

(4) technical facts, ecological and sociological, are highly uncertain (after all, how certain are we over the long term consequences of farming nearly all of the tall grass prairie?);

(5) ecosystem policy problems are meshed in a large framework assuring that policy decisions will have effects outside the scope of the problem (think about the "taking" issue: which "rights" take precedence in public policy?).

What should ecosystem management be -- the paradigm? In the current debate, what is prattle and what is substantive? And do people and prizes fit into the debate? If ecosystem management is to be useful, it must be clearly defined. I've struggled with answering this question elsewhere (Lackey, 1998), so I'll skip the detail and provide the key conclusions.

Pillars

I find it helpful to organize the paradigm, prattle, people, and prizes elements of ecosystem management around seven *pillars* (Lackey, 1998). You could call these principles, tenets, or concepts, but *pillars* connotes a sense of something solid, more fundamental, or at least more literary.

What is the definition of ecosystem management? Agreeing on a definition of ecosystem management seems a reasonable place to start. It is not. The diversity of definitions simply provides a confirmation of the current amorphous nature of the concept. Some definitions have an unmistakable similarity to traditional definitions of fisheries management, wildlife management, and forest management (Wood, 1994; Grumbine, 1994; Freemuth, 1996; Stanley, 1995; Fitzsimmons, 1996). In fact, they are strikingly similar to the often maligned definition of multiple-use management. Others read like the tenets of a religious order -- calls for justice, enlightenment, harmony, balance.

Rather than agreeing on a definition, we need to begin with *people*. Values and priorities, entirely human constructs, drive policy and management decisions. What does society want from ecosystems? Or is that even a fair question if humans are part of ecosystems? What do ecosystems want from humans? There are a lot of word games we can play here, but there are far more important issues than semantics. There are two fundamentally different world views. Both are "right" in the same way that religious and moral positions are right (Lackey, 1995).

The first is *biocentric* or *ecocentric* and considers maintenance of ecological health or integrity as the goal. All other aspects, including man's use -- tangible or intangible -- are of secondary consideration. I reject this view. My rejection stems not from any moral or religious position, but rather its mushy logic. If a person operates with this world view, I don't see how it leads to anything but a "Back to the Pleistocene" set of decisions. More specifically, a child *is* a rat *is* a mosquito *is* a virus. I don't see it as intellectually tenable, and I haven't met any practitioners, only proponents of the philosophical position.

The other view is *anthropocentric* in that benefits (tangible or intangible, short and long-term) are accruable to man. Certainly ecological systems can be adversely affected and care should be taken not to deplete resources for short-term benefit, but sustainable benefits are possible from ecosystems with careful management.

The basic idea behind any "management" paradigm is anthropocentric; to maximize benefits by applying a mix of decisions within defined constraints. Benefits may be tangible or intangible and may be achieved by maintaining a desired ecological condition. Potential benefits from ecosystems may be commodity yields (logs, fish, wildlife), ecological services (pollution abatement, biological diversity, erosion control), intangibles (preservation of particular species, protection of certain pristine areas, maintenance of culturally important vistas), precautionary investments (deferring current use to preserve future options), or maintaining a desired ecological state (old growth forests, unaltered rangelands).

The important central role of values and priorities has long been recognized in management (Shrader-Frechette and McCoy, 1994; Barry and Oelschlaeger, 1996). Roe (1996) is more blunt: " . . . social science is more important than even ecology in making ecosystem management work . . . . " Management paradigms, whether they be multiple-use, dominant use, maximum sustained yield, maximum equilibrium yield, optimum sustained yield, scientific management, watershed management, natural resources management, or environmental protection, are based on values and priorities. Each paradigm has, either formally or informally, accepted a set of values and priorities. There may have been a formal process to derive values and priorities, or they may have been imposed by legislative action or policy, but the basis is some assumption about the public's values and priorities. Ecosystem management is no different.

Therefore, the first pillar of ecosystem management is:

Ecosystem management reflects a stage in the continuing evolution of social values and priorities; it is neither a beginning nor an end.

Boundaries . . . A practical technical requirement with any management paradigm is how to *bound* the system of concern. It may be appealing to defer to the "everything is related to everything else" mantra, but we have to operate in a real world, hence the concern with defining boundaries.

Because no useable definition of an ecosystem has been developed that works within public decision-making, other approaches are used to define the "system" of concern (Fitzsimmons, 1996). Historically, this was accomplished by focusing on one or more species over a defined geographic area. We are used to this in fisheries management. The geographic limits of a species of concern become the operational boundaries for management analysis. Or we manage the game fish populations in a certain lake. The lake and its watershed then become the unit of concern. In all cases the "issue" will define the boundary. No matter how boundaries are defined in ecosystem management, they end up largely being geographically based -- a *place* of concern.

Therefore, the second pillar of ecosystem management is:

Ecosystem management is place–based and the boundaries of the place of concern must be clearly and formally defined.

Health . . . The terms ecological *health* and ecological *integrity* are widely used in the scientific and political lexicon (Calow, 1995; Lackey 1995; Wicklum and Davies, 1995). Politicians and many political advocates widely argue for managing ecosystems to achieve a "healthy" state or to maintain ecological "integrity." By implication their opponents are relegated to managing for "sick" ecosystems.

Natural resource managers often call for monitoring the health of ecosystems, or perhaps the integrity of ecosystems. There is usually the assumption that there is an *intrinsic* state of health or integrity and other, lesser states of health or integrity for any given ecosystem (Lele and Norgaard, 1996). Some explicitly advocate that maintaining ecosystem integrity should take precedence over any other management goal.

Much of the general public seems to accept that there must be a technically defined healthy state similar to personal human health. After all, you know how you feel when a flu virus prospers in your body. By extension, ecosystem sickness must be a similar condition -- and it should be avoided. "Health" is a powerful metaphor in the world of competing policy alternatives. It is very tough to argue against health.

But argue you should. The debate is really over defining the "desired" state of the ecosystem, and secondarily, managing the ecosystem to achieve the desired state. There is no intrinsic definition of health without a benchmark of the desired condition -- often called the reference condition, the natural condition, the pristine condition, the nominal condition (Kay, 1995). But these are human constructs -- they have no intrinsic scientific basis (Wicklum and Davies, 1995). Useful they can be, but they are human choices.

Therefore, the third pillar of ecosystem management is:

> ***Ecosystem management should maintain ecosystems in the appropriate condition to achieve desired social benefits; the desired social benefits are defined by society, not scientists.***

Stability . . . . *resilience, fragility,* and *adaptability* are interesting and challenging concepts in ecology (Shrader-Frechette and McCoy, 1994). These are the characteristics of ecosystems that provide an opportunity to realize benefits for society, but these same characteristics constrain options. Stability and the related concepts are very difficult to describe clearly because of the variations in definition for all the terms associated with this topic.

There is a widespread, if sometimes latent, view that ecosystems are best that have not been altered by man (Gomez-Pompa and Kaus, 1992). Further, it just seems obvious that such "healthy" ecosystems *must* be more stable than the altered, less "healthy" ones, just as the Romantic School held that nature realized its greatest perfection when not affected by man. This is the classic "balance of nature" view. Pristine is good; altered is bad -- perhaps necessary for food, lodging, or transport, but still not as desirable as pristine (Lele and Norgaard, 1996).

This is not how nature works. There is no "natural" state in nature; it is a relative concept and entirely a human construct. For example, what is the natural state of Mount St. Helens? -- the verdant mantle of coniferous forest or the moonscape after the recent volcanic events? The only thing natural is change, sometimes somewhat predictable, oftentimes random, or at least unpredictable. It would be nice if it were otherwise, but it is not.

Ecosystems are resilient to various degrees, but are not without limits. A key role of science in ecosystem management is to identify the limits or constraints that bound the options to achieve various societal benefits. The trick in management is to balance the ability of ecosystems to respond to stress (including use or modification) in desirable ways, but without altering the ecosystem beyond its ability to provide those benefits. We want shelter, food, personal mobility, energy, and other benefits, but we do not want the systems that are producing those benefits to collapse.

Therefore, the fourth pillar of ecosystem management is:

Ecosystem management can take advantage of the ability of ecosystems to respond to a variety of stressors, natural and man–made, but there is a limit in the ability of all ecosystems to accommodate stressors and maintain a desired state.

Diversity . . . The level of *biological diversity* in an ecosystem is an important piece of scientific information, and this knowledge can be useful in understanding the *potential* of an ecosystem to provide certain types of social benefits (Baskin, 1994; Lackey, 1995). Some propose an ecocentric version of ecosystem management as a response to today's deepening biodiversity crisis. Others openly contend that "advocacy for the preservation of biodiversity is part of the scientific practice . . ." of conservation biology (Barry and Oelschlaeger, 1996). This is a legitimate position, but it is a *political* position. Biological diversity is purely a technical piece of information; what decisions you make concerning biological diversity involve people's values and preferences. What people value about biotic resources, whether biological diversity or something else, is not a technical question.

An argument often made is that biological diversity is necessary to maintain ecosystem stability. This argument contains an element of truth, but there is only the most general linkage between biological diversity and ecosystem stability (Johnson and Mayeux, 1992). Like any other attribute of ecosystems, the value of biological diversity to society must be based on society's preferences. That is not to say that biological diversity (and many other characteristics of ecosystems) is not important; it is. But, as a characteristic of ecosystems, biological diversity operates as an *ecological constraint*, not as a *benefit -- unless there is an explicit societal preference.* Many people's values clash over biological diversity, but that is a human *preference* issue; the ecological role and function of biological diversity is purely a *technical* question.

Therefore, the fifth pillar of ecosystem management is:

Ecosystem management may or may not result in emphasis on biological diversity as a desired social benefit.

Sustainability, and a host of related concepts, are important elements of nearly all natural resource management paradigms (Wood, 1994). There is a considerable literature on defining exactly what these concepts actually mean and whether the concepts, however defined, are really relevant or useful. In natural resource management there is always debate over whether particular societal benefits *are* sustainable, but there is little debate over the assumption that benefits *should* be sustainable. We take sustainability as a management commandment.

Of course, sustainable *tangible* outputs (fish, deer, visitor days, drinking water, logs) are much easier to identify and measure than are the more *intangible* benefit yields (ecosystem integrity, biodiversity, endangered species) typically of importance in ecosystem management. However, whether "yields" of benefits are described and measured in logs, fish, deer, visitor days, skiers, boaters, bird watchers, diversity of recreational opportunity, or maintenance of "wilderness areas that no one visits," all are realized *benefits* accruable to man.

More tenuous is the foundation for the concept of sustainable development -- a term often used interchangeably, but inappropriately, with sustainability. The goal of sustainable development typically offered is "... to meet the needs of the present without compromising the ability of future generations to meet their needs." The concept of sustainable development masks some fundamental policy conflicts that mere word-smithing will not alleviate. What are the needs of the present generation, much less future generations? Who decides these needs? What degree of risk are we willing to assume in order to increase benefits to society? These are not new questions and we have a long history of addressing them in natural resource management. But, we also have a long history of failures, in part due to promising too much to the public when providing blunt, clear consequences of the various choices facing the public would be more honest (Ludwig, *et al.*, 1993).

Therefore, the sixth pillar of ecosystem management is:

> ***The term sustainability, if used at all in ecosystem management, should be clearly defined — specifically, the time frame of concern, the benefits and costs of concern, and the relative priority of the benefits and costs.***

Some level of ecological understanding and *information* is essential for effective ecosystem management. How much understanding and information is needed is a real question. After all, it is the characteristics of ecosystems that largely constrain various management options to produce societal benefits. We cannot easily provide marlin fishing in Michigan, nor can we easily provide salmon fishing in southern Florida.

There is also the ambivalent role that scientists and managers play in the management and policy game. The line between advocacy and information provider can be pretty hazy but there *is* a line. Part of this confusion over "providing information" vs. "advocating policy" rests with scientists. Many professional natural resource scientists have a strong tendency to support "green" political positions (Barry and Oelschlaeger, 1996). How often do you hear: "If we don't advocate for the fish, who will?" Individuals in any profession naturally tend to be advocates for what is important in that profession. And it is not difficult to understand the reluctance that many natural resource ecologists have in deleting from their scientific vocabularies such value-laden and emotionally charged words as "sick," "healthy," and "degraded." Language is not neutral and we should be very careful when speaking as *scientists*.

Therefore, the seventh pillar of ecosystem management is:

> ***Scientific information is important for effective ecosystem management, but is only one element in the decision-making process that is fundamentally one of public or private choice.***

Final Thoughts

Much, but not all, of what is proclaimed as a scientific basis for ecosystem management is, at its heart, an assertion of fundamental values. At the very least, the claimed scientific basis for ecosystem management is an expression of personal policy preferences. To fairly characterize ecosystem management or to effectively debate its appropriateness as a public policy paradigm or decision support tool, it is essential to clearly separate those elements of the paradigm that should be driven by science from those components that should be based on individual or societal values and preferences.

It is incorrect to say that ecosystem management (or the traditional natural resources management paradigm) should be science driven. Rather, it is more accurate to say that ecosystem management is constrained by science and scientific information. Regardless of how ecosystem management may be defined, a key role of ecological (scientific) information is to identify the limits or constraints that bound the options to achieve various societal (or in some formulations of ecosystem management, *non*societal) benefits. Ecological information is important for implementing effective ecosystem management (or any other management paradigm), even though it is only one ingredient in the decision-making process that should be driven largely on public or private choices.

There appears to be two policy trajectories for resolving the operational meaning of ecosystem management. The first, and most likely to happen, is that the expression "ecosystem management" might be defined as functionally equivalent to the classic natural resource management paradigm and merely reflects another stage in evolving societal values and preferences. The other path, less likely to happen in my opinion, is that "ecosystem management" will come to be policy banner for an eco-centered world view closely tied to concepts of species egalitarianism, bioregionalism, democratization, and possibly local empowerment.

In spite of the scientific character of much of the debate over ecosystem management, most of the divisive issues are not scientific; they are most often clashes over moral and philosophical positions or simply different individual preferences. Stated in a more pragmatic context, the policy debate in ecosystem management will continue to be who (or what) wins and who (or what) loses and over what period of time.

Ecosystem management remained relatively free of controversy as long as it was defined in sufficiently general terms that nearly anyone's policy position plausibly could be accommodated. However, efforts to demand precision of thought have forced deep-seated societal moral and economic divisions to the surface. Rather than be judged a political platitude that offends no one, ecosystem management has become, justifiably, a lightning rod for controversy in public policy.

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