

# Ecosystem management: A practitioners' guide\*

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## Abstract

Ecosystem management represents an evolving philosophical approach to managing natural resources. Rather than managing multiple resources independently, an ecosystem-based approach focuses on the collective management of all resources—maintaining ecological integrity while allowing resource extraction. This approach seeks to ensure the co-existence of healthy, fully functioning ecosystems and human communities and development. In this extension note, we outline the basics of ecosystem management, highlighting a number of key concepts related to this shift. In particular, we discuss the wide range of ecosystem management definitions and provide a summary diagram. This diagram helps to position the many interpretations of ecosystem management along a continuum that ranges from environmentally sensitive multiple use to ecoregional management. Using available case studies as a basis for drawing conclusions, we also explore the significant changes needed to address existing institutional, policy, science-based, and management barriers to the implementation of an ecosystem-based approach to natural resource management. Finally, we offer a list of web-based resources on ecosystem-based management. Together with a companion paper, this extension note provides useful information to natural resource managers considering ecosystem management as an approach and to policy-makers interested in enabling this approach in British Columbia.

**KEYWORDS:** *adaptive management, collaboration, ecosystem-based management, ecosystem management, natural resource management, sustainable forest management.*

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### \* Editor's Note

*Issues and innovations relating to the topics presented in this article may have evolved since the original submission. We invite readers to contribute articles to further the dialogue.*

## Introduction

Far off the west coast of British Columbia lies a 250 000-ha island, mountainous and forest-covered. In this fictional world, people live as part of the ecosystem. The forested lands are harvested for a huge variety of natural resources—berries, mushrooms, wood, fish, and animals—all of which are used locally as well as sold nationally and internationally. Local people decide how ecosystems are managed, and because they are part of the ecosystem, they hold its protection as paramount and sacred. Their lives, their social systems, and their livelihoods depend on protecting the ecological integrity of their island.

While this may sound like a utopian dream, the description fits at least some interpretations of ecosystem management, an evolving philosophical approach to managing natural resources. In recent years, numerous global, national, and local natural resource management initiatives have embraced the concept of ecosystem management (or ecosystem-based management; see sidebar). On a global scale, ecosystem management is embedded within the World Conservation Strategy (International Union for the Conservation of Nature, United Nations Environment Program, and World Wildlife Fund 1980), the United Nations Conference on Environment and Development's "Agenda 21" (United Nations 1992a), and the United Nations Convention on Biological Diversity (United Nations 1992b). In the United States,

### Ecosystem Management vs. Ecosystem-based Management

In the literature, the terms *ecosystem management* (EM) and *ecosystem-based management* (EBM) are used more or less interchangeably. Some authors prefer the term EBM because it emphasizes the human role (i.e., makes it clear that we are managing people, not ecosystems). Others prefer EM because of concerns that EBM seems to put ecosystems above all other considerations.

In general, the preferred term seems to be EBM: "Ecosystem-based management is preferable to ecosystem management because it reflects the notion that the . . . [principal] activity is the management of human interactions with the ecosystem rather than the ecosystem itself" (Piro et al. [editors] 2000:1).

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at least 18 federal agencies are exploring ecosystem management, including the US Forest Service (Rigg 2001; Robertson 1992). In Canada, several federal agencies highlight ecosystem-based management as part of their vision, including Parks Canada and the Department of Fisheries and Oceans. Ecosystem-based management is also embedded in Objective 1 of the Canada's fifth National Forest Strategy, and is mentioned as an ongoing key priority in the Canadian Council of Forest Ministers' recent paper, "A Vision for Canada's Forests: 2008 and beyond" (Canadian Council of Forest Ministers 2008). In British Columbia, the principles of ecosystem management were at least partially used to develop alternative forest management approaches both in Clayoquot Sound and, more recently, on the Central Coast (Coast Information Team 2004), where full implementation of ecosystem-based management is expected by March 31, 2009.

The increasing use of ecosystem management to achieve sustainable natural resource management is based on a recognition that traditional management approaches have generally resulted in a loss of biodiversity and degradation of the environment (Piro et al. [editors] 2000). The basic tenet of an ecosystem-based approach is that conserving ecosystem functions and integrity is vital because viable ecosystems are the basic life support system for human communities. The approach is therefore seen as a useful tool for developing a particular area's natural resources and for promoting sustainable development.

In this extension note, we discuss ecosystem management as a paradigm, or model. We provide some definitions of ecosystem management and illustrate the wide range of interpretations that exist for this philosophical approach to natural resource management. We highlight a paper by Yaffee (1999) that describes a continuum of ecosystem management definitions, and illustrate this continuum through a summary diagram. Finally, we discuss lessons learned from ecosystem management projects elsewhere, and

provide suggestions for overcoming specific challenges in using an ecosystem-based approach to management.

This extension note is a companion piece to an EBM case study of Clayoquot Sound (Butt and McMillan 2009). Natural resource managers and policy-makers should find both papers useful resources for enabling ecosystem management in British Columbia. Readers should also review Bourgeois (2008), a recent *JEM* paper that compares EBM with sustainable forest management, and provides a list of policy and management changes required to successfully implement EBM in British Columbia.

### Defining ecosystem management

Ecosystem management is essentially an approach to development that takes a more holistic view of natural and social systems. In the old world (still the current world for most of us), different government agencies are responsible for managing each natural resource industry. There are individual agencies for mining, forestry, conservation, fisheries, and tourism, each operating within its own legislative limitations and administrative boundaries. Little integration occurs across the different industries or the different government agencies that manage each industry. This reality may encourage an exploitative approach to natural resource management, as each resource industry maximizes its own use of

the ecosystem without consideration for overlapping development. In general, social, economic, and natural systems are considered separately.

A fundamental principle of the ecosystem management realm is that natural resource development should occur at multiple scales, within ecosystem boundaries, not administrative boundaries. This approach recognizes that ecosystems are both biophysical and socio-cultural systems—that is, ecosystems include social and cultural uses, not just the more generally recognized physical and biological properties. It also recognizes that implementing ecosystem management depends on the management of social, economic, and institutional factors (Quinn 2002). Ecosystem management thus requires co-operation across jurisdictions, government agencies, and industries, and this necessitates significant institutional change (Cortner et al. 1998).

“Ecosystem management” has been defined in many ways (see Table 1 for some examples). Fortunately, a few authors have distilled some key principles or themes from the literature. In his review chapter on ecosystem management, Quinn (2002) presented these common themes as four primary characteristics that seem to be reflected in all definitions of ecosystem management (Table 2).

TABLE 1. Some definitions of ecosystem management.

Source	Definition
Brussard et al. (1998)	Managing areas at various scales in such a way that ecosystem services and biological resources are preserved while appropriate human uses and options for livelihood are sustained.
Rowe (1992)	The application of the ecosystem approach in the conservation, management, and restoration of regional and local landscape ecosystems. It means that everyone attends to the conservation and sustainability of ecosystems, instead of sharply focusing on the productivity of individual or competing resources—which has been our traditional mode of operation.
Pirot et al. (2000)	Ecosystem-based management attempts to regulate the use of ecosystems so that we can benefit from them while at the same time modifying the impacts on them so that basic ecosystem functions are preserved.
Quinn (2002)	Ecosystem-based management is an approach to guiding human activity using collaborative, interdisciplinary, and adaptive methods with the long-term goal of sustaining desired future conditions of ecologically bounded areas that, in turn, support healthy, sustainable communities.
Coast Information Team (2004)	An adaptive approach to managing human activities that seeks to ensure the co-existence of healthy, fully functioning ecosystems and human communities. The intent is to maintain those spatial and temporal characteristics of ecosystems such that component species and ecological processes can be sustained, and human well-being supported and improved.
University of Michigan (2007)	For other definitions of ecosystem management compiled by the University of Michigan's Ecosystem Management Initiative, see <a href="http://www.snre.umich.edu/ecomgt/emapproach/quotes.htm">www.snre.umich.edu/ecomgt/emapproach/quotes.htm</a>

TABLE 2. Primary characteristics of ecosystem management (Quinn 2002).

Characteristic	Description
Ecosystem Boundaries	<ul style="list-style-type: none"> <li>• Management along ecological boundaries rather than administrative boundaries. In natural resource management, these are usually landscape-scale boundaries such as watersheds.</li> <li>• Co-operation among different agencies responsible for natural resource management within an ecological area is thus critical.</li> </ul>
Ecosystem Sustainability	<ul style="list-style-type: none"> <li>• A shift in focus from the sustained yield of some output (e.g., timber) to the long-term sustainability of the ecological system that produces those products and services.</li> <li>• Built on the principle that ecosystems are in constant flux, but within a natural range of variation.</li> <li>• Maintaining ecological integrity is a key focus of ecosystem management. Ecological integrity may be defined as “a quality or state of an ecosystem in which it is considered complete or unimpaired; including the natural diversity of species and biological communities, ecosystem processes and functions, and both the ability to absorb disturbance (resistance) and to recover from disturbance (resilience)” (Coast Information Team 2004).</li> <li>• Maintaining ecosystem goods and services is necessary both for human intergenerational requirements and for its own sake.</li> </ul>
Adaptive Management	<ul style="list-style-type: none"> <li>• Using science and basing decisions on good inventory data are key themes related to ecosystem management.</li> <li>• Recognizing the limitations of existing research is also important, and treating ecosystem management as an experimental approach from which managers can learn and adapt by monitoring outcomes is critical.</li> <li>• The precautionary principle is often invoked. The precautionary principle may be defined as “measures taken to reduce potential harm resulting from human activities or environmental change even if some cause and effect relationships are not fully established scientifically. It includes taking action in the face of uncertainty; shifting burdens of proof to those who create risks; and analysing alternatives to potentially harmful activities” (Coast Information Team 2004).</li> </ul>
Human Dimension	<ul style="list-style-type: none"> <li>• People are part of the ecosystem.</li> <li>• Co-operation across administrative boundaries is important: the appropriate institutional framework needs to be in place for this to occur.</li> <li>• It is people, not ecosystems, that require management. As Pirot (2002) states, this distinction helps explain the current preference in the literature for the term “ecosystem-based management” over ecosystem management, since this term reflects the notion that the principal activity is the management of human interactions with the ecosystem rather than the ecosystem itself.</li> </ul>

### The three faces of ecosystem management

As Salwasser and Pfister (1994) commented, the implementation process ultimately defines ecosystem management. Despite commonalities, the broad principles of this approach are often interpreted differently during implementation. Some interpretations put the ecosystem first; others espouse a balance of governance, socio-economic, and ecological values;

and still others remain entrenched in a multiple-use philosophy that maximizes human resource use within a set of ecological constraints and wider considerations.

In a 1999 *Conservation Biology* essay, Steven Yaffee offered a perspective on the different approaches used to implement ecosystem management. Rather than focus on pinning down a single interpretation, he suggested the acceptance of a range of ecosystem management definitions. He classified three currently

followed natural resource management paradigms—“environmentally sensitive multiple use,” an “ecosystem approach to resource management,” and “ecoregional management”—as points along an “ecosystem management continuum.” Because individuals and different groups could be at different places along this continuum, Yaffee concluded that success should not necessarily be measured by the achievement of a single state called “ecosystem management,” but rather by movement along the continuum. He also added that several “ecosystem management approaches are desirable as long as we learn from the diverse experiences that result.”

The poster presented in Figures 1 and 2 provides an overview of ecosystem management and how it can be implemented.<sup>1</sup> It describes the three paradigms of Yaffee’s ecosystem management continuum, as well as two others that fall outside the realm of ecosystem management. The following groups will find the poster useful as a teaching and planning tool.

- Natural resource managers requiring a better understanding ecosystem management concepts and implementation processes.
- Educators looking for clear and concise tools when teaching ecosystem management concepts and processes.
- Policy-makers working to develop sustainable forest management standards and guidelines.
- First Nations monitoring and implementing sustainable management practices through governance in collaboration with policy-makers.

This poster will help these groups determine the current management regime status of institutions and will be valuable for motivating behavioural changes and designing policy interventions to facilitate movement towards implementation an “Eco-Regional Management” approach (Yaffee 1999).

### Learning from ecosystem-based management implementation

Given the number of conventions, vision statements, and government agencies embracing ecosystem management in recent years, it is not surprising that we have much in the way of practical EBM implementation experience to draw upon in new endeavours. In 2000, the World Bank Environment Department commissioned a guidebook

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on ecosystem-based management that highlights 24 field-based case studies illustrating how EBM can be translated from theory to practice (Pirot et al. [editors] 2000). This guidebook is a useful resource for managers and policy-makers interested in implementing EBM. In the United States, Rigg (2001) offered a case study of ecosystem management in the Sequoia National Forest that provided a glimpse into the challenges encountered. In addition, the University of Michigan’s Ecosystem Management Initiative (University of Michigan 2007), a program promoting sustainable natural resource management through ecosystem-based teaching, research, and outreach, has documented more than 100 case studies, many driven by state and federal agencies as well as non-profit groups such as the Nature Conservancy. These studies provide a record of several facilitating factors and impediments to the success of EBM projects (Schueller 2004), and document policy recommendations suggested by this research (Brush et al. 2000) (Table 3). More detailed information is available through the Initiative’s website ([www.snre.umich.edu/ecomgt/index.htm](http://www.snre.umich.edu/ecomgt/index.htm)).

Locally, there are two well-recognized attempts to use ecosystem-based management to improve land use planning and forest management in British Columbia: one in Clayoquot Sound (see Butt and McMillan 2009), and one on the central and north coast. The latter example is currently evolving from vision to full implementation of EBM (scheduled for March 2009). The application of an EBM approach in both of these cases was undertaken largely in response to pressure from First Nations and environmental organizations to improve management practices in these areas. Although a shift to EBM should help tackle the many social and environmental issues at play in these areas, it could also address economic interests by allowing forest companies operating in coastal British Columbia to retain access to global timber markets. The following lessons were drawn from all of these experiences.

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<sup>1</sup> This poster can be printed out for handy reference or as a larger display poster.

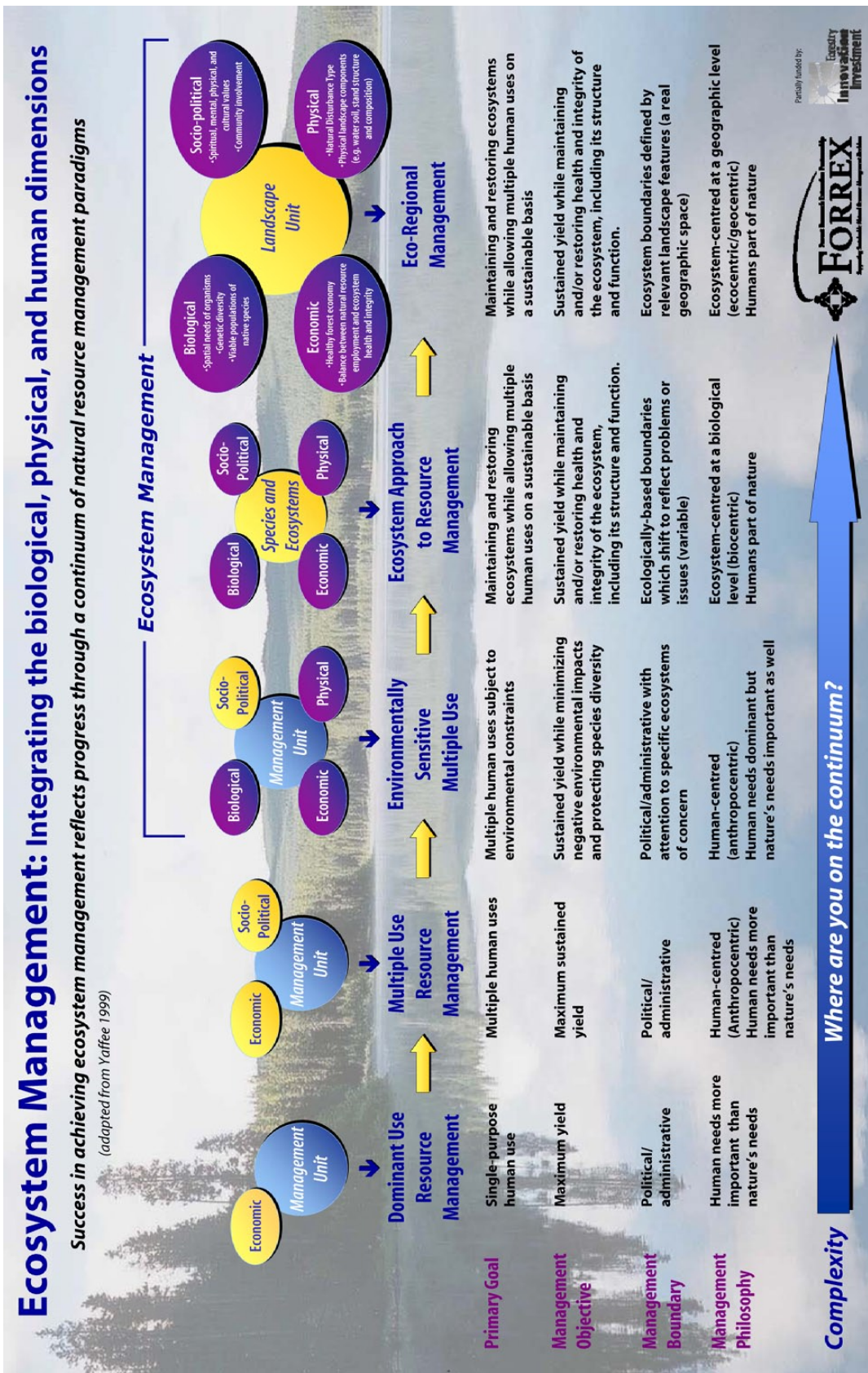


FIGURE 1. Ecosystem management poster – panel 1: ecosystem management continuum.



## Definitions & Concepts

### Ecosystem Management

"Any land-management system that seeks to protect viable populations of all native species, perpetuate natural-disturbance regimes on the regional scale, adopt a planning timeline of centuries, and allow human use at levels that do not result in long-term ecological degradation" (Grumbine 1992)

- Holistic approach to natural resource management
- Moves beyond a compartmentalized approach focusing on the individual parts of the forest
- Steps back from the forest stand and focuses on the forest landscape and its position in the larger environment in order to integrate the human, biological, and physical dimensions of natural resource management
- Aim is to achieve sustainability of all resources

(Adapted from Thomas 1994)



### Ecosystems

"Coherent, self-defined, and self-organizing units comprising interacting ecological, economic, and social components" (Slocombe 1993)

### Sustainability

"Maintenance of the potential for our land and water ecosystems to produce the same quantity and quality of goods and services in perpetuity" (Franklin 1993)

### Landscape Unit

"A large area composed of many different kinds of ecosystems...The working scale for ecosystem management" (Salwasser and Pfister 1994)

"It has repeatable patterns of habitats, physical features, and human influences" (Forman and Godron 1986)

### Adaptive Management

"cyclic, incremental management ...changing management protocols in response to experimental results or other reliable sources of new information" (Brussard et al. 1998)

## Steps for Implementation

- 1 Define an ecosystem boundary based on the range of limiting resource(s)
- 2 Determine strategic management goals (e.g. ecological viability, integrity, restoration)
  - requires public involvement
  - requires stakeholder cooperation and input
- 3 Collect ecological data on ecosystem characteristics (e.g. structure, processes, composition)
- 4 Obtain socio-economic data (e.g. social values, location of human activities within the ecosystem)
  - requires involvement of social scientists
- 5 Determine measurable indicators that serve as a link between social values and the forest—modelling can be used to integrate collected ecological and socio-economic data
- 6 Manage adaptively—respond to changes in ecosystems and social values.
- 7 Monitor the ecosystem—a vital component of adaptive management

Adapted from Brussard et al. (1998)

## Challenges

- 1 There is a discrepancy between current social/political boundaries and natural landscape boundaries—ecosystems within landscape units are being independently managed by several groups, each with differing approaches and agendas.
- 2 Ecosystem processes operate over a wide range of spatial and temporal scales. Thus, there is no single, appropriate scale or timeframe for management.
- 3 We face an ever-increasing human population and consumption of goods and services.



FIGURE 2. Ecosystem management poster – panel 2: concepts, definitions, steps for implementation, and challenges.

**TABLE 3.** Some lessons learned from ecosystem management projects (summarized from Schueller 2004 and Brush et al. 2000). For the full list and explanation of these points, please see [www.snre.umich.edu/ecomgt/index.htm](http://www.snre.umich.edu/ecomgt/index.htm).

Top 5 Facilitating Factors for Success	<ol style="list-style-type: none"> <li>1. Presence of dedicated, energetic individuals</li> <li>2. Adequate funding</li> <li>3. Strong project leadership</li> <li>4. Well-trained personnel</li> <li>5. Support of government agencies</li> </ol>
Top 5 Impediments to Success	<ol style="list-style-type: none"> <li>1. Funding shortages</li> <li>2. Personnel shortages</li> <li>3. Insufficient scientific information</li> <li>4. Severity of ecological stresses</li> <li>5. High turnover rate of agency personnel</li> </ol>
Key Recommendations to Managers and Policy Makers	<ul style="list-style-type: none"> <li>• Develop policies recognizing the long-term nature of ecosystem management projects</li> <li>• Develop land acquisition programs</li> <li>• Focus on stakeholder outreach and involvement</li> <li>• Use pilot approaches to demonstrate the EBM approach and show early success</li> <li>• Collect baseline information and establish monitoring programs</li> <li>• Set realistic timelines for achieving both ecological and process outcomes</li> </ul>

**1. Overcome discrepancies between social/political boundaries and natural landscape boundaries, and institutional barriers related to implementing EBM through multi-sector collaboration and collaborative decision making**

Ecosystem management is a holistic process, requiring input from different disciplines, governments (including First Nations), sectors, and stakeholders. By contrast, most ecosystems are studied, managed, and used on a sector-by-sector basis. No single group or agency possesses the broad information base or broad focus necessary to manage the whole ecosystem. It is vital, therefore, that the various sectoral interests and other stakeholders recognize the need for multi-sector collaboration (Pirrot et al. [editors] 2000), and that the right people are involved from the outset (Quinn 2002). Participation of the public and/or local communities is absolutely essential, since EBM is a place-based approach to management. Having the right people involved from the beginning can help to ensure that everyone agrees on common goals and has a common understanding of where they are trying to go.

Collaborative management is frequently identified as critical to the success of ecosystem management (Rigg 2001). Building confidence and trust is an important component of this collaborative management approach. Rigg summarizes several strategies that successfully maintain trust.

- Motivated individuals must continuously reinforce their commitment to, and confidence in, the process, and must work towards establishing a stable group with sincere and effective leadership (Shindler and Cheek 1997; Shindler and Neburka 1997; Yaffee and Wondolleck 1997). This factor is cited as the single most important element in contributing to the success of ecosystem management projects (Schueller 2004).
- Collaborative partners need to be involved from the beginning and meet regularly throughout the decision-making process (Moote and McClaran 1997; Shindler and Cheek 1997; Brush et al. 2000).
- Spending time on the group’s administrative structure is important: establish explicit protocols for decision making (Moote et al. 1997) and ensure that “rights, needs, roles, desires and responsibilities” are clear (Thomas 1996).



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- Decision makers should be available, so participants have an opportunity to directly affect management decisions (Shindler and Cheek 1997).
- Demonstrating progress and results is important to achieve trust and sustain public participation in the process (Moote et al. 1997).

Rigg goes on to discuss the importance of acknowledging bias. Highlighting ecosystem management in the Sequoia National Forest, Rigg explains that individual, institutional, and organizational biases have precluded successful collaborative decision making. The US Forest Service, for example, views itself as a neutral mediator, and fails to recognize that it has its own agenda and biases in policy making. Stakeholders also need to acknowledge bias and recognize they do not represent the public, but have their own distinct self-interests. As Rigg states: “Acknowledging interests and personal value systems couched in institutional and organizational agendas will improve mutual understanding, increase trust and facilitate a more veracious process.”

## **2. Deal with long-term planning horizons under short-term policy and funding constraints**

Ecosystem-based management is inherently long term in nature, spanning time frames that extend well beyond those of most political regimes. This in itself is a barrier to EBM, as political turnover can affect policy environments, funding stability, land and resource planning, and on-the-ground practices. One of the key barriers to success of EBM projects is lack of long-term funding (Schueller 2004). A critical recommendation to policy-makers is to develop flexible and adaptive policies that recognize the long-term nature of ecosystem management (Brush et al. 2000).

To address this issue, a useful next step would be an analysis of existing policies in British Columbia and how these may facilitate or impede ecosystem management. In the meantime, reconciling ecosystem management with short-term political time frames, policies that require results in a short period of time, high rates of

personnel turnover, and fiscal constraints will likely remain a considerable challenge in this province.

## **3. Ensure data are available to set goals and targets and to monitor success**

Lack of data is consistently cited as an important impediment to the success of EBM projects (Schueller 2004). Ecosystem management projects frequently lack baseline ecological data such as Terrestrial Ecosystem Mapping (TEM); scientific, experiential and indigenous data to address knowledge gaps; and follow-up monitoring data to evaluate ecological, social, and economic trends and outcomes. Although lack of information should not be used as an excuse for inaction, this gap highlights the importance of using an adaptive management approach to establishing, evaluating, and adjusting ecosystem management projects.

## **4. Focus on stakeholder outreach and involvement**

A critical factor in the success of many ecosystem management projects has been involving stakeholders from the beginning, especially those stakeholders who are most resistant to the idea (Brush et al. 2000). Managers of ecosystem-based projects need to focus on acquiring the knowledge and skills to work effectively with stakeholders. Government and non-governmental agencies considering this approach need to hire personnel with the requisite skills and to support outreach work. Participants, particularly community members and First Nations, may need training and resources to build capacity and participate effectively in these processes.

To supplement these lessons, we encourage readers to review Bourgeois' (2008) description of some specific changes required in British Columbia to enable ecosystem-based management.

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## Summary

Ecosystem management is an evolving approach to natural resource management that requires significant adjustments to institutions, policies, and the current “norms” of doing business in natural resource management. Far off the coast of British Columbia, residents of our fictitious island embraced ecosystem management as an approach that would help them solve conflicts between resource use, conservation, societal needs, and sustainability. Once they assembled the right people, they got down to work to identify knowledge gaps, gather inventory data, and make critical management decisions about where to create reserves and where to focus resource extraction. At times, they lost sight of the big picture. They got bogged down in model development, in quibbles over management decisions, in never-ending discussions about how best to measure their success—all important elements of an ecosystem management process. They were lucky, though. They had an enthusiastic project leader and a clear vision of what they were trying to achieve. They had the right people at the table and were enabled by an effective political environment, good working relationships between different jurisdictions and agencies, a well-defined adaptive management process, and a stable funding source. Through their work, they learned that ecosystem management hinges on the human element: relationship-building is critical in developing the interagency collaboration, stakeholder involvement, and public trust necessary to implement ecosystem management.

### Resources and websites

University of Michigan’s Ecosystem Management Initiative: [www.snre.umich.edu/ecomgt/](http://www.snre.umich.edu/ecomgt/)

University of Washington, College of Forest Resources; USDA Forest Service, and other co-operators’ website on Ecosystem Management: [silvae.cfr.washington.edu/ecosystem-management/EcoManFrame.html](http://silvae.cfr.washington.edu/ecosystem-management/EcoManFrame.html)

Selected Ecosystem Management definitions: [www.nres.uiuc.edu/outreach/esm\\_il\\_lo/esm\\_defs.htm](http://www.nres.uiuc.edu/outreach/esm_il_lo/esm_defs.htm)

Ecosystem Management as a Basis for Forest Stewardship on Private Lands (Jacobson and Long 1998): [www.sfrc.ufl.edu/Extension/fweco.htm](http://www.sfrc.ufl.edu/Extension/fweco.htm)

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## Test Your Knowledge . . .

### *Ecosystem management: A practitioners' guide*

How well can you recall some of the main messages in the preceding Extension Note?

Test your knowledge by answering the following questions. Answers are at the bottom of the page.

1. Which of the following are considered fundamental characteristics of an ecosystem management approach?
  - A) Multiple use
  - B) Management based on ecosystem boundaries
  - C) Maximum yield
  - D) Multi-stakeholder planning processes
  - E) Meeting human needs is the first priority
  
2. Name two of the top 5 facilitators of success and two of the top 5 impediments to success of an ecosystem-based management approach.
  
3. Which of the following are critical components for ensuring success of an ecosystem-based management approach?
  - A) Compiling comprehensive, ecosystem-based data sets
  - B) Engaging and involving all stakeholders, management organizations, and sectors in planning
  - C) Developing a plan to deal with existing institutional barriers to EBM
  - D) Developing a long-term, sustainable funding plan for the work required to implement EBM
  - E) All of the above

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### **ANSWERS**

1. *B and D: The others are typical of a sustained yield or multiple-use approach to resource management*
2. *See Table 3*   3. *E*