Old growth near Coos Bay, Oregon

Chapter 8: Future Directions

The Department of the Interior and other natural resource organizations must grapple with critical decisions affecting our nation's resources and environment. These decisions bear directly on management of our lands and waters, the development of renewable and non-renewable energy, and our responses to climate change and the continuing alteration of nature by human activities. It will be increasingly important to make resource decisions in a structured and transparent way that is based on science and accounts for uncertainty. Because adaptive management meets these conditions, it can be a valuable template for effective decision making by managers in the DOI bureaus.

In this guide we have described the components of adaptive management as interconnected and mutually reinforcing. We've argued that models and management alternatives need to be developed synergistically and framed in terms of learning and management objectives. A critical assumption underlying the adaptive management framework is that science activities (modeling, decision analysis, assessment, learning/feedback) are embedded in a context of natural resource management, where learning is valued because it contributes to management.

Adaptive management and planning

We have characterized adaptive management in this guide in terms of a set-up or deliberative phase in which the elements of adaptive decision making are developed and refined, and an iterative phase in which those elements are incorporated into an ongoing cycle of decision making, monitoring, assessment, and learning (Figure 2.2). However, adaptive decision making also can be usefully portrayed in terms of planning and learning. For example, the adaptive learning cycle is often described as a cycle of planning, implementation, tracking, and feedback (U.S. Fish and Wildlife Service 2006; Figure 8.1).

There are natural linkages between these two perspectives. For example, one can recognize the essential elements of strategic planning (the setting of objectives, selection of alternatives, prediction of consequences, metrics for tracking results, etc.) in our set-up phase. On the other hand, the elements of strategy implementation, such as monitoring, feedback, and adjustment, are represented in our iterative phase. Finally, the larger adaptive cycle of institutional learning and adaptation is expressed through double-loop learning. In this sense, adaptive decision making can be seen as an ongoing cycle of planning, implementation, and learning.

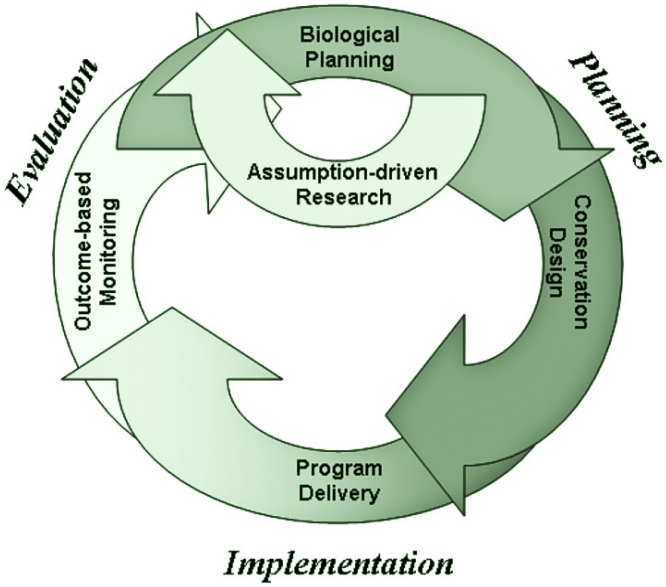

Figure 8.1. The adaptive cycle in terms of planning, implementation, and evaluation and learning.

The practices currently used for natural resources management in DOI have the potential to be incorporated naturally into an adaptive approach.

All government agencies are currently engaged in both strategic planning and the tracking of results in plan implementation. Thus, their business practices already involve many of the important elements of adaptive management. A remaining need is to incorporate learning as a fundamental element of strategic planning and implementation, whereby the learning resulting from monitoring and assessment is fed back into future planning. By proactively linking plan implementation to plan development through a learning process, the adaptive cycle of learning-based management is completed and becomes standard business practice. A number of

important questions need to be addressed in completing the cycle – for example, how to recognize and represent uncertainty, how to track it over time, and how to reduce it efficiently through learning-based management. Nevertheless, the practices currently used for natural resources management in DOI have the potential to be incorporated naturally into an adaptive approach.

Stakeholder compromise

Active stakeholder engagement helps parties learn from each other, find areas of common ground, and build trust in developing management strategies collaboratively. Among other things, collaboration reinforces the sharing of viewpoints and objectives, and promotes efforts to find acceptable management options among stakeholders. When effectively managed, active stakeholder engagement can help to avoid the paralysis that otherwise can be induced by uncertainty (or disagreement) about management impacts and the controversy that uncertainty brings.

However, the challenges in managing stakeholder involvement should not be underestimated. Strong disagreements among stakeholders about management objectives, alternatives, and consequences are common in natural resource management. Without a process for revisiting these elements as management proceeds over time, stakeholder commitments to decision making by consensus can easily collapse into confrontation and even litigation. It is much easier to agree to move forward with a management strategy if everyone understands that objectives, management alternatives, and the other elements of decision making can be reviewed and renegotiated as new evidence about management performance becomes available. Such an arrangement offers an incentive to stakeholders to agree on an initial strategy that involves compromise on all sides. On the other hand, negotiation to establish a fixed and inflexible strategy leaves all parties with less flexibility as they hold out for their ideal conditions because they think the outcome can't be changed.

The point here is that a possibility of learning from system performance, and then adjusting management strategy based on what is learned, can foster collaboration and aid decision making. In that sense, the expression and treatment of uncertainty, which is one of the key challenges in adaptive decision making, is also one of its strengths.

Synthesis of advances in adaptive management

Two broad focus groups have worked more or less in parallel but independently to develop adaptive management of natural resources. One group focuses on technical issues (models, metrics and propagation of uncertainty, projection of the future consequences of present actions, optimal decision making in the face of uncertainty). This guide provides a framework for incorporating these issues into the process of adaptive decision making. The other group focuses on collaboration (institutions, stakeholders, cooperative interactions, elicitation of stakeholder values and perspectives). Throughout this guide we have pointed out the latter issues, and in particular the role of stakeholders in all aspects of adaptive decision making. The many examples we include here all emphasize the importance of incorporating stakeholder values when identifying objectives, acceptable management alternatives, and models that express stakeholders' perspectives.

At present, the collaborative and technical thrusts in adaptive management are being pursued separately. For the most part, researchers, practitioners, and even organizations tend to emphasize either one thrust or the other. The challenge is ultimately to join the two in a more unified vision and process in which each reinforces and strengthens the other. We hope this guide will promote that integration.

Applications of adaptive management in the thematic areas

Although we have emphasized four thematic areas that are important to DOI, the practice of adaptive management is not developed evenly in these areas. For example, there are many examples in the area of human/natural interactions, and few in climate change. In part this is because the roots of adaptive management are in renewable natural resources, especially biological resources. Applications of adaptive decision making have been documented for many different biological problems, such as fish and wildlife harvest, insect pest control, endangered species recovery, invasive species control, and wetland management. The examples of adaptive decision making in biology are extensive and varied, as one might expect of applications developed over the course of more than 40 years.

A key challenge is to join the collaborative and technical thrusts of adaptive management into a more unified vision and process in which each reinforces and strengthens the other.

Conversely, climate change has only recently become a principal focus of conservationists and managers, and is yet to mature as a field of investigation with an agreed-upon conceptual and methodological framework. Under these circumstances it is reasonable to expect fewer examples of adaptive decision making for climate change mitigation and adaptation. But opportunities for adaptive decision making are likely to grow rapidly, because systemic environmental change, whether a manifestation of long-term climate patterns or the result of human-induced landscape alterations, almost certainly will continue well into the future. Environmental change will continue to produce highly uncertain changes in natural resource systems, and resource managers will have to learn about these systems as they are changing. In this guide we have suggested some ways of framing this problem in terms of adaptive management, but much more work needs to be done. As the urgency of coping with long-term environmental change increases, there is little doubt that the breadth of adaptive management applications will increase as well.

Adaptive management and ecosystem services

Like all strategic approaches to the management of natural resources, adaptive decision making can have unintended consequences, often for resources that aren't the target of the application. Such impacts are often inadequately monitored. The developing field of ecosystem services can contribute to a framework for evaluating management impacts on the quantity and value of services provided by ecosystem attributes and processes. Its integration into adaptive management can be seen most clearly in the production and valuation of ecosystem services, the integration of these values into objectives, and the prediction of changes in ecosystem services and their valuation with models. The connections between adaptive management and ecosystem services need further research, but there are obvious opportunities for collaboration between these important fields of investigation.

Adaptive management and sustainability

Throughout this guide we have emphasized the importance of accounting for the future consequences of present actions. The idea of change over time is fundamental to adaptive management, whether in terms of changing environmental conditions, repeated adjustment of management strategies, or the use of dynamic models that characterize resource changes. By its very nature, adaptive management requires us to sustain resource structures and functions in order to sustain the ecosystem values that contribute to long-term objectives. In particular, adaptive decision making has to be flexible and resilient enough to respond to the inevitable surprises that arise in resource management; only then can ecosystems and their values be dependably maintained in the future. Resilience, vulnerability, and risk all have important roles in adaptive decision making, and their linkages need further examination and development.

As we have described it in this guide, adaptive management can be applicable to local resource projects as well as large-scale conservation programs, though the operational and legal constraints on an adaptive approach may differ across scales. But the basic framework presented in the guide, involving an iterative process of management, monitoring, and evaluation, applies in either case. The key issues in deciding to use adaptive management are whether there is substantial uncertainty about the impacts on management, and whether the reduction of that uncertainty can be expected to improve management.

The framework for adaptive management presented here is not conceptually complex. However, adaptive decision making does require users to acknowledge and account for uncertainty, and maintain an operating environment that allows uncertainty to be reduced through careful planning, evaluation, and learning. An initial investment of time and effort by stakeholders and implementing organizations will increase the likelihood of better decision making and resource stewardship in the future. In addition, the parties must commit to providing the necessary resources for monitoring and assessment over a project time frame to make progress in achieving project objectives. The associated up-front costs are compensated by more informative and collaborative resource management over the long term.

Adaptive management holds great promise in expressing and reducing the uncertainties that keep us from managing natural resources effectively. In many cases, the use of management itself in an experimental context may be the only feasible way to gain the understanding needed to improve management. Producing better understanding by means of transparent, objective-driven decision making is one important way to promote the conservation of America's natural resources for future generations.