Grand Canyon National Park, Arizona

Chapter 1: Introduction

In the early 21st century, the Department of the Interior (DOI) is presented with natural resource problems that are bigger, more complicated, and at the same time more uncertain than at any time in our history. The Department has enormous responsibilities that include managing one-fifth of the nation's land mass, 35,000 miles of coastline, and 1.76 billion acres of the Outer Continental Shelf. DOI upholds the federal government's trust responsibilities for 562 Indian tribes; conserves fish, wildlife, and their habitats; manages water supplies for more than 30 million people; and protects the icons of our national heritage.

DOI faces pressing challenges in meeting these responsibilities. Our dependence on foreign oil threatens our national security and our economy, and DOI can contribute to the development of domestically produced energy to help put an end to that dependence. But energy production must be done in a way that protects other resources such as fragile ecosystems and their components. We need more water than ever – for a growing population, farms, industry, businesses, and ecosystems – at a time when many watersheds have been degraded, droughts are increasing in frequency and severity, and freshwater supplies are dwindling. DOI must provide the leadership in finding new solutions to restore watersheds and equitably address competing demands for water so that people as well as the aquatic resources on which they depend can thrive. Every day there is another news story about the impacts of a changing climate on resources – extended droughts in river basins, the devastation of forests by wildfires, warming temperatures causing glaciers to melt, coasts and islands threatened by rising sea levels and fiercer storms. Identifying resources that are particularly vulnerable to climate change is a high-priority performance goal for DOI, along with implementing coordinated responses to these threats.

Given the scale of these challenges, and the uncertainty about the best courses of action in a complex environment, we need to change the way we address resource management. We must become more proactive in our approach to resource problems and how we manage resources sustainably. Collecting data and using our science capabilities to enhance understanding is crucial, but we cannot wait for perfect information to make decisions and take action. That would risk losing not just an opportunity, but in many cases the resources we are trying to protect.

A learning-based approach like adaptive management holds great promise for dealing with the challenges ahead. In fact, one of the goals in the DOI strategic plan (FY 2011–2016) calls for adaptive management as part of DOI's mission to provide a scientific foundation for decision making. Adaptive management involves the use of management in the spirit of experimental science to learn how to manage more effectively. It calls for explicit identification of objectives and alternative management strategies, and the involvement of stakeholders in making decisions. It feeds new information about management impacts back into the decision-making process so that resource management can be adjusted on the basis of what is learned.

In this applications guide we describe how adaptive management can be applied in the areas that are critically important to DOI: water resources, energy, climate change, and human impacts on the landscape. We build on the framework for adaptive decision making described in the DOI Adaptive Management Technical Guide (Williams et al. 2007). The technical guide includes a discussion of the basic criteria for applying adaptive management as well as step-by-step descriptions of implementation. This applications guide is a companion document to the technical guide, yet it includes sufficient detail to be read as a stand-alone document.

The applications guide is intended to be useful to multiple audiences – from technical users who need information on particular issues such as components of uncertainty, to managers who want practical information on the sequence of steps involved in applying adaptive management. A key challenge is to describe adaptive management in terms general enough that its scope and breadth of application are apparent, while retaining the flavor of specific management projects and issues in the four thematic areas. The guide is not intended to be a detailed "cookbook" – in part because it would not be feasible to go into all the details of every project, and in part because every new application is unique and needs to be designed on an individual basis. Our hope is that readers will use the guide to envision the "who, what, when, where, and why" in applying adaptive management for their own particular resource issues.

After this introduction, we discuss the foundations of adaptive management and its components. Chapter 2 contains background and an overview of the elements of adaptive management, and Chapters 3 and 4 discuss some issues that arise in its implementation. Chapters 5 and 6 illustrate the components of adaptive management with examples from the thematic areas of water resources, energy, climate change, and human impacts on the landscape. Chapter 7 contains case studies showing the integration of individual components of adaptive management into a whole. Finally, we describe some future directions in the field of adaptive management. Readers may wish to skim portions of the guide and focus in more detail on the particular issues and examples of greatest interest to them.

In the guide we describe examples and case studies ranging from river flow management, to protecting migratory birds, to siting renewable energy projects. These examples, drawn from our four thematic focus areas, show the breadth of adaptive management applications at different scales and different levels of ecological complexity. On one hand, large-scale ecosystem management is shown by examples of rivers (e.g., Glen Canyon Dam; the Tallapoosa River), forests (e.g., fire fuel management in the Sierra Nevada; Biscuit Fire landscape management), and coral reefs (Great Barrier Reef marine zoning). In other examples, adaptive management is applied on the scale of an individual national wildlife refuge (e.g., native prairie restoration; prairie pothole restoration). Some applications apply broadly to multiple species and habitats (e.g., management of North American waterfowl) whereas others target a single species in a localized area (e.g., Laysan duck translocation; golden eagles in Denali National Park). The examples involve a variety of natural resources, including aquatic (e.g., Blanca wetlands; vernal pools), energy (e.g., solar facility siting and permitting; Cape Cod National Seashore wind turbines), and biological (e.g., endangered species such as Etowah River stream fishes or the Florida scrub-jay; Columbia River chinook salmon; forests of the Northwest). Taken together, the mixture of examples is intended to provide context and give the reader a feel for the operational principles common to applications of adaptive management. The appendix contains paragraph-length thumbnail overviews of the projects used as examples.

Lee Metcalf National Wildlife Refuge, Montana