

In this chapter we describe the conditions under which adaptive management is applicable, and highlight some challenges, limitations, and benefits of an adaptive approach to resource management.

2.1. Conditions that Warrant an Adaptive Management Approach

Not all decisions can or should be adaptive. In some cases there is no opportunity to apply learning; in others, there is little uncertainty about what action to choose; and in still others, there is disagreement about objectives. But the concept of adaptive management is so intuitively appealing that the phrase has been applied indiscriminately, with the result that many management applications fail to achieve the improvements expected from adaptive management. In many instances, that failure may have less to do with the approach itself than with the inappropriate contexts within which it is purported to apply (29). An important question is which decision problems are appropriate for the application of adaptive management.

There is a considerable literature that explores reasons why the practice of adaptive management has not lived up to its promise, and extensive documentation of some of the more prominent failures. But only recently has attention focused proactively on those attributes of resource management that make a problem amenable to adaptive

management. The following discussion draws from published sources as well as the experiences of management agencies within the Department of the Interior.

There are two key conditions that are mentioned in all thoughtful analyses. First, “there must be a mandate to take action in the face of uncertainty” (12,24). That is, the problem must be important enough to require action of one sort or another. Situations without this imperative can result in either delayed action as more information is acquired or action foregone altogether. Second, there must be the institutional capacity and commitment to undertake and sustain an adaptive program. This condition includes an institutional stability for long-term measurement and evaluation of outcomes, which should allow the early investment in an adaptive approach to pay off in long-term management. Together, these two conditions imply that decision makers must be motivated and patient, that is, they must care about improving management over extended time frames (12).

In addition to these two overarching conditions, six more conditions can be identified directly from the meaning and context of adaptive management, as described in the previous chapter. Adaptive management is warranted when there are consequential decisions to be made, when there is an opportunity to apply learning, when the objectives of management are clear, when the value of reducing uncertainty is high, when uncertainty can be expressed as a set of competing, testable models, and when a monitoring system can be put in place with a reasonable expectation of reducing uncertainty.

A real management choice is to be made

As described in Chapter 1, adaptive management is first and foremost an approach to the management of natural resources and not simply an opportunity to learn. Thus, an application of adaptive management must involve a real choice among management alternatives that affect resource systems. The variability among alternatives must be consequential (i.e., different alternatives produce substantively different management impacts), and the alternatives must be ecologically, economically, politically, and legally feasible.



The genesis of alternatives should be multidisciplinary and participatory. They can arise from within the management agency, from scientists or engineers working for, with, or in opposition to the management agency, from the regulated community, or from other stakeholders. Some decisions are particularly difficult because a suitable range of alternatives cannot be easily identified. In such cases, a collaborative approach in identifying alternative actions is especially useful.

Because natural resource systems operate at multiple spatial and temporal scales and involve interactions among many component systems, the development of alternative actions should account for multiscale responses. One consequence of this complexity is that several pathways may exist to achieve similar outcomes, with alternative pathways differing enough in some relevant aspects (feasibility, cost, public acceptance) to be considered as bona fide alternatives.

The alternatives considered in adaptive management are constrained by existing laws, regulations, and policies, both substantive and procedural. A number of substantive laws govern natural resource decision making (for example, Clean Water Act, Clean Air Act, Endangered Species Act, etc.). Of the procedural laws, the National Environmental Policy Act (NEPA) and its implementing regulations provide considerable guidance about developing and considering alternative management actions. An emerging view discussed in Section 3.2 sees the NEPA process as a powerful and potentially effective way to embody adaptive management (30).

There is an opportunity to apply learning

A condition of adaptive management is that resource management decisions can be revisited and modified over time or that multiple decisions of a similar nature can be made over time. That is, decision making needs to be iterative over time and possibly space; otherwise, learning cannot be applied. Many examples of adaptive management treat a single management unit (for example, a single river or a continental population of ducks) over time, applying the learning derived from earlier actions to decisions made at later times. But equally appropriate are situations where similar management units are each treated only once, and the learning accrued from treatments of some units is used in decisions about how to treat other units at a later time (31).

Besides iterative decision making, several other considerations affect the opportunity to apply learning. First, perhaps obviously, the adaptation of actions must be possible. That is, there must be flexibility in the

decision making process to adjust management actions in response to measured outcomes (32). This requires both flexibility in the actions themselves as well as flexibility within the management institutions to adopt the change. Second, management institutions must have the stability to measure outcomes and use the results at later times. Adaptive management sometimes has failed because institutions managing the process dissolved before the learning could be applied (33). Third, it must be possible to acquire understanding quickly enough to apply it to subsequent management decisions. Some ecological processes respond very slowly to management (for example, forest systems). If learning can occur only after observing slow response variables, many iterations of decision making may have passed before the new knowledge can be applied.

Ideally the response to previous management actions can be assessed before a decision about the next management action is made. For example, the response of waterfowl populations to hunting regulations in one year can be assessed in time to inform the setting of hunting regulations in the following year (34). On the other hand,



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applications of adaptive management in forestry can be limited by the fact that the relevant response variables may not be measurable until decades after a management action is taken (35).

Clear and measurable management objectives can be identified

An adaptive approach requires explicit and measurable objectives. As described in the next three conditions, uncertainty about how to achieve objectives is what motivates adaptive management and drives the design of the monitoring system. To address this uncertainty stakeholders must agree on the objectives. Although an adaptive management framework can serve to structure dialogue among stakeholders, adaptive management itself is not designed to resolve conflicts about management objectives. If the objectives are not clear and measurable, the adaptive framework is undermined.

Objectives need to be measurable for two purposes: first, so progress toward their achievement can be assessed; second, so performance that deviates from objectives may trigger a change in management direction. Explicit articulation of measurable objectives helps to separate adaptive management from trial and error, because the exploration of management options over time is directed and justified by the use of objectives.

Objectives must be relevant to the project or program to which they apply. An example of a project objective might be to increase biodiversity of amphibians by 25 percent in a local watershed. An example of a program objective is that used by the U.S. Fish and Wildlife Service for adaptive harvest management, namely the maximum long-term harvest of waterfowl consistent with population goals in the North American Waterfowl Management Plan (36, 37). In both cases, the objectives are measurable, relevant to the management problem, and useful for decision making, evaluation, and learning. The nature and use of objectives are discussed in more detail in Section 3.1.

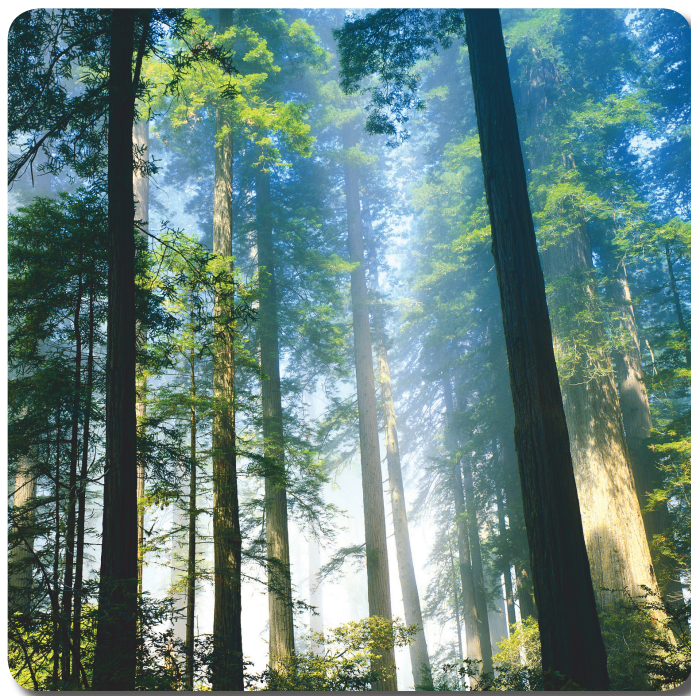
The value of information for decision making is high

The fundamental motivation for adaptive management is that the impact of management actions on resources is uncertain, and the reduction of that uncertainty will accelerate progress in meeting management objectives over time (34). Although uncertainty can be identified in almost any resource management problem, its reduction does not automatically lead to better decision

making. An adaptive management application should target learning that will change management actions and improve the ability to achieve management objectives.

The “value of information” refers to how much better the expected performance of a managed system would be if uncertainty were reduced. A high value of information means that the decision maker will potentially choose different alternatives if the system is better understood. With improved understanding comes better decisions, so that success in achieving objectives becomes more likely. The prospect of substantially improved decision making justifies the cost of monitoring and assessment (24) in adaptive management. Conversely, an adaptive approach is not warranted if the value of information is low, essentially because the potential improvement in management does not justify its costs. Sometimes the tradeoffs between costs and benefits can be made explicitly, particularly in applications in which an economic value can be ascribed to learning.

Provided careful thinking, analysis, and modeling are undertaken prior to implementation, one of the advantages of an adaptive approach is that surprises can be anticipated (29). Preparing for the unexpected means fully acknowledging uncertainty, articulating the ways in which assumptions might be wrong, exploring the consequences to management of uncertainty, and having the appropriate monitoring in place to recognize and benefit from unexpected outcomes.



Uncertainty can be expressed as a set of testable models

A formal approach to adaptive management uses the tools of structured decision analysis to inform and analyze the problem. A key step is to predict the effects of management actions that are relevant to the objectives. But predictions require models, whether conceptual or quantitative. Adaptive management utilizes multiple models, each imbedding a particular hypothesis about how the natural resource system responds to management. These models are tested with monitoring data to determine which model best represents system responses. In this way the hypotheses underlying management decisions can be expressed and tested.

Models are critical in an adaptive management process, if only as a means to encourage managers, scientists, and other stakeholders to think carefully about the structure and dynamics of the systems they are managing. When there is contention among stakeholders about how the system will respond to management, modeling forces stakeholders to express these differences as alternative hypotheses, which then can be tested. The models embodying the hypotheses in question also can be used to identify critical monitoring variables to use for comparing hypotheses, and they provide a framework for interpreting monitoring results and evaluating alternative actions to best achieve management objectives.

Models can be qualitative and conceptual, quantitative and highly detailed, or anywhere in between. In all cases, their function in an adaptive management context is to make predictions about how a natural system will respond to management actions and to evaluate the consequences of uncertainty. A common complaint used to justify not undertaking an adaptive program is that the data are sparse and there is too much uncertainty to build models. But this is precisely where adaptive management is most valuable—in expressing and reducing uncertainty. The alternative to building models of system dynamics is

to allow the assumptions of decision makers and stakeholders—essentially, the models that exist in the minds of a few individuals—to remain unexpressed and untested.

A monitoring system can be established to reduce uncertainty

Monitoring is fundamental for adaptive management, as a source of data with which to test alternative models and measure progress toward accomplishing management objectives. Simply put, adaptive management is not possible without effective monitoring (see Section 3.1 for a more detailed discussion of monitoring).

There are important details, however, that influence whether a monitoring system will help reduce uncertainty to any useful degree, and these should be considered when evaluating whether to undertake an adaptive program. For example, anticipated effects of alternative actions need to be substantial, because field monitoring can seldom detect subtle differences. Thus, management experiments must be dramatic enough to produce an observable response from the ecosystem, or they will not facilitate learning (32). It is useful here to recall that the statistical power to distinguish among hypotheses is influenced by sample size and the magnitude of treatment effects, and these factors apply as well to an adaptive monitoring system. Poor monitoring precision does more than simply slow the rate of learning; imprecise monitoring can produce misleading evidence that supports inappropriate management. Inaccurate or imprecise monitoring can actually be counterproductive to the goals of management (38).

Learning is accelerated when the principles of experimental design—replication, randomization, and control—are used. Attention to these principles, and their incorporation where possible, will lead to more rapid improvements in management. The amount of temporal and/or spatial replication is an especially important design feature because it determines the

necessary sampling intensity. All other things being equal, management actions that can be replicated many times at different locations will reduce uncertainty more quickly. Replication over time is also valuable (and more common), but typically the sample size is necessarily lower, and information accrues more slowly.

A realistic assessment of the potential for monitoring is a critical condition for adaptive management. This assessment should include not only the power of the monitoring system and the efficiency of its design, but also the institutional resources needed to sustain the monitoring (and analysis of the resulting data) over the time frame required to inform management.

2.2. Institutional Context for Adaptive Management

There are a number of factors associated with management problems that can encourage the use of adaptive management. These include not only certain characteristics of the management situation itself, but also the nature and commitments of implementing organizations.

Using pre-existing institutional structures

Certain characteristics of the record of management may help to determine whether adaptive management is appropriate for a particular situation. One is a history of decision making that indicates a willingness to address the risk of unintended and/or undesirable natural resource impacts. Others include previous stakeholder involvement in a collaborative group environment, cost sharing of collaborative efforts, and a demonstrated commitment to evaluation and scientific rigor. The existence of these characteristics prior to the creation of a formal program is a strong indication that adaptive management is potentially useful.

An example of designing around pre-existing conditions is the U.S. Fish and Wildlife Service adaptive harvest management (AHM) program, which was built upon a series of features that were already in place

when it was first initiated. Thus, stakeholders were already involved in harvest management, well developed models were available, a decision making process was in place that involved federal, state, and public interests, and extensive, long-term monitoring programs were ongoing (39). AHM was designed from the outset to take advantage of these preadaptations, recognizing that considerable uncertainty still remained about the impacts of harvest regulations.

Commitment of executive leadership

Adaptive management involves an ongoing commitment of leadership and support. Soon after the initiation of an adaptive management project, executive leadership may anticipate a reduction or elimination of stakeholder conflict, a rapid reduction in the amount of scientific investigation that is needed, and early declines in funding needs. But adaptive management activities require management involvement and funding throughout the life of the project, not just at its inception.

From a financial perspective, long-term funding highlights the commitment of implementing organizations to adaptive decision making, and it promotes the planning and implementation of the monitoring and evaluation needed for adaptive management. Conversely, a lack of long-term support limits progress in reducing uncertainty.

The support required for an adaptive approach may include not only funding for monitoring and evaluation, but also an investment in more inclusive and robust decision making processes. It is essential that executive leadership be aware of uncertain outcomes and be prepared to make the necessary changes as adaptive management progresses through implementation.

Finally, executive leadership is needed to support an institutional culture and the organizational arrangements that will acknowledge uncertainty and promote learning. Adaptive management flourishes in a learning organization that encourages experimentation, rewards risk taking, and embraces the lessons learned from experimentation. To successfully employ an adaptive approach in management, a philosophical shift from “expert” to collaborative



learning will likely be necessary. Executive leadership must play a critical role in the transition to a learning organization and in sustaining it thereafter. These issues are discussed in more detail in section 5.4.

Consensus on management objectives

Although technical information and scientific understanding are required to assess tradeoffs and levels of risk associated with different actions, the selection of an appropriate management strategy is in essence a social decision that requires consensus building. In order for a management strategy to work on the ground, stakeholders must support the project goals and its objectives.

Consensus on goals and objectives at the beginning of an adaptive management project sets the stage for an iterative, adaptive management cycle (40). However, consensus must continue through the life of the project. Consensus is sustained by ongoing collaboration, through which the potential conflicts arising in experiential learning can be resolved (41,42).

Consensus is promoted by collaborative frameworks that foster mutual learning, relationship building, and the creation of a shared understanding as the basis for agreement. Collaborative structures are in essence negotiated agreements among stakeholders, which are embraced and sustained because the stakeholders accept the outcome of a process they perceive to be participatory and fair (43,44).

2.2 Key Points

- ❖ For adaptive management to be successful, executive leadership must support needed changes to existing institutional culture and structures.
- ❖ Stakeholders must be willing to work collaboratively in a group environment to plan specific courses of action.
- ❖ In order for a specific adaptive management strategy to work on the ground, stakeholders must support the strategy goals and objectives.
- ❖ Implementation of adaptive management can be facilitated by using pre-existing structures and processes.

Glen Canyon Dam

2.3. Limitations of Adaptive Management

Although adaptive management often can enhance an agency's ability to achieve resource objectives, there are situations where its application may not be appropriate. An agency considering the employment of adaptive management should ensure that its use is suitable for the particular situation. Adaptive management should not be employed if one or more of the following limitations apply.

Decision making occurs only once

If resource management decisions cannot be revisited and modified over time, then adaptive management cannot be meaningfully employed. Many decisions are essentially irreversible in that follow-up adaptation is either infeasible or impossible. An example is the removal of a dam on a large river where the decision can be made only once. Of course, such a decision may be part of a larger decision making program, for example the management of a watershed that includes many dams, where learning that follows from the removal of one dam informs subsequent decisions about other dams.

Monitoring cannot provide useful information for decision making

A suitable monitoring strategy is a key requirement for any adaptive management approach. Data collected from monitoring are used to test alternative models and measure progress toward management objectives. There are several situations in which an effective monitoring program cannot be established:

- The frequency of monitoring cannot keep pace with changes in the natural system. If monitoring is too infrequent or the system changes at too rapid a pace, monitoring data may be unrepresentative of the resource system by the time a decision is to be made.
- A design for experimental management and monitoring cannot be developed to test hypotheses. If understanding of the resource system is so limited (or management is so constrained) that designing a meaningful experiment becomes problematic, adaptive management may not be appropriate. This problem is most likely to occur when the geographic scale of the problem is extensive, replication is difficult or impossible, or there are many potentially confounding environmental factors that combine to influence outcomes.

- A firm commitment to funding and institutional support for monitoring is lacking. Adaptive management should not be employed without a clear commitment to monitoring over the life of the project. If a commitment for monitoring is in question, it may be necessary to take another approach to decision making that does not rely on monitoring, such as expert systems, management intuition, or non-technical understanding of the system.

There are irresolvable conflicts in defining explicit and measurable management objectives or alternatives

If explicit and measurable management objectives cannot be identified or alternatives cannot be determined, then adaptive management is not feasible. Conflicts may arise in a collaborative process in which stakeholders with different interests fail to agree upon these components. One alternative in this situation is conflict resolution. Collaborative management is never easy, and agencies and stakeholder groups should not abandon the approach until the possibility of agreement on the key components of adaptive management is exhausted.

Decisions that affect resource systems and outcomes cannot be made

Adaptive management should only be considered in situations where management actions substantially influence the outcome. In certain situations, a management agency can only partially influence the resource system. For example, if an agency manages a relatively small area surrounded by private land, and the adaptive management project applies only to the agency-managed land, management activities on the private lands may well dominate the effect of agency actions. In such a situation, adaptive management is unlikely to be useful.

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Risks associated with learning-based decision making are too high.

It is sometimes considered inadvisable to use adaptive management when the “worst case scenario” resulting from a management action would be unacceptable to stakeholders. An example of such a situation might arise when management actions can lead to the extinction of extremely rare, threatened, or endangered resources. In this particular situation one approach might be to include management thresholds that prevent the worst-case scenario from occurring.

The limits of acceptable risk can vary substantially among applications, so adaptive management should not automatically be discounted even when dealing with rare or fragile resources. The relevant issue here is the value of information (see Section 2.1), taking into account the risks associated with learning-based decision making. In assessing risks, it is important to analyze the risk of the “do nothing” alternative, because the risk associated with maintaining the status quo may well be as high or higher than that of the alternatives.



An example of high-risk management involves management actions that can lead to the extinction of extremely rare, threatened, or endangered resources.

In fact, an adaptive management approach often can alleviate the level of risk through a careful articulation of objectives, management alternatives, and other elements of the resource problem. If the levels of uncertainty and risk are high, an adaptive approach that includes pessimistic alternatives and very high penalties for negative outcomes may well be the preferred approach to management.

Each of the limitations listed above is often encountered in natural resource management. In addition, other conditions can undermine adaptive management, for example an inability to reach agreement about the key elements of structured decision making, or a mismatch between the rate of change in system process and the frequency of management interventions. When such limitations are encountered, decision makers should question whether the use of adaptive management is appropriate, and perhaps consider other approaches to manage public lands and resources.

2.3 Key Points

- ❖ Adaptive management is not appropriate for single-time decision making.
- ❖ It is not appropriate if monitoring information is unavailable to decision makers.
- ❖ It is not appropriate if there are irresolvable conflicts about objectives or decision alternatives.
- ❖ It is not appropriate if management interventions cannot influence system behaviors in ways that affect management returns.
- ❖ It is not appropriate if there is not a commitment to sustained funding for monitoring and assessment.

2.4. Benefits and Challenges in using Adaptive Management

Benefits

An adaptive approach provides flexibility to act in the face of uncertainty

Adaptive management helps managers address resource issues by providing the flexibility to adjust management actions as additional understanding is gained. It can help determine whether management actions are having desired effects and whether mitigation measures are cost effective. The flexibility of adaptive management to respond to changing environmental conditions and improved understanding can result in better decision making.

An adaptive management approach is learning based

The concept of learning is central to adaptive management (8), with learning seen as a means to good management. Learning within the context of adaptive management derives from evaluation of previous management actions, the results of which are used to inform subsequent actions (8). The premise of an adaptive management approach is that the behavior of resource systems is uncertain but management is required anyway, and the reduction of uncertainty over time can lead to better management.

Adaptive management specifies what actions are to be taken and when

Adaptive management produces management strategies that specify what management actions are to be taken and how and when they should be adjusted. These strategies are based in turn on an explicit articulation of the management problem, what is known (and not known) about the resource system being managed, and the objectives of management (8). This explicitness makes it possible for stakeholders to focus on the key attributes involved in learning-based resource management, while avoiding the confusion and controversy that typically results when key management elements are not open to discussion and negotiation.

Adaptive management encourages long-term collaboration among stakeholders

Adaptive management brings resource managers, researchers, and other stakeholders together and encourages long-term collaboration through the development and strengthening of institutional ties (45). These ties are important in maintaining the level of support needed to successfully implement adaptive management. Through strengthened collaboration, stakeholders can be encouraged to remain involved over the life of an adaptive management project.

Adaptive management promotes optimal decision making with the information available

Adaptive management fosters the acquisition of new knowledge and understanding by specifying hypotheses and designing management alternatives to test them against field data (8, 46). The information accumulated through this process is used to adjust strategy periodically on the basis of what has been learned. In this sense, adaptive management allows decision makers at each juncture to make the best decisions they can with the information available at that time (41).



Challenges

Institutional reluctance to change

For adaptive management to be embraced on an institutional level, refinements in existing approaches to natural resource management are needed (8,47). An example might involve new ways of dealing with overlapping responsibilities and authorities among agencies, so as to reduce or eliminate resistance to one agency's adaptive management project by another agency that has regulatory oversight.

Some barriers to implementation go beyond the operational level. One such barrier is an inadequate recognition that the targets of resource management are rapidly becoming more inclusive. For example, ecosystem management traditionally is approached by targeting only one or a few system attributes, failing to account for the broader resource context and its implications for resource management. A framework for adaptive management allows the resource problem to be identified in a more inclusive context that includes issues like system viability and sustainability.

Another institutional barrier is a lack of the resource planning and design capacity that are required for adaptive management (see Section 3.1). For example, agency programs often have an inadequate capacity for the outcome-based monitoring needed for adaptive management. The problem here is not so much an inability to understand the process and procedures of adaptive management, as it is that program operations focus on tracking and assessment of activities and outputs rather than resource outcomes.

Implementation of adaptive management will require a shift in focus toward resource sustainability as a strategic target, with resource planning and design, decision-based monitoring, and assumption-driven research as central activities. In essence, adaptive management will require refinements to the resource management business model and adjustments in the organizational and institutional arrangements that support it. See Section 5.4 for further discussion on organizational roles and implications.

Commitment to monitoring and evaluation over the life of the project

In times of shrinking funding, managers must carefully assess the cost of the monitoring and assessment that inform decision making in an adaptive approach. The costs of timely monitoring and assessment over extended time scales are substantial, and often appear to be especially high at the outset of a project when compared with the costs of trial and error with only incidental monitoring (8). Agencies must be willing to make a commitment to cover the costs of monitoring and evaluation over the life of an adaptive management project; otherwise, discontinuing the monitoring effort will lead quickly to the cessation of adaptive decision making. Agencies also need to commit to a schedule for monitoring, analysis, and re-examination of decisions as understanding accumulates. In the absence of a commitment of resources for timely monitoring and evaluation over the life of the project, the use of adaptive management becomes problematic.

Significant time lags between management actions and their impacts

Time itself is a challenge in implementing adaptive management (48). In many cases, the overall costs associated with adaptive management are tied as much to the timeframe of the project as they are to its complexity. Some adaptive management plans require years of monitoring in order to be able to ascertain the results of an initial action. Of course, models that forecast some future endpoint as a consequence of a decision or series of decisions should also be able to predict resource status at various intervals prior to that endpoint, allowing management assessments to be performed on the predicted status over an abbreviated interval. The problem of time lags is further complicated by the fact that individual decision makers and/or managers rarely remain in the same position over the needed timeframes (8).

Implementing adaptive management in a complex legal environment

Legal issues must be weighed when deciding whether to implement an adaptive management strategy. In many cases, a NEPA decision process is required of federal agencies.

Depending on the resource problem and the scope of the project, requirements under other federal laws may also be triggered. Some laws may constrain or even preclude the use of adaptive management (see Section 3.2); on the other hand, legal considerations sometimes can be successfully integrated with it. Indeed, the case studies included on the enclosed CD suggest that adaptive management might make NEPA compliance more effective and efficient in some instances.

Collecting enough information to evaluate progress

The amount of data required for adaptive management depends on the system being managed, the actions being implemented, the objectives of management, and the amount of uncertainty (49,50). Project costs obviously increase for applications that require more frequent monitoring and the collection of larger amounts of data during each monitoring event.

Projects should be assessed individually, with each project tailored to the resource being managed, the environmental conditions of the project area, the project objectives, and the capabilities of the manager to implement decisions and carry out the subsequent monitoring and assessment. A considerable amount of up-front planning may be required; however, an initial investment of time and effort increases the likelihood of better decision making and resource stewardship in the future.

Projects should be tailored to the resource being managed, the environmental conditions of the project area, the project objectives, and the capabilities of the manager to implement decisions and carry out the subsequent monitoring and assessment.

2.4 Key Points

- ❖ Adaptive management promotes cooperative decision making in the face of uncertainty about the impacts of management interventions.
- ❖ Adaptive management produces management strategies consisting of actions that are tied to resource status and current understanding.
- ❖ Adaptive management brings resource managers, researchers, and other stakeholders together and encourages long term collaboration.
- ❖ Resistance to institutional change and a complex legal environment can be impediments to adaptive management.
- ❖ Agencies must be willing to commit to monitoring and evaluation over the life of an adaptive management project.