

ADAPTIVE MANAGEMENT AT THE REGIONAL SCALE: BREAKTHROUGH INNOVATION OR MISSION IMPOSSIBLE? A REPORT ON AN AMERICAN EXPERIENCE

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Introduction

The core concept of adaptive management is simple and intuitive: “policies are experiments; learn from them” (Lee 1993). Since publication of Holling’s *Adaptive Environmental Assessment and Management* (1978) and Walters’ *Adaptive Management of Renewable Resources* (1986), a number of efforts to apply adaptive management to natural resource management issues have been undertaken, including agriculture, coastal and riparian zone management, fisheries, and forestry and over a variety of social and political settings (e.g., Gunderson *et al.* 1995; Röling and Wagemakers 1998). In each case, efforts have focused on utilising the results of policy implementation as a source of insight and learning which, in turn, inform subsequent actions. This focus on policies and actions as hypotheses subject to purposeful analysis and evaluation is the distinctive contribution of an adaptive approach; as Gunderson (1999, p. 35) explains, such an approach treats policies as “questions masquerading as answers.” Over time, an adaptive management approach would yield a continuing flow of new knowledge that shapes future actions.

Yet, despite the compelling and intuitive logic of an adaptive approach, examples of demonstrated successes are rare. For example, Walters (1997, p. 2-3) notes “I have participated in 25 planning exercises for adaptive management of riparian and coastal ecosystems over the last 20 years; only seven of these have resulted in relatively large-scale management experiments, and only two of these experiments would be considered well planned in terms of statistical design.” Lee (1999, p. 1) concludes “adaptive management has been more influential, so far, as an idea than as a practical means of gaining insight into the behavior of ecosystems utilized and inhabited by humans.” These conclusions, especially by two individuals who pioneered efforts to apply adaptive management to natural resource management problems, are troubling. If the concept of adaptive management is compelling and intuitively appealing, why has it proven so resistant to successful implementation?

No simple or single answer exists; the reasons are undoubtedly complex and multi-faceted, transcending obvious culprits such as insufficient funding or intransigent bureaucrats. In the following discussion, I focus on clarifying the barriers an adaptive approach faces. My comments draw on an extensive review of the adaptive management literature, and on the results of a two-year evaluation in which I participated in the Pacific Northwest region of the U.S. regarding efforts to implement an adaptive approach to a forest management policy initiative.

A focus on barriers might be seen as negative, but, as the adaptive management literature itself argues, mistakes, errors, and undesirable outcomes—so-called “negative feedback”—often are the major source of learning and insight. The challenges facing adaptive approaches are grounded in a complex web of inadequate institutional structures and

processes, organizational norms and belief systems, and internal and external sanctions. Collectively, these forces interact to stymie efforts to experiment, learn, and innovate. Thus, there is a need to clarify the nature of these barriers as a first step to reforming institutions, organisations, and policies; as Kotter (1995, p. 60) notes, most successful organisational change efforts start with a frank discussion of potentially unpleasant facts, the purpose of which is “to make the *status quo* seem more dangerous than launching into the unknown.”

The Northwest Forest Plan

The management of public forests in the United States has generated similar controversy to those occurring in Australia. Changing public values, expectations, and demands increasingly challenge prevailing management programs and policies, resulting in contentious confrontations between citizens and forest management agencies (Wondolleck 1988). In the past 35 years, these debates have escalated in the Pacific Northwest region of the United States. Long a major source of saw timber, harvests on the region’s federally-owned lands virtually had ceased by 1990 in response to a series of legal decisions that found inadequate attention given to the protection of various conservation values, particularly the maintenance of viable populations of the endangered northern spotted owl (*Strix occidentalis caurina*) and its old-growth forest habitat.

Because of the intensity of the debate and the social and economic impacts on timber-dependent communities across the region, the issue became a key factor on the political agenda. In 1993, President Clinton announced he was directing federal departments with responsibilities in forest management, endangered species conservation, and economic development to prepare a set of management options for his consideration that would help achieve both environmental conservation and socio-economic goals. To undertake this assignment, the Forest Ecosystem Management and Assessment Team (FEMAT) was created.

The team was charged with examining a 10 million hectare region, spread across the western portions of Washington state, Oregon and a portion of northern California (Figure 1). The study area boundary was shaped by current knowledge regarding the distribution of the northern spotted owl and the old-growth forest habitat upon which it was (assumed to be) dependent. However, lands owned by the states, by corporate entities, or private citizens were not included.

FEMAT represented an effort to apply the best science available in developing options for management of the region, built upon other recent assessments. Yet, despite substantial scientific investments—monetary, time, skills—in the preceding decade, the contentious political environment effectively stalled efforts to implement active forest management. In 1993, as the FEMAT team began to consider options, there was growing realisation that the problem comprised two distinctive, yet connected, components (Shannon and Antypas 1997). First, management of the bio-physical regime involved an unforeseen level of *technical complexity*. That is, it became increasingly apparent as to the limits of existing knowledge as to what would constitute appropriate future actions and policies and what the consequences of those actions and policies might be on both the biophysical and socio-economic systems. It also involved a growing appreciation that the existing body of site- and stand-level studies had limited utility when applied at the landscape and regional scale (i.e., the system possessed emergent properties revealed only at large scales of analysis). Second, the technical complexity was matched by an equally formidable level of *political ambiguity* within which the issue was nested. Here, the challenge was effectively

addressing the diverse, often conflicting, values and preferences held by members of the public. What was shared between these two features was the limited understanding available to analysts and the uncertainty facing any option that might be proposed.

Adaptive Management and the Northwest Forest Plan

Because of the risks and uncertainty created by the complexity and ambiguity of the problem, the selected option (hereafter the Plan) was grounded on two strategies. In the short term, the Plan was grounded in the precautionary principle, with an emphasis on reserves in which management actions were closely controlled or prohibited altogether. For example, within the 10 million hectare region, nearly 30% was already protected by various Congressional designations, such as National Parks or Wildernesses. Another 30% was designated as “Late-successional” reserves, where the management emphasis was on protecting or restoring late-successional, old-growth conditions. Eleven percent was in “riparian reserves”, areas along streams, wetlands, and lakes where conservation of aquatic and riparian-dependent terrestrial resources would receive primary emphasis. Another 7% was administratively withdrawn for other purposes (e.g., recreation, visual quality). In total, nearly 80% of the planning region was designated as some type of reserve, again reflective of the high levels of uncertainty.

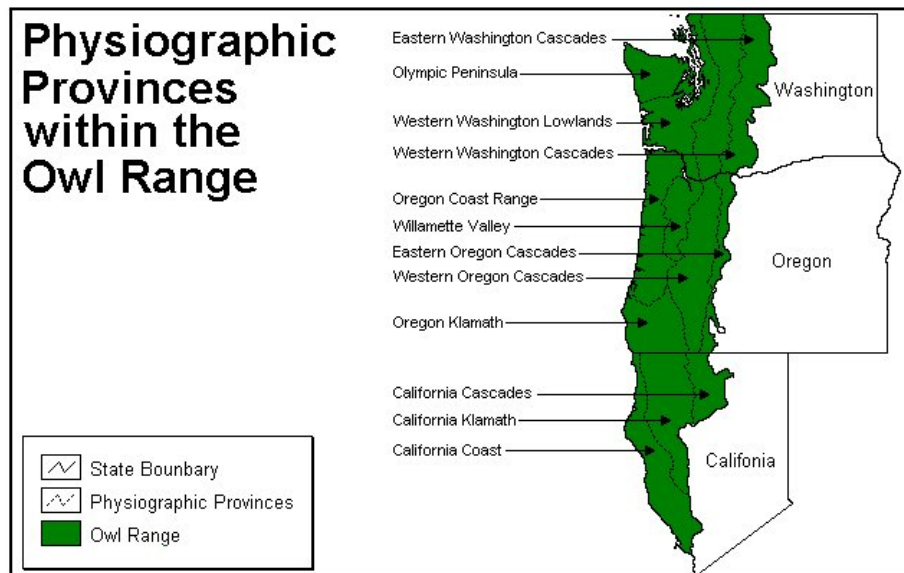


Figure 1. The FEMAT Planning Region

The reserve designations were augmented by “standards and guidelines” (S&Gs) that imposed specific, prescriptive management direction. For example, the S&Gs set quantitative measures for the required width of riparian buffers. Coupled with the reserve allocations, the S&Gs framed a short-term strategy that minimised and prescribed management intervention. The approach rested on an assumption that limited understanding of bio-physical processes and the consequences of active management strategies placed at-risk species and conditions at undue jeopardy, justifying the risk-averse approach.

But such risk-adverse strategies, intended to prevent harm from happening, operate most effectively when one understands *the source of harm*. In the case of the Plan, there was widespread acknowledgement that classic uncertainty prevailed. This included a lack of understanding of how biophysical and socio-economic systems operated, particularly at large-scales, as well as uncertainty about the causes, consequences, and implications of interactions between these systems. Under such conditions, risk-averse strategies can prove counter-

productive. What is needed, instead, are strategies that build a capacity for resilience, based on trial-and-error learning (Wildavsky 1988).

Thus, the Plan also proposed a long-term strategy, grounded in recognition that management experience and emerging knowledge would lead to new understandings that, turn, would challenge the validity of the assumptions upon which the allocations and S&Gs were founded. Thus, in addition to traditional reliance upon formal scientific inquiry as a source of such new knowledge, the Plan recommended an adaptive management approach to further as a continuing source of information to inform subsequent actions. The team's mission statement noted: "Your assessment should include suggestions for *adaptive management* that would identify high priority inventory, research, and monitoring needed to assess success over time and essential or allowable modifications in approach as new information becomes available" (FEMAT 1993, p. iii, emphasis added).

In addition to the inclusion of adaptive management as a strategy, the Plan further endorsed an adaptive approach by creating a specific allocation called Adaptive Management Areas (AMAs). Ten areas, comprising about 6% of the region, were distributed across the three-state region (4 each in Washington state and Oregon, 2 in California) to encompass a range of bio-physical and socio-economic conditions (Figure 2). Ranging in size from about 40,000 ha to nearly 200,000 ha, they were "to encourage the development and testing of technical and social approaches to achieving desired ecological, economic, and other social objectives" and to help agencies "learn how to manage on an ecosystem basis" (Record of Decision 1994, p. 6).



Figure 2: The Adaptive Management Area System

Adaptive management was key to the success of this long-term strategy; indeed, the evolutionary, knowledge-driven nature of this strategy made it more than a tactic or allocation; it is *the* cornerstone to the Plan's long-term success (Pipkin 1998). Yet, concerns soon began to emerge as to whether this crucial role for adaptive management was being realised; Pipkin (1998, p. 9) described efforts to implement an adaptive approach as "another area where initial expectations have fallen short" and called for a review of progress, including an assessment of impediments and suggestions for improvement. Soon after, a team of Forest Service scientists and academics undertook such a review.

Methods

The evaluation methodology utilized a variety of information sources. First, we undertook an extensive literature review, including both a review of the adaptive management literature (including other resource management sectors, such as agriculture as well as experiences reported from other countries), as well as related fields, such as evaluation research, diffusion-adoption, and public policy.

Second, 50 interviews with agency personnel involved in administering the adaptive management and AMA program were conducted. For example, each AMA had individuals assigned to them to lead the adaptive management effort, including AMA coordinators (representing the management organisations of the Bureau of Land Management and Forest Service), and lead scientists (representing the Forest Service's Pacific Northwest [PNW] and Pacific Southwest [PSW] Research Stations). We also interviewed key staff in the management, research, and regulatory agencies, technical specialists, and selected citizens. Finally, we undertook secondary analyses of existing quantitative and qualitative surveys, which expanded the ability to tap into citizen experiences and perspectives on adaptive management.

Third, we reviewed plans, research proposals, and policy papers developed during implementation of the AMAs. We also reviewed existing evaluations of the AMAs undertaken earlier by independent investigators.

Fourth, our evaluation team included both agency staff as well as university cooperators¹. This enabled us to combine a diversity of disciplinary backgrounds, experiences, and perspectives with the high level of familiarity with the AMAs and adaptive management our internal review group possessed.

Adaptive management: integral or incidental?

Evaluating the performance of adaptive management and the AMAs has to account for the larger context within which the rapid and dramatic changes in forest management proposed by the Plan occurred. The Plan imposed many changes to forest management processes; it assigned new roles and responsibilities, it imposed systemic shifts in the focus of forest management—from commodity production to restoration and maintenance of underlying

¹ In addition to the author, the evaluation team was composed of Drs. Bernard Bormann and Roger N. Clark, Pacific Northwest Research Station, Dr. Victoria Sturtevant, Department of Sociology and Anthropology, Southern Oregon University, Dr. Clare Ryan, College of Forest Resources, University of Washington, Dr. Bruce Shindler, Department of Forest Resources, Oregon State University, and Dr. Charles Philpot, private consultant and former Director, Pacific Northwest Research Station.

ecological processes—and it resulted in added institutional complexity. In short, it truly did call for a new way of doing business.

But there are consequences when a new way of doing business takes hold. The Plan established processes where little precedence existed and where substantial organizational resources would be required. For example, it required undertaking watershed assessments prior to implementing any significant land management actions. This, and other requirements, absorbed (and continue to do so) large amounts of time, energy, and money, partly to determine simply what needed to be done and how, even before the actual work was undertaken. Agency staff continued to face scrutiny of the regulatory agencies and the need to satisfy the legislative requirements of the Endangered Species Act, leading to further competition for time, staff, and money. And, all these demands were coming at a time when organizational resources—personnel and operating budgets—were stable or in decline.

In this midst of this rapid and dramatic change, calls for an adaptive management approach and the management of the AMAs became only one of the competing demands for attention and resources. Although these concepts represented an important element underlying successful implementation of the Plan, neither adequate preparation, training, resources, leadership, nor direction were put in place to capitalize upon the opportunity afforded by adaptive management and the AMAs.

Yet, consistent with the fundamental notion of adaptive management—actions and policies are the source of learning—the experience to date offers insight as to the kinds of changes that might be undertaken and the areas where improvements are called for. A key point here is that adaptive management and the AMAs represent innovative strategies for resolving complex natural resource management issues and because they are innovative, they will take time; new ideas, no matter how compelling and appealing, always face the challenge of breaking down inertia and leaving the status quo behind (Stankey and Shindler 1997). Thus, despite the problems encountered to date, our evaluation by no means should be interpreted as an obituary for adaptive management and the AMA program, but rather a critical appraisal of the kinds of changes to which the agencies must more effectively respond.

In this paper, it is not possible to describe our findings in detail. Moreover, there remains the problematic issue as to the extent to which the US experience, involving another socio-political system and a differing resource sector, are reflective of the issues, opportunities, and challenges facing efforts to apply adaptive approaches to management of agriculture in Australia. Along with members of the evaluation team, we leave that assessment to the reader. But, with these caveats in mind, we turn now to the results of our evaluation.

The problems in implementing adaptive management began at the beginning

Adaptive management was envisioned as central to implementing an ecosystem approach to management of public forests in the Pacific Northwest. The FEMAT report outlined the role and purpose of adaptive management and the AMAs, focusing particularly on their value in testing underlying assumptions of the Plan and in validating the S&Gs. It also addressed the social objectives of adaptive management and the AMAs, focusing on opportunities for innovative partnerships among citizens, managers, and scientists.

The discussion of adaptive management in FEMAT offered a *vision* of an innovative approach to management, or in conventional parlance, a strategy for a new way of doing business. It anticipated the need to consider new organizational structures and processes, it

recognized the need for organizational leadership, and it envisioned a new type of working relationship among citizens, managers, and scientists.

However, while the FEMAT report was an assessment of innovative concepts and strategies for future forest management, it was not an implementation document. Once the government had selected an alternative from the options offered in FEMAT, an entirely new decision process came into play. First, an environmental impact statement (EIS) was prepared, followed by development of a legally-binding document called the Record of Decision (ROD). Unfortunately, as attention shifted to providing specific structures and processes, along with establishing the Plan's legal foundation, much of the vision and innovativeness foreseen in FEMAT was lost. This type of structural disconnect has a major impact on efforts to reform the policymaking process. In part, it was aggravated by the fact that an entirely new group of people became involved in preparing the legal justification and implementation strategy. This meant that the history of premises, assumptions, and experiences in which the FEMAT discussion of adaptive management had been grounded was largely lost. It also meant that the planning process became dominated by a reliance upon traditional technical-rational approaches—because they were ideologically familiar and comfortable—and a preoccupation with satisfying legal and organisational requirements—to minimise agency exposure to political and legal risk. The discontinuity in process and personnel—between those who framed the vision and those who framed the implementation strategy—represents a significant structural constraint on efforts to initiate change.

An important implication of this disconnect is that while the rhetoric of adaptive management remained a part of the Plan, it lacked substantive and critical discussion of how it was to be implemented, including a critical examination of the extent to which current structures and processes could, or could not, facilitate adaptive approaches, what internal changes in decisionmaking, budgeting, or organisational structure would need to be undertaken, or what kinds of interactions with key external interests—political, regulatory, citizenry—would need to occur. For example, given the high level of public and legal scrutiny under which natural resource management in the US must operate, who were the key players who held “veto” power over agency efforts to implement adaptive management (e.g., environmental interest groups) and what processes might be employed to gain their interest and potential support in such a strategy? Given the regulatory authority (i.e., political power) held by agencies such as the Environmental Protection Agency (EPA) or Fish and Wildlife Service (FWS), how could support from these players for strategies that explicitly engaged risk (therefore potentially jeopardizing certain species or habitats for which these agencies had responsibility) be fostered? Unfortunately, such strategic questions received little attention as efforts to develop the adaptive management program took form, resulting in a failure to build the coalitions needed to provide political support for innovation in management. As a result, the promise of adaptive management as a strategy for implementing the Plan failed to gain early understanding, support, and credibility among key internal and external players.

Building adaptive organisations: easy to say, hard to do

A second important lesson emerging from the evolution of adaptive management from FEMAT to the ROD is that there remains a need to undertake a thoughtful, deliberative assessment of the organizational requirements to embrace an adaptive approach consistent with the vision framed in FEMAT. This would involve questions such as what an adaptive approach implies for day-to-day management, how various organizational structures and processes facilitate and/or constrain an adaptive approach (e.g., budgeting, research-

management links), what skills are required and how they might be obtained when lacking, the impact of the external political and legal environment (e.g., links with regulatory agencies, impacts of legislation such as NEPA and ESA), and relationships with the public (e.g., roles, issues of trust). None of these issues are simple; none of the problems deriving from them are subject to easy resolution, and addressing them adequately cannot be done quickly nor will it be inexpensive. For example, in evaluating efforts to implement an adaptive approach in management of the Glen Canyon Dam on the Colorado River, the authors concluded “It is important to recognize that the fiscal and human resources needed to manage a newly formed and evolving institution (i.e., adaptive management) are probably greater than those required to manage a decades-old, established program” (National Research Council 1999, p. 61). Yet, the failure to institute a comprehensive and candid assessment of what is needed to act adaptively has plagued efforts to implement adaptive management and will continue to do so until they are explicitly engaged.

Despite rhetoric about building learning organizations, a central lesson from the literature is that *individuals* learn, not institutions (Clark 2001). However, what institutions can, and should do, is promote the conditions to encourage, reward, and sustain learning by the individuals that comprise them. This means such things as providing time for individuals to learn, providing the skills and techniques for learning (training, protocols), and facilitating and supporting networks with others. However, we found little evidence of such support. For example, the AMA coordinators were not provided with any training, little was done to equip them with the concepts, techniques, and processes that would facilitate learning, and most of them reported that the time they could allocate to adaptive management and AMA-related issues steadily diminished as competing demands for their time escalated.

The erosion of time and energy devoted to adaptive management was particularly serious because it meant that the role of the coordinators as advocates and champions of adaptive management was severely diminished. The literature stresses the importance of such advocates (Gilmour *et al.* 1999). Clark (2001) observes that information does not just flow to willing learners, but must be pushed by would-be teachers or sought by dissatisfied learners; in short, it must arise from someone wanting to do something different. Although the coordinators and lead scientists in general were people who sought to achieve “something different”, the crush of other demands effectively overrode their ability to do this.

Structuring a learning, adaptive organization has been handicapped by a pervasive belief that adaptive management did not constitute a significant departure from the past. One consequence is that little attention has been paid to how organizational structures and processes might be redesigned to accommodate an adaptive style of management. Although it is difficult to assess why this is so, one possible explanation is simply that adaptive management is seen as a marginal activity that does not represent a significant issue confronting the management agencies and therefore does not warrant special efforts to accommodate. Alternatively, there was a recurring notion expressed during our interviews that adaptive management was nothing new—i.e., “we’ve always been adaptive”—and this sentiment reinforces the idea that no new changes, structures, or processes are required.

Both ideas miss the point of an adaptive approach. As we, and others (e.g., Pipkin 1998) argue, adaptive management is not just a marginal feature of the Plan, but central and fundamental. Moreover, although the resource management agencies historically have demonstrated an ability to make changes in practices and policies, often these have been driven by external interests or by simple organisational survival instincts (Clarke and McCool

1996). Taken together, however, these two ideas suggest another fundamental shortcoming of efforts to implement an adaptive approach; namely, what does it mean to be adaptive?

The importance of fashioning common understanding about adaptive management, among both organisations as well as with external stakeholders, seems to be a key aspect underlying effective implementation. In their evaluation of the Glen Canyon adaptive management project, the National Research Council (1999) noted that it was not clear whether the definition and interpretation of adaptive management provided in the 1997 Grand Canyon Strategic Plan was widely shared among stakeholders. They recommended that efforts be made to work toward a common definition as a key step in promoting effective management.

Their finding is reminiscent of efforts to implement the Plan; i.e., there is a lack of a shared understanding—both within the management agencies as well as among the wider regulatory and political environment—of the role of adaptive management in achieving the goals of the Plan. For example, within the agencies, the AMAs are seen as only one allocation (and a “small” one, at that, representing only 6% of the region) of the Plan, and are therefore only one more competitor for attention, funding, and priority. The failure to work deliberately and purposefully in building a supportive regulatory and political environment to support undertaking an adaptive management approach has further constrained efforts to implement the Plan.

Adaptive management is a risky business

A major challenge to implementing adaptive management and the AMAs in the Plan derives from the reluctance, or outright opposition, to engage risk and uncertainty. Gunderson (1999a, p. 7) argues, adaptive management will not occur “...until management institutions are capable and willing to embrace uncertainty”, and Michael (1995, p. 479) adds “Taking advantage of the opportunities to learn from uncertainties requires constructing procedures that embrace error.” However, in the US, organisational culture, the legal environment, and the social milieu are dominated by risk-aversion. Although “risk averse” often is taken as a pejorative, it simply means that care is taken to prevent harm from occurring, whether to human health or the management of endangered species. But such an approach has important limits; harm can only be prevented when one understands the origins of harm. In the case of uncertainty, where such understanding is low, it is difficult to prescribe what a risk-averse course of action should be. In the face of uncertainty, the notion that “no action” is the safest course is unfounded; a “no action” decision can hold potentially catastrophic results. When high risk and/or uncertainty characterize a situation, Wildavsky (1988) argues that a more fruitful strategy comes from building resiliency which, in turn, is best achieved by a “trial-and-error” approach. Using the learning that derives from such an approach, uncertainty can be reduced and policies and programs can be adapted to minimize the extent to which harm occurs.

The treatment of risk and uncertainty is core to effective adaptive management. Any experiment involves the possibility of error. Ironically, however, one of the most significant sources of learning derives from “negative feedback”, or in lay terms, mistakes. In risk-averse organizations, however, extraordinary efforts often are undertaken to avoid mistakes. Concerns about impacts on personal careers or the fear of external sanctions provide credence to such avoidance behavior. However, an unwillingness to undertake risk (and the associated possibility of mistakes) is effectively the “death-knell” of an adaptive management approach. For example, Gunderson (1999b, p. 35) notes “if the risk of failure during experimentation is

not acceptable, then adaptive management is not possible.” Similarly, Volkman and McConaha (1993, p. 14) conclude that the “bold testing that was central to the original concept of adaptive management...is unlikely to fit comfortably in the endangered species era” because of the risks involved.

This issue is full of irony. Our evaluation revealed an unquestioning presumption that the conservative, non-interventionist approach (i.e., the Plan’s short-term strategy) was risk-free; conversely, it is assumed that any departure from that conservative approach (i.e., active intervention, such as thinning young stands) imposed high risk to the objective of establishing old-growth habitat. But many of the S&Gs were based on limited information, with little evidence to support the idea that their steadfast application is, in fact, either the least risky or the most effective approach. However, in the absence of a willingness and capacity to test (which means to verify and/or alter) the S&Gs, we have become locked into a course of action that might ultimately prove detrimental to the very species and values these policies were designed to protect.

From learning to action to learning

The adaptive management literature devoted considerable attention to learning, deriving from the core idea that “policies are experiments; learn from them.” However, that literature also acknowledges that examples where this has been done in a formal, rigorous manner (i.e., scientific) are rare. Our interviews and review of projects and plans for the AMAs produced a similar conclusion. Despite widespread rhetorical ascription to the importance of learning, the lack of formal documentation processes and protocols belies this. In some cases, there was open resistance to the idea of developing such formal processes; in one interview, we were told that if managers were “required to write everything down and get statistical approval”, adaptive management would fail; the importance of documentation in ensuring accuracy, clarity and a discernible record of results would suggest exactly the opposite.

The largely rhetorical attention given learning further masks the fact that little effort to build a learning organization, which in many ways is what adaptive management means, has occurred. There are good, or at least, discernible reasons for this. Probably most simply, learning often produces discomfort; learning reveals that something we’ve been doing isn’t working, is wrong, is taking us in a different direction than we imagined, etc. As Michael (1995, p. 468) observes, “contrary to popular belief, most people under most circumstances are not all that eager to learn” (Perhaps the strongest assertion of this argument is found in a little known paper by Welles (1984) entitled “The survival advantage of stupidity”).

Clark (2001) bluntly concludes that learning often is unwanted or openly resisted in many organisations; most are not interested in what they should be doing differently and the predominant focus is on defending the *status quo*. Changes are feared because of their potential impacts on status, authority, and influence. Also, learning can lead to changes in policies and practices which might be interpreted among the public, politicians, or agency critics as evidence of prior mistakes and errors, feeding fears among agency personnel that organisational credibility (and perhaps even survival) will be threatened. Collectively, such concerns jeopardize efforts to be adaptive.

We found little evidence in our interviews, document reviews, or knowledge of the management and research organizations that much attention has been devoted to examining explicit organizational structures or processes that facilitate learning or that facilitate the flow

of learning to action. “There are two kinds of learning: one for a stable world and one for a world of uncertainty and change. Learning appropriate for the former world has to do with learning the right answers...learning for our world (i.e., a world of change and turbulence) has to do with learning what are the useful questions to ask and learning how to keep on learning since the questions keep changing” (Michael 1995, p. 484). To think and behave adaptively will necessitate we move purposefully to learn how to live in the latter world.

Perhaps most critically, we found little evidence of applied applications of learning. Often, learning seems to have been valued as an end in itself. Although learning is a key element in adaptive management, it is principally a means to an end, which are better informed actions and policies. However, despite wide and common ascription to the importance of learning, there was a virtual dearth of evidence where that learning had been used to either modify or substantiate current policies. Nor did we find evidence that actions and policies were implemented with a specific objective of enhancing the ability of the actions and policies to inform subsequent activities (i.e., to design them to maximise the learning they would yield).

Similarly, little attention was given to the question of what it means to learn. Although attention was given to the idea of the AMAs serving as locales where the S&Gs could be tested, validated, and if appropriate, revised, little discussion occurred about the question of what type, level, and specificity of learning would lead to a decision to modify them. Virtually any management decision produces some outcome, but what standards of evidence or proof would lead to the conclusion that a change in prescription was warranted? This is a particularly critical issue in implementation of the Plan. For example, what are the characteristics of the results of learning experiments that would constitute sufficient grounds to modify or alter the S&Gs? In short, when do we know we’ve learned something? What processes are in place to modify existing management guidelines and/or to extend results from one place (e.g., coastal forests) to another (mountain forests)? We found virtually no debate regarding such matters.

The literature identifies modeling as a key element in enhancing the learning value of the adaptive process (Walters 1986); it provides a venue in which current knowledge (scientific, managerial, experiential) is identified and assessed, key questions framed, and the search for viable alternatives begun. As Michael (1973, p. 125) notes, “to learn requires recognizing what one wants to learn, and that means recognizing what one doesn’t know.” In short, modeling provides for an explicit and public acknowledgement of what is not known. However, the literature also concludes that all too often, processes become paralyzed at the modeling stage or modeling becomes an end in itself (Walters 1997).

In the case of the Plan, we found few examples of where modeling had been undertaken. Although this might be seen as a benefit (i.e., the organization has not gotten “locked up” in model-building exercises), the more critical assessment is that there has been a general lack of attention to processes for comprehensive problem identification and framing, search for alternatives, etc.

Finally, we found that an indiscriminating search for evidence of the success of adaptive management (e.g., USDA Forest Service 1996). One result of this has been a cataloging of activities and actions undertaken within the AMAs being defined as *prima facie* evidence of their success, when in fact, they lack any adaptive qualities, often including things that could have been done in any allocation within the Plan, or in some cases, including projects that had been underway for many years, but coincidentally now reside within an AMA boundary. In

short, this suggests a lack of an agreed-upon definition of adaptive management or of indicators for assessing progress in implementing an adaptive approach (e.g., a focus on identification of learning objectives or means of specifying how learning affected implementation).

Organizational leadership, willingness, and capacity to implement adaptive management remain problematic.

There has been a serious lack of leadership within both the management and research organizations. Leadership is a source of vision, support, energy, and motivation, and represents a critical element typically associated with any innovation. Yet, our interviews revealed widespread concern about, and the debilitating effects of, its absence.

There were important exceptions. In Oregon's Central Cascades AMA, aggressive leadership from both management and research has occurred, promoting and supporting a strong link between the two. However, it must also be noted that this relationship is the legacy of years of interaction among area managers, and university and federal scientists, established well before creation of the AMA. On the Applegate AMA in southern Oregon and the Hayfork AMA in northern California, leadership arose from local citizens, with strong agency support, although again it must be noted that this coalition of interests predates creation of the AMA. Moreover, there are concerns about the capacity of local citizens to sustain their level of leadership over the long term. It seems essential that the management organizations charged with administration of an adaptive management program be a primary source of assertive and aggressive leadership here; their command of resources, their legally-defined stewardship responsibilities, and the compelling need to find better, more effective ways of managing the land should be primary motivators. Additionally, the challenge and potential afforded by an adaptive approach might constitute the kind of opportunity that management organizations need to reclaim a leadership role in conservation management, a role that many sense as been lost in recent years.

We previously noted the importance of local advocates/champions who provide leadership of, and capacity for, adaptive management (Gilmour *et al.* 1999). Such individuals can be found among managers, scientists, or citizens, or a combination, providing the motivation, energy, enthusiasm, and ideas that can spark initial implementation.

Yet, we uncovered an interesting tension between the efforts of these local champions and their efforts to set up innovative programs and the efforts by agencies to provide regional direction and support. On the one hand, many locals favor that the impetus and energy for adaptive management arise at that level and that the regional or national level not "get in the way." At the same time, the lack of regional or national direction, support, or other involvement is interpreted as *prima facie* evidence of a lack of understanding and commitment on the part of organizational leadership. For example, the decision by agency officials in the regional (head) office to not provide policy guidelines for implementation of the AMA program, grounded in concerns to avoid a "top down" imposition of direction, was interpreted by many local agency personnel as a clear statement of the agency's disinterest in, and lack of support for, the program.

There is a sense among many that we interviewed that adaptive management is not, in their words, "on the radar screen" (i.e., it has not a priority). In an interview with former Forest Service Chief Jack Ward Thomas, he confirmed that he found little or no interest at the WO

level in adaptive management, a circumstance he attributed to staff concerns that adaptive management might erode their power, influences, budget control, etc. The National Coordinator of Adaptive Management took the view that because adaptive management was “not on the radar screen”, advocates were best advised to focus locally because efforts to raise its prominence would be doomed and could lead to adverse consequences.

Burnout is a problem among the coordinators; at the time of our interviews, at least two AMA coordinators had left their positions as a direct result of this. In part, this derives from the fact that AMA responsibilities are typically an “add-on” task, rather than a sole responsibility. There are also concerns on the part of many coordinators that their assignment was *pro forma* (e.g., we have to have someone in the job), rather than recognition on the part of supervisors of an opportunity to be cultivated and supported. The stress of high levels of interaction with outside interest groups, coupled with the frustration of attempting to follow through on the potential of adaptive management and the AMAs in organizations that were less than fully committed also took its toll. There is a tension between an AMA program deeply grounded in one or a small group of individuals (who bring enthusiasm, energy, innovation, etc.) and the need for developing an enduring organizational capacity for an adaptive approach. Both appear to be important; however, in the case of the AMAs, much of the progress and learning that has occurred can be attributed to the former situation (i.e., grounded in individuals); there is much less evidence of a developing organizational capacity.

Applying Evaluative Criteria to Adaptive Management: A Conclusion

Is it possible to provide a summary of our findings? Four criteria can be used to provide some basic evaluation of our findings. These include:

1. Conceptually sound—is the underlying idea sensible?
2. Technical—is the idea translated into practice well?
3. Ethical—Who loses and who wins when the policy is implemented?
4. Pragmatic—Does it work?

Conceptually sound: Is the idea sensible?

The concept of adaptive management gained support because of the growing recognition that we do not know enough to manage ecosystems (Lee 1999). The experience in preparing the FEMAT report, as well as that revealed in other large-scale regional assessments (Johnson *et al.* 1999) confirms this. Moreover, there is a growing appreciation that the rate of knowledge acquisition through traditional scientific inquiry is inadequate in addressing the challenge of insufficient knowledge. In part, this is a result of insufficient resources devoted to scientific inquiry—people, money, time. But it is also more; it is a consequence of a particular form of inquiry, grounded in reductionism, disciplinary narrowness, and restricted conceptions of what constitutes knowledge and knowing. These very qualities are desirable and productive in dealing with certain kinds of problems and issues; however, they become less useful at the interface of knowledge application, implementation, and policy.

Interest in adaptive management has grown out of this context. Utilizing the idea of treating management policies as experiments and as the source of learning which, in turn, informs both the search for understanding and subsequent action, it is a powerful, intuitively compelling concept. Thus, in terms of this first criterion, we must conclude that adaptive

management is sensible; it represents a viable, productive alternative (not a replacement) to traditional management and scientific approaches.

Technical: Does adaptive management translate into practice well?

Although conceptually, adaptive management is sensible, logical, and appealing, efforts to translate it into practice have fared poorly. A variety of problems and barriers operate to stymie effective application; structural and organizational, social-psychological, political, legal, value-based, and so on. The inability and/or unwillingness to acknowledge the limits of our knowledge and capacity, the fear of mistakes, the difficulty in “letting go” of a way of doing business—these and other factors combine to create strong resistance to the idea of experimenting, of considering new ways of learning, and of searching for innovative structures and processes.

A major challenge facing the agencies responsible for implementation of the Plan is how to overcome these barriers. This will require intentional action, leadership, and a willingness to confront risk. However, unless such steps are taken, it is likely that the concept of adaptive management, despite its compelling appeal, will languish as little more than rhetoric.

Ethical: Who wins and who loses with adaptive management?

Thinking and acting adaptively might appear logical and compelling, but it is important to acknowledge that such behavior results in costs as well as benefits. In discussing forest management in New Brunswick, Baskerville (1995, p. 88) notes that a major reason why bureaucracies have trouble with adaptive management is that it requires them to acknowledge “I don’t know; I must learn.” Such an admission is treated as a cost. Bureaucracies are often taken to be a primary source of expertise and skill and to admit ignorance seems to represent a confession of weakness and, in a competitive political environment, an invitation to dissolution. However, to paraphrase an earlier cited quote from Gunderson (1999), policies are questions masquerading as answers. An adaptive approach explicitly acknowledges this, but the admission of a failure to understand will often be treated as a cost.

Moreover, there are always those who see benefits in any particular suite of policies and who would then see an adaptive approach that seeks to test, validate, and, as appropriate modify them, as undesirable. Lee (1999, p. 8) notes “there are risks of disclosure which look inappropriate in the eyes of one or more stakeholders.” For example, to experiment with thinning in riparian zones, with the intention of facilitating old-growth structure, carries with it the possibility that the conditions desired in those environments will not eventuate under the current policy regime which prohibits silvicultural treatments, or, even if they do, that adverse impacts on other values, such as salmon, might also occur. Thus, the knowledge that emerges will represent benefits to some interests, costs to others. When costs become apparent, resistance is often not far behind.

Pragmatic: Does adaptive management make a difference?

Lee (1999, p. 9) asks: does adaptive management work? Answering his own question, he acknowledges “we do not know yet.” Moreover, given the kinds of time scales involved, for both biophysical and socioeconomic systems, it might be a long time before we can answer the question more definitively. Unfortunately, the nature of the world in which we reside is uncomfortable, perhaps even intolerant and unaccepting, of delay. The acrimonious nature of

conflict, the demands for immediate resolution and accommodation of individual interests, the antipathy to deferred gratification, and the structural nature of budgeting and planning cycles might combine to make the notion of “wait and see” untenable.

The irony here is that implementation of adaptive management, considered as an innovation, cannot be rushed. The diffusion-adoption literature suggests that it is not uncommon that innovations often take considerable time—a decade or more—to take root. The expectation that the adaptive management directives in the Plan will be able to produce demonstrable evidence of “success” in only a few years might be unrealistic. However, as noted above, given the nature of the political and organizational environment within which the Plan is imbedded, such an inability might foreshadow the conclusion that adaptive management has failed.

Where From Here?

What did we learn from this evaluation? Perhaps more importantly, where does what we learned lead us, particularly with regard to the kinds of institutional reform needed to make adaptive management a viable, realistic alternative?

Three broad conclusions emerge from our experience in evaluating adaptive management in the Pacific Northwest. First, despite good intentions, and the investment of much hard work, energy, and enthusiasm by some agency personnel, it is hard to conclude anything other than adaptive management has failed to achieve its potential and promise in the Plan. As a concept and allocation, investment in adaptive management has been largely confined to rhetorical language and cosmetic attention.

Second, this situation stems from a failure to develop a broad organizational commitment to adaptive management as a central strategy for achieving the long-term goals of the Plan (and the same might be said regarding commitment to the overall Plan). Such a lack of commitment is reflected in a lack of staffing, financial resources, training, and other organisational resources. Important opportunities for the research organisations to provide leadership and technical support have not been seized. The failure to seize such opportunities has also likely dissipated potential public and political support, making adaptive management simply the latest in a series of faddish labels for resource management. Permeating this has been a lack of leadership.

Third, despite our objective to evaluate implementation of adaptive management in the Plan, we found little to evaluate; i.e., examples of on-the-ground demonstrations of policies that would serve as the basis of learning, with a designed structure to facilitate and evaluate that learning, and ultimately be used to inform subsequent rounds of action. One major exception is an effort to implement a management program that relies upon mimicking the natural disturbance regime as an alternative to the reserve-based system outlined in the Plan on the Central Cascades AMA. This holds great promise and is a good example of an adaptive management approach, presuming that on-the-ground implementation proceeds; at present, it is still largely in the planning stage.

Given these conclusions, coupled with the generally pessimistic tone of the wider adaptive management literature, one might reasonably ask “can adaptive management ever work?” Our evaluation team still feels that it could, but some significant changes will be required. At a most basic level, we see a need for three key developments:

1. Adaptive management represents an innovative, bold response to the need to better integrate knowledge into decisionmaking. This will require equally innovative and bold leadership, in both the technical as well as political arenas. Technically, it calls for development of protocols and techniques that facilitate the development of learning and its integration in subsequent decisions. Politically, it calls for support and endorsement of acknowledging and embracing risk and uncertainty and of ensuring adequate resources and support and a patience for results.
2. Following the last point above, there needs to be recognition on the part of both the resource management community and the larger body politic that adaptive approaches will be neither quick nor cheap. Walters (1997) argues that although there is a common belief that adaptive management will lead to quick results at minimal costs, the inverse is almost certainly true. As a consequence, there is a need for support in terms of finance, personnel, and time from both management organisations and the political arena.
3. Finally, adaptive management involves fundamental, systemic changes in how resource management is undertaken and as a part of these changes, it requires development and nurturing of specific skills and abilities and decisionmaking processes. For example, adaptive management has a capacity to change the dialectic between resource managers and scientists, making both partners from the problem-formulation stage through to implementation and evaluation. This will diminish the distinction between the notion of knowledge-producers and knowledge-users. It will also have implications for how we think about technology transfer; rather than its present compartmentalised and linear quality, it becomes an on-going process.

What would an adaptive organisation look like? First, it's important to acknowledge that reorganisation often is substituted for substantive and systemic change; job titles change, lines of authority and responsibility shift, organisational names disappear and reappear. However, what is needed involves significant alterations in the structures and processes through which natural resource programs are developed and implemented. From an adaptive perspective, the following characteristics seem crucial:

1. *Learning needs to be identified as a performance element.* That is, the work of decisionmakers and organisational staff needs to be evaluated, at least in part, in terms of demonstrated learning that better informs subsequent actions and policies. Too often in the current situation, such demonstrated learning carries little weight in how the performance of managers is evaluated. Encouraging an adaptive approach necessitates that this change.
2. *Encourage risk and uncertainty.* The focus on risk-aversion must re-center on an openness to experimentation and trial-and-error learning. As noted earlier, when there is intolerance of undertaking risk and uncertainty, whether sustained through organisational policies, disciplinary norms and beliefs, or through external sanctions such as laws, adaptive approaches are extremely difficult to promote. This will often require organisational

leadership that confirms the importance and legitimacy of risk-taking and also works to develop a supportive political environment.

3. *Treat adaptive management rigorously and formally.* Adaptive approaches involve more than simply muddling through. They establish a deliberative and purposive process through which questions are framed, hypotheses proposed, implementation is designed to enhance learning opportunities, results are critically evaluated, and, if appropriate, subsequent actions and policies are revised and applied, again in such a manner as to enhance the continuing process of learning. These kinds of actions depart significantly from current practices and will require development of new protocols, frameworks, skills, and perspectives. However, they are essential to effective adaptive management.
4. *Leadership and clarity of vision is essential.* We have cited the importance of leadership repeatedly in this paper. The ability to excite, motivate, and sustain organisational commitment to adaptive management requires people who lead, not just manage. It also requires an articulate vision as to what adaptive management can lead. For example, in forest management in the US, we would see this as including an ability to recapture public recognition as a conservation leader and an ability to replace the growing dependence on legislative and judicial remedies by facilitating the exercise of professional management expertise, skills, and judgments in decisionmaking.
5. *Integration, not compartmentalisation, characterises organisations.* Despite widespread rhetoric about integrated management organisations and decisionmaking processes, resource management remains dominated by reductionism and compartmentalisation. An adaptive approach must permeate organisational thinking and behaviour. One factor that has made efforts to integrate an adaptive approach in the Plan has been the separation of monitoring as a responsibility distinct from adaptive management. Without a coherent program of monitoring, adaptive management is fatally compromised; for example, a recent report from here in Australia points to how the inability to monitor fish numbers made it impossible to assess a reintroduction program for trout cod (Todd 2001). As discussed earlier, discussion about adaptive management in the US Forest Service has been resisted because of concerns about loss of influence, budget, and power from other functional areas. Again, leadership is challenged to confront and break down these forces, if adaptive management is to succeed.

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