

Random thoughts about Adaptive Management

for the workshop on adaptive management at the Aspen Global Change Institute (June 2003)
John Shurts June 19, 2003

The Northwest Power Act and “Adaptive Management” coincide

In the Northwest Power Act of 1980, Congress authorized the Northwest Power Planning Council to develop and periodically revise a regional power plan as well as a fish and wildlife program to protect, mitigate and enhance the fish and wildlife of the Columbia River and its tributaries affected by the Columbia River hydrosystem, and to do so while assuring the region an adequate, efficient, economical and reliable power supply. In developing the program, the Council was to recognize that “anadromous fish are of significant importance to the social and economic well-being of the Pacific Northwest and the Nation” and “dependent on suitable environmental conditions substantially obtainable from the management and operation of Federal Columbia River Power System and other power generating facilities on the Columbia River and its tributaries” and that “[b]ecause of the unique history, problems, and opportunities presented by the development and operation of hydroelectric facilities on the Columbia River and its tributaries, the program, to the greatest extent possible, shall be designed to deal with that river and its tributaries as a system.”

The 1980 Power Act could not have been better timed to become part of an experiment in the use of adaptive management. Adaptive management as a systematic concept was a child of the 1970s; 1978 was the publication year for the classic collection of essays on *Adaptive Environmental Assessment and Management* edited by Holling. If the essence of adaptive management is a method to help solve the conundrum of the need to take action on environmental problems in the face of uncertain science, the Power Act presented the Council with the need to plan for significant changes in the regional power system and river management to solve complex, uncertain, systemwide problems with respect to energy supply and salmon recovery. The disastrous regional investments in the WPPSS nuclear power plants (created as much as anything by a failure to understand and deal with the future as an uncertainty), and the first petitions for listing of Snake River salmon under the Endangered Species Act, indicated at best that we did not really know yet how to address these problems. And in Kai Lee, the Council soon had a person immersed in the bubbling ideas of adaptive management, with a clear understanding of the usefulness of the concept in addressing the tasks assigned to the Council and the inclination and energy to stump for the ideas.

It is no surprise then that the Council’s power plan and, especially, its fish and wildlife program became organized around the concept of adaptive management.

Elements of adaptive management, Council style

I constantly hear references to “adaptive management,” in this basin and others, but people often seem to have different ideas as to what that term means or what its elements are. So, I think it is important to be clear and explicit as to how I understand what are the elements of adaptive management -- or at least how I understand what the people at the Council thought were the elements when they first built adaptive management into the fish and wildlife program:

- Scientific and management skepticism, in the face of complexity and uncertainty. The problems faced by the Council -- especially rebuilding salmon runs in the Columbia -- were complex and systemic and fraught with scientific uncertainty, especially as to the direct and cumulative biological effects of any particular actions we might choose. This requires explicit recognition of the uncertainties involved and that we bring a significant amount of skepticism to our choices of actions.
- Yet we also have a directive and/or need for action, not just study. The political, social, legal and physical context demands action, not just study, to address the declines in salmon and the other fish and wildlife and power supply problems the region faces. The Council is told to use the “best available scientific knowledge” and get on with the job of protecting and enhancing fish and wildlife.
- Thus, implement management actions to address fish and wildlife problems as experiments. Implement management actions, as the context demands, based on the best information and judgments we have, but recognize the considerable scientific uncertainty underlying these actions by implementing them as experiments, with a specific experimental design, testable hypothesis, etc.
- Monitor and evaluate the effects of these management actions/experiments to see what works and what does not. This includes both the effects of specific actions and the cumulative effects on populations of a program’s worth of actions. Requires significant investments of time and money in monitoring and evaluation.
- Be willing to focus investments on those actions/experiments (or specific elements of the actions) that show promise. Be just as willing to pull investments from those actions that do not show promise.
- Develop computer models to model the fish and wildlife ecosystem of the Columbia so that a wide range of experiments and experimental designs and assumptions may be studied and their possible systemwide consequences explored. Adapt the models to be more useful as we learn about the system from the experiments.
- Decide on what experiments to implement in an inclusive process involving a range of key parties.

Adaptive management adapted to power planning

Kai Lee and the Council first focused on how to adapt the concept to power planning. Early on came Lee's 1982 article, *The Path Along the Ridge: Regional Planning in the Face of Uncertainty*, soon followed in the 1986 power plan with this understanding of what the Council was up to on the energy side of its responsibilities:

Perhaps the greatest departure from traditional planning in the Council's power plan was the explicit recognition that the future is uncertain and the development of risk management strategies to deal with that uncertainty. Past planning had taken off from a single forecast of the region's most likely energy demand. Resources that took ten or 15 years to build were planned and constructed to that best guess; if the future turned out differently, the region faced the problem of either having underbuilt or overbuilt resources. The cost of error on either side was enormous.

The Council explicitly recognized that the future could not be predicted accurately and that uncertainty was a fact of life in power planning. To accommodate this problem, the Council developed a plan to meet a broad range of potential growth in energy demand, setting a boundary of high and low load growth forecasts over the next 20 years. The Council also identified flexible resources such as conservation and options that shorten the lead time of generating resources. Resources were then selected to meet all potential growth needs within this range and ranked in an order designed to produce the lowest total cost resources across the range.

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Because the future is uncertain and conditions are likely to change, this plan is not a static document. Flexibility and risk management are underlying concepts throughout the Council's planning strategy. The Council developed this plan [with the specific goal of providing] . . . a flexible strategy so that the plan can be modified as conditions change and new information becomes available. . . .

The range forecast has two important functions. First, it is an explicit statement that the future is uncertain and that the Council will not base decisions on the traditional "most likely" forecast. Rather, the Council evaluates the consequences of specific actions across a wide range of possible futures. Second, the range forecast represents the Council's judgment on the potential futures that the region should plan and invest for.

The plan then emphasized close monitoring and evaluation of energy demand as the future unfolded, to determine as soon as possible what path within the range (or outside of it) the region was really on. Similarly, we needed a serious investment in monitoring and evaluating how well the resource strategies were working to address that demand, to be in the position to adapt the strategies and re-direct investments at as early a point as needed.

Subsequent versions of the power plan have stayed true to these organizing concepts.

Adaptive management in the Council's fish and wildlife program

The Council's fish and wildlife program under the Power Act presented a more obvious seedbed for the concept of adaptive management. An important building block was the article Lee wrote with Jody Lawrence titled "*Adaptive Management: Learning from the Columbia River Basin Fish and Wildlife Program*," 16 *Environmental Law* 431 (1986), that set out an experimental approach to rebuilding the salmon runs of the Columbia. And so the Council organized the 1987 fish and wildlife program around this understanding:

Adaptive Management Should Guide Action and Improve Knowledge.

The goal of doubling the runs can be achieved only if all parties in the Columbia River Basin learn from implementation of the program. This policy of learning by doing is called "adaptive management." Faced with substantial biological uncertainty, the parties involved should act affirmatively to protect and enhance fish and wildlife affected by hydropower development and operations. They must design projects carefully so that information can be collected to improve future management decisions. Projects should test quantitative hypotheses wherever possible, taking into account the need for control or comparison cases and for statistical validity.

Adaptive management is a scientific policy. It calls for a conscious effort to improve fish and wildlife management, using elements of the program as experiments that can provide useful information not otherwise available. Adaptive management also is a system policy, combining monitoring, evaluation and research throughout the Columbia River Basin so that the aggregated effects of this program can be detected, assessed and improved over time. The system monitoring and evaluation process described [elsewhere in the program] will aid adaptive management by providing feedback on program projects.

Adaptive management in the Council's fish and wildlife program (cont'd)

Subsequent versions of the fish and wildlife program carried similar language up until the 2000 amendments to the program, which began a comprehensive overhaul of the program framework. The omission of an explicit statement about adaptive management in the 2000 program revision probably reflected three factors:

(1) Kai Lee may have left the Council in the late 1980s, but influential staff members close to Lee and immersed in the same ideas, especially John Volkman and Chip McConnaha, remained and were important participants in shaping the program until the 2000 amendments. By the 2000 program amendments, however, Volkman was gone and McConnaha was on loan to the City of Portland and soon to leave the Council. The people remaining, while in many cases sympathetic to the concepts of adaptive management, did not organize their understanding of the program around this idea as a core concept. They are of a different generation.

(2) Adaptive management -- or at least the rhetoric of adaptive management -- has become so embedded in the program and the way people casually talk about the program and its projects and Columbia River salmon management in general that it no longer seemed necessary to mention the concept in the program itself. Despite the lack of an explicit reference to "adaptive management" in the 2000 program framework, the Council and others continue to refer to and understand adaptive management as a central program approach. Thus, for example, the recent report to the Council from the Council's Independent Scientific Advisory Board on the use of artificial production to try to rebuild naturally spawning runs (what is called "supplementation") assumes the Council's program still understands supplementation as an adaptive management experiment and criticizes the Council for allowing the supplementation initiatives on-the-ground to expand beyond what a proper adaptive management experiment would allow. ISAB, *A Review of Salmon and Steelhead Supplementation*, Document No. ISAB 2003-03 (June 4, 2003), <http://www.nwcouncil.org/library/isab/isab2003-3.htm>. In another example, the Council's 2003 program amendments that docked a specific plan for the mainstem Columbia and Snake rivers into the 2000 program framework call for a number of actions in the mainstem to be undertaken as experiments, with rigorous monitoring and evaluation to learn from what we do, even while never mentioning the term "adaptive management. Northwest Power Planning Council, *2003 Mainstem Amendments to the Columbia River Basin Fish and Wildlife Program*, Document No. 2003-04 (April 2003) (pre-publication copy).

(3) On the other hand, to keep repeating the explicit, specific statement of adaptive management as the key scientific/management tool of the program, intended to address the uncertainties inherent in the tasks we face by implementing management actions as experiments, could be a bit of an embarrassment, as this is not really a description of how and why we actually do things, or even why (I would argue) we continue to talk about adaptive management in the context of the program.

Specific examples or case studies in the use and implementation (or not) of adaptive management in the Council's power plan and fish and wildlife program

In my presentation at Aspen, I described the power planning demand forecasts and energy resource strategies in the 1991 power plan, and then about how the next few years unfolded into a world of independent power producers in an emerging wholesale power market that had nothing to do with the power plan. And I talked about adaptive management examples out of the fish and wildlife program and salmon recovery on the Columbia involving supplementation and what was known as the PATH process (Plan for Analyzing and Testing Hypotheses). I could have substituted any number of other examples out of the fish and wildlife program, such as involving water management and flow augmentation out of the storage reservoirs; experiments in dam passage technologies (such as surface bypass systems); the spill program for also passing juveniles past the dams; the “mainstem passage experimental approach” and “mainstem hypotheses” in the 1994 program; the idea of drawing down or breaching the run-of-the-river reservoirs in the lower Columbia and Snake rivers, including the 1992 drawdown test at Lower Granite; the provision in the just-adopted mainstem amendments calling for implementation of a particular summer operation at Hungry Horse and Libby dams as an experiment; the idea of implementing a change in flood control as an adaptive management experiment; etc.

[This part of the write-up needs to be fleshed out with the details or elements of some of these examples, but I do not have the time right now.]

All of these examples point to the same general conclusion: While adaptive management played some role in how we understood and embarked on these actions, how we really implemented and learned from them and what we did next did not much match the elements of adaptive management that I set out earlier.

Reasons for not implementing “adaptive management” in the manner that Holling or Walters or Lee conceived

I would say we are pretty good in the Columbia at adaptive management as those words could be commonly understood in a general sense, at learning by doing or, more precisely, by doing and then learning something and then adapting what we do because of what we learned (or at least think we learned). For example, how we manage the water in the U.S. storage reservoirs for salmon migration purposes is quite different now than it was in the late 1980s and much of the 1990s, primarily as a result of what we have been learning from these operations. Our legal tools (especially the Northwest Power Act) may look out-of-date, largely because the tools were created at moments when Congress and others had a specific understanding of the energy and salmon problems of the region and a specific understanding of the solutions to those problems, both of which are understood differently today. But the reality is that these tools leave us the flexibility for rather extensive efforts at creative adaptive management *in a practical sense*.

On the other hand, we do not implement “adaptive management” as specifically understood by those involved in developing the concept as a tool of scientific/management experimentation in the face of scientific uncertainty, as spelled out above or in the works of Holling, Walters, Gunderson, etc. The constant references to adaptive management in the Council’s program and in the Columbia in general helps make some of us more skeptical about what we do, and many of us more systematic in what we learn. That’s about it, at least as people typically understand the role of adaptive management. Some of the many reasons for this include:

- **Lack of uncertainty.** Central to the concept of adaptive management, it seems to me, is basic agreement that we are uncertain about the effects of the actions proposed for implementation. That is rare to absolutely missing, in my experience. There are a few of us who are healthy skeptics about what we really understand, but we are rare and that is more of a function of personality than scientific rigor. Political decisionmakers are usually quite certain as to the nature of the problems we face and the appropriate solutions -- as Congress exhibited in the Power Act, in the clear assumptions built into the act and expressed in the legislative history that we could solve the Columbia salmon problem through easily accommodated changes in the way we manage the storage reservoirs and investments in passage technologies. But, it seems to me that the management, scientific and technical people actually involved in the work are for the most part just as certain about what how they understand the relationship between actions and effects. The proponents of all the major systemic actions to benefit salmon in the Columbia, such as huge changes in flows, dam breaching, supplementation, etc., seem quite certain that we know enough to know that these actions will be beneficial, even as many of these actions seem, to me, fraught with uncertainty and the possibility of unintended consequences. And those opposed to the proposed actions are usually just as certain that the benefits will not be there, at least not compared to the costs. People recognize some uncertainty in all actions, or exploit what uncertainties there may be, but in reality, there is precious little skepticism or uncertainty in the attitudes of the people at work in the Columbia. So, trying to do things in an adaptive management can often be used as or perceived as just a reason for delaying the good action.

Reasons for not implementing “adaptive management” in the manner that Holling or Walters or Lee conceived (cont’d)

- We rarely have the ability or the inclination to implement actions as experiments, in any scientific or classic adaptive management sense. Part of the reason for that is political and social; it’s just not the way people really think and work when deciding on and implementing management actions to address problems. In part, the lag time is often too great. Also, when changes are made, the whole political, social and environmental context moves on, and it’s nearly impossible to imagine holding it still to be able to look at and possibly reverse the “experimental” action taken -- instead, we just evolve to another stage. But a bigger part of the reason relates to the fact that the basin is so large, the environmental variation from year to year so great, the ability to control or even understand sufficient the confounding variables or designate a control area to compare against the area of experiment so impossible, and the life cycle of the critter of most interest (Pacific salmon) so complex and subject to so many variables over that big geographic spread. This has made it impossible (so far) really to understand the effects of any particular management action or compare two different management actions against a common environmental template and understand which worked better.
- We monitor the heck out of our actions in the Columbia, but serious evaluation in a systematic way is lacking, for at least two reasons. The first is the reason noted above -- it is still proving very difficult to tease out the effects of any particular action or to tell what actions out of many are the sensitive ones given a particular population change we are seeing. The other is that real m&e at the level needed for classic adaptive management can be expensive and time consuming and difficult, and as in every other region, it is hard to allocate much out of tight budgets and limited human resources to the kind of m&e needed, and thus away from additional actions to benefit fish and wildlife.
- Pulling investments and cutting our losses on any particular strategy has proven very difficult to do. This is largely because we rarely have definitive answers that the things we do in order to benefit salmon are either clear failures or clear successes (or, if they are successes in some way, that is clear that the benefits are substantially greater than costs). So, the proponents of any particular strategy (usually quite certain of its benefits going in) rarely have reason to give up on it, and where success is not obvious, usually have an argument that this is because their preferred actions was not really implemented to the extent necessary (e.g., even as we dedicate more flows to salmon migration through slow pools, and it is not clear that the marginal benefits are there, the proponents seek far greater flows and so always argue that the region has not really tried their certain strategy). Another reason, of course is that investments create vested interests, jobs, budgets, constituents, etc., and so the human costs of terminating particular approaches can be hard to bear.
- Our use of computer models has largely deteriorated into the war of competing models. This is largely due to the fact that the scientific information we have in this world of complexity is susceptible to different interpretations and the scientists involved are quite certain of their differing interpretations of the information.

The real role of adaptive management in the Columbia -- as a tool of persuasion to allow for resistance to desired actions to stand aside

If we really don't do adaptive management as Kai Lee or the others would have us do it, why do we still talk of it as so central to our program and our actions? Part of the answer is that it just sounds so right -- everyone likes to think of themselves as learning by doing -- as that is the way humans really do work, I suggest -- and we especially like to think we do this in the learned, scientific, rigorous way the use of the term suggests (rather than in the more realistic haphazard way). But I think it is more than that. My interests are often in how and why people decide to act, or decide to allow an action to proceed without trying to stop it. And the concept of adaptive management has proven quite useful as a mediating force in a dialogue between those who want to implement an action and those who resist it out of fear of the action's consequences. Think of it this way:

- In what seems to me to be the typical scenario in the Columbia, on the one hand we have the “actors” or the proponents of a particular action. They see a problem (such as declining salmon runs), and they have information which suggests to them what is a major cause of the problem (e.g., reduced river flows at the right time) and what could or should be done to solve or help solve the problem (e.g., shift the flow management in the system to the desired time and amount). (I could use dozens of different examples of what different people in the region would see as the major cause or causes of the problem and the right action to solve it, such as shutting down harvest, or getting rid of predators, or removing dams, or shutting down or cranking up hatcheries, or it's just the ocean and we should just stop doing things, etc.) While these proponents sometimes recognize some of the uncertainties inherent in their preferred scenario, and in other times give at least lip service to that notion, in general the proponents are relatively certain about the expected benefits of the action they propose.
- On the other hand, you have the “resistors” -- those people in the same social setting who resist the implementation of the action proposed by the actors, almost always because of the consequences or perceived consequences of the proposed action (e.g., shifting river flows will cause an unacceptable loss of energy at a high replacement cost, a loss of water needed for irrigation, etc.). These people may dispute that the proposed action will have the benefits expected by the proponents (e.g., providing more flow augmentation from storage for fish won't help the fish), and/or may emphasize or exploit the uncertainties inherent in the proposal. But the real objection is not acting in the face of uncertainty or unknown benefits, their objection is the consequence for some other, entirely different use of the river. And often the resistors have the political power (or legal or economic, etc.) to keep whoever must decide whether the proposed action is implemented from making that decision to implement.
- Adaptive management then becomes a mediating tool in the dialogue between the actors and resistors, or between the actors and the decisionmakers in order to overcome the force of the resistors: “Let us just try it as an experiment.” “Just try it as an interim operation, and we'll evaluate what happens and see what the benefits really are.” That sort of argument. A comfort tool. It seems to help people be more willing to go along

with letting a proposed action take place -- under the guise of a scientific effort in adaptive management to investigate “uncertainties” that precious few are uncertain about. And the real effects are to greatly lessen the sense or the fear among the decisionmakers and often also the resisters that the action is irreversible if the consequences turn out truly to be as bad as the resisters believe, and to give the proponents a chance to show that the consequences will not be so great. I see it as a general example of the specific phenomenon that we see of farmers (and local governments) willing to lease water for in-stream flows, but strongly opposed to permanent transfers. (One end result, of course, as is always true of decisions wrung out between opposing forces through some sort of compromise dialogue, is that the action that gets implemented is a compromise action that in the end satisfies no one.)

- For this reason, while it remains important to monitor and evaluate the effects of the action on the thing intended to be acted upon once implemented, in reality the question of effect that it is far more important to track is the consequence of the action on the other uses protected and desired by the resisters -- another reason for our lack of serious investments in m&e in the classic sense.

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