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Science

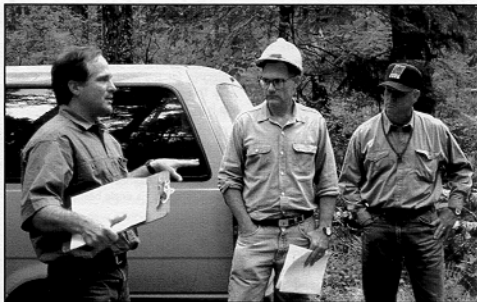
FINDINGS

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"Science affects the way we think together."

Lewis Thomas

CONFRONTING ILLUSIONS OF KNOWLEDGE: HOW SHOULD WE LEARN?



A Bernard Bormann (left) discusses proposed changes in on-the-ground management with John Johansen, (center) silviculturist for Hebo Ranger District, and Jim Furnish, Siuslaw National Forest Supervisor.

"The great obstacle to discovering the shape of the earth, the continents, and the ocean was not ignorance, but the illusion of knowledge."

Daniel J. Boorstin (1914-)

If you subscribe to the idea that scientists are both midwives and protectors of new knowledge, you are supporting a long-held system of societal beliefs, but you also are standing on ground that is starting to shift in America's forests. Adaptive management of forest resources, for all the conflict over its definition, is profoundly changing the quest for knowledge.

"The idea behind adaptive management is so ridiculously simple that it's hard to know why people can't relate to it," says Bernard Bormann, research plant physiologist with the PNW Research Station, and lead investigator on several studies relating to adaptive or sustainable ecosystem management.

"We define adaptation as responding positively to change and adaptive management as managing complex natural systems using an approach that builds on common sense and learning from experience."

Not much to argue with there, but he acknowledges that changing institutions and the way they function is about as easy as managing a forest ecosystem. Like jugglers, public land managers in the 1990s try to

IN SUMMARY

Adaptive management. What is it and how can it help us learn? Bernard Bormann, a PNW Research Station scientist, is leading a study on the subject. He defines the term this way: the management of complex natural systems by building on common sense and learning from experience. Experience can often mean change. The challenge of implementing adaptive management is how to adapt to constant change—in society and in the ecosystem.

The learning process is often not fast enough, however, to deal with quickly emerging land management issues. Bormann proposes that management produce knowledge alongside recreation, timber, and wildlife. This approach would accelerate learning and eliminate short-term reactive management. Reactive management, according to Bormann, has not proven to be successful or useful over the long term.

His research also shows that the range of alternatives available to land managers should be expanded. Having several options from which to choose will more likely meet the needs of societal values and ecological capacity. The current idea of so-called "best" management practices assumes that one prescription will work on every site. Adaptive management assumes that there is no best practice. "By first accepting that more than one pathway can achieve a given goal and then by comparing the chosen pathways, managers are seeking to learn, to expand their decision options over time," says Bormann. Citizens, managers, and scientists working together can help achieve sustainable ecosystems. Learning how to learn, says Bormann, is more valuable to various partners than only hearing what researchers have learned.

cope gracefully with more demands, from more directions, than one forest supervisor can reasonably be expected to endure.

"The goal of management on Federal lands is to create and maintain sustainable ecosystems that can support human needs indefinitely, and traditionally, scientists have been responsible for creating new formal knowledge about ecosystems," Bormann says. "But the amount and kinds of information required by today's greatly expanded scales of geography, time, and complexity mean we must increase the effectiveness of our learning and adapting."



KEY FINDINGS



- Concepts of adaptive management are confused. Existing definitions range from simply completing the planning-doing-monitoring-evaluating cycle, local public participation, and "fiddling" with new approaches in an unstructured way. The focus should be on accelerating learning, adapting through new partnerships, and changing management and research institutions.
- New citizen-manager-scientist partnerships are essential to learning to achieve sustainable ecosystems. Society no longer accepts expert-based learning and decisionmaking, or separating learning by scientists from doing by managers.
- Learning needs to be balanced with other resource objectives. By making learning central to the mission of management, research, regulatory agencies and the public, we can move away from short-term, reactive management.
- The purpose of adaptive management is to expand the range of alternatives available to managers and society in their efforts to meet the needs of both societal values and ecological capacity.

SPEEDING THE LEARNING PROCESS

We can no longer afford reactive learning, he asserts. In truth, little time may be left for society to learn the limits of the world ecosystem and how to live at a sustainable pace within those limits. Under the decades-old agency style, where external influences dominate decisions, collecting and using feedback are hindered because learning is not fast enough to deal with quickly changing issues.

Bormann proposes accelerating learning in several ways. "If we design management projects to produce knowledge as well as the other resources, such as timber, recreation, and wildlife, we can then compare a range of management approaches simultaneously," he says. "This allows us to create, over time, a wider range of acceptable approaches."

In practice, management is recognized as an experiment, a method to generate information and knowledge just as research itself

always has been. In a real sense, management has always been experimental in that all of the effects of any management action have never been known.

Are there risks inherent in speeding the learning process? Are we trying to skip crucial steps in our haste to come up with better answers?

"We do have to consider the virtues of speed versus effectiveness of learning," Bormann says. "We cannot abandon either standard scientific methods or scientific rigor just because we are experimenting simultaneously and working at larger scales. We also need to remember that what happens in the first 5 years after an experiment has been set up may be very different from what develops in the next 5 years."

How about requiring adaptive or experimental management to compare several alternative strategies, each of which can be reasonably expected to achieve the same

objective for the area being managed, he asks. This is surely another way to accelerate learning.

"The current idea of 'best' management practices presumes that one practice is most suited to every site; active adaptive management presumes that not enough is known to identify a single best practice."

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Think about it: your objective is to sustain ecosystems that support people, wildlife, plants, ecosystem processes and their interactions. How adequate is your knowledge and how strong your certainty that a single solution applies to individual sites?

"By first accepting that more than one pathway can achieve a given goal and then by comparing the chosen pathways, managers are seeking to learn, to expand their decision options over time," Bormann says. Furthermore, he adds, when individual pathways are connected to the societal values of specific groups, then multiple comparisons present a new opportunity to connect with various groups.

Developing multiple pathways becomes particularly important in long-term ecological research, in which today's learning

MANAGEMENT IMPLICATIONS

- The focus on learning needs to be expanded. People learn and adapt in many ways, and the process of learning and adapting also must evolve over time. Particularly important is adapting to changes in understanding of society's needs and wants, and of ecological capacity.
- Assume that various pathways can meet a given objective. Recognize that the pathways may represent conflicting world views. Designing and testing a wide range of pathways to achieve the current generation's objectives will provide future generations with better choices.
- Some important questions can only be addressed at large scales. Many environmental, social, and organizational dynamics cannot be measured at the stand scale. Assessments and forest plan revisions and amendments can add learning objectives and approaches to begin effective learning at this scale.

opens—or closes—the opportunities for future learners. For example, Bormann says, consider the value to future generations of

side-by-side prescriptions that are not only established but also fully documented today.

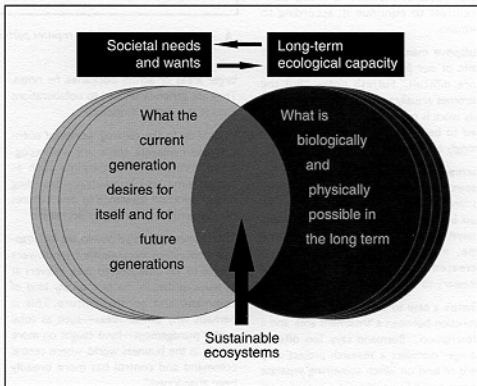
HOW ABOUT TRYING THESE CONCEPTS ON THE GROUND?

It's an enormous challenge to change the way we have traditionally done business," says Jim Furnish, supervisor of the Siuslaw National Forest. "We are creatures of habit. We used to figure out the best stuff to do and then go and do it. Any process of fundamental change like this makes day-to-day management more difficult."

Despite the difficulty, Bormann notes, Furnish and the Siuslaw management team have been open to the "risks" inherent in undertaking large-scale experiments that double as management, or vice versa. Their response to an approach by the Confederated Tribes of the Grande Ronde provides a sample case.

Taking on the goal of developing late-successional characteristics in parts of the forest, Furnish and the tribes have agreed that there is more than one way to achieve their objectives, and see the lasting value of exploring these pathways simultaneously.

"We're interested in trying to combine some Indian sentiments about relationship with the land and some of our own Federal bureaucratic things, to see if we can come up with a blend that achieves our goals on a selected watershed," he explains. The watershed selected for the management experiment contains tribal, Forest Service, and Bureau of Land Management lands.



A Balancing societal needs and ecological needs assist in creating sustainable ecosystems.

Furnish has taken on various adaptive management practices but remains reticent about the largest scales of experiment. "There is a high level of uncertainty, and I am concerned about generating outsized consequences," he says. Consequently, he

determined that the whole Siuslaw should not become a single adaptive management experiment, though he remains enthusiastic about the overall adaptive management framework and agrees that the ideas are elegantly simple.

WHAT STANDS IN THE WAY OF ADAPTIVE MANAGEMENT?

Simplicity notwithstanding, several barriers narrow the opening to widespread adoption of the adaptive management philosophy and its practices. The first is the quasicultural gap between managers and scientists. Managers are not trained in the rigorous design and method of scientific experimentation, and they are trained to set things in place across large landscapes according to requirements that most often come from above—sometimes far above, in Washington, D.C.

"They've become used to cookbook solutions such as standards and guidelines, and don't generally have the resources to pursue more complex approaches," Bormann says.

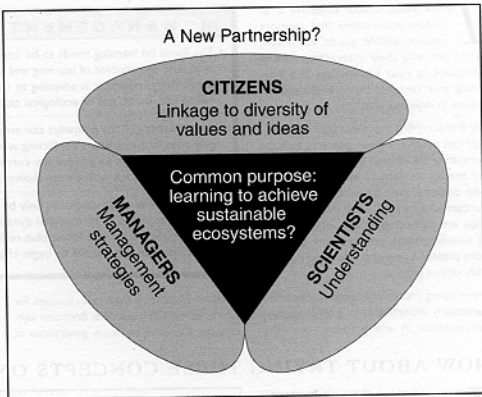
Comparing multiple pathways will require rearranging practices across the landscape and is therefore likely to generate slightly higher planning costs than a single pathway. But additional costs should be offset by lower costs of monitoring and greater incentives to continue it, according to Bormann.

"Adaptive management has indeed made some of our processes, such as planning, more difficult," Furnish notes. "But the outcomes actually make our lives easier. The daily work is not nearly so contentious as it used to be; there are far fewer people so strongly opposed to every move we make."

Bormann believes it is essential for researchers to recognize management as a dominant ecosystem process, one which must be taken into account when analyzing ecosystems on a large scale. At the same time, managers must recognize that increased information and analysis are necessary to manage large land bases.

"There's a case to be made for erasing the distinction between a 'treatment area' and a 'prescription,'" Bormann says. Too often a manager dismisses a "research project" as a piece of land on which something separate is going on, and to a scientist a "prescription" is something rather messy, rarely perceived as a series of interactions designed to achieve a goal.

Researchers most often work with a small piece of the system, in which they can hold everything constant except a single variable—hardly efficient at a landscape scale. They have not traditionally made significant efforts to synthesize their findings across



▲ *Adaptive management often requires partnering among citizens, managers, and scientists.*

larger areas or across disciplines, he notes. They are generally unused to collaborations outside the world of research.

In addition to the clashing worlds of scientists and managers, there are well-recognized institutional constraints such as budget, time, and bureaucracy, providing deeply ingrained resistance to new cultures of management, according to Bormann.

"The framework we've developed for adaptive ecosystem management empowers people to ask questions, to seek answers at all levels. It flies in the face of any kind of command and control culture. This is perhaps why similar ideas—such as total quality management—have caught on more rapidly in the business world, where central command and control has more broadly been abandoned."

Making management more experimental does not require scientists to become managers. One role of scientists is to review designs of proposed pathways. Another is to study the process of adaptive management as it is applied. And other new roles for researchers are likely to evolve. This approach is not an attempt to convert managers into researchers. Instead, scientific



▲ *New citizen-manager-scientist partnerships are essential to achieving sustainable ecosystems.*

learning tools such as replication, random allocation of treatments scattered across different areas with similar initial characteristics, and long-term monitoring, can be borrowed by managers to answer questions about multiple issues.

And not least among those issues are evolving and multiple societal viewpoints. Ah yes, "the public."

Science FINDINGS

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SCIENTIST PROFILE



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