

By proposing that "ecological integrity" be the lodestar for managing the national forests, a committee of scientists may have inflamed the conflicts over these lands

Call for 'Sustainability' in Forests Sparks a Fire

For more than 90 years, the national forests and grasslands that cover more than 8% of the United States have effectively been all things to all people. Loggers regarded them as reserves of low-cost timber, easily reached on government-built roads. Vacationers treated them as giant playgrounds, studded with picnic areas and campsites. Environmentalists wanted them to be nature reserves, minimally touched by human hands. Inevitably, the different visions collided, and the national forests and grasslands have become snarled in protest and seemingly endless litigation.

On 15 March, an independent scientific committee proposed what it hopes will become a more coherent vision for these public lands. "Ecological sustainability," the committee said, should become the principal goal in managing the national forests and grasslands—a suggestion that U.S. Agriculture Secretary Dan Glickman immediately endorsed as "a new planning framework for the management of our forests for the 21st century." According to Chris Wood, an assistant to chief U.S. Forester Mike Dombeck, the committee's proposals will help guide the Forest Service through a more immediate challenge: Within 5 years, the agency is legally required to produce updated management plans for more than three-quarters of its land.

In selecting ecological sustainability, the committee staked out new terrain in long-standing debates over the mission of the Forest Service—and in ecology itself. Since 1960, the agency has been guided by an explicit congressional mandate to manage the forests for "multiple use," serving industry, recreation, and conservation all at once. But it has been unable to satisfy its different constituencies. By recommending that ecological sustainability be given first priority, the scientific committee hopes to end the conflicts—and, its members say, keep the forests able to satisfy demands for timber, grazing, and

recreation as well.

Instead, they may have opened a new round of controversy—one that at times has engulfed the committee itself. Its chair briefly resigned, feeling that it had overstepped its mandate of giving scientific and technical advice, and its final report is accompanied by another member's expression of similar concerns. And on 15 March a second blue-ribbon panel, this one from the Society of American Foresters (SAF), the leading professional asso-

more than attempts to cloak a conservation agenda in scientific garb. The committee's report tries to offer more quantitative methods for measuring sustainability. But with even supporters of these concepts conceding that their use inevitably involves a host of value judgments, the committee's report and the reaction to it illustrate the complex, sometimes uncomfortable roles played by scientists in land-use and conservation decisions.

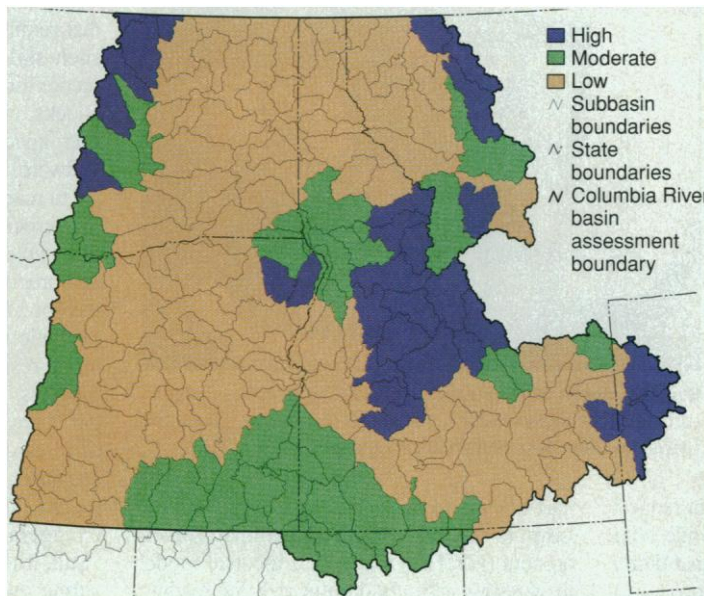
Congress had hoped to settle the debates

over the national forests more than 20 years ago with the National Forest Management Act (NFMA) of 1976, which required the Forest Service to develop detailed plans, using public participation, for managing the 155 national forests and 20 national grasslands. The plans, to be revised every 10 to 15 years, were supposed to set out how the agency would "coordinate" logging, recreation, and conservation. Unfortunately, the legislation was less than clear about how to make trade-offs when the various uses conflicted.

"You could view [NFMA] as a Rorschach," says Errol Meidinger, an environmental law professor at the State University of New York (SUNY), Buffalo. "Some people say it's about economic efficiency because there's language in it

about the efficient use of the nation's resources, whereas others see it as a promise to support timber-dependent communities, and there's language to support that, and still others see it as a mandate for protecting ecological integrity, and there are parts of NFMA that seem to me to very clearly say that as well."

Not only that, other environmental laws, such as the Endangered Species Act and the Clean Water Act, add further constraints and duties, many of them at odds with each other and with NFMA. With the Forest Service's mission increasingly confused, the door was opened for litigation—the agency estimates that 1000 appeals and 20 to 30 new lawsuits



Picture of health. The Interior Columbia Basin Ecosystem Management Project gauged "ecological integrity" for a vast tract of the Northwest, demonstrating an approach that might be applied to all national forests and grasslands.

ciation of silviculturists, issued a summary of its own report, arguing that selecting any one criterion—sustainability or anything else—as a single management goal will inevitably preclude some forest uses, and calling on Congress to make the crucial choices about how the lands should be managed.

If that weren't enough, the concept of "sustainability" itself is at the center of a simmering debate in ecology. Along with sister concepts like "integrity" and "health," sustainability has long been indicted by some ecologists for being vague and impossible to quantify. Other critics—many, but not all, outside the field—argue that these terms are little

are filed every year, from both environmental and timber interests.

Whipsawed between the combatants, the Forest Service became widely regarded as paralyzed. Its troubles caught the attention of Congress. In dozens of workshops and hearings in 1997, according to Mark Rey, a staffer on the Senate Environment and Public Works committee, "what we found was in one sense extraordinary: Nobody, in all the testimony and statements, told us they were satisfied with the status quo." That year, Senator Larry Craig (R-ID) introduced legislation that would have boosted the role of logging in forest planning and restricted the opportunities for appeals and lawsuits. Meanwhile, the Sierra Club campaigned to end logging altogether in national forests.

Worried about the Craig bill, the Clinton Administration set out to revise NFMA regulations to give greater weight to ecological protection. To help it formulate its position, the Administration convoked a scientific advisory panel in December 1997. Consisting of 13 forest, ecological, and social scientists, led by Norm K. Johnson, a forester at Oregon State University in Corvallis, its mission was to provide scientific and technical advice on new regulations. Beyond that, the committee was asked by Agriculture Undersecretary Jim Lyons "to develop a conceptual framework for land and resource planning that could last at least a generation" and "to dream a little."

From the start, the Committee of Scientists, as it became known, was racked by disputes over how much weight to give ecological goals. The overriding reality, according to committee member Barry Noon, an ecologist at Colorado State University in Fort Collins, is that "we are losing biological diversity and changing landscapes at an unprecedented rate, and there may be severe consequences to human welfare as a result." He proposed that the Forest Service choose as a lodestar the concept of sustainability—ecological, economic, and social. (Social sustainability, the committee report explains, involves "the capacity for future generations to maintain cultural patterns of life and adapt to evolving societal and ecological conditions.") All three are important, Noon says, but "ecological sustainability is primary—it takes precedence over the other two, and it basically sets the bounds for the other two."

Using a forest socially and economically depends on understanding its ecological limits, explains committee member Charles Wilkinson, an environmental law professor at the University of Colorado, Boulder. "You have to

be sure you've got that environmental baseline before you can assure that the other two uses are sustainable. When the forest crashes, you lose some of the economic benefits."

But committee member Roger Sedjo of Resources for the Future, a Washington-based public-policy institute, argues that NFMA regulations are supposed to be a framework for negotiations among different interests. "If you make ecological sustainability preeminent, then there are no trade-offs," says Sedjo, who outlines his concerns in an appendix to the report. "Anytime there's a conflict, we



Sustainable? Clear-cut in Tongass National Forest, Alaska.

know which side wins." Such a broad change should only come from Congress, he contends, not a panel of scientists.

"The hardest thing for this committee," Johnson says, "has been to decide where scientific and technical advice ends and policy-making begins." A dispute over where to draw this line in fact led to Johnson's resignation from the committee last December. "We were saying much more strongly that the Forest Service had to do certain things," Johnson says now. "I didn't want to write things in stone." He quickly rejoined, however, and by February the committee had hammered out a compromise. He now says that the report "provides a useful approach" to ecological sustainability—a two-pronged attack on the issue.

First, the committee suggests, the Forest Service should assess the "ecological integrity" of a planning area, looking at broad factors such as the proportion of old-growth forests, stream flows, wildfire frequency, and the amount and distribution of large dead trees. Because these factors vary over time, the committee argues that the benchmark for assessing integrity must be their "historic range of variability," with that range, in effect, being the conditions before European settlement. The more current conditions fall outside the historic range, the report argues, the lower the ecological integrity; the lower the ecological integrity, the greater the risk to ecological sustainability. Armed with this information, the Forest Service would then cre-

ate plans to safeguard ecological integrity; economic and social activity could take place within this constraint.

Second, the Forest Service should identify a set of "focal species": native species whose abundance and well-being would be indicators of the functioning of the larger ecological system. Forest planners would then seek "to provide ecological conditions needed to protect and, as necessary, restore the viability of focal species." Although "protect" and "restore" are strong standards, they would be a departure from current regulation, which requires the agency to "insure" the viability of all native populations.

Environmentalists are watching these recommendations closely. Early committee drafts raised "concerns," according to Mary Munson of Defenders of Wildlife, because they appeared to relax the standard of viability and let "politics play a little with the risk of extinction." But the final report somewhat allayed these fears. The change in standards, says Mike Francis of the Wilderness Society, "might not be as dramatic a difference as it appears," although he emphasizes that the group's lawyers are going through the report "with a fine-toothed comb."

But some critics charge that the choices made by the committee are rife with value judgments. Forest sociologist Robert Lee of the University of Washington, Seattle, argues that making ecological sustainability paramount amounts to making the "arrogant" claim that "the needs of the ecology determine the needs of the people—the needs of the people can be satisfied in many different ways." Others are troubled more specifically by the use of "ecological integrity," a term that has proven notoriously hard to define. "Ecological integrity—that term bothers me," says silviculturist Chad Oliver of the University of Washington, Seattle, a member of the SAF task force. "It doesn't have a specific enough meaning, so that everyone could agree that a certain piece of ground has it."

Noon concedes that "there's no single indicator that one can use to capture or assess the degree of integrity of an ecosystem." What's more, because ecosystems can have more than one state in which they seem to function stably, the choice of benchmarks depends on who is choosing them. For this reason, even supporters of the concept are often worried by it. "What needs to be measured and how is it best done? ... For what values of the measures will [ecological] integrity be deemed to have been lost? Who will make this decision and who will act on it?" James J. Kay, a systems ecologist at the University of Waterloo in Ontario, has asked.

In its report, the SAF task force provides its own answers to these questions, contradicting the vision laid out by the committee of

scientists. Convened in December 1996, the 10-member SAF task force was chosen from academia, government, and—unlike the Forest Service committee—industry. According to Don Floyd, the natural-resource policy specialist at SUNY Syracuse who heads the task force, individual parcels of land can be managed either as long-lasting tree farms for industry or as long-lasting wilderness preserves, but not both at once. “You can’t both clear-cut an area and keep it as wilderness,” he says. “It’s common sense.” Society, he explains, should decide which areas to devote to logging, and manage them as timber farms, and which to devote to nature preserves, and manage them to restore desired environmental qualities.

Although many SAF task force members favor giving greater overall weight to ecological factors, they argue that it’s not up to scientists to make that choice. Congress, the task force’s draft report concludes, should “act decisively,” revamp or scrap NFMA, and “establish clear priorities ... through new legislation.”

Members of the Forest Service commit-

tee say they are not the ones setting the priorities. The idea of parceling the land into separate timber and wilderness areas has “consistently and roundly been rejected by the American people,” says committee member Margaret Shannon, an environmental-policy analyst at Syracuse University’s Maxwell School of Citizenship and Public Affairs. And the Forest Service’s Wood rejects the notion that Congress needs to settle the debate over values. “Most folks have so much disposable income,” he says, “that they are looking at forests in terms of the positive outcomes of good stewardship, like biodiversity, like tourism, like existence values, like knowing that there’s a wilderness out there and I can go there if I want to even if I’m sitting in this cubicle in Washington, D.C.” Worrying about the role of value judgments in science is “interesting but academic,” because society has already made the relevant decisions on values—and chosen sustainability.

As long as Congress remains interested in forest management, this conclusion may be premature. Craig’s bill, which reaffirms

the importance of logging, will likely resurface in the next few weeks, says Senate staffer Rey. As for the committee report, he says, “we’re interested in seeing the work, because the system needs to be modernized.” But Rey says that his interest may be tempered if the report ventures from “scientific and technical advice” into policy-making. “If scientists want to offer me a policy recommendation, they may have experience that’s useful,” he says. “But I hope they don’t expect me to genuflect to them just because they’re a scientist.”

On 16 March, both committees testified to their contrasting views in the House. Providing Congress does not quickly pass Craig’s bill, the Forest Service will incorporate the committees’ suggestions into a new set of draft regulations. It hopes to issue final regulations early in 2000. Whether it can meet that ambitious schedule depends, in part, on whether the two reports help to settle, rather than further ignite, the controversy over the forests.

—CHARLES C. MANN AND MARK L. PLUMMER
Mann and Plummer are the authors of *Noah’s Choice*.

SCIENTIFIC PUBLICATIONS

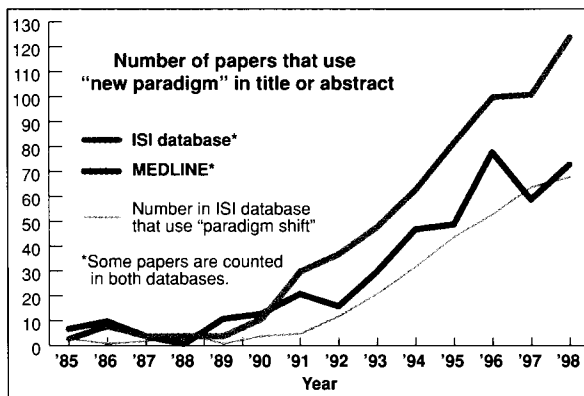
The March of Paradigms

The number of grants and papers invoking the term “new paradigm” has been growing by leaps and bounds, yet most seem to have little impact

Forget about those dour predictions of the end of science or those lamentations about the passing of a golden age of discovery. New findings are apparently overthrowing entire bodies of evidence at an unprecedented rate, replacing them with novel frameworks for understanding everything from particles to organisms to the universe itself. The evidence is right there in the scientific literature: Last year alone, 124 papers in leading journals invoked the term “new paradigm” in their titles or abstracts. And use of the expression has been growing steadily throughout the 1990s.

Many of these claims, however, may not be quite the kinds of developments science philosopher Thomas Kuhn had in mind when he made the term new paradigm famous with his paradigm-shifting 1962 book, *The Structure of Scientific Revolutions*. Kuhn described the process—which he called a paradigm shift—by which a prevailing set of theories and supporting evidence gives way to a new set: the replacement of natural order by natural selection, for example, or Newtonian mechanics by quantum theory. The recent spate of new paradigms has a different ring: integrating genomic function and nuclear architecture, osteopathy to manage back

pain, EBNA1 and E2 as origin-binding proteins, and links between spiritual care and the environment or between epidemiology and



the liberal arts. New paradigms are now so commonplace that one author felt obliged to note that “problem-based learning” was not a new paradigm.

To get a quantitative sense of the remarkable proliferation of new paradigms, *Science* asked the Institute for Scientific Information (ISI) in Philadelphia, Pennsylvania, to analyze the frequency with which the phrase crops up in papers published across a broad

range of scientific disciplines. Use of the term in abstracts and titles in the ISI database of leading journals increased steadily from 30 papers in 1991 to 124 in 1998. A search of MEDLINE—a database of biomedical publications maintained by the National Institutes of Health (NIH)—for the same period reveals a similar trend: “New paradigm” usage increased at a rate of 26% a year, from 21 papers to 73. And probes of the NIH and National Science Foundation

databases of new grants turned up evidence of the same sharp increases (see graphs)—which should keep new paradigms flowing into the literature for years to come.

If these papers point to new scientific vistas, they should be highly visible in the scientific literature. To find out, ISI’s David Pendlebury analyzed how many times other publications cited each of the 292 papers published between 1981 and 1999 that used new paradigm in their titles. Surprisingly, only 32 received 10 or more cites—including citations in separate publications by the same authors. “These data show that 90% of new paradigm papers affected the research world very little indeed,” Pendlebury says. Indeed, they were cited less often, on average, than papers that avoided the term. Only 22 of the most cited papers, notes Pendlebury, exceeded the average

SOURCE: INSTITUTE FOR SCIENTIFIC INFORMATION/NATIONAL LIBRARY OF MEDICINE