PNW
Pacific Northwest
Research Station

Science
FINDINGS

issue seven / september 1998

"Science affects the way we think together."
Lewis Thomas

ADAPTIVE MANAGEMENT: GOOD BUSINESS OR GOOD BUZZWORDS?

Limber Jim ridge was a high-priority fuel-reduction project, carrying up to 80 tons of fuel per acre before treatment.

"Where there is much desire to learn, there of necessity will be much arguing, much writing, many opinions; for opinion in good men is but knowledge in the making."
John Milton 1608-1674

It looks good on paper; it's hard to imagine why adaptive management hasn't raged through our National Forests like wildfires in August. What's not to like about combining the rigorous standards of science and the practical requirements of management in order to learn by doing?

Outside and on the ground, however, adaptive management has multiple definitions, a raft of day-to-day problems in implementation, and a central, inescapable conflict: a clash of cultures.

"There is a natural resistance to blending science and management from both sides," says Jim McIver, research coordinator with the Blue Mountains Natural Resources Institute (BMNRI; PNW Research Station). "Managers are not trained to apply their treatments in the context of control and replication, and scientists don't like losing control over their experiments, in a setting where treatments are implemented imprecisely."

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IN SUMMARY

Adaptive management is a fusion of science and management used to improve and care for natural resources. This issue of "Science Findings" centers on how this type of management is used to tame wildfire incidents in northeastern Oregon's Blue Mountain range.

The following article considers how adaptive management is being used by the La Grande, Oregon-based Blue Mountains Natural Resources Institute (BMNRI). The institute, with headquarters in the La Grande Ranger District, Wallowa-Whitman National Forest, uses adaptive management as part of the Limber Jim project to assess several logging systems and their impact on wildlife. It also demonstrates environmentally sensitive logging and fuel-reduction methods.

The undertaking is noteworthy because the BMNRI, founded in 1990, is itself a fusion of research and management, whose partners include Forest Service management and Forest Service research along with university, private sector interests, and environmental groups. The institute incompasses a 14-county area of northeastern Oregon and southeastern Washington and has more than 80 partners who work to enhance the long-term economic and social benefits derived from natural resources in an ecologically sound and sustainable manner.

"Managers are typically asked to apply science on the ground when the data have been collected independently of them, and understandably they resist this," McIver adds. Scientists shudder at the increase in variability and the scale of problems over the large landscapes to which managers are accustomed.

"Nonetheless, I believe it is essential to move steadily towards adaptive management now more than ever," he says. "With the types of questions society is expecting us to answer, over larger scales, it is crucial that we gather information from actual management settings and learn by testing the science just as fast as we can."

There can be benefits both ways, McIver claims. Research cannot afford the landscape-scale experiments, whereas management can, particularly if a timber sale is involved. Management, on the other hand, is not set up to do the rigorous monitoring needed to track the effects of an experiment, whereas scientists are fully trained to do so.

KEY FINDINGS

- **Fuel reduction can be economically feasible by using mechanical systems, but stand conditions, percentage of saw log material, and market conditions for chips are critical factors in designing viable fuel-reduction timber sales.**
- **The single-grip harvester is an ideal felling tool in fuel-reduction projects; for log retrieval, skyline yarding and forwarders offer similar levels of efficiency but differing levels of soil disturbance and revenue, depending on terrain.**
- **Fuel-reduction objectives and habitat-protection objectives are often in conflict, but careful design of silvicultural prescriptions offers various compromise solutions.**
- **Conscientious adaptive management provides rapid learning opportunities for scientists, managers, and the public.**

FUEL-BURDENED FORESTS

Consider, then, the possibilities for dealing with a real, on-the-ground management issue of the magnitude of fuel loading (read wildfire risk) in east-side forests. How can the benefits of research best be combined with the urgent needs of management to confront this massive challenge?

The scale of the fuel problem in east-side forests is hard to comprehend. For nearly a century, we have successfully suppressed fires, especially the lower intensity kind that feed off the debris on the forest floor. During the same period, the forests have tended towards fir rather than pine. This has all set the stage for much more extensive and hotter fires.

"Historically, the Blue Mountains experienced many more lower intensity, surface fires. These less extensive and less intense fires tend to preserve large forest structure," McIver explains.

What's more, suppression has happened over vast landscapes, so that the continuity of fuel for a fire moving across the landscape at any speed is virtually uninterrupted. In the La Grande Ranger District alone, McIver has been told that high fuel loads currently exist on about 60,000 of the 450,000 district acres.

Among the many areas of forest in this condition is the ridgeline above the La Grande municipal watershed, a string of mixed-conifer/lodgepole pine stands. There in 1996, the La Grande Ranger District identified the Limber Jim ridge as a high-priority fuel-reduction project, with up to 80 tons per acre of potential fuel.

Managers worked with researchers to design, implement, and monitor a plan to reduce fuel. Their objectives were to measure fuel reduction, soil disturbance, and operational economics in three replicate stands, as well as to monitor potential effects on wildlife.

"The idea for fuel reduction was to create a shaded fuel break centered on the logging road that split two watersheds," McIver explains. "This break—about 7 miles long and 1,000 feet on either side of the road—could then serve as an anchor point to station fire fighters in the event of a wildfire in the area." Because of wildlife considerations, the final result was a fuel-reduction corridor, rather than an actual fuel break.

McIver recalls many challenges: reduce fuel to about half of observed loadings by removing both standing and down dead wood; remove some of the smaller diameter green trees to create growing space for the residual stand; accomplish fuel reduction economically and without damaging

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Purpose of PNW Science Findings

To provide scientific information to people who make and influence decisions about managing land.

PNW Science Findings is published monthly by:

Pacific Northwest Research Station
USDA Forest Service
P.O. Box 3890
Portland, Oregon 97208
(503) 808-2135

Cindy Miner, Communications Director
clminer/r6pnw@fs.fed.us

USDA United States Department of Agriculture

Forest Service

the residual soils or stand; and demonstrate sensitive and feasible logging practices for fuel reduction on a larger scale.

"This was an adaptive management project, built on findings from previous fuel-reduction research, and designed to provide information for the next set of treatments we might prescribe. We wanted to do comparative management by using several types of machinery and prescription, thereby learning faster and in parallel."

MANAGEMENT IMPLICATIONS

- Integrating research across economic and environmental variables allows managers to better assess the tradeoffs among often conflicting viewpoints.
- No-treatment areas and comparative treatments are crucial to enhancing the adaptive management process, and to transferring usable management information into practice more rapidly.
- Fuel-reduction objectives and habitat-protection objectives need to be considered across whole landscapes, with varied prescriptions and attention to adequately sized undisturbed areas.
- Conscientious adaptive management requires a tolerance for uncertainty, a flexibility in approach, and a commitment to both teaching the public and learning on the fly.

COMBINING ECOLOGY WITH ECONOMICS

The Deerhorn Fuel Reduction Project (located north of Ukiah, OR) had demonstrated that the skyline retrieval system of logging was ideal for protecting sensitive soils, but it was expensive compared to more commonly used ground-based systems. Thus the replicated design for Limber Jim was to compare skyline retrieval of the low-value material with an articulated rubber-tired forwarder, both using a single-grip harvester, already known to be suited to small-diameter materials. Each cutting unit was paired so that logs on one side were retrieved by skyline yarding, and on the other side by rubber-tired forwarding.

"We had to create a prescription that balanced needs for wildlife and for fuel reduction, while providing enough saw logs and pulp material to make the project work economically as a timber sale," McIver says. Furthermore, stands differed substantially in tree types and structure, so prescriptions had to be crafted individually to meet fuel-reduction objectives. The general guideline required removing only standing or down dead material smaller than 15 inches in diameter and leaving at least 40 logs per acre.

The wildlife element of the Limber Jim project focused on the American pine marten, which is a management indicator species for the Forest Service. "We wanted to determine the direct effects of fuels reduction on the American marten," says Evelyn Bull, research wildlife biologist for the PNW Research Station in La Grande, who led the wildlife part of the project. "But their home range is around 5,000 acres, far larger than the Limber Jim project, so we decided instead to look at the marten's prey base and see how it was affected."

Previous food habit studies revealed that the mountain vole, the red-backed vole, squirrels, and snowshoe hares were small mammals of choice for the marten and their relative abundance should be monitored before and after treatments. Subnivean (under snow) habitat is crucial for the marten's winter hunting and shelter, so the actual structure offered by logs is significant.

"Suitable structure occurs where logs are piled on top of each other, 'jackstraw' fashion," says Bull, "but not where single logs are scattered across the landscape. We therefore designed three kinds of silvicultural treatment for the Limber Jim area: no treatment, some leaving evenly scattered logs, and some areas where islands of forest were left intact."

Bull notes that this was a pilot study on a small scale because research funding was limited. Ideally, the next project will offer more and larger stands.

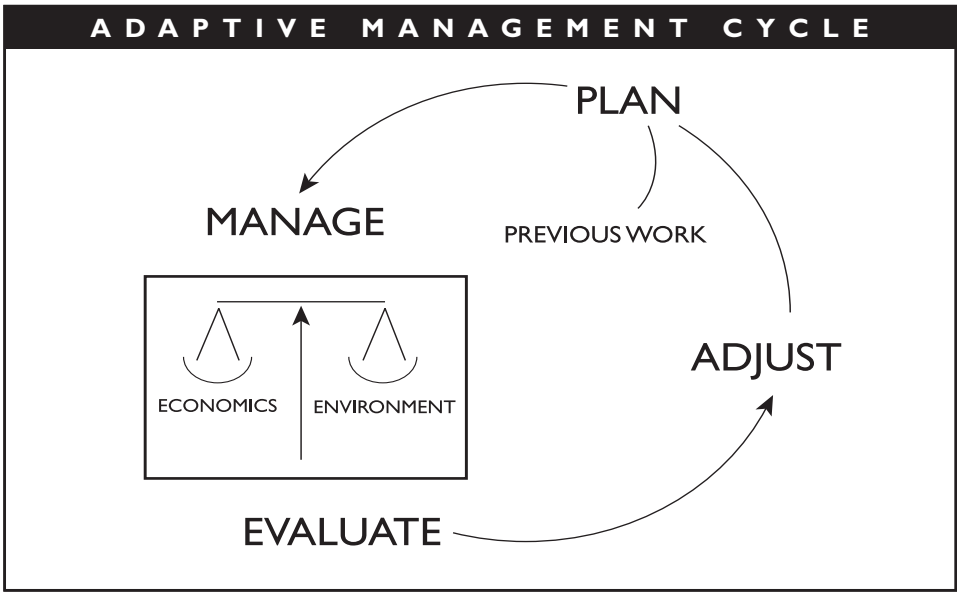
After treatments, the Limber Jim area fuels were reduced by as much as 50 percent, with acceptable levels of soil disturbance, and a small profit margin for the operator. About 80 percent of the total material removed was dead.

UNDERSTANDING THE SOCIAL ELEMENT

The project was designed to provide information to managers about various logging systems and to study effects on wildlife. But McIver points out that it was equally important to demonstrate environmentally sensitive logging to the concerned public. Several field tours were conducted during research and operations, and there was a conscious attempt to integrate the public's probing questions into research design.

"If the public is not confident of both the need for fuel reduction on Federal lands or the means to accomplish it, land managers will find it much more difficult to explain and carry out their plans," he says. A survey commissioned by the BMNRI, and conducted by Bruce Shindler of Oregon State University, revealed strong support for fuel-reduction efforts, both by controlled burning and mechanical thinning and removal. McIver noted that citizens had a slight preference for mechanical methods, as these offer an end product.

The profit margins in these stands with such heavy fuel loadings, however, continue to be slim. Although only 400 acres, Limber Jim took 5 months to harvest, by using one contractor and all his resources. McIver believes the time required to treat stands with such high fuel loadings precludes the use of mechanical thinning and removal on every acre of land. "It seems, therefore, that we must apply these methods strategically, in order to break fuel continuity at the landscape level."



The adaptive management cycle uses an integrated management experiment to develop new information. The next management experiment then adapts and feeds from prior experiments.

WHAT PRICE PROFITS?

Limber Jim further clarified some of the constraints and parameters of fuel reduction in the intermountain West. Clearly, significant fuel reduction can be accomplished by using a single grip harvester, which has already proven its ability to handle small-diameter material. Whether any kind of fuel reduction is economically feasible depends heavily on stand conditions, percentage of saw log material, and market conditions for chips. (See May 1998 *Science Findings*.)

Fuel was reduced by between 50 and 80 percent across the Limber Jim landscape, comfortably meeting the fuel-reduction objective. Although some areas were left untouched with heavy fuel loading, McIver notes that in the harvested stands, the crown fire potential was greatly reduced.

There was little statistical difference in the tonnage of fuel removed by either yarding system. Soil disturbance for the two systems was statistically identical and well within Federal limits for the region, although the pattern was different, with the forwarder causing more compaction and the skyline yarder causing more displacement. Revenue from retrieved material in skyline units was slightly higher than in forwarder units, possibly because more saw logs were retrieved. But cost of operation was notably higher in the skyline units, leaving a net revenue loss of $10 per ton in the skyline units, and a gain of $19 per ton in the forwarder units. Overall, the entire project was a narrow economic success, according to McIver, at just over $10 per ton profit.

"Limber Jim was small sale, much of the dead material was not marketable, and the chip market was down at the time, so these were rather arduous conditions," McIver says. Nonetheless, the contractor turned a small profit. The economics were sound, the soil was protected, and some structure was retained. "By measuring both economic and environmental effects at the same time and in the same place, we could provide the kind of information that managers need to assess tradeoffs."

When snow covers piles of logs, a complex array of snow-free spaces and runways provides important habitat for protection and foraging by American martens (shown above) and the small mammals on which they prey.

REDUCED FUELS, REDUCED HABITAT?

The risks of extrapolating economic data from a small area like Limber Jim are even greater for wildlife data, when home ranges are so large and single-year conditions can skew results. As McIver notes, we had better know the wildlife implications of fuel reduction on a landscape scale before we start covering much larger areas than Limber Jim with similar treatments.

Results at Limber Jim show a general decline after harvest in numbers of red-backed voles, snowshoe hares, and red squirrels.

Bull is quite emphatic about the tradeoffs involved. "In the mixed-conifer stands, there was too much downed wood removed to meet wildlife sustainability objectives. The wildlife absolutely needs the downed wood, and many species, like the marten, need it in layers, not in the form of single scattered logs," she says. "We would lose wildlife habitat if we simply replicated from Limber Jim over extensive areas." It is well known that logs in any form are extremely important to many creatures, including bears, owls, lynx, grouse, pileated woodpeckers, and many more, vertebrate and invertebrate species.

Bull sees the island treatments as the best way to maintain the subnivean structures martens and other wildlife need in the winter, but notes that the islands need to be identified and marked ahead of harvesting, requiring more labor than the scattered log prescription.

In future adaptive management projects, Bull would like to see larger treatment areas, larger stands, a larger percentage of the forest untreated, and different island sizes, up to at least 5 acres. "I believe we can reduce fuels and still retain wildlife habitat, but we can't do both at either extreme and still meet the combined objectives," she says. "The best compromise will be to spread different silvicultural treatments broadly across the landscape." And adaptive management offers the opportunity to compare and learn quickly.

ROLES OF COMPARISON AND UNCERTAINTY

"Even while they teach, men learn."

Seneca 4 B.C.- 65 A.D.

Clearly, significant questions remain in the wildlife response arena. The questions represent a central element of all adaptive management: the need to proceed although still uncertain.

"An important characteristic of adaptive management philosophy is the recognition of uncertainty in the management process," McIver says. "A good way to deal with uncertainty is to compare management treatments undertaken in an operational context. Whether this is done with replication or control at any particular point is less important than is the process of comparison itself."

To McIver, Limber Jim represents one "turn of the wheel" in the adaptive management process: information from a previous project was used to plan it, and the project offered comparative results that provided information in a timely manner to managers who could then make better decisions about future projects. These will in their turn be designed to enhance learning.

With the Limber Jim work, McIver would like silviculture to return finally to its rightful place as a tool of management, particularly the adaptive kind. "Silviculture to some is associated solely with timber harvest, whereas in fact it is simply a tool of vegetation management. It can be employed to address fuel, fire, wildlife, timber, or habitat objectives." Applied silvicultural research is thus bound to be a common tool of adaptive management in forests of the West.

Limber Jim has indeed turned the wheel in the ongoing adaptive management challenges: replicated scientific design knowledge gaps identified and prioritized by managers and the public, and quicker turnaround of more reliable information. Perhaps true "learning by doing" will yet spread through Federal forests like a well-fueled fire.

WRITER'S PROFILE

Sally Duncan is a science communications planner and writer specializing in forest resource issues. She lives in Corvallis, Oregon.

FOR FURTHER READING

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Pacific Northwest Research Station
333 S.W. First Avenue
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SCIENTIST PROFILES

JIM MCIVER is research coordinator for the BMNRI. Research at the institute is aimed at understanding the economic and environmental effects of current management practices in rangeland and forested ecosystems. An ecologist by training, McIver is dedicated to promoting the concept of adaptive management. He is currently involved in several operational studies that blend science and management in an effort to improve our care of the land.

E-mail: jmciver/r6pnw_lagrande@fs.fed.us
Phone: (541) 962-6528

EVELYN L. BULL is a research wildlife biologist with the PNW Research Station. She has conducted research for 25 years on sensitive wildlife species and unique or critical wildlife habitats, particularly old-growth forests and dead trees. Current research includes the ecology of American martens, diet and habitat use of black bears, squirrel use of mistletoe brooms, overwintering habitat of Columbia spotted frogs, and artificial nest sites for Vaux's swifts.

E-mail: ebull/r6pnw_lagrande@fs.fed.us
Phone: (541) 962-6547

McIver and Bull can be contacted by mail at:
La Grande Forestry and Range Sciences Laboratory
USDA Forest Service
1401 Gekeler Lane
La Grande, Oregon 97850-3368

Other scientists key to the Limber Jim project include:
Paul Adams, Oregon State University
Jim Doyal, Oregon State University
Erik Drews, University of California, Davis
Bruce Hartsough, University of California, Davis
Loren Kellogg, Oregon State University
Bob McGaughey, PNW Research Station (Seattle)
Chris Niwa, PNW Research Station (Corvallis)
Roger Ottmar, PNW Research Station (Seattle)
Mark Taratoot, Oregon State University
Torolf Torgersen, PNW Research Station (La Grande)
Bob Vihnanek, PNW Research Station (Seattle)
Andy Youngblood, PNW Research Station (La Grande)

Key managers include:
Arlene Blumton, La Grande District, Wallowa-Whitman NF
Gabbi Bosch, La Grande District, Wallowa-Whitman NF
Tom Burry, La Grande District, Wallowa-Whitman NF
Steve Howes, Wallowa-Whitman National Forest
Tracy Kissire, La Grande District, Wallowa-Whitman NF
Annette Pepin, La Grande District, Wallowa-Whitman NF
Bob Rainville, La Grande District, Wallowa-Whitman NF
John Szymoniak, Wallowa-Whitman National Forest
Tom Wordell, Umatilla National Forest

Key operators include:
Andy Munsey, Masonite Corp., Pilot Rock, OR
Bill Corley, Pendleton, OR
Pete Bailey, Springfield, OR

Funding for the Limber Jim project was provided by the Productivity Program of the PNW Research Station (Steve Reutebuch), the fuels program of USDA Forest Service Pacific Northwest Region, the La Grande Ranger District (Wallowa-Whitman National Forest), the Wallowa-Whitman National Forest, the Blue Mountains Natural Resources Institute, the National Audubon Society, and the National Wildlife Federation.

Limber Jim was conceived by the Ecosystem Management Council, a consortium of stakeholders, Forest Service Ranger Districts, and the Blue Mountains Natural Resources Institute, centered around La Grande, Oregon, and dedicated to active ecosystem management.