

Science

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"Science affects the way we think together."

Lewis Thomas

AN EVOLVING PROCESS: PROTECTING SPOTTED OWL HABITAT THROUGH LANDSCAPE MANAGEMENT



Tom Iraci

Fire, such as the 2003 B&B Fire on the Deschutes National Forest shown above, has replaced logging as the biggest threat to spotted owl habitat east of the Cascades.

The more intensely we have protected the forest from fire, insects, and disease, the worse many of our problems have become.

—James Agee

The Northwest Forest Plan was adopted in 1994 to break the legal stalemate over logging versus wildlife habitat protection. Years of controversy had culminated in a court-ordered injunction against federal timber harvests in the region. The plan guides management on federal land within the range of the northern spotted owl in Washington, Oregon, and northern California. The northern spotted owl is a threatened species protected by the

Endangered Species Act, and its preferred habitat is old forests. The plan sought to preserve spotted owl habitat by creating a network of late-successional reserves. These reserves are set within a matrix of lands assigned various levels of active management.

After 16 years of conservation efforts through implementation of the Northwest Forest Plan, spotted owl populations continue to decline. Loss of habitat continues to be an issue—but instead of losing it to logging, in dry forests, a significant amount of habitat is being lost to wildfire. Since the plan's inception, some forest managers have questioned if the reserve strategy can address the complex problem of managing dry mixed-conifer forests with high fire danger while maintaining viable

IN SUMMARY

A network of late-successional forest reserves is central to the Northwest Forest Plan, the guiding vision for managing federal forests in Washington, Oregon, and northern California within the range of the northern spotted owl. These reserves were created to maintain older forest structure as habitat for the northern spotted owl, marbled murrelet, and other associated species. Since the plan's adoption in 1994, however, scientific thinking has evolved to question the ecological suitability of reserves as the primary recovery strategy for the northern spotted owl in the fire-prone forests of eastern Washington and Oregon.

After a century of fire suppression, forest conditions have emerged that have heightened the threat of insect outbreaks and larger, more intense wildfires than occurred historically. Research by John Lehmkuhl, Paul Hessburg, and colleagues describes how the northern spotted owl habitat is threatened under current conditions of dry forests east of the Cascades. They suggest the owl would be better served by replacing the reserve system on the east side with a whole-landscape-management approach designed to maintain and create habitats in dynamic landscapes, restore natural fire ecology, and maintain populations of species associated with older forests. The researchers are working with land managers and other scientists to address on-the-ground issues of managing for ecological objectives such as fuel reduction and spotted owl habitat.

populations of northern spotted owls. A century of wildfire suppression, selectively harvesting the largest trees, and the lack of widespread treatments to mimic fire have placed many forests in eastern Washington and Oregon in the highest risk category for uncharacteristically intense wildfire.

John Lehmkuhl, a research wildlife biologist, and Paul Hessburg, a research ecologist, both with the Pacific Northwest Research Station in Wenatchee, Washington, responded to managers questions about reserve strategies with a group of studies that led to a unique, whole-landscape conservation model. "Within the Northwest Forest Plan, there was recognition of the reserve strategy's limitations on the east side of the Cascades because we have such a dynamic fire regime over here," says Lehmkuhl.

The conventional reserve network design, when applied to dynamic landscapes, takes disturbance into account by making many big reserves so that if a few are lost over time, sufficient habitat will still be retained. But the thinking about landscape management and reserves has evolved in the last 16 years.

Lehmkuhl points out that 75 percent of federal forest in the eastern Cascades landscape is already in reserves or wilderness. "You might as well just manage the whole landscape with owls in mind," he says. "It doesn't make sense to have spotted owls and their habitat in the matrix areas within the Northwest Forest Plan where active forest management is allowed. The owls could be eliminated through permitted management or lost from unplanned disturbances. It's better to have a strong vision



KEY FINDINGS



- Mixed-conifer forest landscapes are dynamic systems where fire, insects, and other disturbances play key roles in shaping patchy and shifting landscape mosaics. Fire suppression and other management activities over the 20th century have created unstable and unpredictable forest conditions.
- A whole-landscape-management approach would help maintain habitats in dynamic landscapes; restore ponderosa pine and mixed-conifer forests; restore natural fire ecology; and maintain populations of species associated with old forests, such as the threatened northern spotted owl, especially given projected climate change scenarios.
- Over the last century, the acreage of 100- to 150-year-old forests in eastern Washington and Oregon has increased, but the condition of these older forests is unsustainable under current fire regimes. Research shows where late-successional and old forest historically persisted and where current old forest can persist if managed in a sustainable landscape context.

of what the entire landscape can support," says Lehmkuhl.

"Reserves may offer part of a strategy in the wet Coast Range and western Cascades forests, and their counterparts on the east side, but they just don't make as much sense in the dry forests of the east side," Hessburg says. "Setting up large areas as hands off to management and saying, this is going to work for 50 years in the face of wildfires and ongoing insect outbreaks—how do you make that work? The processes that can destroy the reserves are contagious. Habitat conditions that are vulnerable to these disturbances are largely contiguous under current conditions." The question becomes, says Hessburg, "How do you maintain landscape patchworks of down

logs, snags, forest structure, and composition that are highly useful to spotted owls, while retaining a more natural resistance to large, landscape-altering wildfires?"

To answer this, Lehmkuhl and Hessburg started studying current landscape patterns and reconstructing historical patterns of the same landscapes. "We found that landscapes prior to the fire-suppression era had fairly predictable characteristics," Hessburg explains. "For example, they were dominated by a more fire-tolerant patch structure and composition, and the more fire-vulnerable patches were disconnected spatially from other fire-vulnerable patches. So long fetches of running crown fires were relatively uncommon in the historical landscape where the

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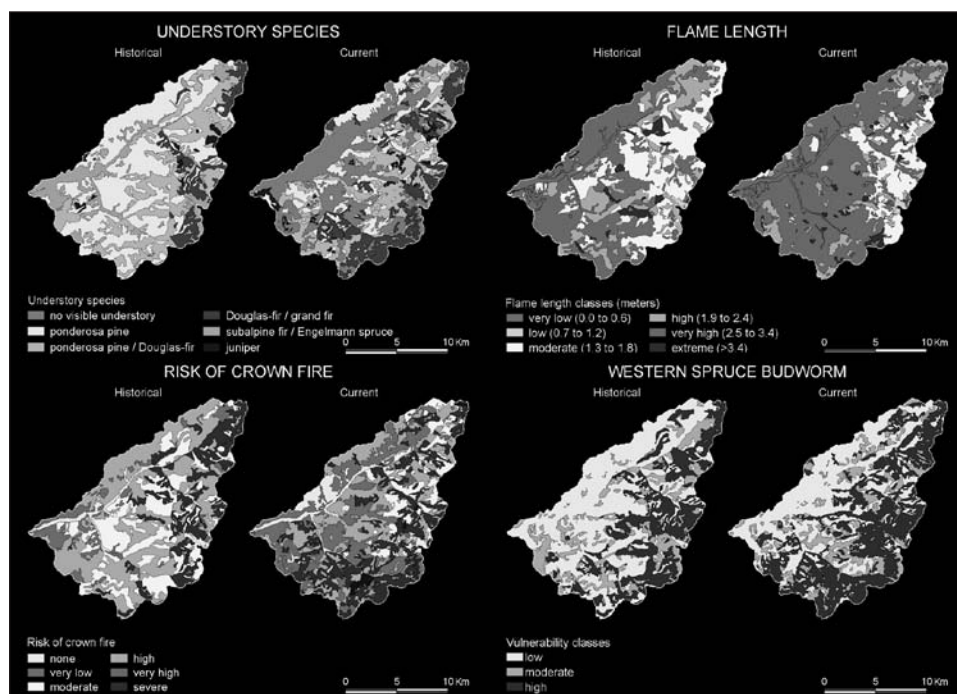
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Comparisons of presettlement era (historical) and current forest vegetation, fire, and insect vulnerability in a watershed in the Crooked River subbasin, Oregon.

spotted owls apparently evolved. Instead, stand-replacement patches were less common and more variable in size, most being less than 1,000 acres,” Hessburg says.

“More importantly, when we compared historical landscapes to our existing landscapes, we saw that our past management had inadvertently set up a near perfect-storm scenario for wildfires, bark beetles, defoliators, dwarf mistletoes, and root diseases. We are learning that we need to evaluate large landscapes by considering a variety of features and processes, asking how do they currently function and how would they naturally function as landscapes in this or any other future climate? Management can then adjust patterns of forest structure, fuels, and composition accordingly to enhance species and process functionality of entire landscapes,” says Hessburg.

“The trouble with large unmanaged reserves on the east side today,” Hessburg continues, “is that they’re wildfire habitats with a bull’s-eye on them. A 10,000-acre reserve has so much edge that fires migrating from many directions can find them. If you want to keep stand-replacing wildfires from spreading over great distances, you have to alter the mosaic of surface and canopy fuels to create a resistance to fire spread and intensification.”

Hessburg and Lehmkuhl think that this troubling situation can be addressed by restoring some of the spatial isolation of late-successional forest patches that once characterized the native landscape. This can be done by treating the surface and ladder fuels in between untreated late-successional patches. This reduces the likelihood that fires will spread across the landscape. They theorize that based on reconstructions of historical landscape dynamics, certain landscape patterns of forest structure and composition lessen the ability of fires and insects to move from one stand to another, whereas others actually facilitate their spread.

The scientists base their ideas on key spatial characteristics of the historical dry-forest mosaics. No two mosaics were ever alike, but they exhibited patterns within a particular set of conditions. Their research over the years has attempted to characterize those patterns in terms of the way fire, insects, and even pathogens functioned within them.

THE STRATEGY’S EVOLUTION

The two scientists’ theory of whole-landscape management evolved from their collaboration in the early 1990s on ecosystem management projects. Lehmkuhl was examining the influence of landscape changes on habitats and species abundance, while Hessburg was focused



U.S. Forest Service

Prescribed burning alone is useful in some stands for reducing surface and ladder fuels.



Yakama Indian Reservation

Thinning may also be used alone or in combination with burning where it is difficult to meet the intent of fuel and habitat management objectives through prescribed burning alone.

on landscape composition, structure, and interactions with fire and other disturbance processes. Hessburg recognized in Lehmkuhl a wildlife biologist who not only understood the habitat dynamics of species of various sizes and mobility, but also the way landscapes worked.

At the time, much research underway at the Wenatchee Forestry Sciences Laboratory focused on fire regimes, fire history, and the condition of the inland Northwest landscape. When the Northwest Forest Plan was adopted, Hessburg, Lehmkuhl, and Richard Everett, a now retired range ecologist, began thinking

about managing for ecological objectives across the landscape, regardless of the land's reserve status. They were intrigued by the idea of providing suitable habitat in spatial configurations that worked for wildlife and the species they prey on, in a landscape that was highly dynamic.

Lehmkuhl and Hessburg also saw the similarities between fire and insect as disturbance processes. Both disturbances have the ability to move from one susceptible habitat location to another. To Lehmkuhl and Hessburg, that meant patterns of forest conditions really mattered across the landscape. For example, tree-killing bark beetles seek susceptible, weakened hosts after they emerge from the host trees where they develop and reach maturity. If stands of host trees of adequate size and species are adjacent to each other, beetle populations can keep expanding, and tree mortality expands along with them. The same is true of wildfires. If many adjacent forest stands, including those in reserves, have large accumulations of surface and canopy fuels, severe wildfire can spread among them.

"Landscape management is a dynamic problem-solving process where properties of the landscape are continuously emerging over space and time," Hessburg says. "Planning needs to acknowledge this dynamism and work with it." According to



U.S. Forest Service

After decades of selective harvesting, fire suppression, and ingrowth by more shade-tolerant species, this ponderosa pine stand is more vulnerable to fire and insect outbreaks than it would have been under historical conditions. Arrows show two remaining large ponderosa pine after selective harvesting.

Hessburg, landscape management tries to simultaneously influence the behavior of disturbance processes such as insects and fires while providing networks of habitats that can work over space and time. The other virtue of this approach, the scientists say, is that

managers do not have to keep the whole forest free from fire. Instead, they can look at the patterns that supported the kind of desired fire behavior and then manage landscapes accordingly.

CHARTING A NEW COURSE

In 2008, the U.S. Fish and Wildlife Service contracted the Sustainable Ecosystems Institute (SEI) in Portland, Oregon, to conduct a third-party science review of written comments from three scientific societies on the Draft Northern Spotted Owl Recovery Plan. The SEI gathered together a panel of recognized scientists, and asked them to assess the comments. In their review, the SEI concluded, that "a simple reserve network is unsustainable in east-side fire-prone habitats. Conservation strategies, to be viable, must be designed and implemented at the landscape level."

The whole-landscape approach would require some management changes. On one hand, it would give land managers more flexibility and simplify management by eliminating the differing rules and guidelines for reserve and matrix lands. By looking at the bigger picture, rather than treating a particular patch of fire-prone owl habitat and risk losing it in the process, that patch could be protected by treating neighboring patches to prevent fires

and insects from migrating to it. Silvicultural treatments could be planned now to provide replacement habitats later—and with plenty of redundancy to allow for fire and nature's unpredictability.

Lehmkuhl and Hessburg have been working with managers and other scientists to address on-the-ground issues of managing for such ecological objectives, particularly how to write silvicultural prescriptions for ecologically functional stands. With several colleagues, Lehmkuhl is working on a computer program called FuelSolve to help land managers decide how much fuel to remove and where treatments would effectively maintain ecological values such as spotted owl habitat. FuelSolve is unique among landscape planning programs because it helps users find a set of optimal solutions that trade-off multiple goals. Other optimization planning programs typically find a single optimal solution for a single goal like fuel reduction, for example. Having a set of solutions, instead of just one solution, gives managers options to achieve their multiple

goals for that landscape, and importantly, it makes ecological goals equivalent to fuel reduction, rather than acting as constraints on fuel reduction as with typical optimization planning.

"None of us know the perfect way to realize these multiple goals in the first cut, but we see a path clearly," says Lehmkuhl. He continues, "In terms of a scientific process, we've done a lot of research that indicates that we could accomplish them. We do know a lot about the needs of the spotted owl in terms of habitat, prey, and what kind of stands they use. We also know a lot about vegetation, fire behavior, and stand characteristics. We need to put our minds together and then get started in the spirit of adaptive management, building in ways to assess our methodology and validate and adjust tactics and assumptions systematically along the way."

*There's nothing wrong with change,
if it is in the right direction*

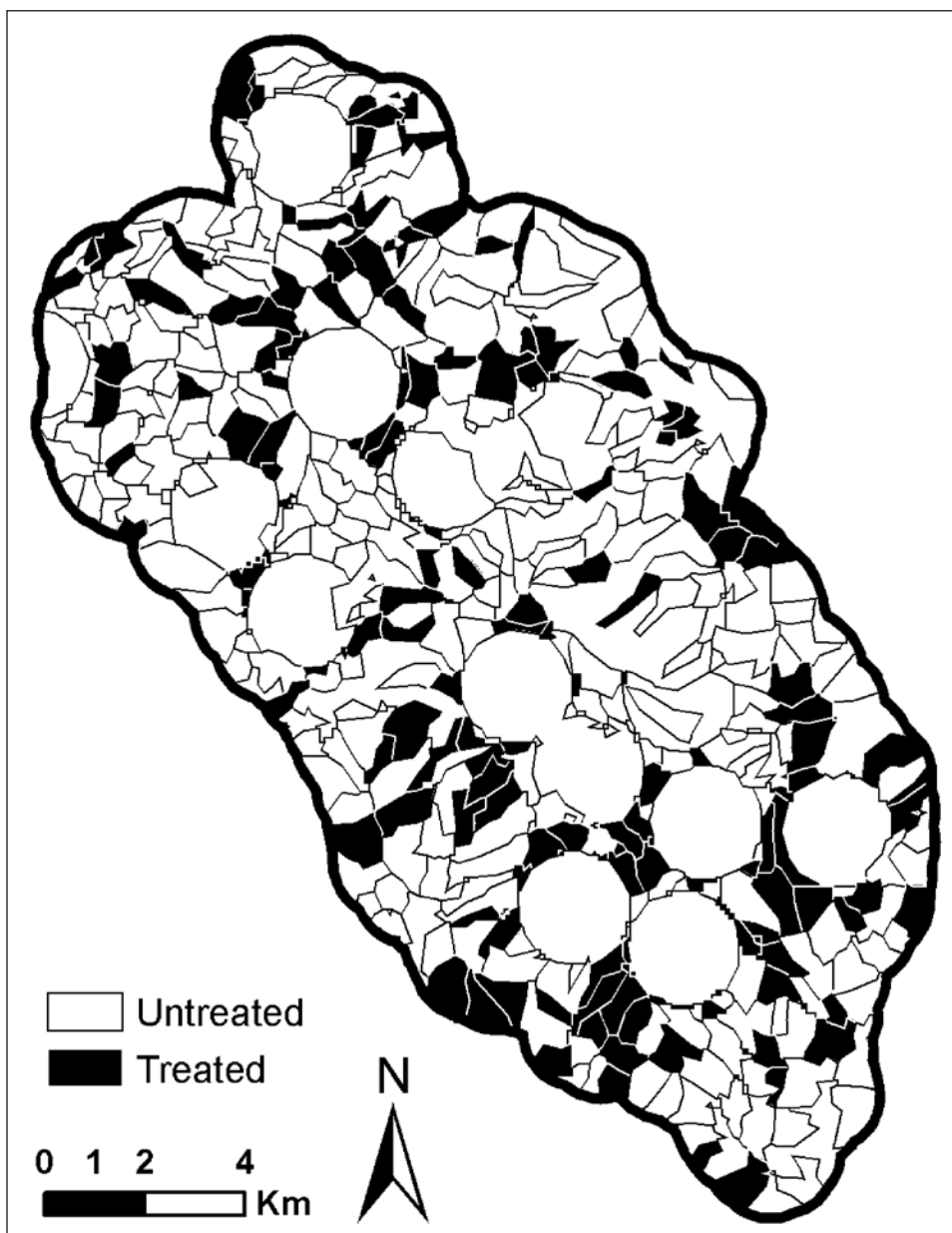
—Winston Churchill



LAND MANAGEMENT IMPLICATIONS



- Under a whole-landscape-management approach, the ecological and regulatory complexity of management could be simplified by a unifying standard and guideline for maintaining ecological integrity.
- Using a whole-landscape-management approach, managers would have more flexibility to manage forests across the landscape to meet both conservation and societal objectives. Conservation would no longer be mostly relegated to reserves. Landscape units would be managed according to their needs and potential, not by arbitrary lines around land allocations.
- The spatial allocation of management across the landscape requires innovative planning solutions, decision-support systems, and an adaptive-management approach.
- New landscape-level silviculture prescriptions would need to be developed to integrate fuels reduction, vegetation management, wildlife habitat networks, and other ecological considerations into management.



FOR FURTHER READING

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WRITER'S PROFILE

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An example of optimal allocation of fuel reduction treatments around spotted owl locations on the Mission Creek Drainage, Okanogan-Wenatchee National Forest. To arrive at this solution, the FuelSolve planning tool simultaneously considered the dual goals of minimizing potential fire behavior and maximizing the maintenance of spotted owl habitat. The open round circles are protected habitat around owl nest sites; the black patches are treated stands.

Science FINDINGS

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PAUL F. HESSBURG is a research ecologist with the Pacific Northwest Research Station. He earned a Ph.D. degree in botany and plant pathology from Oregon State University, and a B.S. degree in forest resource manage-

ment from the University of Minnesota. He has worked for the Forest Service in various positions in research and forest health protection for the past 25 years, specializing in forest pathogen and insect ecology, epidemiology, and management, and in landscape ecology. His current research interest is the study of mechanisms of landscape resilience and of forest landscape pattern and process interactions.

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