Joint Fire Science Program

Fire Science Brief

RESEARCH SUPPORTING SOUND DECISIONS

This female Northern spotted owl, known as the Miller Mountain female, maintained territory after fire with her mate in the center of the Timbered Rock fire. She was observed using areas of all fire severities and habitats during the study. She and her mate were occasionally found using different patches of high-severity burn during the day. In this photo she is roosting in a patch of high-severity burn adjacent to their historic nest tree. They made an unsuccessful attempt at nesting one year post-fire.

Burned Landscapes of Southwestern Oregon: What's In It for Northern Spotted Owls?

Summary

Northern spotted owls are known to spend time in areas burned by wildfire, but there has been little scientific investigation of how and why they use these landscapes. A trio of wildfires in southwestern Oregon during the summers of 2001 and 2002 burned through dozens of documented spotted owl territories, providing a rare opportunity to study many important aspects of how these raptors respond to wildfire in dry forest ecosystems. For this project researchers used radio telemetry and demographic surveys to investigate habitat selection, home range size, occupancy, productivity and survival of spotted owls within and adjacent to burned areas.

Results suggest that outside of large-scale stand-replacing events, wildfire is not likely a major threat to the persistence of spotted owls in this forest type—even though there are numerous negative short term impacts. Survival and occupancy rates declined after fire in two study areas. However some remaining owls used areas that burned with a broad range of severity for roosting, foraging and nesting. Several owl pairs successfully produced young following fire. Owls avoided burned areas where clear cut salvage logging had taken place. Results indicate that low-severity prescribed fire may be used to help reduce fire hazard in dry forest ecosystems occupied by spotted owls. This project provides the first concrete guidelines for fuels reduction in spotted owl territories in southwestern Oregon.

Key Findings

- Post-fire home ranges were on average about 700 acres larger than pre-fire home ranges. Pre- and post-fire habitat fragmentation (e.g., severe fire and salvage logging) contributed to the increase.
- Low intensity prescribed fire can likely be used to reduce risk of stand replacing fire in spotted owl habitats without long term negative impacts.
- Owls roosted and foraged in areas that burned with low, moderate and high severity and avoided burned areas that received clear cut salvage logging.
- Owl populations declined during the five years following the fires.
- Survival rates of owls in burned landscapes were lower than unburned landscapes.
- Owls produced and raised young successfully in burned landscapes, but fewer offspring were produced overall because there were fewer nesting pairs.
- In burned landscapes, owls were more likely to select habitats in areas of lower elevation and/or closer to perennial streams.

Sixteen ounces of nocturnal controversy

The Northern spotted owl is one of three subspecies of spotted owl, all of which dwell in the American west. Conservation of spotted owls and their habitat has fueled fierce debate for over thirty years. The owl is listed as threatened by the U.S. Fish and Wildlife Service and the state of California, and listed as endangered in Oregon and Washington. Concern for the species has increased over recent decades as threats continue to change. For several decades, timber harvest was the primary cause of habitat loss. Despite drastic reduction in timber harvest on federal land in recent years, several spotted owl populations in portions of the Pacific Northwest are still declining.

Recent wildfires in dry forest ecosystems have consumed more habitat than originally predicted. Wildfire surpassed timber harvest as the leading cause of spotted owl habitat loss on federal lands from 1994–2003, largely due to timber harvest decline. Remaining critical habitat in this forest type is under increasing threat of fire. This has raised questions about whether or not long-term sustainability of the species is feasible in these ecosystems.

Spotted owls that make their homes in dry forests have evolved with wildfire. Frequent, low-severity fires have burned through southwestern Oregon's dry forests for millennia. These fires served to clear accumulated dead wood and understory fuels while maintaining mature overstory trees. But contemporary fires differ from the historical norm: They burn hotter and move faster, often killing the large, mature trees that Northern spotted owls rely on for nesting, reproduction, shelter and survival.

Tenacious tenants

Many fuels reduction strategies have been used to mitigate risk of these large scale severe fires, including prescribed fire, even though very little is known about how fire of any kind impacts the owls. Details surrounding spotted owl response to fire have been sparse, so there haven't been any science-based guidelines for fuel reduction or postfire management in their habitat.

Although it's long been assumed by some that burned areas have nothing to offer the birds, many biologists have suspected that there are features of postfire landscapes that the owls find useful. Northern spotted owls have been observed using burned areas and have probably been doing so for thousands of years. One reason may be that adult spotted owls exhibit behavior known as 'high site fidelity,' meaning they are very attached to their territories and typically remain there even after a disturbance occurs. There must be *some* benefits that allow them to stick around. This research project was the first to document the specifics.

Telemetry tracks some answers

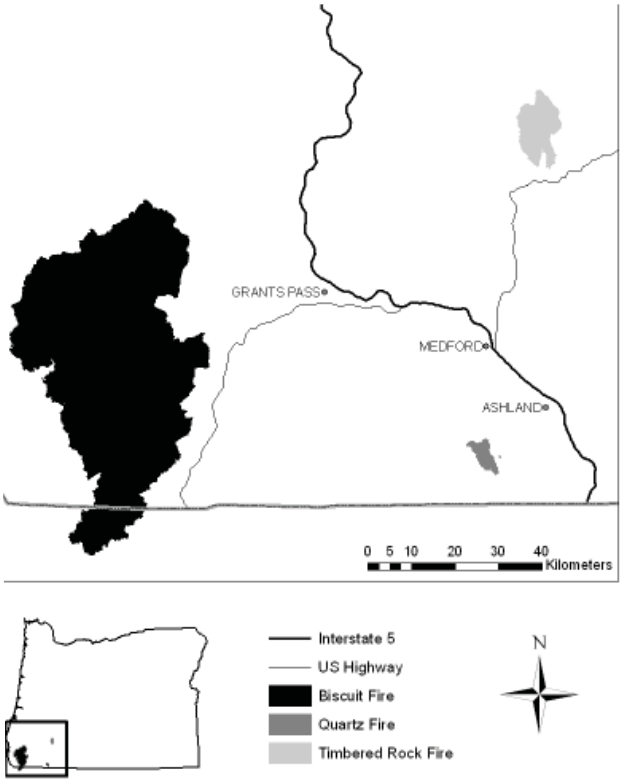
With Joint Fire Science Program support, researchers from Oregon State University have shed some light on the conundrum. Dr. Robert Anthony and graduate research assistant Darren Clark studied three postfire landscapes located in the dry forest ecosystems of southwestern Oregon, all of which contained documented spotted owl territories. Radio telemetry was used along with demographic surveys to determine which burned areas the owls were occupying and what they were using each area for. The project was the first to track spotted owls in burned areas with radio telemetry, which provided new insights on habitat selection in postfire landscapes. Results generated the first science-based guidelines for planning fuels reduction and post-wildfire actions for spotted owl territories in the region.

"It's essential that we develop an understanding of wildfire impacts on spotted owl survival and reproduction," says Clark. "We can incorporate these impacts in management plans to ensure the long-term conservation of the species."

The Biscuit, Quartz and Timbered Rock wildfires burned through over eighty known Northern spotted owl territories during the summers of 2001 and 2002. The 2001 Quartz fire was started by lightning and eventually burned 6,000 acres. It burned seven owl territories entirely, and part of two more that straddled fire boundaries. The Biscuit fire burned in July of 2002 and eventually spread across nearly

half a million acres of public and private land. Fifty spotted owl territories were completely or partially within the fire boundaries. The 27,000 acre Timbered Rock fire burned twenty-two spotted owl territories to varying degrees during the same period as the Biscuit fire.

Between 2002 and 2006 Clark conducted annual demographic surveys within fire boundaries, at their partially burned edges and in unburned areas. Radio telemetry study took place from 2004 to 2006. Surveys were a collaborative effort between the Oregon Cooperative Wildlife Research Unit, the Bureau of Land Management, the U.S. Forest Service and private timber companies.



Locations of the Biscuit, Quartz and Timbered Rock fires in southwestern Oregon.

Owl territories and habitat suitability were mapped using pre- and post-fire satellite images. The team analyzed reproductive success, habitat selection and home range size relative to the pattern and severity of wildfire at known territories, many of which had pre-fire data. Analysis was supplemented with data derived from Anthony's earlier surveys in unburned owl territories in the southern Cascade Range.

Radio-telemetry allowed researchers to track owl movements and locations. Between September 2004 and August 2006, the location and fate of each owl was recorded approximately every other day. When a signal indicated that an owl had died, field crews hiked in to find the bird and determine cause of death. If an owl wasn't found from the ground, aerial searches were conducted using fixed-wing aircraft.

Owls were fitted with backpack-mounted radio transmitters that weighed 7.5 grams.

Where are the owls and what are they up to?

Although overall occupancy dropped following all three fires, results indicate that spotted owls continue to occupy areas burned with low- to moderate-severity, as well as areas that partially burned with high-severity. Owls utilized areas near edges (the interface of green and dead trees) suggesting that habitat created by mixed-severity fire mosaics provide benefits to spotted owls in this forest type.

During the study period, more owls died in burned landscapes than unburned. Eight of twenty-four radio-marked owls (33%) died. Six of the dead owls underwent necropsy at the Oregon State University Veterinary Diagnostic Lab. All six were severely emaciated and had likely starved. Scattered feathers and transmitters were all that remained of the other two owls that died, indicating that they had likely been killed by a great horned owl or northern goshawk. There was no evidence of injuries caused by the radio-transmitter in any of the birds, and they all tested negative for West Nile Virus.

Owl	Mortality Date	Cause of Death
Upper Timber Female	01/18/2005	Emaciation
Upper Timber Male	05/07/2005	Emaciation/Parasitism
Oliver Springs Female	05/16/2005	Emaciation/Parasitism
Miller Mountain Male	07/12/2005	Predation
Yale Creek Male	07/13/2005	Emaciation/Broken Leg
Hawk Creek Male	01/04/2006	Emaciation
South Boundary Male	02/13/2006	Predation
Glade Creek Male	04/08/2006	Emaciation

Date and cause of death of 8 radio-tagged Northern spotted owls monitored during radio-telemetry research at the Quartz and Timbered Rock Fires from September 2004 to August 2006.

Owls were observed nesting, roosting and foraging within a wide range of habitats and fire severity—including patches that burned with high-severity. In areas where pre-fire roosting and foraging habitat burned severely, owls roosted and foraged again after fire—but it's not known if these birds were the same individuals that frequented the area before. Burned areas that had been clear-cut salvaged logged were avoided. No owls were observed nesting in severely burned patches in nesting cores. In areas of mixed-severity fire, nesting only occurred in sites that burned with low or moderate-severity. Several owl pairs that had only small patches of high-severity fire within their nesting core

continued to occupy their territories. In territories where fire severity was mixed and some large trees remained standing, owls established new nest trees if the historic nest tree was consumed by high-severity fire. The reproductive rate of remaining pairs was similar to that of pairs in unburned landscapes, but wildfire reduced overall reproductive output because after fire there were fewer pairs.

All territories colonized following wildfire had supported spotted owls at some point in the past. Owl territories that had low to moderately severe fire at their core had more suitable habitat remaining after wildfire, so they were likely to be re-colonized. Interestingly, patches that burned with high-severity that were occupied before fire also had a fairly high probability of being re-colonized. Clark says that although this may seem counter-intuitive, it actually makes sense. "Territories that still had large amounts of suitable habitat remained occupied after fire, so they were unavailable for colonization. High-severity fire contributed to sites becoming vacant, so severely burned sites were the only territories available for re-colonization. Several new owls colonized areas within the fire."

Researcher Darren Clark holds the Alco Rock female from the Timbered Rock fire. This owl and her mate nested successfully and fledged young after the fire. She maintained their territory throughout most of the study, and she was observed foraging in all fire severities throughout the course of the study. Parts of her territory burned with low, moderate and high-severity. Some historic nest trees burned severely at this site. Others burned with low-severity.

Owls used areas near burned edges which suggests that habitats created by the historic mixed-severity fire mosaic benefits the birds in some way. In burned landscapes, owls were more likely to select habitats in areas of lower elevation and/or close to perennial streams where available. Clark offers that these choices could be driven by the owls' thermoregulation needs, more abundant prey or both.

Although owls used high-severity burns within mixed-severity mosaics, large scale stand-replacing events were detrimental overall to spotted owl populations, at least in the short term. High-severity fire contributed to declines in spotted owl occupancy where large amounts of the territory were consumed. Large expanses of high-severity fire (1 to 1.5 sq. miles) were not occupied by owls. Clark thinks that the birds are not likely capable of persisting in large areas of complete stand replacement because most of the critical habitat features required by spotted owls no longer exist.

The Glade Creek nest Tree.

The Glade Creek nest.

The Glade Creek male 3 years after fire.

The nest tree, which was within the Quartz Fire, burned with moderate-severity immediately adjacent to a patch of high-severity fire. The Glade Creek pair used the nest prior to fire and for at least 2 years following fire. Their young fledged successfully.

Fewer owls need more space

The 1600-yard Buffer—In burned landscapes owls ranged outward from nest trees or territory centers in a circle with a minimum radius of approximately 1600 yards. This is substantially larger than home ranges studied in the same area in the late 1980s, suggesting that owls in postfire landscapes use larger areas than owls in unburned landscapes. Owls that had larger postfire home ranges

typically had decreased amounts of mature/older forest and greater amounts of habitat fragmentation in their territories.

Clark says that the owls' apparent need to expand the home range after fire must be taken into account when managing postfire landscapes for owl conservation, and that a 1600-yard protective buffer around occupied nesting centers is appropriate. He also recommends that green trees and snags be retained and riparian buffers preserved in order to encourage use by the birds. Clear-cut salvage logging is not an appropriate management activity in postfire landscapes where spotted owl conservation is an objective. The effects of mechanical thinning and other methods of salvage logging are still unknown.

Prescribed fire with a light touch

Although more research is needed, results suggest that low intensity prescribed fire can likely be used to reduce risk of stand-replacing fire in spotted owl habitat without long-term negative impacts. Low intensity prescribed fire can mimic the fires of the past by preserving mature trees that are so critical to the owls. Clark recommends that within occupied owl habitats, prescribed fire should be applied to small areas and that treatment should be initiated and brought to completion within five years.

Juggling paradox, perspective, proof and prudence

Owls in this study used postfire landscapes—albeit in lower numbers and sometimes in different ways than before fire or in unburned landscapes. Because owls in the region evolved in fire-prone ecosystems, mixed-severity fire is likely a crucial component of long-term owl conservation in dry forest ecosystems where fires are common. Likelihood of stand-replacing fire can be reduced by low to moderately severe wildfire and the proper application of prescribed fire. However it must be kept in mind that even low to moderate-severity fires appear to reduce the number of owls occupying a given area in the short term.

Long-term monitoring of postfire owl populations is needed to clarify long-term impacts of fire, as it's entirely possible that owl populations may recover over time. Longer term postfire study will clarify the impacts of fire on the sustainability of southwestern Oregon's spotted owl populations.

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Additional questions surround economic feasibility and sustainability of the species given shrinking owl populations, historic and projected habitat loss, declining survival rates, failure of existing protective measures, and limited budgets. Fuel reduction programs may not be possible on a large enough scale to be effective.

Development of strategies for postfire management and reduction of severe fire hazard in spotted owl habitat remains contentious. A fundamental conflict remains between the forest structure in quality spotted owl habitat and the forest structure conducive to reduced fire hazard. The dense, complex features of suitable owl habitat are the same features that many fuel treatments seek to eliminate.

Many questions remain unanswered. But thanks to this research, the void of scientific information surrounding spotted owls in burned landscapes is shrinking, and managers will have information to manage this controversial, silent predator of the night.

Management Implications

- The minimum territory size for spotted owls in postfire landscapes in southwest Oregon should be defined by a circle with a 1600-yard radius centered on the nest tree or territory center. This buffer zone may be used to identify and protect owl habitat during postfire land management activities.
- Clear-cut salvage logging is not an appropriate land management activity in areas where Northern spotted owl conservation is an objective. It's recommend that no clear-cut salvage logging take place within 1600 yards of occupied spotted owl nesting centers.
- In areas where other methods of salvage logging are deemed appropriate, great care should be taken to ensure that operations have minimal impacts on the birds—as the impacts of methods other than clear cutting are still unknown. In any case, Clark recommends that green trees and snags be retained and riparian buffers preserved in order to encourage use by the birds.
- Because owls were observed using older forests that had burned severely, these areas likely benefit them. This habitat should be given some level of protection following wildfire if spotted owl conservation is a primary objective of postfire management.
- Prescribed burning in Northern spotted owl territory should be restricted to a small portion of a nesting territory within a 5-year period to reduce the short-term impacts of prescribed fire on the owls and their prey.

Further Information: Publications and Web Resources

JFSP Project # 04-2-1-52 Final Report, Productivity and Habitat Use of Spotted Owls in Relation to Fire Severity in Southwestern Oregon: Can Prescribed Burns be used to Reduce Fire Hazards in Spotted Owl Habitat?

Master's Thesis: Clark, D.A., 2007. Demography and Habitat Selection of Northern Spotted Owls in Post-Fire Landscapes of Southwestern Oregon.

Scientist Profiles

Bob Anthony has been a Research Wildlife Biologist with the U.S. Geological Survey and a Professor of Wildlife Ecology in the Department of Fisheries and Wildlife at Oregon State University since 1977. He's the Unit Leader of the Oregon Cooperative Wildlife Research Unit. His research interests include forest-wildlife relationships, wildlife population analysis, biometrics and environmental contaminants.

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JFSP *Fire Science Brief* is published monthly. Our goal is to help managers find and use the best available fire science information.

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Productivity and Habitat Use of Spotted Owls in Relation to Fire Severity in Southwestern Oregon: Can Prescribed Burns be Used to Reduce Fire Hazards in Spotted Owl Habitat?

Written By: Paige Houston

Purpose of this opinion piece

Manager's Viewpoint is an opinion piece written by a fire or land manager based on information in a JFSP final report and other supporting documents. This is our way of helping managers interpret science findings. If readers have differing viewpoints, we encourage further dialogue through additional opinions. Please contact Tim Swedberg to submit input (timothy_swedberg@nifc.blm.gov). Our intent is to start conversations about what works and what doesn't.

Problem

This study highlights the benefit versus risk and challenges that face managers when developing strategies that include putting fire back on the landscape to reduce crown densities and ladder fuels, while simultaneously protecting habitat. Because the goals associated with protecting spotted owl habitat require diversity within an ecosystem, prescribed fire might actually interfere with that diversity by eliminating the vegetative structure for owls. This could also lead to fragmentation due to reduced canopy and forage structure, as well as a decline in the numbers of spotted owls over time. Hence, fire managers must find a balance in promoting a positive relationship between putting fire on the land and protecting habitat.

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Application by Land Managers: Diligence Required in Formulating Fire Strategies

This study recognized the impact of several large, post-2000 wildfires in southwest Oregon—the Biscuit, Timbered Rock, and Quartz fires—that contributed to reduced spotted owl habitat. The study acknowledged that for fire managers to reduce the future threat of large wildfires by implementing prescribed fire in these critical areas, they will need to be extremely diligent when formulating their fire strategies.

The study's findings point strongly to post-fire activities such as salvage logging having negative impacts—reducing productivity as well as habitat. Other findings also suggest that where wildfires and salvage logging typically go hand-in-hand, these areas reflect reduced numbers of

reported spotted owls. However, this study recognizes that more data are still needed to confirm the coincidences of this inverse relationship.

Other recommendations suggest that fire managers use diligence in how they apply prescribed fire treatment when reducing fire hazards by tactically using small increments. Due to spotted owl foraging and nesting behavior, the strategy of small-scale, low-intensity burning in spotted owl habitat should not exceed more than five years. In addition, lower-intensity application seems to offer positive benefits by providing decreased mortality in the canopy and keeping burned areas small, thereby providing the vegetative structure and diversity required. Also, this lower-intensity fire process allows for observation of nesting, foraging, and roosting behavior of spotted owls within those areas (Anthony 2007).

Maintaining some vegetative structure is the goal for protecting spotted owl habitat. Conversely, however, fire has the opposite effect of increasing the risk for impacting spotted owl habitat. It will be increasingly important for fire managers to be aware of this reality. Fire has been absent for quite some time and further research will be ongoing to determine long-term effects. If fire managers are looking to utilize fuel reduction methods that include thinning, this study is still researching those impacts.

Other evidence from this study reveals that post-wildfire management activity can include salvage logging the remaining material for use—or for possibly reducing wildfires in the future. However, salvage logging can also contribute to negative spotted owl impacts by reducing habitat, prey, foraging, nesting and roosting, as well as reproduction. Furthermore, salvage logging within a half-mile radius reduces the colonization of spotted owl (Anthony 2007). Even so, fire managers might find it too expensive to conduct small treatments. In addition, fire managers might need other land managers to take more accountability in managing this problem.

What is Correct Management Action?

Other scientists agree that wildfires are becoming more and more threatening and severe, thus requiring action. But, due to the ineffectiveness of how fire managers are reducing fuels in such ecosystems, just *how* that action becomes implemented is called into question (LaHayne 2005).

The consensus seems to orbit around the theme that prudent management objectives are essential. However, simply just saying that fire hazards need to be reduced and prescribed fire or salvage logging are ways to achieve these objectives is *not* meeting the intentions outlined in numerous studies and through empirical data.

Many scientists conclude that to fully understand the long-term effects, more data and research is needed. Through modeling programs, fire managers can also adequately assess and evaluate target areas, as well as weigh the benefits versus risk when conducting treatment in spotted owl territory (Lee and Irwin 2005).

Compelling data collected from this study and the spotted owls captured within the boundaries of three fires in southwest Oregon has provided statistics to assist in formulating strategies of weighing the benefits versus risk regarding whether or not to implement low-intensity prescribed fire.

Radio-transmitter devices were placed on spotted owls during the fall of 2004 to identify patterns for drawing conclusions with data still being gathered. A total of 21owls were observed in and around the fire boundaries. The behavior of owl pairs is included in the mix.

The data collection methods are very detailed and offer excellent illustrations of spotted owl activity resulting from wildfire activity. While conclusions are yet to be finalized until all data is collected, post-fire information is now available to fire managers that provides some behavioral and home range characteristics. This data help illustrate the areas that will need further evaluation before conducting fuel treatment activities in areas of spotted owl habitat (Anthony 2005, Anthony 2006).

Overall, the study supports that prescribed fire might be a necessary tool to achieve objectives. Scientists understand that fire hazards are accumulating at accelerating rates. Therefore, to attain the desired levels will be a challenge. The basic idea framed within this study is that more evidence is still needed, and that putting fire back on the landscape can have both positive and negative impacts. Thus, the study confirms that taking small measures is the best approach to the situation.

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Further Reading

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Manager Profile

Paige Houston is the Regional Aviation Training Specialist at the Northern Rockies Training Center in Missoula, MT. She has 22 years experience in fire management across several USDA Forest Service regions, and a few years with the USDI Bureau of Land Management. She currently serves as a primary Division Group Supervisor on the Northern Rockies Type 1 Incident Management Team and instructs a variety of fire and leadership courses in northwest Montana, at the Wildland Fire Apprentice Academy, and with the National Smokejumper Association. She spent eight years with the Bitterroot and Lolo hotshot crews and worked two seasons with the Alaska Smokejumpers. She has several more years of experience in other primary firefighter and fuel management positions, including a season with the rappellers out of Chelan, WA. She's a graduate of the University of Montana where she received a degree in resource conservation.

The information for this Manager's Viewpoint is based on JFSP Project 04-2-1-52, Productivity and Habitat Use of Spotted Owls in Relation to Fire Severity in Southwestern Oregon: Can Prescribed Burns be Used to Reduce Fire Hazards in Spotted Owl Habitat?; Principal Investigator was Robert G. Anthony.