Joint Fire Science Program

Fire Science Brief

RESEARCH SUPPORTING SOUND DECISIONS

Researcher Tom Manning works with monitoring equipment in a logged area of the Davis Lake Fire in Oregon. Credit: John Hayes.

Post-fire Salvage Logging in Central Oregon: Short-term Response in Bats, Birds and Small Mammals

Summary

Some studies of wildlife response after fire have shown that habitat condition during the years immediately following fire are very important for many species. Because of this, it's important for managers to have full knowledge of the short-term effects of salvage logging on wildlife. This short-term study looked at the effects of different intensities of post-fire salvage logging on bat activity, population densities of breeding songbirds and small mammal abundance. The project took place on the 2003 Davis Lake Fire in central Oregon during the second and third years following fire. Although there were some exceptions, results generally showed that differences in logging intensity did not alter impacts on species that were negatively affected by salvage. Small mammal populations were not significantly impacted by salvage logging, while bats were more active in more intensely logged (open) sites. Negative impacts on bird populations were mitigated somewhat by retention of small islands of unlogged snags within logged areas.

Key Findings

- For species that were impacted by salvage logging, reducing logging intensity did not decrease impacts.
- Bat activity was greatest in more open stands subject to intensive salvage logging.
- Leaving islands of standing snags untouched within salvage logged sites may help maintain populations of several bird species that were negatively impacted by salvage, even if the islands are relatively small.
- Small mammal populations were not statistically different among moderately salvaged, heavily salvaged, or unsalvaged sites.

Introduction

Even though wildfire is one of many natural processes that maintain fire-adapted ecosystems, areas that have recently burned can appear lifeless to the untrained eye. Although many animals relocate to unburned areas after fire, several species are specially adapted to thrive in the conditions that fire leaves behind. Quick to take advantage of altered forest structure, decomposing wood, and the post-fire menu of bark-eating insects and sprouting re-growth, many animals thrive in the habitats left following severe fires. In fact, science is showing it's their ecological role to move right in and make it their own.

So what happens to these species if one of the biggest sources of attraction—fire-killed trees—is removed? John Hayes, former professor of forest science at Oregon State University and now Department Chair of Wildlife Ecology and Conservation at the University of Florida, wanted to find out. Working closely with researchers Tom Manning and Rebecca Cahall, his short-term study in the Deschutes National Forest of central Oregon evaluated the effects of different intensities of salvage logging on bat activity, population densities of breeding songbirds and small mammal abundance.

Fire-killed trees. Credit: Forest Service, online photo gallery: http://www.fs.fed.us/photovideo/.

"Surprisingly there's been relatively little work done on this," Hayes says. "There are still some major gaps in our understanding of how salvage logging influences a variety of different ecological aspects of these sites, wildlife in particular. Our project began to fill in some of the holes." Hayes says that questions about post-fire management effects weren't as pressing when fires were smaller and consumed fewer resources. But research has broadened as the number of acres burned annually has grown by leaps and bounds over the last ten years. "The magnitude and scale of fire that we've had over the past decade is really unprecedented in most of our lifetimes," he says. "It has become increasingly important to learn all we can about the environmental benefits and trade-offs of different kinds of post-fire activities."

He adds, "It has taken a bit of cultural and scientific maturation to recognize the value of dead wood to the environment. In the 1970s it started to become clear that it's not just litter on the forest floor, and that dead trees aren't necessarily wasted if they don't go to the mill. It took some time for us to fully appreciate the role of burned forests in ecosystems and the importance of disturbance ecology in general."

Wildlife blind to differences in salvage intensity

The 2003 Davis Lake Fire in central Oregon served as the laboratory as Hayes and his colleagues compared effects in unsalvaged stands with stands that were salvaged at two different intensities. The fire burned 21,000 acres in the Crescent Ranger District of the Deschutes National Forest on the east slope of Cascade Range. Salvage logging was already taking place when the project began a year after the fire. Prior to burning, the area was dominated by Douglas-fir, white fir, and ponderosa pine, with an understory composed primarily of snowbrush and manzanita. Study sites had to meet several criteria because the researchers wanted to evaluate three completely different wildlife species. Sites had to be 30 to 40 acres in size so that each had room for three separate 260-foot bird survey circles. They had to have burned with high intensity and have been well stocked with trees at least three feet in diameter at breast height prior to the fire. They analyzed four replications of three different treatments representing two different salvage intensities and controls. The "moderate" salvage sites retained roughly 12 snags per acre. Sites considered heavily salvaged retained 2.5 snags per acre. Controls weren't salvaged at all. Hayes analyzed salvage intensity levels that were operationally meaningful with full expectation that the considerable difference between them would have a large influence on the species they studied.

But they didn't see a difference, at least in the short term. "For most of the species we looked at, the response

was pretty much the same for both salvage intensities," Hayes says. "This was somewhat surprising. The salvage intensities are quite different visually, and there was certainly a difference in the economic value of these two levels of harvest intensity. There was a definite economic hit at the lower intensity. But that didn't result in significant differences in the abundances of most of the species we studied for the short term."

Hayes is convinced that there are levels of intensity at which the difference matters. He says, "What this suggests is that if you are going to try to reduce the environmental consequences of salvage logging on some of the species that are impacted by it—you would have to salvage at a lower intensity than the lowest intensity we investigated to avoid impacting them."

"We did find though, as you always do in these studies, there are winners and losers to some degree," he continues. "We found a couple of exceptions worth noting. For management it's most important to address this from the perspective of the species you're interested in. There is no such thing as a treatment that is all 'bad' or all 'good.' Usually if one species benefits, then there's probably one that's impacted negatively."

The study found that bats tended to be most prevalent in open areas, several species of birds need unsalvaged islands, and small mammal populations didn't appear to differ under different logging intensities. Hayes states in his report that, "In not a single case did we find a significant effect of salvage logging or intensity of salvage on any population or community parameter for the four mammal species studied, which included the yellow-pine chipmunk, Siskiyou chipmunk, golden-mantled ground squirrel and deer mouse."

Going batty

One of the few instances where the research did find a difference in response between salvage intensities had to do with the activity levels of bats. For analysis, Hayes used Anabat equipment and software to capture and evaluate the characteristics of recorded bat echolocation calls. They recorded in three of the twelve study stands at a time for seven consecutive nights twice each season, from 45 minutes before dusk to 45 minutes after dawn. In total they captured over 20,000 bat echolocation calls in 2005 and over 37,000 in 2006.

A yuma myotis, one of the bat species studied for this project, grabs dinner on the fly. Credit: © Merlin D. Tuttle, Bat Conservation International.

Hayes explains that measuring bat response can be tricky because they need two distinctly different habitats: places to roost and places to forage. Forest management activities often have a big influence on both. This study only analyzed the foraging component, but Hayes emphasizes the importance of roosting ecology too. He says, "We don't want to lose sight of the roosting issue. Bats tend to roost in old, dying and decaying trees so the influence of salvage logging is a critical question, but it's a heck of a lot harder to answer."

A number of species were present in the study areas, including the silver-haired bat, Yuma myotis, long-legged Myotis, long-eared Myotis, little brown Myotis, California myotis, big brown bat and possibly an occasional Townsend's big-eared bat. Hayes says that none of these species fit the typical stereotyped concept that most people have when bats come to mind. "People generally have two visions of bats—swarms of them hanging upside down in caves or bats the size of housecats wrapped up in their wings, dangling by their feet from the branches of large trees." He says there are a couple of species in the region that do hang from foliage, but that most of them tuck themselves under tree bark or wedge themselves in cracks in trees or stony crevices—like little upside-down rock climbers. Most of the bats in the study area are so lightweight you could mail one across the country with a single postage stamp (not recommended). "These are very, very small animals," he says. "Everyone is always amazed to see how tiny they actually are—smaller than a lot of mice. But they look larger when you see them flying around because their wings are big. Plus, people have big imaginations when it comes to bats."

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He explains that when it comes to foraging there are two things that are important for bats: The presence and abundance of flying insects and the bats' ability to negotiate a site with echolocation. If an area has a lot of obstacles it can make foraging tough. "Bats are out there sending out very high frequency sounds that bounce off things and come back," he says. "This is how they perceive their environment. If there is too much clutter—too many objects for sound to bounce off of—it's very difficult for the bats to interpret signals. It varies with different species as to how big a deal that is—but in general cluttered sites are a problem." In some situations, reducing clutter can be preferable for bats when it comes to their ability to feed.

So there are two competing factors. It is likely that bats move in to an area after fire to take advantage of the all the insects that converge on the dead wood. Salvage logging removes that dead material from the forest, taking away potential sources of bat food. On the other hand it opens things up which might make it easier for them to forage in there. "You can imagine this going either way," Hayes says.

Most of the bats in the study, like this long-eared myotis, are so lightweight you could mail one across the country with a first class stamp (not recommended). Credit: © Merlin D. Tuttle, Bat Conservation International.

"We found that in fact the bats foraged more frequently in sites that were most intensively salvaged, so this was a situation where foraging habitat appears to have been improved through more intensive salvage. The stands were more open—easier to navigate. Foraging was higher in the areas where more trees were removed, which was a positive thing." It's not known whether there were actually more bats in the more intensely salvaged sites or if they were just moving to where it was easier for them to find their way around. The study didn't address the effects of salvage logging on the size of bat populations.

"We were really only looking at one piece of a much bigger story, and we need to know more," Hayes notes. "The population and roosting issues are also very important. These are questions that need still to be looked at."

Birds need unlogged islands

"Unlike the bat study, we can really say something about population sizes for birds because most birds are territorial," Hayes says. The research found that bird populations were generally lower in logged areas than in unlogged areas, even though the patches of unlogged forest in the study were fairly small. Intensity of salvage had no apparent effect on bird abundance. Hayes notes that this may be because the two salvage densities weren't distinctive enough in terms of snag densities.

Salvage logging had significant effects on several species that were probably related to effects on foraging and nesting habitat. Brown creepers, yellow-rumped warblers, western wood pewees, black-backed and hairy woodpeckers were more abundant in unsalvaged stands. Hayes notes in his report that, "while this response might be expected for woodpeckers and creepers that feed primarily on insects found in dead trees and nest in cavities of dead trees, the response of warblers and pewees is harder to explain."

Salvage clearly impacted black-backed and hairy woodpeckers, both of which are very closely associated with burned forests. "Anything that happens after fire is going to affect them," Hayes says. The brown creeper, a bark-foraging species that occurs in highest abundance in unburned, older forests, also appeared to be negatively impacted by the salvage logging, at least in the short term. Conversely, species that feed primarily on the ground, like fox sparrows and the dark-eyed juncos, were more abundant in salvaged stands than in unlogged stands. The post-fire shrub community of snowbrush and chinkapin recovered rapidly in these more open areas, providing lots of cover for ground foragers.

Researcher Rebecca Cahall peers through binoculars to confirm a bird sighting in Oregon's Davis Lake Fire. Credit: John Hayes.

Hayes says that providing patches of unlogged forest within the matrix of salvage logging can mitigate for some of the impacts. "One of the things that this said to me is that retaining even fairly small patches as unsalvaged within salvage areas can make a big difference with regard to populations over time," he says. When it comes down to specifics there is still more work to be done. How small can unlogged patches be and still mitigate effects on bird populations? How may trees should be left?

Brown creepers were among the bird species found to be more abundant in unlogged stands. Credit: © Bill Schmoker, www.schmoker.org.

"Our work suggests that, at least for the birds, the answer is—more trees than we've left in the past," Hayes answers. "It also must be kept in mind that this was a very short-term study. That was a limitation of this research. In some cases where we didn't see a difference in response in the short term, response may become more apparent over time. But in the short run, results suggest that even at the sites where logging was less intensive, the reduction in intensity was not enough to reduce impacts on bird species that were negatively affected."

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"The question is really nuanced," he continues. "We had some bird species that increased in number after logging, some that decreased and some that stayed the same. We need more information. In the mean time, retain and maintain patches of habitat for species you need to manage for, and do your best to balance that with broader societal demands for your resources."

Long-term study next in line

The study provided a good foundation for future work. Hayes is hopeful that there will be follow up research in the study sites and says that looking at longer term influences is an important next step. "My guess is that we'll lose trees that were left standing in sites that were intensively logged at a more rapid rate than those in less intensively logged sites. So in some of these cases where we may not have seen a difference in response in the short term, responses may become more apparent over time."

"We're continually trying to get more and more out of less and less in terms of our natural resource base," he concludes. "Determining how to best manage our forests after fire, where it makes sense to extract timber resources and how to do it are all increasingly critical questions. From a societal and management perspective, it's important that we have this information."

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Management Implications

- Retaining patches of unlogged forest within a matrix of salvaged areas helps maintain populations of birds (e.g., black-backed woodpecker, hairy woodpecker, and brown creeper) that eat insects living in bark.
- Cup-nesting species of birds can be negatively impacted by salvage logging.
- At the intensities studied, the moderate intensity of salvage logging did not reduce the negative impacts of salvage logging for some species of birds.
- Though bats used more open habitat for foraging, examining population distributions and roosting habitat following salvage logging are necessary to understand the complete impact of salvage logging on bats.

Further Information: Publications and Web Resources

The Influence of Post-fire Salvage Logging on Wildlife Populations Final Report to Joint Fire Science Program: http://www.firescience.gov/projects/04-2-1-95/project/04-2-1-95_final_report.pdf

Bat photos courtesy of Bat Conservation International: http://www.batcon.org

Scientist Profile

John Hayes is Professor and Department Chair in the Department of Wildlife Ecology and Conservation at the University of Florida. His research interests focus on the influences of forest management on wildlife populations, the influences of spatial scale on habitat selection, the ecology and conservation of bats, and the interactions between wind power and wildlife.

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The information in this Brief is written from JFSP Project Number 04-2-1-95, which is available at www.firescience.gov.

An Interagency Research, Development, and Applications Partnership

JFSP *Fire Science Brief*
is published monthly.
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