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Of Woodpeckers and Harvests: Finding Compatibility Between Habitat and Salvage Logging

On August 12, 2015, an early morning lightning storm passing through central eastern Oregon resulted in 12 fire starts on the Malheur National Forest. By November 5, what became known as the Canyon Creek Complex was officially declared controlled with a price tag of $31 million and more than 110,000 acres burned and 43 residences destroyed. How to manage this post-wildfire landscape was the decision facing Steve Beverlin, the Forest Supervisor on the Malheur National Forest at the time.

Disturbed forests, such as those that recently experienced wildfire, are the preferred habitat for a number of woodpecker species (such as the Lewis's woodpecker shown in the inset photo). The dead and dying trees provide nesting and foraging substrates. However, these dead and dying trees also have economic value when salvaged logged. Managers must balance providing wildlife habitat when conducting salvage logging (photo: USDA Forest Service; inset photo: T. Kogut).

Salvage logging was an option, as had been done after wildfires that occurred during the 2000s.

"This community is natural-resources dependent," explains Mark Webb, the executive director of the Blue Mountains Forest Partners. "A lot of community members feel strongly that there should be economic recovery of the burned trees."

Community members belonging with Blue Mountains Forest Partners, one of the two local collaboratives that have partnered with the Malheur National Forest to design landscape-management projects, were among those who had contested recent salvage logging projects.

Webb recalled being on field trips in the spring of 2015 to visit sites that had been salvaged logged 15–20 years earlier. What he saw was a landscape that had recovered both from the wildfire and the salvage logging. That made him wonder: "What would it take for

SUMMARY

The western United States is home to many woodpecker species that are strongly associated with recently disturbed forests, including post wildfire and post-beetle outbreaks. These types of landscapes are favored habitat because the dead and dying trees provide nesting and foraging substrates. When managing these landscapes, managers must balance providing habitat for woodpeckers considered species of conservation concern with conducting salvage logging sales that generate economic revenue for the surrounding communities. Until recently, managers couldn't be certain where suitable woodpecker habitat was located and whether the salvage logging would negatively impact the population.

Vicki Saab, a research wildlife biologist with the Rocky Mountain Station, has spent over two decades studying the habitat niches of disturbance-associated woodpecker species in post-wildfire landscapes. These data form the basis of FIRE-BIRD, a new habitat mapping tool that managers can use to locate probable woodpecker habitat within the area.

To demonstrate how FIRE-BIRD can be used to inform management decisions, Saab collaborated with the Malheur National Forest and the Blue Mountains Forest Partners on an experimental salvage logging study called the Canyon Creek Experimental Salvage Study. This 4-year project seeks to determine how 3 woodpecker species responded to 3 different salvage harvest levels. Although the data are still being collected, early analysis reveals that FIRE-BIRD is a valuable tool that can bring transparency to a salvage logging sale and assist managers in reserving wildlife habitat.

the environmental community to even think about doing salvage logging now?"

Knowing that salvage logging would be proposed by the Blue Mountains Ranger District, Susan Jane Brown, the vice president of the Blue Mountains Forest Partners' board, approached Beverlin to discuss the proposed sales. Specifically, she shared the environmental community's concerns that the logging would negatively impact the habitat of black-backed woodpecker, Lewis's woodpecker, and white-headed woodpecker, all of which were species of conservation concern on the Malheur National Forest. And as an attorney with Western Environmental Law Center, Brown had experience challenging the Malheur National Forest in court on salvage logging sales.

Beverlin respected Brown's concern. They developed a solution: conduct research to evaluate salvage logging effects on woodpeckers. "The Malheur National Forest has a long relationship with the two collaborative groups," Beverlin explains "We work with them on all our large landscape-scale restoration projects. The unique part of this project was working with the collaborative to engage in research to answer some of those questions that we just didn't have the ability to answer."

"It still sounds odd to say—a research salvage project—because it is an oxymoron in some ways," Webb says. Although some collaborative members were wary of conducting salvage logging, even within the context of a research project, what allayed their concerns was the expert whom Brown reached out to lead the research study: Vicki Saab.

Over 20 Years of Observation, Collection, and Monitoring

A research wildlife biologist with the Rocky Mountain Research Station, Vicki Saab has spent over 2 decades studying woodpeckers, specifically disturbance-associated species whose habitats are post-wildfire landscapes. Although she initially began her Forest Service career studying riparian landscapes, the large wildfires in the Intermountain West's dry conifer forests of ponderosa pine and Douglas-fir during the early 1990s presented a different research opportunity.

"I proposed to study birds after wildfire, because fires were becoming larger and more frequent," Saab explains. "Woodpeckers were an obvious focus because several of them are strongly tied to recently disturbed forests."

In these disturbed forests, the dead and dying trees provide snags that are easily excavated for nesting cavities and substrate for bark and

wood-boring beetles that are crucial woodpecker food sources However, during salvage logging, which was frequent during the early 1990s, these dead and dying trees were often removed from the landscape.

Saab sought to answer how nesting densities, survival, and birthrates were affected by factors that included the severity of the wildfire, length of time after the wildfire, and salvage logging. Previous research focused on whether woodpeckers were present after a wildfire rather than conducting long-term and larger landscape studies as Saab had proposed.

To build her research program, Saab's first hire was Jonathan Dudley as a field assistant. She advised him to study woodpeckers while in graduate school, and later Saab hired Dudley as a permanent ecologist with RMRS. "Jon has been instrumental in carrying out the field operations and data management for the duration of the woodpecker studies," Saab says.

With the initial study site on the Boise National Forest in Idaho, Saab and her team gradually collected data of logged and unlogged research plots in Oregon and Washington. Programs that funded her work included the Joint Fire Science Program and the National Fire Plan, along with several individual National Forests.

During the early years of her fire research, Saab envisioned using the data to create a habitat-suitability mapping tool. The intent of the tool would be to inform managers on locations to salvage following wildfires that would minimize negative consequences to woodpeckers.

In 2007, Saab coauthored *Habitat-Suitability Models for Cavity-Nesting Birds in a Postfire Landscape*, a research paper that detailed the first woodpecker habitat-suitability models. Since

Biologists use a number of methods to monitor woodpecker populations in a given area. One method is to broadcast sounds of woodpecker drumming to survey for responding woodpeckers. Jon Dudley is pictured here (left). Another method is using a camera to view nest cavities to determine whether a nest is being used, and if so, how many chicks are present (center and right). Woodpeckers will typically nest in large diameter trees (photos: USDA Forest Service).

that time, Saab and her team have conducted additional studies of woodpeckers and fire. Her team is frequently requested to create maps of woodpecker habitat suitability to help inform the design of postfire salvage logging operations and for environmental analyses. In these instances, Saab and her team used the opportunity to field-test or perform cross-site validation to develop FIRE-BIRD, a GIS tool that district biologists could use to create their own maps of woodpecker habitat suitability.

This GIS tool could prove very valuable in the near future. With climate change, "We expect increases in wildfire and bark beetle outbreaks, which will allow more opportunities for salvage logging," says Saab. "The FIRE-BIRD tool is intended to help managers make the best decisions for maintaining habitat of key wildlife species, while still allowing economic benefits to local communities."

While fine-tuning FIRE-BIRD, Saab and her team were publishing papers that revealed interactions of salvage logging and woodpecker survival with time since disturbance. One of these studies showed that after 10 years of monitoring nearly 1,800 nests of 6 cavity-nesting bird species, 4 of which were woodpeckers, salvage logging could be compatible with maintaining habitat if managers accounted for how individual bird species used post-wildfire landscapes.

Areas without salvage logging are prime habitat for black-backed woodpeckers, who strongly favor high densities of snags (photo: USDA Forest Service).

Field-testing FIRE-BIRD

When Saab was approached by Brown and the Blue Mountains Forest Partners to see if she was interested in undertaking the experimental salvage logging study, she welcomed the opportunity to formally field-test FIRE-BIRD.

Because burned trees must be salvaged within 1–2 years to retain their marketable value and the Environmental Impact Statement had to be completed prior to salvage operations, the team was under a time crunch to design the study. According to Saab, it took 3 people working part-time over a 4–month period to design the study. A challenge was finding areas within the burned landscape that met the criteria of woodpecker habitat and were large enough to replicate the three snag retention levels (i.e., treatments; high, moderate, low) and controls. Although there was a number of woodpecker species on the Malheur National Forest, three species that represented a range of habitat conditions after wildfires were selected for monitoring: black-backed woodpecker [*Picoides arcticus*], Lewis's woodpecker [*Melanerpes lewisii*], and white-headed woodpecker [*Dryobates albolarvatus*].

When the study design was finally approved, the Canyon Creek Experimental Salvage Study covered 7,000 acres across the

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Malheur National Forest. Within the study area, Saab located 9 300–400 acre units; each harvest treatment had 2 replicate units and there were 3 control units. The three treatment levels were associated with the stand density and mixture of tree sizes for each of the three woodpecker species being monitored. For example, the unit assigned to the Lewis's woodpecker had on average 8 trees greater than 20" diameter breast height (DBH), no trees between 15–20" DBH, 4 trees between 12–15" DBH, and 22 trees between 9–12" DBH.

In contrast, "The control units, where no logging was done, represented habitat for black-backed woodpeckers, because they're typically found in areas with higher densities of trees," Saab says.

Data would be collected 4 years post-salvage logging, because FIRE-BIRD's habitat-suitability models are based on a landscape found 1–5 years postfire; at 4–5 years postfire, there are significant ecological changes across the landscape such as the emergence of shrubs and snags falling to the ground.

In early 2016, Saab and her team were out in the field collecting pretreatment data that included snag density, snag and tree measurements, woodpecker occupancy, and nest densities. Then came the marking of the trees that were to be retained, and Saab credits the foresters and silviculturists on the Malheur as being really helpful in this process. Before logging commenced in late 2016, field trips were conducted to ensure everyone understood why certain trees were marked and how the trees would be harvested. Logging began after the 2016 woodpecker nesting season.

"Most salvage NEPA that we do is challenged one way or another, and we weren't," Beverlin says. "I really place that at the feet of the collaborative and their engaging with us and talking with their constituents."

"We had a lot of trust in what the loggers were doing," Webb says, adding that, "I cannot stress enough that in this situation both the Forest Service and Iron Triangle [the logging contractor] were willing to implement and harvest less cost-effective salvage treatments to address the critical research issues."

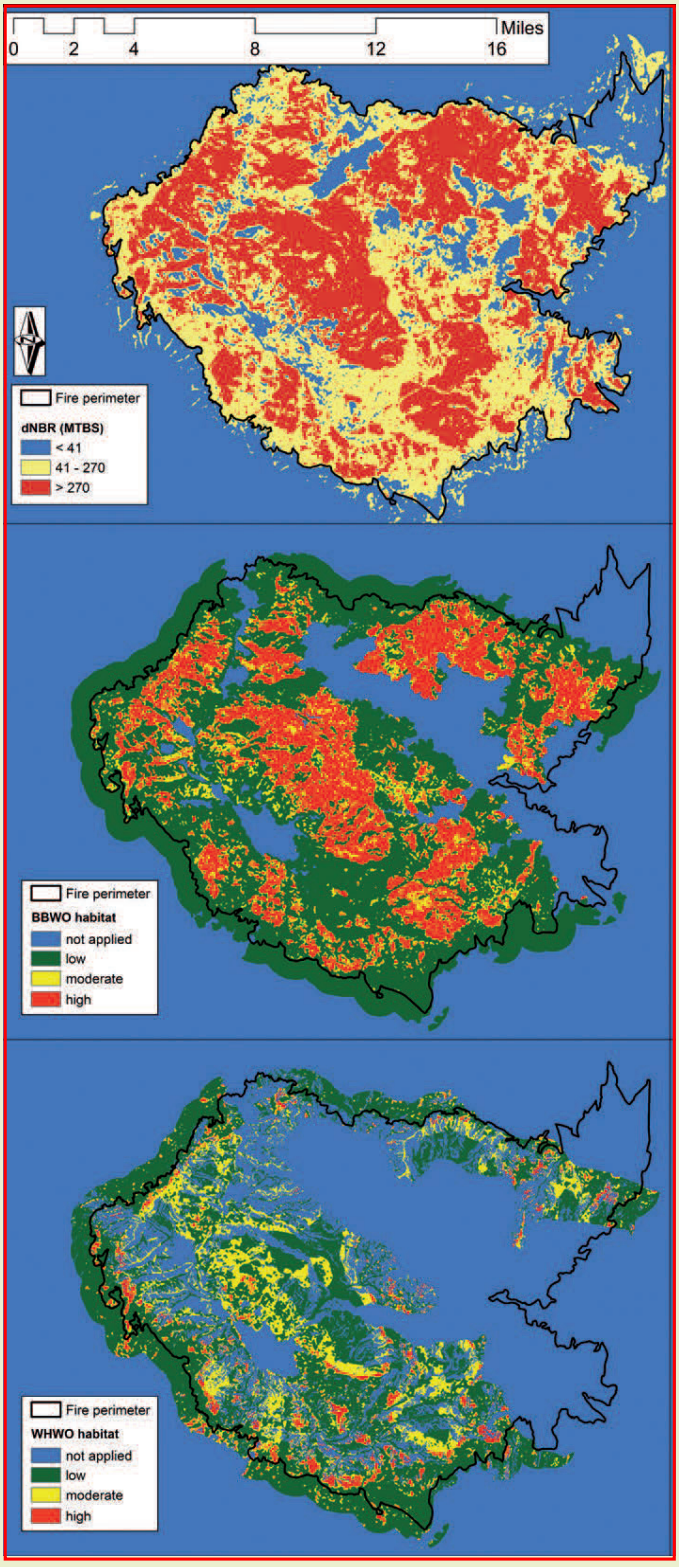
Preliminary Results Are In

This year marks the fourth year of data collection. Although the results won't be finalized until winter of 2020, Saab has several preliminary findings. All three woodpecker species are nesting in the different treatments. Even more encouraging, the white-headed woodpecker population is stable, and the Lewis's woodpecker continues to increase. However, the response of the black-backed woodpecker puzzles Saab.

MANAGEMENT IMPLICATIONS

- Managing post-wildfire landscapes potentially provides both benefits to the local economy and suitable wildlife habitat for woodpecker species of conservation concern. The key to this compatibility is incorporating woodpecker habitat requirements into salvage prescriptions.
- Managers can use FIRE-BIRD to identify probable woodpecker nesting habitat to minimize the effects of salvage logging projects and provide transparency during project planning.
- Engaging with collaborators and researchers to address management questions can yield benefits that include gaining the public's trust in management decisions; generating research that is relevant to other comparable landscapes; and implementing projects on the ground in a timely manner.

FIRE-BIRD: Habitat Mapping Tools for Disturbance-Associated Woodpeckers



For forest managers balancing postfire salvage logging and dry-forest restoration projects, while providing habitat for woodpecker species of concern, there's a recently developed tool to help with management planning. FIRE-BIRD is an ArcGIS-based modeling tool that can create habitat-suitability index (HSI) maps for three woodpecker species (black-backed, white-headed, and hairy woodpeckers [*Picoides* and *Dryobates* spp.]) in the Inland Northwest and Northern Sierras.

For the Canyon Creek Experimental Salvage Study, Saab used FIRE-BIRD to determine the locations of the treatment plots. "The tool allowed us to map the habitat suitability for three woodpecker species using remotely-sensed data within the perimeter of the burn," she says. "Mapping suitability helped us determine the locations for salvage logging, while our field-collected data helped us develop the silvicultural treatments that retained specific snag densities and diameters."

To access the software and GTR, visit https://www.fs.fed.us/rmrs/tools/fire-bird-habitat-suitability-model-application-tools-disturbance-associated-woodpeckers.

An online instructional FIRE-BIRD tool is available at: https://vimeo.com/301080500. Half-day workshops involving hands-on use of FIRE-BIRD can be arranged upon request.

Burn severity (top) and Habitat Suitability Index (HSI) maps for black-backed (center) and white-headed (bottom) woodpeckers at the Canyon Creek Fire (Oregon, 2015).

The Canyon Creek Experimental Salvage Study's Woodpeckers

Although there are several woodpecker species on the Malheur National Forest, three species were selected for monitoring because they represent the range of habitat conditions used by cavity nesters after wildfires.

With flying insects as their preferred prey, Lewis's woodpeckers nest in areas of high burn severity, resulting in open habitat that allows for aerial capture of insects. They favor nesting in large diameter snags (> 20" DBH). Wildfires release nutrients into the soil, which increases shrub development and associated flying insects. Salvage prescriptions that retain large diameter (> 20" DBH) snags and reduce densities of smaller snags (9–15" DBH) are expected to be compatible with Lewis's woodpecker (photo: T. Kogut and USDA Forest Service).

White-headed woodpeckers principally use burned forests for nest placement, while foraging in nearby live trees. Mixed-severity fires that result in a mosaic of burned and unburned areas provide the postfire conditions favored by white-headed woodpeckers. White-headed woodpeckers typically nest in moderate diameter snags (12–20" DBH) while foraging in larger diameter (> 20" DBH) live trees. Salvage prescriptions that retain the highest densities of moderate diameter snags (12–15" DBH) are expected to be compatible with white-headed woodpecker (photo: T. Kogut).

Black-backed woodpeckers nest in areas that experience high-severity burns, with high densities of relatively smaller diameter trees (> 9–15" DBH). High densities of burned snags provide substrate for a high concentration of wood-boring beetles, which are this species' preferred food choice. Therefore, burned forests with no logging are most favored by this species (photo: USDA Forest Service).

"The responses that we have seen for white-headed and Lewis's woodpeckers are what we expected," she explains. "But for black-backed, their nesting densities are declining." She cautions that they have yet to ascertain nesting productivity yet, which will ultimately tell us about population persistence.

In between her field visits to other study areas, Saab leads field trips with the Malheur National Forest and the Blue Mountains Forest Partners to explain preliminary findings about woodpecker responses to the treatments.

"Folks on these field trips are a bit surprised we could have the harvests and economic recovery along with a positive species response following the harvests," Webb says, adding that "the logging treatments essentially accelerated the habitat conditions some woodpecker species prefer while not compromising the habitat needs of others. I think these are some of the interesting lessons to take away from this study that we haven't had a conversation about yet."

In his new position as the USDA Forest Service Director of Natural Resources for the Intermountain Region, Beverlin is excited for the results and anticipates sharing them with all the forests in Region 4. "The ponderosa pine community is prevalent across the west, and fires aren't going away anytime soon," he says. "We know that communities will want some volume output from some salvage logging. I'm hopeful and optimistic this study will help inform other folks as they move forward."

Looking Ahead

Although the intent of the Canyon Creek Experimental Salvage Study was to answer the question of how best to design salvage logging to minimize negative consequences to woodpeckers, there important takeaways from this research study.

One crucial one for Beverlin is the benefit of leveraging research to answer management questions. "The Forest Service has a whole research arm that we don't use that nearly enough," he says. In his experience, across different landscapes and regions, Beverlin hasn't found that bringing researchers into the management process doesn't slow down the decision-making process.

"Another benefit of having research involved is there's going to be a published document that is going to show here's what we did and here's what it means," Beverlin says. "Typically forests just don't have that capacity. We're very bad at telling our story."

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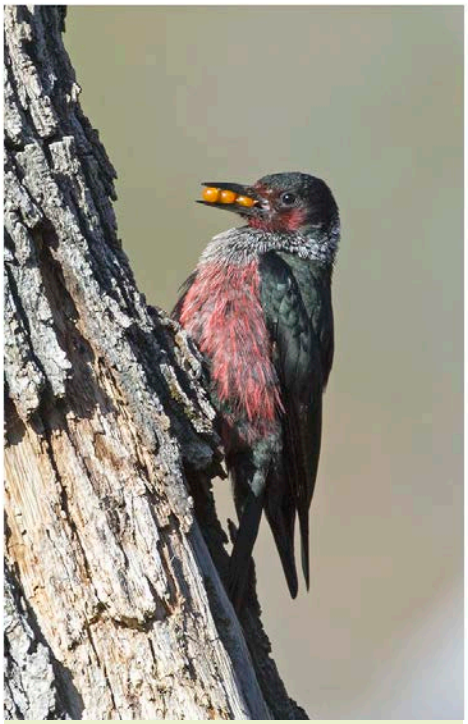
— Steve Beverlin

Since its release, FIRE-BIRD is now being used in the Pacific Northwest interior (USFS Regions 1, 4, 6) and California (USFS Region 5). Biologists in Pacific Southwest Region (5) even followed the program's methodology to develop a program called FIRE-BAT, which can model bat habitat in a post-wildfire landscape. "We're honored that they are following our methodology," says Saab.

For Saab, this study could be considered the culmination of her career. "I feel really fortunate that I had the opportunity to lead this study," she says. "After a career of studying woodpeckers and fires, I finally designed an experimental study in collaboration with managers, who implemented it on the ground. This is unique for research and we pulled it off."



Lewis's woodpecker (photo: T. Kagut).

KEY FINDINGS

- Each woodpecker species requires different habitat characteristics for population persistence in a post-wildfire landscape, and these habitat characteristics should be considered when managers are developing salvage logging projects.
- Studies have found that in the 10–12 years following salvage logging that selected harvest levels provided habitat for multiple woodpecker species.
- Preliminary results from the Canyon Creek Experimental Salvage Study during 1–4 years after the wildfire indicate that the white-headed woodpecker nesting population is stable through time, Lewis's woodpecker nesting densities continue to increase with time, and unexpectedly, black-backed woodpecker nesting densities were highest during the first year postfire.

RMRS ongoing research on the effects of salvage logging and large-scale tree mortality

At the Rocky Mountain Research Station, salvage logging and vegetation management related to large-scale mortality is an active area of research. Vicki Saab is one of several Station scientists who are studying salvage logging. While Saab's research is on the interactions of woodpeckers and salvage logging, other scientists study the effects of salvage logging upon ecosystem services, wildlife, and vegetation.

Here is a snapshot of some recent RMRS studies related to salvage logging:

Is that tree dead? Quantifying fire-killed trees to inform salvage and forest management

Research Ecologist Sharon Hood studies tree mortality following wildfires to identify characteristics of fire injuries that will result in tree death. Through her research over the past decade, she has improved the First Order Fire Effects Model (FOFEM), a modeling tool that forest managers can use to predict tree mortality and subsequently plan for salvage and other management activities.
https://www.fs.usda.gov/rmrs/sites/default/files/documents/SYCU_issue36_firesalvagelogging_FINAL.pdf

Post-spruce beetle timber salvage drives short-term surface fuel increases and understory vegetation shifts

Research Forester Mike Battaglia was part of a team who studied the effects of salvage logging on surface fuel loads and plant understory communities in high elevation Engelmann spruce (*Picea engelmannii*) -dominated forests. They found that surface fuels did increase in salvaged areas compared to untreated areas but expect over time surface fuels in untreated stands to increase to comparable or greater levels. Understory plant cover was reduced in salvaged areas due to shrub cover loss, but there was no difference in species diversity or richness between salvaged and non-salvaged stands. The team recommended that salvage harvest effects be monitored over extended time frames to detect longer-term trends.
https://www.fs.usda.gov/rmrs/publications/post-spruce-beetle-timber-salvage-drives-short-term-surface-fuel-increases-and
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Lynx and snowshoe hare response to spruce-beetle tree mortality: Evaluating habitat suitability and timber salvage in spruce-fir forests

Since 2015, John Squires, an RMRS Research Wildlife Biologist, has led a team of researchers and Rio Grande National Forest, Colorado Parks and Wildlife, and the Montana State University collaborators to study the effects of spruce beetle outbreak on lynx habitat. Their current focus is on how to identify areas that can be salvaged logged without compromising the quality of lynx habitat. Stay tuned for new findings soon!
https://www.fs.usda.gov/rmrs/projects/lynx-and-snowshoe-hare-response-spruce-beetle-tree-mortality-evaluating-habitat-suitability

Post-fire logging produces minimal persistent impacts on understory vegetation in northeastern Oregon, USA

RMRS Forester Erich Kyle Dodson collaborated with David Peterson, a Research Scientist with the Pacific Northwest Research Station, to study the long-term response of understory vegetation to two post-fire logging treatments in northeastern Oregon. The logging treatment was a commercial salvage logging with and without additional fuel reduction logging. Among their findings: Post-fire logging treatments produced no significant effects on understory vegetation cover, diversity, or community composition 15 years after treatment. Understory vegetation was seen to be resilient to post-fire logging, particularly when best management practices, like logging over snow, is used to limit damage to soils and understory vegetation.
https://www.fs.usda.gov/rmrs/publications/post-fire-logging-produces-minimal-persistent-impacts-understory-vegetation

Overlapping bark beetle outbreaks, salvage logging and wildfire restructure a lodgepole pine ecosystem

A team that included RMRS scientists Chuck Rhoades, Research Biogeochemist; Kristen Pelz, Forester; and Paula Fornwalt, Research Ecologist, studied post-fire soil and vegetation responses in beetle-killed lodgepole pine (Pinus contorta) stands in Colorado. Some stands had recently been salvaged logged, which created an opportunity to compare salvage logging, wildfire and the combination of logging followed by wildfire. Among their findings: Logging roughly doubled woody fuel cover while forb and shrub cover were reduced by half, and wildfire consumed all conifer seedlings in uncut and cut stands but did not stimulate conifer regeneration within four years of the fire. Salvage logging had mixed effects on tree regeneration, understory plant and surface cover and soil nitrogen, but neither exacerbated nor ameliorated wildfire effects on those resources.
https://www.fs.usda.gov/rmrs/publications/overlapping-bark-beetle-outbreaks-salvage-logging-and-wildfire-restructure-lodgepole

"I feel really fortunate that I had the opportunity to lead this study. After a career of studying woodpeckers and fires, I designed an experimental study in collaboration with managers, who implemented it on the ground. This is unique for research and we pulled it off."

— Vicki Saab

White-headed woodpecker (photo: T. Kagut).

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SCIENTIST AND MANAGER PROFILES

The following scientists and managers were instrumental in the creation of this Bulletin:

VICKI SAAB is a research wildlife biologist with the Rocky Mountain Research Station. Her research focus is on understanding wildlife habitat relationships to provide guidance on management activities that promote wildlife population and habitat persistence. She studied the ecological relationships between fire and birds for over 25 years. She led the team that developed FIRE-BIRD, a GIS-based tool that allows managers to develop habitat-suitability models for woodpecker species. Saab earned an undergraduate degree in wildlife ecology from Oklahoma State University, a master's degree in fish and wildlife management from Montana State University, and a Ph.D. in environmental, population, and organismal biology from the University of Colorado. Connect with Vicki at https://www.fs.usda.gov/rmrs/people/vsaab.

STEVE BEVERLIN is the director of Natural Resources for the Intermountain Region. Prior to accepting this position, Beverlin served on the Malheur National Forest as the deputy forest supervisor and later the forest supervisor.

MARK WEBB is the executive director of Blue Mountains Forest Partners. Prior to joining the nonprofit, Webb served as Grant County Judge, taught at Eastern Oregon University, and worked in natural resource-related jobs across eastern Oregon. He received an undergraduate degree from Reed College, and Ph.D. from the University of Notre Dame.

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Helena National Forest: Denise Pengeroth

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Malheur National Forest: Amy Unthank, Steve Beverlin, Lori Stokes

Okanogan-Wenatchee National Forest: Kent Woodruff

Pacific Northwest Research Station: John Lehmkuhl

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Plumas National Forest

Point Blue Conservation Science: Brent Campos and Ryan Burnett

Rocky Mountain Research Station: William Block

USFS, Region 6: Kim Mellen-McLean, Josh Chapman

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POSTAGE

The purpose of the Science You Can Use Bulletin: To provide scientific information to people who make and influence decisions about managing land.

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