How is Wildfire Affecting Wildlife Habitat?

Editor's note: To share with readers the research being conducted related to the interactions of wildfire and wildlife, I invited Dr. James River at Oregon State University and Dr. Brian Harvey at the University of Washington to highlight the ongoing research they and their graduate students are conducting.

Forest Animal Ecology Lab, Oregon State University

Native Bee Research in the Douglas Fire Complex

Animal pollinators provide a foundation for ecological communities through their pollination services, yet our understanding of how pollinators such as wild bees respond to variation in fire severity is limited, particularly for forest ecosystems.

Our research team has taken advantage of a natural experiment created by the Douglas Fire Complex, a large-scale (>48,000 acre) mixed-severity wildfire in southern Oregon, to address two important questions about how native bees respond to wildfire in mixed-conifer forest. In the first study, we sampled the native bee community after wildfire and found that fire severity was a strong driver of bee diversity: 20 times more individuals and 11 times more species were captured in areas that experienced high fire severity relative to areas with the lowest fire severity. We also found that two critical habitat components for maintaining bee populations—flowering plants and boring insect exit holes used by cavity-nesting bees—also increased with fire severity.

In the second study, we quantified the population response of the blue orchard bee (*Osmia lignaria*), an important spring crop pollinator, across the fire severity gradient by placing nest blocks with a standardized number of male and female cocoons in the spring just prior to hatching. We found that the number of offspring produced increased with fire severity, although the increase was modest. We also found female offspring production was >10% greater at nest sites experiencing the greatest landscape-scale fire severity relative to the lowest-severity areas.

Because females are larger than males and take more to produce, the increase in female offspring indicates higher quality habitat for rearing young in areas of high fire severity. Taken together, our studies demonstrate that severely burned mixed-conifer forest contained the most diverse wild bee communities, which have important implications for conserving biodiversity in fire-prone areas given the expected expansion of wildfires in the coming decades.

Black-backed Woodpecker research

PHOTO COURTESY OF JAMES RIVER

Woodpecker populations can reflect rapid changes to forest health and often serve as indicator species to help guide forest management decisions. The Black-backed Woodpecker (*Picoides arcticus*) is known for its strong association with recently burned forests and is a species of conservation concern due to habitat loss stemming from post-fire management of burned forest. Recently, several studies have found the Black-backed Woodpecker occupying green, unburned forests in the western part of its range during the breeding season, raising questions about whether green forests can support viable nesting populations in this region.

We studied breeding Black-backed Woodpeckers in southern Oregon to evaluate whether two vital rates critical to population recruitment—nest and post-fledging survival—differed between green and burned forests. We found that neither daily nest survival rate nor reproductive output (i.e., the number of fledglings per successful nest) differed between nests located in green and burned forest; nestlings in the two forest types were also similar in their body condition. We also quantified survival of recently fledged individuals using VHF radio telemetry and found that the survival rate of birds in green forest was nearly identical to those in burned forest. Black-backed Woodpeckers in green forests were equally successful at breeding as conspecifics in recently burned forest, indicating green forest can support viable populations in the western portion of its range.

These findings have important conservation implications given that green forest occupies the majority of the forested landscape in the western United States. Therefore, forest management practices that promote pyrodiversity and connectivity between green and burned forest within pyrodiverse landscapes are likely to provide the greatest conservation benefits for this species.

To learn more about these studies, visit https://people.forestry.oregonstate.edu/jim-rivers/.

The Harvey Lab, University of Washington

In our lab, we conduct fire ecology research in the Northwest, often in close collaboration with partners in federal, state, and tribal organizations. While most of our research is not focused on wildlife, per se, fires and how they shape forest structure are one key dimension affecting wildlife habitat. Our lab group is currently conducting a series of projects examining wildfires, the role they play in structuring forests on both sides of the cascades, and management approaches to foster forest resilience.

For example, graduate student Michele S. Buonanduci (mbuon@uw.edu) is leading research on patterns of wildfires across the Northwest US, assessing trends in high-severity, or stand-replacing fire, in forests over the last two decades. This work presents critical information on regional trends in where forests are likely to experience fire-catalyzed shifts in wildlife habitat. This work is paired with field research explained below, using detailed measurements of vegetation structure in burned and unburned forests across the Northwest.

Forests on the westside of the Cascades in Washington and northern Oregon are typically not thought of as 'fire-prone,' yet fire plays a profound

PHOTOS COURTESY OF BRIAN HARVEY AND MADISON LAUGHLIN

In eastern Washington, research questions that graduate students are pursing include how the forests are recovered or not following recent wildfires and how management treatments that reduce fuel loads can decrease fire severity. While on the westside, research questions are focusing on the creation of early-seral forests following wildfires and post-fire tree regeneration.

role in shaping these forests and the habitat they provide-from immediately following fire through centuries later in old-growth forests. Large, infrequent, and severe (stand-replacing) fires are a natural part of the historical disturbance regime in the western Cascades.

Recent large fires in 2017 and 2020 have shifted some areas of forest from late-seral (mature or old-growth) to early-seral conditions—a rare habitat condition in the western Cascades. Early-seral forests are notable as the only time in forest succession where trees are not dominant and instead are characterized by a wide variety of open habitat niches that lead to high plant and animal diversity. Our lab group, along with scientists Dan Donato and Josh Halofsky at the Washington Department of Natural Resources (WA DNR) and our partners across the Northwest are setting up a network of 150 long-term forest plots recently burned on the west side of the Cascades (https://www.youtube.com/watch?v=3sfJSrdCgI4&t=2s).

Graduate student Liliana K. Rangel-Parra (lkrp@uw.edu) is focusing her research on the early-seral plant communities in these plots and how they compare to pre-fire forests across gradients of burn severity and past disturbance history. So far, through quantifying the presence, abundance, and relative dominance of more than 200 plant species in these early-seral forests, this work shows that not only is early-seral post-fire diversity high, but differs widely depending on how severe the fire was and how old the forest was when it burned. This diverse plant community in early seral forests lays the foundation for a complex food web and assemblage of wildlife that is different from other stages of forest development.

Graduate student Madison M. Laughlin (laughmad@uw.edu) is focusing on post-fire tree regeneration in these plots, and so far is finding abundant and diverse establishment of shade-tolerant (e.g., western hemlock, Pacific silver fir) and shade-intolerant (e.g., Douglas-fir, noble fir) species. This early co-dominance of trees with different functional roles will provide for diverse arboreal habitat structures in post-fire years to come. Graduate student Jenna E. Morris (jemorris@uw.edu) is characterizing aboveground carbon and fuel profiles in this network of plots to help forecast the potential for these forests to reburn in the future. Her work so far highlights the abundance of snags and downed wood in these forests and how post-fire structure varies by burn severity and past disturbance history.

The eastern Cascades are the portion of the Northwest more commonly associated with frequent fires, though many of these forests have been strongly impacted by the exclusion of Indigenous fire and a century of fire suppression. Collectively, these changes lead to concern about the potential for uncharacteristically severe fires, how forests can be managed to minimize this risk, and how forests are recovering (or not) following recent wildfires. Each of these questions has strong implications for the wildlife habitat that forests provide prior to, and after wildfires in the eastern Cascades and are the focus of additional research by our lab group and our management collaborators.

Graduate student Don C. Radcliffe (dradclif@uw.edu) is examining how management treatments that reduce fuel loads and restore historical forest structure can decrease fire severity when fires occur more than a decade after treatment. In an upcoming project, Don is also examining how forest restoration treatments and their spatial arrangement across forest landscapes influence bird diversity. When forests in the eastern Cascades do burn, how fast and whether or not trees reestablish is an important question that dictates post-fire habitat structure and potential conversions between forest and non-forest habitats.

Graduate student Angie D. Gonzalez (agonza29@uw.edu) is beginning a project in collaboration with Dan Donato and Josh Halofsky at the WA DNR to characterize the drivers of post-fire tree regeneration across forest zones and burn severity gradients in eastern Washington. Especially in areas where forests burn and transition to non-forest ecosystems as the climate warms, these findings will help inform understanding about how different types of habitat are arranged across dry interior fire-prone forests.

These projects are ongoing, so stay tuned for exciting findings to come! For more information, visit (https://depts.washington.edu/bjhlab/). *WF*