SPECIAL ISSUE: FIRE AND WILDLIFE INTERACTIONS

Fire regimes and vegetation structure and composition form a direct feedback loop, where fire regimes shape patterns in the vegetation and vegetation affects fire regime attributes. For decades, researchers focused their attention on the essential relationships between fire and vegetation; however, there is a vast gap in our knowledge about the more mobile inhabitants of these habitats. What about the wildlife that depend on these plants for food and shelter? Plants and animals are also part of a feedback loop, with the actions of animals affecting vegetation structure and composition, and the vegetation structure and composition influencing animal occupancy, survival, and reproductive rates. Animals have evolved with their habitat and with the fire regime of that habitat. Yet, we know very little about the influence of fire on wildlife use patterns, survival, or reproductive success immediately following fire or throughout post-fire succession.

This special issue presents research on the direct and indirect effects of fire on various wildlife taxa inhabiting a variety of fire-prone habitats across North America. The first article, by Korb *et al*., opens our minds to new and exciting possibilities that wildfire can bring to wildlife ecology and conservation. In an area where over-fishing and introduction of non-natives led to the extirpation of a native fish, a wildland fire burned with sufficient severity that the subsequent post-fire ash and mud flows killed all of the non-native fish in a particular reach of a tributary of the Colorado River. Korb and her colleagues took advantage of the non-native fish kill and reintroduced a native fish that had not been present in this river basin for over 100 years.

The second paper shows how fire is essential in creating nesting habitat for the red-headed woodpecker, a species that is declining throughout its range. In the Black Hills of South Dakota, Vierling and Gentry compared abundance and productivity in older burns to that in recent burns. They suggest that it is the interplay of fire severity and time since burn with predator density that drives the nesting success of this species.

Fire burns heterogeneously across the landscape leaving unburned patches within fire perimeters as well as a mosaic of habitat patches that burned at varied severities. Patch size, shape, and severity can influence wildlife distributions across that burned landscape. In the third paper, Kolitar *et al*. assessed how this spatial heterogeneity in fire severity and the scale of observation influenced the habitat use patterns and occupancy rates of American three-toed woodpeckers in the Colorado Front Range.

Compared to species-specific information, there is an even broader gap in our knowledge on the ecological relationship between fire and animal communities. The next three papers apply a community approach to investigating this relationship. The first paper of this group, Marx *et al.*, highlights the positive aspects of not only using fire to maintain a landscape mosaic of habitat succession, but applying it in accordance with the natural fire regime of the area. Land managers often conduct prescribed burns outside the natural fire regime (e.g., burning in spring rather than fall) in order to precisely control the burn or to help cultivate human activities (e.g., agriculture). However, it is important to remember that the flora and fauna evolved with a particular fire regime. Although the native flora may recover within a 1 yr to 2 yr post-fire regardless of the season of burning, the wildlife may take much longer to re-colonize the area and could be locally extirpated altogether if we burn outside of situations with which they evolved. The research of Marx *et al*. also reminds us that many habitats provide important wintering grounds for birds and should be burned carefully.

The next paper, Mendelsohn *et al.,* investigated the effects of large-scale wildland fires on bird communities in five vegetation types in coastal scrub areas of California. Their study was unique in that they capitalized on the opportunity of having two large wildfires burn through areas where they had completed two years of bird surveys before the fires burned.

The final paper of this group examined the relationships between fire severity, related spatial and vegetation aspects, and small mammal populations. Roberts *et al.* studied both prescribed and wildland fires that burned across a landscape of mixed-conifer forests in Yosemite National Park, California. They emphasized that the spatial complexity in burned landscapes can influence small mammal abundance patterns.

All of these papers show that species respond differently to various vegetation and spatial characteristics across the landscape. This habitat mosaic, whether formed through fire severity or post-fire succession variability (time since the fire burned a particular patch), is important for maintaining species diversity, habitat suitability, and population persistence.

Although it is important to evaluate the interactions of wildlife and fire, it is essential to broaden our scope to investigate as much of the food web as possible. Many animals, such as chipmunks and northern flying squirrels, rely heavily on below-ground food sources such as truffles, the fruiting bodies of ectomycorrhizal fungi. Meyer *et al.* compared truffle abundance and diversity in burned and unburned mixed-conifer forests of Yosemite National Park, California. They showed that fire impacts below-ground organisms and suggest that burning may locally enhance species diversity, and that both abundance and diversity may be driven by litter depth.

Through this special issue, we hope to encourage fire ecologists to consider wildlife in the scope of their research and burn plans. As Hutto *et al*. point out in the first paper in our Forum section of this issue, many wildlife species evolved with and adapted to particular fire regimes. They suggest moving beyond solely relying on dendrochronolgical studies for determining the fire regime of a region, to using the resident wildlife to provide valuable insight as well. Through evolutionary time, these creatures adapted to specific post-fire conditions and their distribution patterns and reproductive success can reveal specific aspects of their habitat that persisted through time (e.g., fire severity and fire return intervals).

Finally, Vierling and Lentile provide an insightful review of the effects of fire severity on wildlife in aspen and ponderosa forests in the western United States. They reconfirm, through other published studies, that spatial complexity and juxtaposition of burned and unburned patches in the post-fire landscape are important to wildlife use patterns and reproductive success. They advise that scientists incorporate fire severity and the resultant spatially explicit data in their future investigations of fire and wildlife interactions.

How we burn or suppress fires determines what wildlife species can inhabit and reproduce in an area. Wildlife evolved with the fire regime of their habitat; therefore, if we change one, we affect the other. It is important that land managers consider wildlife in their burn plans, and that we encourage fire researchers to incorporate the inhabitants, as well as the habitat, in their plans as well.

Susan L. Roberts
US Geological Survey Western Ecological Research Center
Yosemite Field Station
El Portal, California 95318, USA