

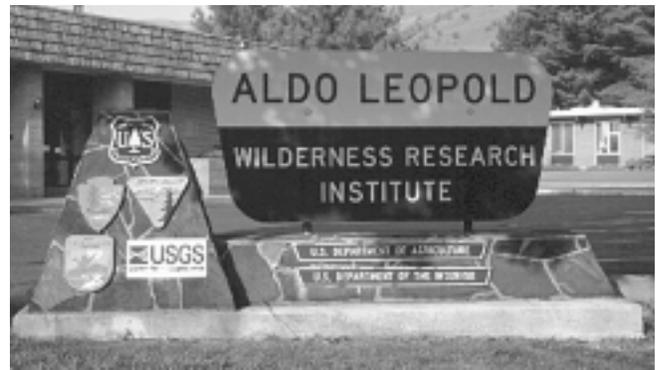
Amphibians and Wildfire in the U.S. Northwest

BY BLAKE R. HOSSACK

Recent evidence of amphibian declines along with outbreaks of large wildfires in western North American conifer forests has underscored our lack of knowledge about effects of fire on amphibians in these ecosystems. Understanding the connection between amphibian declines and wildfire is proving complex in some areas because the past century of fire suppression and other management activities have already altered amphibian habitats. For example, ponderosa pine forest types typically had low severity understory fires that likely maintained open habitats preferred by some amphibians. Fires in these, or other forests that have been altered by fire suppression, may be more intense than what occurred historically, and may have immediate negative effects on amphibians (direct mortality) or long-term beneficial effects (habitat restoration).

Amphibian communities in the southeastern United States benefit from frequent (1–5 years) low intensity fires, and prescribed fire is now a tool in managing some forests for biodiversity. In western North American forests, wildfire was the dominant historic disturbance, but there have been surprisingly few studies on its short- or long-term effects on amphibians. Notably, one study in Oregon and Washington found that abundance or richness of most terrestrial and stream-dwelling amphibians did not differ between young (40- to 80-year-old) and old-growth (up to 450-year-old) Douglas fir forests. Although this was not directly a fire study, it was conducted in forests naturally regenerated after stand-replacing wildfire, and the results suggest few long-term effects of fire.

There are several studies now underway in the Northwest examining the role of fire in amphibian conservation. D. J. Major (Utah State University) and R. B. Bury (U.S. Geological Survey) are investigating the effects of fire on fuel loads and terrestrial salamanders in the Klamath province of northern California. Initial results from that study suggest that downed



wood and fine fuels (e.g., leaf litter) were reduced after fire, but strong negative effects on the salamander community were not immediately evident. Covering a larger geographic area, D. S. Pilliod (California Polytechnic University–San Luis Obispo), R. B. Bury, and P. S. Corn (USGS–Leopold Institute) are conducting a five-year study of the patterns of distribution and abundance of stream amphibians in areas burned by recent wildfires in the northern Rocky Mountains (including the Frank Church–River of No Return Wilderness) and southern Oregon. The amphibian community of headwater streams in these study areas is often dominated by either the Rocky Mountain tailed frog or the Pacific tailed frog, depending upon location. Species such as tailed frogs and other stream-breeding amphibians are expected to be especially sensitive to disturbances such as wildfire because they breed in cold headwater streams, have larvae that can take more than three years to metamorphose, and are sensitive to increases in stream sedimentation and temperature. Data from this study so far suggest densities of tailed frog larvae are reduced by wildfire, especially in south-facing watersheds, and younger larvae are more susceptible to environmental changes that ensue.

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There are several studies at various stages of completion in Glacier National Park investigating the relationship between wildfire, amphibians, and their habitats. Most of these studies were instigated by wildfires in 2001 and 2003 that burned areas where the area has been monitored for the distribution of breeding populations since 1999, providing the rare opportunity to document potential changes using prewildfire data. A general pattern that has emerged is the number of wetlands used for breeding by the western toad increases the year after wildfire, sometimes in areas where we had found few adults and no breeding activity in years before the fires, followed by a decline toward prefire numbers over subsequent years. The response of other widely distributed pond amphibians in the park, the long-toed salamander and Columbia spotted frog, seems minimal, with no apparent increases or decreases in the proportion of wetlands occupied by breeding populations in burned areas. We have tried to determine why toads rapidly increase their numbers in recently burned areas. We

found few changes to the wetland environment (e.g., temperature, nutrients) that would explain the colonization and expansion, but radio tracking of adult toads and GIS modeling of vegetation gradients suggest they may be responding to changes to the terrestrial environment rather than to the wetlands. Based on similar colonization events in other areas of the Northwest, we suspect the western toad is a habitat generalist that responds to a wide variety of disturbances. Exactly why disturbed habitats are preferred and whether or not the larger population of the area actually benefits from the colonization of new breeding sites is still uncertain and will be the focus of future research.

The 2003 wildfires in Glacier National Park burned half of a group of streams we had sampled in 2001 for Rocky Mountain tailed frog larvae. Postfire reductions in relative abundance and a shift in age structure of the populations were consistent with a moderate fire effect. We do not think the fire represents a long-term threat to the populations. Results from this study will be an important counterpart to the larger

study of wildfire and stream amphibians described above. Wildfire studies are never truly replicated, but similar results from different areas and fires increase our confidence that conclusions we may draw are robust.

Scientists are in the early stages of determining the relationship between wildfire and conservation of amphibians in the Northwest. It will not be surprising if we find that amphibian communities are healthier in areas where fire regimes more closely resemble those prior to European settlement, similar to the relationship between wildfire and amphibians in the Southeast. Also, because fire has often been managed differently in wilderness and national parks during the last 30 years or so, compared to actively managed forests, protected lands may be important to the conservation of many amphibians. **IJW**

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