



Research Brief for Resource Managers

Release:

May 2015

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Fire effects on small mammal communities in California's frequent-fire forests

Susan L. Roberts, Douglas A. Kelt, Jan W. van Wagtendonk, A. Keith Miles, and Marc D. Meyer. 2015. *Effects of fire on small mammal communities in frequent-fire forests in California. Journal of Mammalogy* 96(1):107-119.

<http://dx.doi.org/10.1093/jmammal/gyu011>

Wildland fire is an important tool in the management of wildlife habitat, but the effects of fire on small mammal communities is poorly understood despite their critical importance in forest food webs. A 2015 study by Roberts and others indicates that the reintroduction of fire in frequent fire forests of the Sierra Nevada creates a heterogeneous forest landscape and promotes diverse small mammal assemblages.

The authors compared small mammal communities in ten burned and unburned forests over multiple years in Yosemite National Park. Their burned sites focused on lower and upper montane forests that burned recently (past 15 years) and included a variety of fire severity classes ranging from unburned-unchanged to high severity. Based on an impressive >30,000 trap-nights of sampling effort, they evaluated whether small mammal species diversity was greater in areas where fire has been reintroduced, presumably a result of increased habitat heterogeneity. They also examined whether fire severity patterns and habitat variables could be used to predict individual species responses to fire, based on known habitat associations with closed-canopy forests, open-canopy habitats, or variable habitat structure.

Management Implications

- Small mammal abundance was higher in unburned coniferous forests, largely reflecting the greater proportion of closed-canopy species such as the northern flying squirrel.
- Species diversity was similar between burned and unburned forests, but burned forests were characterized by greater habitat heterogeneity and higher small mammal species evenness.
- Fires that maintain a matrix of burn severities in montane forests, especially low to moderate severity and large patches of unburned refugia, creates a heterogeneous landscape that supports diverse small mammal assemblages.



Small mammals, such as this northern flying squirrel, benefit from a mixture of burn severities, especially unburned patches. *Image Credit: Susan Roberts, USGS.*

Small mammal abundance was higher in unburned forests, largely reflecting the greater proportion of species found in closed-canopy forests, especially deer mice but also northern flying squirrels. The deer mouse, a highly adaptable generalist species, was the most abundant species across the entire study area, including both burned and unburned forests. Species diversity was similar between burned and unburned forests, but burned forests were characterized by greater habitat heterogeneity and higher small mammal species evenness. Fire severity was also the most important factor influencing small mammal assemblages in frequent-fire forests of Yosemite National Park.

Small mammal species associated with closed canopies (e.g., tree squirrels) were most strongly and negatively influenced by fire. This pattern was evident even in burned landscapes with a heterogeneous mixture of fire severities and large, integrated patches of closed canopy forest. Species associated with more open habitats (e.g., ground squirrels) tended to be captured more frequently in burned areas with lower oak cover than in other habitat types. However, none of these open-habitat small mammal species were strictly fire dependent (they were captured in unburned forests too). Also, several generalist species (e.g., deer mice, chipmunks) were frequently captured in both burned and unburned areas but with variable trends among species.

The authors suggest that the strategic use of wildland fire can be an effective habitat management tool for small mammal species in frequent-fire forests. Fire can promote landscape

biodiversity by creating a heterogeneous matrix of burn severities, primarily consisting of low- and moderate-severity fire patches, but also including patches of high-severity fire consistent with an active fire regime landscape. Maintaining forests within their natural fire regime across the landscape, including asynchronous burning across forest stands and re-burning previously burned areas, can be important in promoting spatial and temporal habitat heterogeneity. However, paramount to this strategy is the integration of unburned, closed-canopy forest habitat for species dependent on these conditions.

Additional references for this topic:

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- Roberts, S. L., J. W. van Wagtenonk, A. K. Miles, D. A. Kelt, and J. A. Lutz. 2008. Modeling effects of fire severity and spatial complexity on small mammals in Yosemite National Park, California. *Fire Ecology* 4:83–104.



A patchwork of fire severities, including unburned patches, often promotes diverse small mammal assemblages, as shown in this forest stand in Yosemite National Park managed with wildland fire. *Image Credit: Stephanie Eyes, USGS.*