



Research Brief for Resource Managers

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Degradation and restoration of Indigenous California black oak (*Quercus kelloggii*) stands in the northern Sierra Nevada

Stephens, SL, L Hall, CW Stephens, AA Bernal, and BM Collins. 2023 "Degradation and restoration of Indigenous California black oak (*Quercus kelloggii*) stands in the northern Sierra Nevada." *Fire Ecology*. 19:12. <https://doi.org/10.1186/s42408-023-00172-9>.

Background

California black oak (*Quercus kelloggii*) is a culturally important species to indigenous people due to the oak's presence in their diet, ceremonies, and daily lives. Indigenous people used fire to cultivate desired species and create landscape mosaics with diverse species compositions and successional stages that were not only productive but limited the spread of unwanted fires. Yet with colonial settlement, indigenous people were removed from their homelands and these practices were stopped. After more than a century of fire exclusion and suppression combined with removal of large trees under timber harvesting, there has been a significant infill of small and shade tolerant trees. This encroachment of conifers is occurring in forests that may have previously been dominated by hardwoods tended to by Indigenous burning.

This study summarizes Indigenous oral traditions, assesses current and historical forest structure, and measures fire effects of

Management Implications

- Different outcomes from historical and current stewardship underscore the importance of incorporating Indigenous knowledge and practices into contemporary forest management to promote ecosystem resilience and cultural preservation.
- Active stewardship of surviving California black oaks after the Dixie fire could facilitate the recovery of an oak-dominated forest and the inclusion of Mountain Maidu traditional ecological practices.

the 2021 Dixie Fire to understand the state of forests in the northern Sierra Nevada with cultural significance to the Mountain Maidu. Oral traditions of the Mountain Maidu cultural burning practices were passed down through generations and were incorporated into this work by one of the authors. The focal site of the study was the Plumas National Forest expanded on University of California, and data included Berkeley forest inventory plots, a California black oak census, and dendro-ecological fire history records. Regional forest conditions were assessed historically via a

1924 forest inventory (Fig. 1), while current conditions were quantified through data from the Forest Inventory Analysis program.



Figure 1. Adapted from Stephens et al. 2023. Photo from the 1924 forest inventory on the Plumas National Forest portraying the forest stand structure of the time.

Findings

Oral traditions show that fire was a major cultural component for the Mountain Maidu and frequent use greatly reduced the threat of wildfire to California black oaks. While historically the study area supported open forest stands and a mean fire return interval of 8.6 years, contemporary conditions are characterized by high tree densities, especially in smaller diameter size classes of shade-tolerant species. After the Dixie Fire, all conifer trees were killed in the focal study area, while 61% of oaks survived despite all

trees being top-killed. An examination of historical forest conditions from 1924 in the broader region reports low levels of conifer competition across 82% of the forest area. Current conditions indicate 73% of this region has full site occupancy (35-60% of relative density) or is within the zone of imminent mortality (>60% of relative density; the highest levels of conifer competition). In these areas of high conifer density, there were few California black oak, that also had the smallest average diameter of the species across stands of both high and low conifer density. Conversely, large oak density was relatively high in the few areas where conifer competition was low.

The findings from this study highlight how the reduction of fire on the landscape has been detrimental for California black oak as risks of conifer encroachment and destructive wildfire have increased over time. The local fire history records provide support that fire frequency was influenced by the Mountain Maidu, not only by lightning ignitions. Historically low forest densities maintained by the Mountain Maidu through this practice created beneficial conditions for California black oaks. The oak survival after the Dixie Fire provides an opportunity for the US Forest Service to partner with the Mountain Maidu to steward and restore an iconic and important California species, and to increase forest resilience to wildfire and climate change.
