

# YOSEMITE'S BLACK OAKS

Oaks are a defining element of the California landscape. Found throughout the state, oaks occupy habitats from the coast to the Sierra Nevada and from the Oregon border to Mexico. Oscillations between glacial and non-glacial periods in the past have given oaks a unique evolutionary history in our state. Combined with California's myriad topographic and climatic barriers, this background has led to the evolution of nine tree-sized oak species in the state.

One of the most distinctive oak species growing in Yosemite National Park is the California black oak (*Quercus kelloggii*). Albert Kellogg, an early pioneer botanist, first named this species "California black oak" for its dark bark. Our black oak looks very similar to other oaks found in the Midwest, East, and South. California black oak has palm-sized dark green leaves that turn yellow-orange in fall, when they are shed by the tree. The large size and broad shape of a black oak's leaves are among its most distinctive features. Most other California oaks have leaves that are evergreen, small, thick and adapted to warmer and drier regions of the state.

Within Yosemite, California black oak is found in the western regions of the park, generally between elevations of 2,000 feet and 6,500 feet. The species is a dominant or subdominant member of vegetation communities on approximately 41,300 acres, or roughly 5.5 percent, of the park's area. Black oak is usually a subdominant canopy species when mixed with conifers such as ponderosa pine, incense cedar, Douglas-fir, and white fir, and broadleaf species such as canyon live oak and black cottonwood. However, it does form some pure stands within Yosemite Valley, Pate Valley and around Wawona.

Oaks are unique in producing acorns, small, oblong, hard fruits composed largely of fats and some protein. Native Americans relied heavily on acorns for food, especially through winter. The acorns of black oaks were considered the tastiest of all the oaks of California. An individual oak can produce hundreds or even thousands of acorns each year.

Most oaks flower in the spring and produce ripe acorns the following autumn. However, a few oaks, including black oaks, require two years for their acorns to mature; flowers successfully pollinated in one spring will not mature until the fall of the following year.

When black oaks first begin to leaf out in spring, they not only produce female flowers but also male flowers in structures called catkins. Wind blows the pollen from one tree to receptive female flowers on other trees. If pollination is successful, acorns will result.

In some years, oaks produce an abundance of acorns, while in other years they might be nearly barren. The phenomenon of widely variable acorn production from year to year is called masting. Many flowering and cone-producing plants also mast. The size of an acorn crop can be partially explained by weather conditions during the time of pollination. A warm, dry spring when flowers are mature tends to favor high rates of successful pollination, followed by large acorn crops. In contrast, if the spring is wet and cool, pollination will not be as successful, leading to a smaller acorn crop. Oak ecologists have long speculated about why oaks evolved to mast. One of the leading theories is called predator satiation. The idea is that if an oak produced the same number of acorns each year, acorn predators—deer, mice, birds, insects—would maintain their populations at a size that could take advantage of the entire crop each year. However, if the acorn crop varied from year to year, acorn predator populations would only be large enough to consume the entire crop in low yield years. In high acorn yield years, there would be acorns left over to sprout and produce new trees.

The Miwoks of Yosemite relied heavily on black oak acorns as a major part of their diet. They and other California Indians often used fire to alter and then maintain conditions favorable to certain species. Through oral histories and direct evidence by early Yosemite explorers, archeologists have documented that the Miwok of the Valley manipulated the environment to favor the black oak. Early Yosemite resident Galen Clark observed that "The Valley had been exclusively under the care and

management of the Indians, probably for many centuries. [The Indians would] annually start fires in the dry season of the year and let them spread over the whole Valley to kill the young trees just sprouted and keep the forest groves open and clear ... and to have clear grounds for hunting and gathering acorns." The fires would kill shrubs and conifer seedlings around mature

*California black oaks and Yosemite Falls.*



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*Immature black oak acorns in spring.*

black oak trees, aiding in the persistence of the oaks while ensuring the regrowth of grasses used for basket weaving.

Today's groves of black oaks are likely the results of centuries of management by Native Americans, as well as over a century of management by Euro-Americans. The pure black oak stands of the Valley may be artificial creations. Virtually everywhere else in the park, black oaks are mixed with the more abundant conifers such as ponderosa pine and incense cedar. This may explain why these pure stands appear to be slowly declining; as adults die off, they are not being replaced by younger trees. However, many other factors could help to explain why we have pure stands of mature black oaks in the Valley. These include changes in Valley hydrology, climate change, and changes in the nature and abundance of wildlife.

The declining stands of black oak within Yosemite Valley are located around the developed areas and adjacent to the larger meadows, particularly around Yosemite Village, the Ahwahnee Hotel, and El Capitan Meadow. Although august in appearance, these stands are composed of older individuals that are decaying and dying, with no seedlings or saplings around them.

In some ways, the ecology and status of pure black oak stands in Yosemite Valley mirrors the situation of oaks across California. A number of oak species don't appear to be producing enough new trees to maintain existing populations; however, statewide, black oaks are not apparently one of the species that suffers from this problem.

Since black oaks in Yosemite Valley are a significant biological and aesthetic resource for wildlife, visitors, and Native Americans, the Yosemite Fund granted support for a scientific study to assess their status and population trends within Yosemite Valley. The project examines the population structure of these trees throughout the Valley, studies changes in their distribution in the Valley over time using historical aerial photos, reviews

Native American use and manipulation of black oaks in Yosemite, and analyzes how past land use, fire, hydrological changes, and other factors may be influencing the future of this species. When the project is completed this year, a final report and manuscripts will detail the study's results. The final report will include recommendations to maintain black oak stands in Yosemite Valley, if this is deemed feasible.

Preliminary results indicate that the structure of black oak populations varies greatly throughout the Valley. Whereas the pure, declining stands of black oak around the Valley are heavily skewed toward older adults, other populations have individuals from many size classes.

There are several possible explanations for why we see demographically skewed populations in some places but not others. Mammalian browsing could be one factor. Oaks are a preferred food source for deer. If deer densities are high, excessive browsing could keep oak seedling and sapling densities low. Since deer are protected within the park, their densities are likely much greater now than when Native Americans inhabited the land. Conifers, on the other hand, are not a preferred food source of browsing animals, and we see many small, younger conifers, especially where the canopy is open and allows sufficient light to reach the forest floor. Changes in the hydrology of the Valley also may have affected the ability of black oaks to produce new seedlings from acorns in some areas. For example, the removal of a rock dam downstream of El Capitan Meadow may have made the land around some oak stands drier. Lack of fire, traditionally used by the Miwok, may partially explain why we see such variation in black oak demographics throughout the Valley. Oaks are adapted to recover from fire, as is evident in areas in the western part of the park that have burned in the last twenty years. Oaks may live for hundreds of years, surviving multiple fires by resprouting from the trunk base.

Whatever the reasons for the variation in black oak stand demographics and health that we see throughout the Valley, the distribution and abundance of this species in the Valley is unlikely to change much in the short term. The presence of black oak may shift slightly in the Valley in decades to come, but this tree is unlikely to disappear. This singularly distinctive element of our park will remain here for present and future generations of visitors, Native Americans and wildlife to enjoy.

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