



Blue Oak (*Quercus douglasii*)



Inset: Chico Enterprise Record

Summary:

Blue oak is native and endemic to California. It occurs in valleys and on low slopes of the Coast Ranges and on low foothills of the Sierra Nevada. The core area of blue oak distribution almost completely encircles the Central Valley, from Shasta County in the north to Los Angeles County in the south [98,114,116,188]. On the Coast Ranges, blue oak woodlands and mixed-oak woodlands with a blue oak component typically lie within a mosaic that includes annual grassland, coastal sage scrub, chaparral, redwood, and/or coast Douglas-fir communities. The oldest known blue oak, in Sequoia National Park, is about 400 years old [173]. Blue oak occurs in a mediterranean climate, with hot, dry summers and cool, wet winters.

Blue oak is a medium-sized, fall- and drought-deciduous tree [109,168,188,196]. It may retain its leaves year-round on moist sites [196] or show a flush of new leaves after heavy rains [100]. It is generally short and straight, from 20 to 66 feet (6-20 m) in height and 14 to 24 inches (36-60 cm) in DBH [173]. Blue oak typically has a single trunk, although some trees have few to several trunks [72]. The bark is thin and flaky [66,235]. The canopy is compact, round, and supported by many crooked branches [196]. Leaves are sparse [235], 1 to 3 inches (2.5-8 cm) long, and have wavy, spineless margins. They are bluish-green, waxy, and thick [1,72]. Soils are characteristically shallow, skeletal, infertile, thermic, and moderately to excessively well drained. Soil textures range from gravelly loam to clay [80,173].

The fruit is a nut, commonly called an acorn, that is 5 to 10 mm long × 10 to 15 mm wide. Blue oak regenerates from seed and vegetatively. The acorns mature in 1 year. Since they are not dormant, blue oak acorns germinate rapidly when cool October rains begin, Warm April temperatures and hot summer temperatures result in the largest blue oak acorn crops. One 38-foot (11.6 m) blue oak in Shasta County produced 3,750 acorns during a favorable season [173].



Blue oak is the most drought tolerant of California's deciduous oaks. Adaptations to drought include thick leaves and bluish-green color [1], high water-use efficiency [43,142,182], deciduous habit with summer drought, plasticity in leaf development, and plasticity in early root development. In early root development, root growth is directed toward either upper or lower soil-layer water sources, depending on water availability. Seedlings with access to deep soil layers tend to grow deep taproots [42]. When supplied with a deep water source in the greenhouse, blue oak seedlings rapidly grew a taproot but not an extensive lateral root system. When water was only available in the upper soil layer, however, the seedlings grew many lateral roots [48].

Blue oaks beneath their parents' canopies may show higher establishment and growth rates than seedlings in the open. Blue oak's deciduous habit allows nearly full-sunlight penetration to the ground in some seasons, and blue oak canopies are usually sparse and diffuse in all seasons [43], so light does not usually limit blue oak establishment beneath blue oak canopies.

Seedlings do not compete well with annual grasses. Additionally, annual grasses often outcompete blue oak seedlings for space, water, and light

SEASONAL DEVELOPMENT:

leaf buds swell: January to mid-May

stem elongation: February to mid-May

new leaves appear: mid-March to May

catkins emerge: March to mid-June

leaves fall: August to mid-November

Fire effects:

Blue oak produces root crown or bole sprouts after top-kill by cutting or burning [21,172,173]. Sprouting ability varies with tree age, site, postdisturbance precipitation, and—when the disturbance was fire—fire severity (see [Plant Response to Fire](#)).

In Sequoia National Park, a comparison of contemporary blue oak woodland structure with that noted in historical records from the settlement period showed a large increase in blue oak cover and density. Vankat and Major [244] suggest that increased density of blue oak woodlands is due to a combination of fire exclusion and past livestock grazing. For example, the blue oak-California buckeye phase of the blue oak woodland type is characterized by a partially-closed canopy, and frequent surface fires probably maintained blue oak as the canopy dominant. In the absence of fire or other top-killing disturbances, California buckeye is successional replacing blue oak on some sites in Sequoia National Park, with the blue oak woodland communities succeeding to closed-canopy California buckeye-blue oak forests [18].



Blue oak sprouts from the root crown and/or bole after top-kill by low- to moderate-severity surface fire [28,103,154,165,173,176,176,235,236,253]. Young blue oaks are best adapted to sprout after top-kill [235,236]. Blue oak probably establishes from acorns after fire, likely from several sources including animal-dispersed acorns and acorns dropping from surviving parent trees.

Bark of mature blue oak bark is thin compared to bark of most mature, associated oaks, and it tends to flake off as trees age [235], so blue oaks are less insulated against fire than associated oaks.

Blue oak woodlands historically had a regime of frequent summer and fall surface fires, fueled by groundlayer perennial bunchgrasses and forbs and downed woody debris

blue oak sprouted from the root crown or stump after wildfire or cutting.

Low- or moderate-severity fire generally top-kills blue oak seedlings and saplings [78,124,165,173,176]. The bark of young blue oaks catches fire and burns easily, providing little protection from fire [173]. Mature trees are resistant to top-kill by low-severity surface fires and most moderate-severity surface fires, but are top-killed or killed by severe fires or the sustained heat of most chaparral fires [173,200]. Because the bark is thin [66,235], the boles of mature blue oaks scar easily.

Mature trees crown-scorched by surface fires often replace their leaves the next year with no apparent ill effects [173]. Mature blue oaks with most of their leaves scorched may be top-killed or die back to the bole, however

Fire or flood prior to acorn dispersal can reduce acorn predator populations. Fire kills the larvae of ground-dwelling beetle larvae that damage blue oak acorns [15]. On The Nature Conservancy's Kaweah River Preserve, a large blue oak acorn crop was followed by a wet winter that flooded the Preserve and killed many ground-dwelling, acorn predator insects. The Preserve now supports many saplings that date back to the flood year.

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