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SPECIES: *Quercus lobata*

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Introductory

SPECIES: *Quercus lobata*

AUTHORSHIP AND CITATION :

Howard, Janet L. 1992. *Quercus lobata*. In: Fire Effects Information System, [Online].
U.S. Department of Agriculture, Forest Service,
Rocky Mountain Research Station, Fire Sciences Laboratory (Producer).
Available: <http://www.fs.fed.us/database/feis/> [2017, November 28].

ABBREVIATION :

QUELOB

SYNONYMS :

NO-ENTRY

SCS PLANT CODE :

QULO

COMMON NAMES :

valley oak
valley white oak
California white oak
water oak
weeping oak
white oak
roble

TAXONOMY :

The currently accepted scientific name of valley oak is *Quercus lobata* Nee. in the subgenus *Quercus* or white oak [46,53,72]. Recognized varieties are as follows [53]:

- Q. lobata var. lobata
- Q. lobata var. agillara Jeps.
- Q. lobata var. insperata Jeps.
- Q. lobata var. turbinata Jeps.
- Q. lobata var. walteri Jeps.

Valley oak hybridizes with the following species:

- x Q. douglasii (blue oak): Q. Xjolonensis Sargent [41,46]
- x Q. turbinella ssp. californica (desert scrub oak): Q. Xmunzii Tucker [41,46]
- x Q. dumosa (California scrub oak): Q. Xtowneii Palmer [46,72]
- x Q. engelmannii (Engelmann oak) [72]
- x Q. garryana (Oregon white oak) [72]

MacDonald oak (*Q. macdonalii*), found on the Channel Islands, is recognized by some authorities as a distinct species resulting from hybridization between valley and California scrub oak [53,72,73].

LIFE FORM :

Tree

FEDERAL LEGAL STATUS :

No special status

OTHER STATUS :

Valley oak in the Santa Monica Mountains National Recreation Area is reproducing poorly and is targeted for a long-term monitoring program to assess the health of valley oak populations and communities [20].

DISTRIBUTION AND OCCURRENCE

SPECIES: *Quercus lobata*

GENERAL DISTRIBUTION :

Valley oak is endemic to California. It is distributed from Shasta County south through the Central Valley and lower-elevation foothills and valleys of the Sierra Nevada and Coast Ranges to Los Angeles County [34,71]. It also occurs on Santa Cruz and Santa Catalina Islands [46].

ECOSYSTEMS :

- FRES20 Douglas-fir
- FRES21 Ponderosa pine
- FRES24 Hemlock - Sitka spruce
- FRES27 Redwood
- FRES28 Western hardwoods

FRES42 Annual grasslands

STATES :

CA

BLM PHYSIOGRAPHIC REGIONS :

- 3 Southern Pacific Border
- 4 Sierra Mountains

KUCHLER PLANT ASSOCIATIONS :

- K001 Spruce - cedar - hemlock forest
- K005 Mixed conifer forest
- K006 Redwood forest
- K009 Pine - cypress forest
- K010 Ponderosa shrub forest
- K011 Western ponderosa forest
- K026 Oregon oakwoods
- K029 California mixed evergreen forest
- K030 California oakwoods
- K048 California steppe

SAF COVER TYPES :

- 221 Red alder
- 222 Black cottonwood - willow
- 223 Sitka spruce
- 232 Redwood
- 233 Oregon white oak
- 234 Douglas-fir - tanoak - Pacific madrone
- 245 Pacific ponderosa pine
- 246 California black oak
- 249 Canyon live oak
- 250 Blue oak - Digger pine
- 255 California coast live oak

SRM (RANGELAND) COVER TYPES :

NO-ENTRY

HABITAT TYPES AND PLANT COMMUNITIES :

This species dominates two plant communities: the valley oak woodland and the valley oak riparian forest. It is often the only tree in valley oak woodland, which are composed of grassy savannas with large, widely spaced oaks. The valley oak woodland and the annual grassland are closely associated, and together form a mosaic over portions of California's low-elevation rangeland [41]. Historically, the associated grassland was probably dominated by perennial bunchgrasses [37]. Valley oak woodland, once extensive, has largely been cleared for farmland and now occurs in scattered remnant patches. Isolated trees are sometimes found in cultivated fields [77].

Valley oak riparian forest occurs on levees and the highest parts of

floodplains [38,40]. Canopies are open to densely closed; shrub cover may be as great as 70 percent [13]. Historically, these forests extended 0.6 to 5.0 miles (1-8 km) on each side of major rivers [5,38].

Valley oak riparian forest merges with Fremont cottonwood (*Populus fremontii*) riparian forest near waterways and with valley oak woodland on upland sites [39]. In foothill oak (*Quercus* spp.) woodlands, the valley oak phase merges with the California black oak (*Quercus kelloggii*), coast live oak (*Q. agrifolia*), or interior live oak (*Q. wislizeni*) phases [2]. Valley oak is an indicator of rich, deep alluvial soils that comprise some of the most fertile farmland in the world [41,62].

Publications listing valley oak as a dominant or codominant species in habitat typings are as follows:

A classification system for California's hardwood rangelands [2].
 Blue oak communities in California [3].
 Association types in the North Coast Ranges of California [16].
 Riparian vegetation and flora of the Sacramento Valley [17].
 Oak woodland [31].
 Vegetation and floristics of Pinnacles National Monument [35].
 Terrestrial natural communities of California [39].

MANAGEMENT CONSIDERATIONS

SPECIES: *Quercus lobata*

WOOD PRODUCTS VALUE :

Valley oak lumber has a propensity to crack and warp while drying, and is often stained by fungus. These problems, however, can be overcome, and there is a small commercial market for the lumber in the manufacture of cabinets. The wood is occasionally used for wine barrels. Historically, it was primarily used as firewood and as a source of commercial charcoal. Valley oak wood was also utilized in the construction of the steamboats that once ran the Sacramento and San Joaquin Rivers, and as keel blocks during World War II [34,62,74].

IMPORTANCE TO LIVESTOCK AND WILDLIFE :

Remaining valley oak riparian and woodland areas comprise critical habitat which is intensively used by wildlife. Collectively, valley oak riparian forests support 67 nesting bird species, more than any other California habitat for which data are available [23]. The state-threatened Swainson's hawk is closely associated with riparian habitat in the Central Valley, where these hawks use large valley oaks as nesting sites [66]. Other animal species living within the valley oak riparian forest cover type and in danger of extirpation include the state-threatened greater sandhill crane, the state-endangered yellow-billed cuckoo, and the federally-threatened elderberry longhorn beetle [26,40]. In addition, these forests provide habitat for rare remnant populations of ringtail in the Central Valley [9]. Valley oak woodlands support much wildlife as well. The valley oak woodland of the

Tehachapi Mountains supports 45 species of birds. Valley oaks there are preferred foraging substrate for the northern oriole, housewren, and acorn woodpecker [12]. The valley oak woodland of the Bobelaine Audubon Sanctuary near the Feather River has a mean density of 16 birds per acre (40 birds/ha), with 35 species present. The area is preferred wintering grounds for various sparrows and the dark-eyed junco [51].

Valley oak is used by various cavity-nesting and cavity-storing birds and mammals [50]. It supplies browse for livestock, black-tailed deer, lagomorphs, and various rodents. Pocket gopher, California ground squirrel, and deer mouse are heavy consumers of valley oak seedlings. Acorns are an important diet item of the California ground squirrel, pocket gopher, scrub jay, yellow-billed magpie, acorn woodpecker, black-tailed deer, feral pig, and of cattle. Roots are consumed by feral pig and pocket gopher [30,35,75].

PALATABILITY :

Valley oak acorns are selectively chosen by acorns predators over those of other species, probably because of their large size [70].

The palatability of mature valley oak browse has been rated as poor for cattle; useless for horses; poor to useless for sheep and goats; and fair to poor for black-tailed deer [63].

NUTRITIONAL VALUE :

The percent composition of valley oak acorns is as follows [76]:

moisture	40.57	ash	1.08
crude protein	2.82	calcium	0.08
crude fiber	7.84	phosphorus	0.06
fat	4.25	tannins	3.85

Information on the nutritional value of valley oak browse is sparse. The mineral value of mature leaves for black-tailed deer is rated as follows [67]:

phosphorus: fair
 calcium: good
 phosphorus/calcium ratio: fair (0.20:0.86)

COVER VALUE :

NO-ENTRY

VALUE FOR REHABILITATION OF DISTURBED SITES :

There is great interest among public and private managers to restore as much valley oak woodland and riparian forest as possible, and revegetation projects are numerous [25,26,54,56,58]. Due to heavy acorn and seedling predation, however, mortality of newly-established populations often approaches 100 percent on project sites [1,30]. Enclosing plants in a protective device such as wire caging is recommended until tree height exceeds the browse line. The effectiveness of various protective devices has been detailed in the literature [19,33]. Trees are established from nursery stock or from

acorn plantings. Nursery-grown trees planted in the Sepulveda Wildlife Reserve of Los Angeles County showed good survival during their first year [57]. Trees grown from on-site acorn plantings, however, usually establish a deeper taproot and produce earlier top-growth than transplanted nursery stock [33]. Irrigating seedlings for the first few years greatly increases survival and growth rates [19]. The Nature Conservancy is currently restoring 50 acres (20 ha) of valley oak woodland on an old field on the Consumnes River Preserve of Sacramento County. Seedlings on this project site attained a height of 4 feet (1.2 m) in the first year, and survival was 95 percent in the first 3 years. Seedlings were protected from aboveground herbivory and watered every 2 weeks during summer. Grasses and forbs near valley oak seedlings were weeded [33,34]. In contrast, seedlings at the Hopland Field Station (Hopland, California), protected from herbivory but left unwatered and unweeded, attained little or no top-growth in the first year [19]. Fertilizing seedlings is not recommended because it stimulates growth of competing grass species over growth of the oaks [1]. Acorn collecting methods and detailed cultivation techniques are described in the literature [11,19,54,65].

OTHER USES AND VALUES :

Native Americans used valley oak acorns for making meal [4]. During the last century, domestic pigs were driven to Central Valley oak woodlands for mast feedings [61].

OTHER MANAGEMENT CONSIDERATIONS :

The valley oak cover type currently occupies an estimated 274,000 acres (109,600 ha). About 86 percent of this is privately owned, and miscellaneous federal agencies manage most of the land containing the other 14 percent. National Forests contain only a trace. Fifty-two percent of the valley oak type is in sawtimber stands; 48 percent is in poletimber and sapling stands [13]. Valley oak cover was once extensive, extending through lowlands and into foothills [7]. Jepson [42] reported 400 square miles (91,040 sq km) of valley oak woodland covering the eastern San Joaquin Valley in 1910. Valley oak riparian forest currently occupies about 12,000 acres (4,856 ha) on the Sacramento River System, approximately 1.5 percent of original acreage [38].

The greatest problem facing valley oak managers is lack of sapling recruitment. Due to a number of factors, most young valley oak die before reaching sexual maturity [30,61]. Obstacles to sapling recruitment are discussed in REGENERATION. Another major management concern is loss of mature trees. Valley oak have died in some areas because of greatly lowered water tables. In other areas, the accumulation of saline irrigation runoff has killed oaks. Mature trees are sensitive to overwatering, pruning, grade changes, and blankets of asphalt covering the root system [61]. Trees are resistant to short-term drought; mature trees suffer drought damage only when a series of dry seasons lower water tables to extreme depths [28].

Oak diseases cause scant mortality in valley oak under natural conditions. Most valley oaks are infected with the heart-rot fungus *Armillaria mellea*, but it is usually fatal to only very old trees. It is nearly always fatal, however, to orchard trees planted in fields

recently cleared of oaks [60]. Acorns are frequently infested with filbert worm (*Melissopus latiferreanus*) and filbert weevil (*Curculio occidentis*). Fifty-eight percent of insect-infested acorns germinate and develop normally [43].

Where present, rooting feral pigs cause considerable damage. In the valley oak woodland of Pinnacles National Monument, over 9 percent of total valley oak cover was destroyed by feral pigs. Managers had the community fenced off to exclude pigs [35].

Valley oak are not adapted to snow, and the heavy, wet snowfalls that sometimes occur within their range cause considerable limb breakage [29].

BOTANICAL AND ECOLOGICAL CHARACTERISTICS

SPECIES: *Quercus lobata*

GENERAL BOTANICAL CHARACTERISTICS :

Valley oak is a long-lived, flood- and drought-tolerant, monoecious, deciduous tree [28,56,53]. It is the largest North American oak [34,53,61]. Trees are typically 30 to 75 feet (10-25 m) tall and from 1.8 to 2.4 feet (0.5-0.7 m) in d.b.h. but may become much larger [13,53]. A record tree in Gridley measures 9.3 feet (2.8 m) in d.b.h. [13], and Griffin [30] reported a 138-foot (30 m) valley oak at the Hastings Natural History Reservation of Carmel Valley. Large oaks are usually hollow or rotten in the center, making exact age determinations impossible. Age estimates of very large trees range from 400 to 500+ years [8,30]. Mature stands are typically from 100 to 200 years old [8].

The crowns of open-grown trees are very broad [30]. Valley oaks have a highly branched growth habit. The oaks are sensitive to chloride aerosol, and trees growing less than 4 miles (7 km) inland tend to be scrubby and flagged [55]. Valley oak typically has several vertical roots that tap groundwater and extensive horizontal root branches [28,31]. Vertical root depth has been measured as deep as 80 feet (262 m) in some individuals [45]. Acorns are long (1.2 to 2.0 inches [3-5 cm]) and slender (0.5 to 0.8 inch [1.2-2.0 cm]). The bark is thick and deeply furrowed [53].

RAUNKIAER LIFE FORM :

Phanerophyte

REGENERATION PROCESSES :

Sexual: Valley oak is wind pollinated. Catkins are frost sensitive and are sometimes killed by freezing temperatures [29]. The age of sexual maturity and maximum acorn production are not recorded in the literature. Trees growing in full sun produce the greatest number of acorns [43]. Seeds mature in 1 year [15]. Acorns collected at the Bobelain Audubon Sanctuary were 58 percent viable; loss of viability was attributed to

insect predation [43]. There is no dormancy requirement. Some acorns germinate before falling off the parent tree, and many others germinate soon afterward [27,65]. Seed-caching animals which bury acorns, such as scrub jay and California ground squirrel, are important to species survival. Acorns buried by these animals have a greater chance of germination and successful establishment, as predation of acorns is usually high [15]. At the Hastings Natural History Reservation, Griffin [32] reported 100 percent consumption of acorns on the ground. Some acorns, however, remained until spring when black-tailed deer and cattle were excluded from the area.

Germination is hypogeal. Seedling emergence is best in seedlings buried 2 to 4 inches (5-10 cm). Shallowly-buried acorns usually desiccate or are dug up by seed predators [70]. Seedlings grow best in partial shade or on northern aspects; seedling survival is low on southern aspects [32]. Valley oak is less browse-resistant than competing live oaks, and current levels of herbivory are too high to permit significant seedling recruitment on most sites [6,30]. Random plot samples taken throughout valley oak's range showed sapling-to-mature tree ratios of 1:10 or worse [52]. Exceptions are in localized ecotonal and riparian areas [43]. Loss of seedlings due to pocket gopher root herbivory is high [34]. Pocket gopher populations in the Central Valley, once controlled by drownings during seasonal inundations, have greatly increased following the building of flood-control dams. Aboveground herbivory by pocket gopher and other animals causes much mortality as well. Recruitment at one unproductive site in the Santa Monica National Recreation Area began once cattle were excluded and weeds removed from around germinants [71]. Seedlings are sensitive to competition from grasses and forbs, particularly annual grasses. Where soil moisture is limiting, annual grasses outcompete valley oak seedlings for water [21]. Once saplings grow above the browse line, mortality is low [30].

Vegetative: Valley oak seedlings and saplings sprout from the root crown following damage to aboveground portions of the plant [30]. Mature trees do not have this ability, but often grow epicormic sprouts following damage to branches [32].

SITE CHARACTERISTICS :

Valley oak grows in the deep, rich soil typical of floodplains and valley floors [34,43]. Slope rarely exceeds 35 percent [2]. Soil textures include silty loam, clayey loam, and sandy clay loam. Valley oaks near undammed waterways receive annual inputs of silty alluvium [39]. The oaks depend on water-table access [14]. Best growth is attained when water tables are about 33 feet (10 m) below the surface [5]. They will tolerate poorly drained soil and wet seeps [11,41]. Valley oaks in riparian forests receive subsurface irrigation. Historically, these forests were inundated about every 5 years [26]. Where distribution overlaps with other oaks, valley oaks are found on the more mesic sites with deeper soils [48].

The oaks grow in a Mediterranean climate, characterized by wet, mild winters and hot, dry summers. Coastal valley oaks receive from 20 to 80 inches (51-203 cm) of annual precipitation; inland populations receive from 6 to 30 inches (14-76 cm) [7]. Fog is common along the coast in summer and inland during winter [29]. Elevation ranges from sea level to a maximum of 5,100 feet (1,700 m) in the Tehachapi Mountains [30].

Plant associations: Overstory associates not listed as SAF COVER TYPES include Fremont cottonwood, white alder (*Alnus rhombifolia*), arroyo willow (*Salix lasiolepis*), valley willow (*S. goodingii*), Oregon ash (*Fraxinus latifolia*), Hind's walnut (*Juglans hindsii*), California black walnut (*J. californica*), California buckeye (*Aesculus californica*), box elder (*Acer negundo*), Coulter pine (*Pinus coulteri*), interior live oak, Engelmann oak (*Quercus engelmannii*), and pin oak (*Q. plaustris*). Common exotics are eucalyptus (*Eucalyptus* spp.), tree-of-heaven (*Ailanthus altissima*), and fig (*Ficus caria*) [[5](#),[12](#),[30](#),[36](#),[40](#)].

Shrub associates include poison-oak (*Toxicodendron diversilobium*), coffeeberry (*Rhamnus californica*), redberry (*R. crocea*), Mexican tea (*Chenopodium ambrosioides*), California blackberry (*Rubus vitifolius*), coyotebush (*Baccaris pilularis* var. *consanguinea*), California rose (*Rosa californica*), buckbrush (*Ceanothus cuneatus*), birchleaf mountain-mahogany (*Cercocarpus betuloides*), squawbush (*Rhus trilobata*), and Mexican elderberry (*Sambucus mexicana*) [[1](#),[9](#),[12](#),[53](#)].

Herbaceous associates include bermuda grass (*Cynodon dactylon*), purple needlegrass (*Stipa pulchra*), Harding grass (*Phalaris tuberosa* var. *stenoptera*), wild oat (*Avena fatua*), pine bluegrass (*Poa scabrella*), soft chess (*Bromus mollis*), yellow star thistle (*Centaurea solstitialis*), annual agoseris (*Agoseris heterophylla*), golden brodiaea (*Brodiaea lutea*), and California melicgrass (*Melica californica*). The state-endangered California hibiscus (*Hibiscus californicus*) occurs within the valley oak riparian forest habitat type [[9](#),[11](#),[21](#),[35](#),[64](#)].

Other: Creeping woody plants using valley oak for vertical support include wild grape (*Vitis californica*); poison-oak often assumes this growth form as well [[39](#)]. Mistletoe (*Phoradendron villosum*) is a common valley oak parasite [[60](#)]. *Physconia detera* is frequently the dominant lichen on valley oak bark [[68](#)].

SUCCESSIONAL STATUS :

Valley oak is intermediate in shade tolerance [[49](#)]. It is a climax species in floodplain riparian forests; it is also a secondary colonizer there [[69](#)]. On swales denuded by gold dredging on the Merced River, valley oak seedlings established under the shade of young willows. Since no parent trees were nearby, it is believed that the oak seedlings grew from animal-buried acorns [[78](#)].

Most authorities classify valley oak woodlands as fire climax, and seral to mixed hardwood or coniferous forests in the absence of fire [[12](#),[18](#),[30](#),[31](#),[39](#)].

SEASONAL DEVELOPMENT :

Valley oak seasonal development is as follows:

catkins emerge:	March to April [53]
leaves emerge:	March [14]
acorns ripe:	October to November [15]
leaves fall:	November [14]

FIRE ECOLOGY

SPECIES: *Quercus lobata*

FIRE ECOLOGY OR ADAPTATIONS :

Valley oak has a number of strategies which enable it to survive fire. Mature trees are fire resistant, while top-killed seedlings and saplings sprout from the root crown [30,32]. The symbiotic relationship between this species and animals which store acorns underground favors postfire species regeneration, as buried acorns usually survive fire [15].

Historically, valley oak woodland burned on approximately a yearly basis. Lightning usually struck the taller, older oaks. These hollow, punky oaks were frequently the source of fire ignition once hit. Fires were typically hot but burned quickly, carried by dry grasses and oak litter, with few downed woody fuels [74].

FIRE REGIMES :

Find fire regime information for the plant communities in which this species may occur by entering the species name in the [FEIS home page](#) under "Find Fire Regimes".

POSTFIRE REGENERATION STRATEGY :

Tree with adventitious-bud root crown/root sucker
 Ground residual colonizer (on-site, initial community)
 Secondary colonizer - off-site seed

FIRE EFFECTS

SPECIES: *Quercus lobata*

IMMEDIATE FIRE EFFECT ON PLANT :

Moderate-severity fire top-kills seedlings and saplings. Larger valley oaks are resistant to such fire. Moderate-severity fire on the Chews Ridge of the Santa Lucia Range in Monterey County killed only one valley oak larger than 12 inches (30 cm) d.b.h. [32]. Trees suffering basal burning are most likely to be killed [59]. Hot surface fire may kill large trees with extensive internal rot. During the Chews Ridge Fire, mortality occurred when the interior punky wood of older valley oaks ignited, leaving exterior bark uncharred. Trees less than 20 inches (50 cm) in d.b.h. are usually killed by hot surface fires. Crown fire will kill a large number of valley oak of all size classes. Forty-eight percent of valley oak were killed on portions of the Chews Ridge where crowning occurred [32].

DISCUSSION AND QUALIFICATION OF FIRE EFFECT :

NO-ENTRY

PLANT RESPONSE TO FIRE :

Griffin [32] found that valley oak greater than 26.4 inches (66 cm) in d.b.h. did not produce root crown sprouts following the Chews Ridge Fire. Ninety-three percent of trees with basal sprouts were between 4.0 and 15.6 inches (10-39 cm) in d.b.h. Where fire was moderate, sprouts averaged 18 inches (45 cm) in height at postfire year 1. Trees sapling-size or larger had grown a large number of epicormic sprouts as well. Where fire was severe, surviving valley oaks produced mostly basal sprouts, averaging 19 inches (47 cm) in height. A minority (21 percent) of saplings and larger trees grew epicormic sprouts, but many epicormic sprouts were dying by the end of postfire year 1. Many small trees had severe basal scars where bark was peeling off. Trees with burned crowns grew no epicormic sprouts. Basal sprouts of such oaks, however, were taller than those from any other class of fire, averaging 24 inches (59 cm) in height.

Literature describing postfire natural regeneration and long-term fire recovery of valley oak woodlands are lacking. There are currently no reports of fire research conducted in valley oak riparian forests.

DISCUSSION AND QUALIFICATION OF PLANT RESPONSE :

NO-ENTRY

FIRE MANAGEMENT CONSIDERATIONS :

The threat of severe fire has greatly increased where valley oak woodlands border coniferous forests. Due to fire suppression, these woodlands frequently contain an understory of conifer saplings and small trees, with a deep litter of oak leaves, needles, cones, and downed woody fuels [32].

Prescribed burning would increase valley oak numbers. Near coniferous forests, fire would eliminate invading conifers such as Coulter and ponderosa pine from valley oak woodland [32]. At lower elevations, populations of live oaks and shrubs such as buckthorn (*Rhamnus* spp.) and sumac (*Rhus* spp.) continue to increase in valley oak woodland in the absence of fire [12,31]. Some authorities, however, fear that postfire recovery of valley oak may be impaired under drought conditions [74], and prescribed burning is not recommended in years of low precipitation.

Fire scars provide entry points for various heart-rot fungi. Badly fire-scarred trees are susceptible to windthrow [60].

Scrub jays help facilitate postfire regeneration, as they prefer burn areas as acorn-caching sites [54].

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SPECIES: *Quercus lobata*

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