

Oak Woodland

VEGETATION ASSOCIATION: OAK WOODLAND

MAPPED SUBASSOCIATIONS: Dense Engelmann Oak; Coast Live Oak

DATA CHARACTERIZATION

Because of the use of an undifferentiated oak woodland community type and the similarity between oak woodland and broadleaved upland forest, it is difficult to determine the species composition of mapped areas without field verification. It is probable that areas containing oaks were mapped within a category which includes oaks as a dominant species; *i.e.*, oak woodland, dense Engelmann oak woodland, coast live oak woodland, broadleaved upland forest.

Oak woodlands are generally easily interpreted from other vegetation types. Mapping errors may occur near areas of mesic chaparral.

BIOGEOGRAPHY

Holland and Keil (1995) describe the oak woodlands as being nearly restricted to the state of California. Most authors distinguish southern oak woodlands from other oak woodlands in other parts of the state. There are discrepancies in the description of the northern limit of southern oak woodlands, varying from Mendocino County to northern Los Angeles County. Coast live oaks range through a large portion of the state, extending outside the range of the typically-defined southern oak woodlands.

Thorne (1976) distinguishes between northern, foothill, southern, and island oak communities in California. Southern and coastal woodlands, including coast live oak woodland, extend from eastern Mendocino County at 40° N latitude through the North Coast, Central Coast, and Transverse ranges on north-facing and coast-facing slopes and in canyons below 1200 m (Barbour and Minnich 2000). The range continues through the interior valleys and foothill slopes of the Peninsular ranges, mainly between 150 and 1,400 m, and south to the Sierra San Pedro Martir at 30° N latitude (Barbour and Minnich 2000). According to Munz and Keck (1949), the southern oak woodlands are found in the valleys of southern California between Los Angeles and San Diego counties to about 1,525 m in the San Jacinto Mountains. According to Holland and Keil (1995), coast live oak woodlands range from Sonoma County to Baja California, generally in mesic areas including canyon bottoms and north-facing slopes, whereas southern oak woodlands extend from Ventura County southward. This roughly corresponds



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with Griffin (1977) who distinguishes oak woodlands from the Santa Ynez Mountains of Santa Barbara County southward as southern oak woodland.

The Englemann oak, in the U.S., occurs only in San Diego, Riverside, Orange and Los Angeles counties (Scott 1991). Englemann oak woodlands, which are confined within the distribution of the more general southern oak woodlands, occur from the San Gabriel Mountains to Baja California but are most common in the foothills of San Diego and southwestern Riverside counties (Stephenson and Calcarone 1999). Major occurrences of Englemann oak woodland are generally between the Palomar and Cuyamaca Mountains and on the Santa Rosa Plateau (Stephenson and Calcarone 1999).

RANGE AND DISTRIBUTION WITHIN WESTERN RIVERSIDE COUNTY

Oak woodlands occupy approximately 2.7 percent of the Plan Area (35,330 acres). These woodlands generally are distributed near drainages in the steeply sloped portions of the western Riverside Plan Area. Large acreage of live oak woodlands occur in three large clusters including the Cleveland National Forest from the Santa Ana Mountains near Glen Ivy south toward San Mateo Canyon; between Hemet and Sage from north of Lake Skinner to Bautista Creek; and from Calimesa to the Cherry Valley and the Morongo Indian Reservation. Large individual patches occur south of Banning east of Mount Edna, north of Estelle Mountain, and in the Santa Rosa East area west of Sandia Canyon. A few scattered stands of live oak woodlands occur south of the urbanized highway 91 corridor, and on the Gavilan Plateau.

From the literature, Englemann oak woodlands are described from the following areas: Organ Valley (Cleveland National Forest) on Black Mountain is in an area which was nominated as a Research Natural Area (RNA) (USDA 1986); the Santa Rosa Plateau contains one of the largest, undeveloped Englemann oak savannas; scattered populations of Englemann oak occur on the southern and western edges of the Perris Plain (including Corona and Hemet); and on the ridge between the Coachella Valley and mountains south of Santa Rosa peak (Scott 1990).

Dense Englemann oak woodlands were mapped in the southwestern portion of the Plan Area from San Mateo Canyon to Sandia Canyon on the Santa Rosa Plateau. Two stands of dense Englemann oak woodland occur south of Lake Elsinore near Elsinore Peak, and along a drainage on the Gavilan Plateau.

Undifferentiated oak woodlands which may include live oak, Englemann oak or possibly canyon live oak and scrub oak stands, occurred in three general regions. The largest area is the eastern portion of the Plan Area in the San Jacinto Mountains from the San Geronio River



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south to Table Mountain. Substantial acreage of oak woodland also occurs in a ring around the urbanized portions of Rancho California with the largest areas in the Santa Rosa East, Pechanga Indian Reservation, and north of the Black Hills area. The Santa Ana mountains also support several patches of oak woodland.

VEGETATION CHARACTERISTICS

The two variants of oak woodlands within the Plan Area are either dominated by Engelmann oak (*Quercus engelmannii*), often in drier areas, or coast live oak (*Q. agrifolia*), often on moister slopes (Thorne 1976).

Coast live oak woodland. Many understory plants in a coast live oak woodland are shade tolerant and include wild blackberry (*Rubus ursinus*), snowberry (*Symphoricarpos mollis*), California walnut (*Juglans californica*), California-lilac (*Ceanothus* spp.), *Rhus* spp., currant (*Ribes* spp.), toyon (*Heteromeles arbutifolia*), California bay (*Umbellularia californica*), Engelmann oak, manzanita (*Arctostaphylos* spp.), laurel sumac (*Malosma laurina*), poison-oak (*Toxicodendron diversilobum*) and herbaceous plants including bracken fern (*Pteridium aquilinum*), polypody fern (*Polypodium californicum*), fiesta flower (*Pholistorma auritum*) and miner's lettuce (*Claytonia perfoliata*) (Holland and Keil 1995, Sawyer and Keeler-Wolf 1995, Thorne 1976, Brown 1982). Munz and Keck (1949) identify similar species for this Habitat and include that a variety of grasses and soft shrubs also are commonly found.

The physiognomy of coast live oak woodlands varies from savanna-like, with few to no woody associates, to dense woodlands, typically with canyon live oak and/or Engelmann oak (Brown 1982). Coast live oak trees can reach a canopy height of 30 m, but usually vary from nine to 22 m (Sawyer and Keeler-Wolf 1995; Barbour and Minnich 2000). Canopy coverage varies between continuous to open (Sawyer and Keeler-Wolf 1995). Shrub cover is occasional or common with the ground layer varying from grassy to absent (Sawyer and Keeler-Wolf 1995). Woodlands may intergrade with grasslands in which cases shrub cover becomes diminished and herbaceous cover can reach 80% (Holland and Keil 1995; Barbour and Minnich 2000). The shrub component can be quite developed in areas where coast live oak intergrades with chaparral or coastal sage scrub.

Dense Engelmann oak woodland. Engelmann oak occurs infrequently as pure stands and more commonly as a subdominant to coast live oak (Stephenson and Calcarone 1999). As a subdominant, it may be found in typical southern oak woodlands, with a canopy



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cover varying from 10 to 50%. Engelmann oak may also be found in dense riparian / oak woodlands with a closed-canopy in which it is usually associated with a water-course or canyon bottom (Scott 1990). The riparian / oak woodlands very rarely support dense stands of Engelmann oaks. Scott (1991) sampled over 30,000 ha of Engelmann oak occurrences and found only 1.6% to occur as pure stands compared with 52% occurrence of Engelmann oak as a subdominant to coast live oak.

Although accurate historical data regarding Engelmann oak woodland composition is lacking, Wieslander's vegetation type map (VTM) surveys indicate that some stands were composed of 10-50% tree cover with 90% of the trees being Engelmann oaks while other stands contained 100% tree cover with a mixture of Engelmann and coast live oak or Engelmann oak, coast live oak, and black oak (Barbour and Minnich 2000). Sawyer and Keeler-Wolf (1995) describe portions of this Habitat which are dominated by Engelmann oak or where it is an important component with coast live oak as having a closed or open canopy up to 18 m tall. Engelmann oaks, when mature, typically have a canopy height between 10 and 20 m (Scott 1990). Shrubs may occur commonly or infrequently and ground cover is generally grassy or sparse (Sawyer and Keeler-Wolf 1995). The grassy understory of Engelmann oak woodlands usually is dominated by exotic species: *i.e.*, bromes (*Bromus* spp.), oats (*Avena* spp.), barley (*Hordeum* spp.), filaree (*Erodium* spp.), but may also contain native grasses; *i.e.*, needlegrass (*Nassella* spp.) (Scott 1990). Engelmann oak hybridizes with scrub oak (*Quercus berberidifolia*) and hybrids generally occur on the margins between scrub oak stands and Engelmann oak stands (Sawyer and Keeler-Wolf 1995).

PHYSICAL ENVIRONMENT

In general, oak woodlands occur from 10 to 1500 m (Holland and Keil 1995). Average annual rainfall is between 38 and 64 cm with rapid runoff, and the growing season is seven to 10 months (Munz and Keck 1949). Yearly maximum temperatures are between 29^oC and 33^o C and minima are between 0^oC and 7^o C (Munz and Keck 1949). Engelmann oak appears limited to areas below 1300 m that receive more than 37 cm annual precipitation (Scott 1990).

Generally, oak woodlands are open where moisture is limited, in drier more exposed aspects, and densest in moist areas (Holland and Keil 1995). North-facing slope occurrences are also denser than south-facing slope occurrences (Holland and Keil 1995). Coast live oaks occur more frequently on cooler, steeper slopes and Engelmann oaks on warm slopes (Scott 1990). Engelmann oak woodland can be found in relatively flat valleys, on foothill slopes and adjacent to, but above, stream channels (Stephenson and Calcarone 1999). However, in a canyon containing a stream bottom, Engelmann oaks are more likely to occur on the upper margins



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of the canyon whereas coast live oak will most often occur on the terraces adjacent to the stream channel forming the interior of the woodland canopy (Scott 1990). Scott (1991) found that Engelmann oaks were most concentrated where slopes were southwest-facing, between 0° and 10° and elevation between 700 and 1250 m. Snow (1973) found that coast live oaks are associated with rock outcrops whereas Engelmann oaks are not.

Common soils which support coast live oak include sandstone and shale-derived soils (Sawyer and Keeler-Wolf 1995). Coast live oak typically occupies slopes with deep soils, alluvial terraces, and the recent alluvium of canyon bottoms (Griffin 1977; Brown 1982). Open woodlands form when soils are shallow (Holland and Keil 1995). Engelmann oak tends to occur on deep clay soils from a gabbro or basalt substrate (Stephenson and Calcarone 1999).

ECOSYSTEM PROCESSES

In comparing burned and non-burned oak woodlands on the Santa Rosa Plateau, Lathrop and Osborne (1991) found that although more seedling and sapling oaks were top-killed in burned areas, they resprouted more vigorously and total overall survival was slightly higher in the burned sites. In comparing coast live oak and Engelmann oak survival rates after a burn, coast live oak had a lower long-term survival rate, although mature individuals of both species were generally unaffected (Lathrop and Osborne 1991). Lathrop and Osborne (1991) suggest that prescribed burns occur in the late summer or fall so that resprouts may avoid the summer drought conditions. Following a fire or during a drought, scrub oak and hybrid oaks were found to outcompete Engelmann oak, which may account for the limited distribution of Engelmann oak (Scott 1990).

Oak trees, in general, require 60 to 80 years to mature (Holland 1988). Engelmann oaks typically live between 50 and 80 years, but can reach 350 years of age (Scott 1990). The two species have distinct reproductive characteristics. Natural germination of Engelmann oak acorns occurs in the early winter on the Santa Rosa Plateau compared with later winter and spring germination of coast live oak acorns (Lathrop and Osborne 1990). As an adaptation to the seasonal timing of germination, coast live oak acorns appear much more sensitive to available moisture when compared with Engelmann oak acorns which germinate more easily due to a higher initial moisture content (Snow 1991). Engelmann oak also appears to delay shoot development, compared with the more rapid development of coast live oak, which may allow Engelmann oaks to absorb more moisture on more exposed Habitats (Snow 1991).

Regeneration of Engelmann oaks is more dependent on the site conditions where individual acorns fall than percent of viable acorns produced (Lathrop and Osborne 1990). Engelmann oak seedlings are more abundant in the shade. However, within a general limit, seedling



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survival increases as shade decreases (Lathrop and Osborne 1990). Seedlings also show an affinity to be under the dripline of the parent tree, an area which presumably retains more soil moisture (Lathrop and Osborne 1990). This area, under the canopy, is also the most active area for pocket gophers (*Thomomys bottae*), which have a detrimental effect on regeneration because they predate acorns; they also aerate the soil which is a beneficial effect on regeneration (Lathrop and Osborne 1990). Seedling survival is enhanced when acorns are buried in litter or soil, protecting them from predation and enhancing their ability to root in the ground (Lathrop and Osborne 1990). Because of the need for fairly specific site conditions, regeneration of Engelmann oaks is dependent on undisturbed conditions. Studies have shown that although cattle grazing does significantly decrease seedling survivorship, drought conditions cause the most substantial seedling mortality (Lathrop and Osborne 1990). By comparison, coast live oak is more well adapted to drought conditions (Snow 1972).

THREATS

Holland and Keil (1995) state that in the vast majority of California oak woodland sites, oak reproduction ceased around 1900. The loss of acorn viability can be attributed to cattle and sheep in rangelands and an overabundance of deer in many northern California areas (Holland and Keil 1995). The oak woodland Habitat also has been altered by the replacement of native bunch grasses with exotic annual grasses which produce many more seeds. Man's reduction in the number of predators of seed-eating animals which predate on oak acorns, also has been found to be a threat (Holland and Keil 1995). Introduced annual grasses, due to their rapid growth and uptake of available surface water, also contribute to the loss of native grasses historically present in oak woodlands and savannas as well as diminishing water supplies for oak seedlings (Stephenson and Calcarone 1999). In some areas, it appears that California bay is replacing coast live oak, possibly due to grazing (Holland 1988). In general, regeneration problems in coast live oak are not considered to be as serious as that of blue oak and valley oak (Holland 1988). Wood cutting, although not as prevalent in the southern portion of the state, has left areas of stumps because oaks were not able to reestablish (Holland 1988). Root rot, caused by overwatering during the summer in urban oaks, also has been known to cause mortality (Holland and Keil 1995).

In a study of size class on the Santa Rosa Plateau, Lathrop *et al.* (1991) found that Engelmann oak reproduction in sites where grazing has ceased for the past four years is not sufficient to "maintain the present occurrence and abundance of older age classes in the future." In the one site where grazing has been excluded for the past 20 years, young trees were more readily observed but regeneration rates still would not maintain current stand characteristics (Lathrop *et al.* 1991).



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Management techniques to improve oak regeneration include rotational grazing practices and retention of oaks on rangelands. The benefits of oaks in rangelands include enriched soils and reduced erosion (Holland and Keil 1995). Prescribed fires in broadleaf woodlands were seldom used in the Cleveland National Forest as of 1986 (USDA 1986). However, in the 1986 Forest Service's Land and Resources Management Plan for the Cleveland National Forest, prescribed fires were identified as beneficial and were therefore increased in frequency in order to strengthen oak regeneration and help manage chaparral. The use of dead and down oak wood as fuel wood was identified as an opportunity in the Forest Service Management Plan, whereas the cutting of healthy oaks for timber purposes was not identified and therefore is not thought to be a threat on public land (USDA 1986).

Declines in oak woodland Habitat type are due mainly to Habitat loss on private lands (Stephenson and Calcarone 1999). The majority of Engelmann oaks (57 percent) are held in private lands, with the next largest portion (24 percent) controlled by the Cleveland National Forest (Scott 1991). Because of the scattered distribution of Engelmann oaks within its range, Scott (1991) suggests that this oak is vulnerable to adjacent conditions and human activities. The Land and Resource Management Plan for the Cleveland National Forest (USDA 1986) identifies Engelmann oak woodland as a Habitat suffering from a limited distribution and deteriorating state due to overgrazing and development. The Plan also identifies these woodlands as important for recreation, recognizing that many campgrounds are in oak groves and dispersed recreation use mainly occurs in oak groves. These uses, thought to be increasing, along with grazing usage, contribute to reduction of shrub and herbaceous layers and disruption of natural regeneration (USDA 1986).

LITERATURE CITED

- Barbour, Michael G. and Richard A. Minnich. 2000. Californian Upland Forests and Woodlands. *In* North American Terrestrial Vegetation. Second Edition. Cambridge University Press, Cambridge, UK.
- Brown, D.E. 1982. Californian evergreen forest and woodland. *Desert Plants* 4:66-69.
- George, Melvin R. 1991. Grazing and Land Management Strategies for Hardwood Rangelands. *In* Proceedings of the Symposium on Oak Woodlands and Hardwood Rangeland Management. Richard B. Standiford, Technical Coordinator. USDA Forest Service General Technical Report, PSW-126. Davis, California: 315-319.
- Griffin, James R. 1977. Oak Woodlands *In* Terrestrial Vegetation of California. ed. Michael G. Barbour and Jack Major. John Wiley and Sons, New York: 383-415.



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- Holland, V. L. 1988. Coastal Oak Woodland. *In A Guide to Wildlife Habitats of California.* ed. Kenneth E. Mayer and William F. Laudenslayer, Jr. California Department of Forestry and Fire Protection, Sacramento, California. 78-79.
- Holland, V. L. and David J. Keil. 1995. California Vegetation. Kendall/Hunt Publishing Company.. Dubuque, Iowa.
- Lathrop, Earl. W. and Chris D. Osborne. 1990. From Acorn to Tree: Ecology of the Engelmann Oak. *Fremontia.* Vol.18, No.3: 30-35.
- Lathrop, Earl. W. and Chris D. Osborne 1991. Influence of Fire on Oak Seedlings and Saplings in Southern Oak Woodland on the Santa Rosa Plateau Preserve, Riverside County, California *In Proceedings of the Symposium on Oak Woodlands and Hardwood Rangeland Management.* Richard B. Standiford, Technical Coordinator. USDA Forest Service General Technical Report, PSW-126. Davis, California: 366-370.
- Lathrop, Earl. W., C. Osborne, A. Rochester, K. Yeung, S. Soret and R. Hopper. 1991 Size Class Distribution of *Quercus engelmannii* on the Santa Rosa Plateau, Riverside County California. *In Proceedings of the Symposium on Oak Woodlands and Hardwood Rangeland Management.* Richard B. Standiford, Technical Coordinator. USDA Forest Service General Technical Report, PSW-126. Davis, California: 371-376
- McDonald, Philip A. and Edward E. Littrell. 1976. The Big-cone Douglas-Fir-Canyon Live Oak Community in Southern California. *Madrono*, vol. 23:310-320.
- Munz, Philip A. and David D. Keck. 1949. California Plant Communities. El Aliso, Vol. 2, No. 1: 87-105.
- Sawyer, John O. and Todd Keeler-Wolf. 1995. A Manual of California Vegetation. California Native Plant Society, Sacramento, CA.
- Scott, Thomas A. 1990. Conserving California's Rarest White Oak: The Engelmann Oak. *Fremontia.* Vol 18, No. 3: 26-29.
- Scott, Thomas A. 1991. The Distribution of Engelmann Oak in California. *In Proceedings of the Symposium on Oak Woodlands and Hardwood Rangeland Management.* Richard B. Standiford, Technical Coordinator. USDA Forest Service General Technical Report, PSW-126. Davis, California: 351-359.



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- Snow, Gerald E. 1991. Germination Characteristics of Engelmann Oak and Coast Live Oak from the Santa Rosa Plateau, Riverside County, California. *In* Proceedings of the Symposium on Oak Woodlands and Hardwood Rangeland Management. Richard B. Standiford, Technical Coordinator. USDA Forest Service General Technical Report, PSW-126. Davis, California: 360-365.
- Snow, Gerald E. 1973. Some Factors Controlling the Establishment and Distribution of *Quercus agrifolia* and *Q. engelmannii* in Certain Southern California Oak Woodlands. Doctor of Philosophy Thesis submitted to Oregon State University, Oregon.
- Stephenson, John R. and Gena M. Calcarone. 1999. Southern California mountains and foothills assessment: Habitat and species Conservation issues. General Technical Report GTR-PSW-172. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture; 402 p.
- Thorne, Robert F. 1976. The Vascular Plant Communities of California. *In* Symposium Proceedings: Plant Communities of Southern California. ed. June Latting. California Native Plant Society, Special Publication No. 2. Berkeley, California. 1-31.
- USDA, Forest Service. 1986. Land and Resources Management Plan: Cleveland National Forest. USDA, Forest Service, Cleveland Nation Forest, San Diego, CA.

