# Jeffrey Pine

## VEGETATION ASSOCIATION: JEFFREY PINE

## MAPPED SUBASSOCIATIONS: None

## DATA CHARACTERIZATION

Because of its distinctive character, as well as signature on aerial photographs, and the lack of suitable climate for the dominant species throughout much of the Plan Area, it is likely that the majority of Jeffrey pine forest within the Plan Area was mapped accurately in the San Jacinto mountains. It is possible that areas mapped as Jeffrey pine forest contains areas dominated by ponderosa pine.

## BIOGEOGRAPHY

Jeffrey pine is nearly endemic to California, with stands occurring from the Klamath Mountains of northern California and southwestern Oregon through the Sierra Nevadas and south in the Transverse and Peninsular ranges of southern California and northern Baja California (Jenkinson 1990). Over its range, Jeffrey pine occurs from 150 to 2900 m. Areas where Jeffrey pine shows dominance are in the Klamath Mountains, North Coast Ranges, Cascade Range, Modoc Plateau, Sierra Nevada, and Transverse and Peninsular ranges (Jenkinson 1980).

## RANGE AND DISTRIBUTION WITHIN WESTERN RIVERSIDE COUNTY

Vogl (1976) describes the Jeffrey pine forest within the San Jacinto Mountains, noting that Round Valley, Long Valley, and Tahquitz Valley are exceptional sites in terms of species composition and maturity. In the MSHCP database, this Habitat covers 15,424 acres, comprising 1.2% of the Plan Area. Jeffrey pine forest is mapped throughout the San Jacinto Mountains from north of Pine Meadow (on both sides of SR-74) in Garner Valley, on Thomas Mountain south of Lake Hemet, around the community of Mountain Center, around Pine Cove, and Indian Mountain (west of Tahquitz Peak, in the vicinity of Fern Valley), north to Lake Fulmor within May Valley and on Baldy Mountain. Most areas are within U.S. Forest Service land, except around the Pine Cove and Pine Meadow.

## VEGETATION CHARACTERISTICS

Barbour and Minnich (2000) describe a "midmontane forest" which probably includes areas mapped as Jeffrey pine forest and Ponderosa pine forest. Jeffrey pine typically is situated at higher elevations above ponderosa pine *(Pinus ponderosa)* (McBride 1988). Jeffrey pine forest typically is composed of four layers, although in most xeric sites the herbaceous layer may not be significant and in moderately dry sites Jeffrey pine occurs as a single canopy layer (McBride 1988). The canopy layer may be composed of only Jeffrey pine *(Pinus jeffreyi)*, or also may include ponderosa pine, Coulter pine *(Pinus coulteri)*, sugar pine *(Pinus lambertiana)*, lodgepole pine *(Pinus contorta ssp. murrayana ssp. murrayana)*, limber pine *(Pinus flexilis)*, white fir *(Abies concolor)*, incense-cedar *(Calocedrus decurrens)* and black cottonwood *(Populus balsamifera* ssp. *trichocarpa)* (McBride 1988). Conifer tree canopy varies from 30 to 60 m forming a fairly continuous canopy of 50-80% cover (Barbour and Minnich 2000, Sawyer and Keeler-Wolf 1995). A subdominant tree canopy occurs patchily and varies in species composition. Heights for these trees range from 5 to 15 m and include winter-deciduous species such as bigleaf maple *(Acer macrophyllum),* Pacific dogwood *(Cornus nuttallii),* hazelnut (*Corylus cornuta)* and black oak *(Quercus kelloggii*), and broad-leaved evergreens, canyon live oak *(Quercus chrysolepis),* and curl-leaf mountain-mahogany *(Cercocarpus ledifolius)*. Shrub cover generally is infrequent to common, composing 10-30% of the overall cover and including deciduous and evergreen species and many sclerophylls of the following genera: manzanita *(Arctostaphylos*), California-lilac *(Ceanothus*), mountain-misery (*Chamaebatia*), chinquapin *(Chrysolepis*), tan oak *(Lithocarpus*), snowberry *(Symphoricarpos)*, cherry *(Prunus*), oaks *(Quercus*), currant (*Ribes*) and blueberry *(Vaccinium*) (Barbour and Minnich 2000, Sawyer and Keeler-Wolf 1995, McBride 1988). Herbaceous cover is usually between 5 and 10% but may reach 20% and is dominated by perennial forbs or grasses (Barbour and Minnich 2000, Sawyer and Keeler-Wolf 1995). The following genera occur commonly: trail plant *(Adenocaulon*), *Clintonia, Disporum,* bedstraw *(Galium*), iris (*Iris*), lupine *(Lupinus*), *Osmorhiza,* bracken fern *(Pteridium*), wintergreen *(Pyrola),* false Solomon's seal *(Smilacina),* rockcress *(Arabis)*, bird's-beak *(Cordylanthus)*, buckwheat *(Erigonum)*, fritillary *(Fritillaria)*, ivesia *(Ivesia)*, melic *(Melica)*, beardtongue *(Penstemon)* and needlegrass *(Nassella)* and violet (*Viola)* (Barbour and Minnich 2000, McBride 1988).

In the San Jacinto Mountains, Jeffrey pine occurs in a park-like Habitat with very old trees (Jenkinson 1980). Old-aged Jeffery pines, often over 50 to 100 years old but also reaching 350 to 800 years, dominate this Habitat with few sapling-sized and smaller trees. The understory is mostly non-continuous, although circular clumps of manzanita *(Arctostaphylos parrryana* var. *pinetorum*), spiny snowbush *(Ceanothus cordulatus)* and bush chinquapin *(Chrysolepis sempervirens)* do occur occasionally (Vogl 1976). Other occasional understory plants include herbs which grow close to the soil surface usually with woolly or fleshy leaves

(Vogl 1976). A few level areas contain ideal conditions for a well-developed canopy of pines *(Pinus* spp.) and understory of bracken fern (See discussion of level areas in *Physical Environment* section below). Generally, this Habitat within Riverside County does not exhibit high litter accumulation.

Black oak becomes an important component of Jeffrey pine forest between 1525 and 2135 m in the San Jacinto Mountains (Thorne 1977). Herbaceous cover on dry, rocky slopes and flat areas include rock cress *(Arabis repanda),* bird's-beak *(Cordylanthus* spp.*),* buckwheat *(Eriogonum parishii),* fritillary *(Fritillaria pinetorum), Gayophytum diffusum* ssp. *parviflorum,* mousetail ivesia *(Ivesia santolinoides),* Peirson's lupine *(Lupinus peirsonii),* melic *(Melica stricta),* beardtongues *(Penstemon rostriflorus* and *P. caesius),* and needlegrass *(Stipa parishii)* (Thorne 1977).

## PHYSICAL ENVIRONMENT

Under Barbour and Minnich's (1995) midmontane forest classification, Jeffrey pine forest would range from 800 to 2500 m. Areas supporting Jeffrey pine have a mean annual temperature of 11°C and annual precipitation is about 100 cm (Barbour and Minnich 1995). Over its California range, Jeffrey pine-dominated areas occur from 60 to 2900 m elevation (Sawyer and Keeler-Wolf 1995). In the San Jacinto Mountains, the typical, park-like, old-aged groves of Jeffrey pine occur from 2125 m to the mountain peak (Vogl 1976).

Jeffrey pines occur where many other conifer species cannot. Due to greater tolerance of serpentine soils, drought, smog and warm temperatures, Jeffrey pine outcompetes ponderosa pine in areas with these elements (Thorne 1977). The Jeffrey pine is also more competitive on cold, xeric and infertile sites (Jenkinson 1990). A large portion of Jeffrey pine sites are on ultramafic soils; otherwise they are typically found on well-drained soils of a variety of types (Jenkinson 1990; Sawyer and Keeler-Wolf 1995). At lower elevations and moderate slopes, soils which support this Habitat typically are loamy alfisols or ultisols (Barbour and Minnich 2000). Where slopes are steeper, inceptisols generally are found (Barbour and Minnich 2000). Jeffrey pine is known to have a limited need for soil nutrients and moisture probably due to the tree's short growing season and early dormancy (Jenkinson 1980).

In the San Jacinto Mountains the trees are most common on moderate slopes and flat areas (Vogl 1976). Certain level areas contain the unique combination of deep soils and flat topography allowing for heavy snow accumulations and retained moisture from summer thunderstorms. Much of this Habitat in Riverside County, however, occurs on steep slopes. This fact, added with the presence of dry summers and high winds prevent the accumulation of litter (Vogl 1976).

## ECOSYSTEM PROCESSES

Barbour and Minnich (2000) describe a change in the Jeffrey pine forest physiognomy of the past 100 years due to fire suppression activities where shrub and tree cover have shifted. Pre-suppression studies of fire frequency estimate an interval between four and 20 years (Barbour and Minnich 2000). Estimates are that fires were of low-intensity, small (between 1 and 800 ha), patchy, and irregularly shaped (Barbour and Minnich 2000). In the Sierra San Pedro Martir, Baja California, Mexico, which still maintains a relatively natural wildlife regime, the average fire return interval is 26 years, with most fires being less than 16 ha in size and less than 3% resulting in crown replacement (Barbour and Minnich 2000). It appears that most constituent species of this Habitat are adapted to this fire regime. Bracken fern recovers quickly following fires (Vogl 1976). Pines are well-served by fires which burn local accumulations of litter creating optimum conditions for seedbed growth (Vogl 1976). Fire is thought to help reduce stress and mortality caused by competition by eliminating "over-mature, sick and insect- or disease-infected" Jeffery pines (Barbour and Minnich 2000; Vogl 1976). This is evidenced by the large die-offs in the San Jacinto Mountains of ponderosa pine (42% mortality), Jeffrey pine (50%) and Coulter pine (49%) during the drought period in the 1980's and 1990's when compared to the stability of pine populations in Baja California (Barbour and Minnich 2000).

Jeffrey pines are intolerant of shade and seedlings do not grow well in the presence of old-growth roots (Jenkinson 1990). These species are especially adapted for their seasonal environment. For example, reproduction occurs by vegetative layering, stiff stems help prevent snow crushing, evergreen leaves are adapted to the short growing periods, and the dome-shaped growth of these plants regulates snow deposition (Vogl 1976).

## THREATS

According to the USDA (1999), fire suppression is thought to result in three major problems for this forest type: "(1) a large increase in the number of understory trees (particularly shade-tolerant white fir and incense-cedar), (2) an increased risk of stand-replacing crown fires due to fuel buildup, and (3) increased mortality and reduced recruitment of large trees (due to increased understory competition)." These hypotheses were supported by a study comparing tree diameters and species composition from a population in 1930 and the same population in 1997. Fewer Jeffrey pines and more white fir and incense-cedar were found in 1997; more small-diameter trees and fewer large trees also were recorded in 1997 (Stephenson and Calcarone 1999).

Jeffrey pine is especially susceptible to infection from a strain of *Heterobasidion annosum*, a fungal root disease which colonizes the roots of a freshly cut conifer and eventually kills other trees which come in contact with the infected roots (Stephenson and Calcarone 1999). Also, the western dwarf mistletoe *(Arceuthobium campylopodum*) infects Jeffrey pine in this Habitat. The mistletoe is managed mainly through the pruning and removal of infected trees (Stephenson and Calcarone 1999). In general, sick and diseased Jeffery pines may suffer their final demise due to the Jeffrey pine bark beetle *(Dendroctonus jeffreyi)*. *Ips emarginatus* is another bark beetle known to attack Jeffrey pine (Stephenson and Calcarone 1999). Elytroderma disease *(Elytroderma deformans)* has reached epidemic proportions in some stands (Jenkinson 1990). Other diseases include Medusa needle blight *(Davisomycella medusa)*, Cenangium limb canker *(Cenangium ferruginosum)*, stalactiform rust *(Peridermium stalactiforme)*, filamentosum rust *(Peridermium filamentosum)*, sweetfern rust *(Cronartium comptoniae)*, tarweed rust *(Coleosporium madiae)*, and western gall rust *(Peridermium harknessii)* (Jenkinson 1990).

Although timber harvests largely have been discontinued except to supply local demand, high intensity harvests from the 1950's to the mid-1970's contributed to the reduction in the number of large trees and possibly to the increase of white fir in this Habitat (Stephenson and Calcarone 1999).

Jeffrey pines have been shown to suffer foliage damage from ozone depletion (Stephenson and Calcarone 1999). The major phytotoxins are ozone, nitrogen oxides, hydrocarbons and sulfur dioxide, of which ozone seems to be the most important (Barbour and Minnich 2000). Symptoms of excess ozone are evident on ponderosa and Jeffrey pines through “mottling on the needles, premature needle drop, reduction in net photosynthesis and reduction in needle size (Barbour and Minnich 2000).” The highest rates of mortality occur when ozone-damaged trees enter a drought period and cannot withstand attacks by bark beetles (Stephenson and Calcarone 1999). Forest areas exposed to heavy air pollution are most susceptible to this injury.

Other threats to Jeffrey pine include a susceptibility to extremely low temperatures, the creation of anaerobic conditions, either by flooding or filling, and highway de-icing salts (Jenkinson 1990).

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