VEGETATION ASSOCIATION: LOWER MONTANE CONIFEROUS FOREST

MAPPED SUBASSOCIATIONS: None

DATA CHARACTERIZATION

Because of the diversity of subassociations which may be included in this Habitat type, precise species composition for many of the mapped vegetation stands remains unknown. It is not likely that oak woodlands, grasslands, or shrub-dominated Habitat would be missed-mapped as lower montane coniferous forest. However, other Habitats dominated by conifers; *i.e.,* Jeffrey pine forest and lodgepole pine forest, may be included in this Habitat category.

BIOGEOGRAPHY

The range described by Munz and Keck (1949) probably includes: areas mapped as Jeffrey pine forest; however, they describe this Habitat to occur, in California in the North Coast ranges between 915 and 1825 m, in northern California between 365 and 1675 m, in the Sierra Nevada between 600 and 2290 m, and in southern California between 1525 and 2450 m. Coulter pine forests range from 230 m in the Bay Area to 2290 on San Jacinto Mountain (Thorne 1977). The Coulter pine phase of this Habitat does not occur in the Sierra Nevada range, but rather along the coast ranges from San Francisco to Baja California, Mexico, including the Transverse and Peninsular ranges (Thorne 1977). Information regarding the biogeography of lodgepole pine forest was not reviewed.

RANGE AND DISTRIBUTION WITHIN WESTERN RIVERSIDE COUNTY

Sawyer and Keeler-Wolf (1995) identify this Habitat at Hall Canyon and Millard Canyon Research Natural Area (RNA). A Coulter pine-black oak woodland is described at Cahuilla Moutain (Sawyer and Keeler-Wolf 1995). Ponderosa pine forest surrounds Lake Fulmor in the San Bernardino Mountains of Riverside County (Thorne 1977).

The MSHCP vegetation map shows three areas supporting lower montane coniferous forest in the Plan Area: San Jacinto Mountains and Agua Tibia, totaling 9,097 acres. The San Jacinto Mountains stands occur both east and west of SR-243 from north of Lake Fulmor through Pine Cove, with large populations around Idyllwild, Mountain Center, and Lake Hemet. Lower montane coniferous forest has smaller occurrences in the Thomas Mountains east of Pine Meadow. This vegetation is located mainly within the Cleveland National Forest with the

exception of a few large blocks around Idyllwild and Mountain Center. The Agua Tibia occurrence reaches slightly into the southern edge of the Plan Area, within National Forest land.

VEGETATION CHARACTERISTICS

As an ecotone between lower manzanita chaparral and higher conifer forests, lower montane coniferous forest represents a variety of subassociations. Due to wide discrepancies in the categorization of montane forests, several classification systems are presented here. However, the varying Habitat categories generally list similar constituent species within this Habitat type.

Vogl (1976) identifies a mixed coniferous forest Habitat type occurring in the Santa Ana and San Jacinto Mountains. This Habitat type probably includes areas categorized in the Pacific Southwest Biological Services (PSBS 1995) mapping as lower montane coniferous forest, Jeffrey pine forest, and southern California white fir forest. Dominant tree species in this Habitat occur in a variety of densities and include ponderosa pine, black oak, interior live oak, canyon oak, Coulter pine, incense cedar, white fir, sugar pine and Jeffrey pine (Vogl 1976). Bracken fern *(Pteridium aquilinum)* is a common understory plant often occurring with perennial bunch grasses and meadow plants (Vogl 1976).

Vogl's (1976) description of lower montane coniferous forests is similar to the mixed conifer series of Sawyer and Keeler-Wolf (1995), where three or more coniferous trees are co-dominant in the canopy. The list of co-dominant trees, which occur in Western Riverside County, are black oak, big-cone Douglas-fir, incense-cedar, Jeffrey pine, ponderosa pine and/or white fir. The canopy is generally less than 70 m in height and intermittent, with shrubs occurring infrequently to commonly and ground cover varying from sparse to abundant (Sawyer and Keeler-Wolf 1995).

Thorne (1976) identifies three subassociations of lower montane coniferous forests: Coulter pine forest, yellow pine forest, and mixed conifer forest. The last subassociation has not been described in Western Riverside County and a type of yellow pine forest is described in a separate Habitat account as Jeffrey pine forest.

The Coulter pine subassociation of lower montane coniferous forest, over its California range, can include bigcone Douglas-fir *(Pseudotsuga macrocarpa)*, black oak *(Quercus kelloggii)*, canyon live oak *(Q. chrysolepis*), coast live oak *(Q. agrifolia)*, interior live oak *(Q. wislizenii)* and/or ponderosa pine *(Pinus ponderosa)* (Sawyer and Keeler-Wolf 1995). Tree heights reach up to 30 m and generally form a continuous canopy (Sawyer and Keeler-Wolf 1995). The shrub layer underneath Coulter pines varies from frequent to infrequent with a sparse ground

layer (Sawyer and Keeler-Wolf 1995). Coulter pine *(Pinus coulteri)* may also occur as a co-dominant with canyon live oak in a two-tiered canopy with infrequent shrubs and a sparse ground layer (Sawyer and Keeler-Wolf 1995).

Coulter pine in southern California usually forms open stands with an understory of chaparral shrubs and pineland annual and perennial herbs (Thorne 1977). The lowest zone supports Coulter pine stands often along with black oaks. Manzanita chaparral species are also commonly found in this area, with chaparral whitethorn *(Ceanothus leucodermis)* as the most common shrub species (Thorne 1977, Vogl 1976). Most of the chaparral whitethorn present occurs in mature stands, awaiting fire to stimulate seed growth (Vogl 1976). This lower zone may "give-way" to dense brush or oak-*Ceanothus* chaparral (Thorne 1977). The upper portion of the Coulter pine subassociation may contain a variety of other pine species *(Pinus* spp.) and white fir *(Abies concolor)*. In the Santa Ana mountains, Coulter pine stands intergrade with manzanita chaparral, stands of oaks *(Quercus* spp.), or big-cone Douglas-fir (Vogl 1976).

The yellow pine forest identified by Thorne (1976) is dominated by either ponderosa or Jeffrey pine *(Pinus jeffreyii)* depending on the elevation and exposure, although the two species may occur together and may hybridize in some situations (Thorne 1977). Areas dominated by Jeffrey pines are described in a separate Habitat account. Ponderosa pine associates at lower elevations include Coulter pine and black oak (Thorne 1977). On north- and east-facing slopes, i.e., more mesic conditions, ponderosa pine is associated with big-cone Douglas-fir, incense-cedar, canyon live oak and Pacific dogwood. At higher elevations, under similar conditions, white fir and sugar pine *(Pinus lambertiana)* may co-occur (Thorne 1977). Scattered shrubs include manzanitas, deer brush *(Ceanothus integerrimus),* yerba santa (*Eriodictyon trichocalyx),* chinquapin *(Chrysolepis sempervirens),* thimbleberry *(Rubus parviflorus),* silk tassel bush *(Garrya flavescens),* grape soda lupine *(Lupinus excubitus),* lupine *(L. formosus),* cherry *(Prunus* spp.), California coffeeberry *(Rhamnus californica),* Sierra gooseberry *(Ribes roezlii)* and nightshade *(Solanum xanti)*. A diverse herbaceous layer is comprised of many of the following species, which are absent from Jeffrey pine forests: morning-glory *(Calystegia occidentalis* ssp. *fulcrata)*; sedge *(Carex multicaulis);* clarkia *(Clarkia rhomboidea);* collinsia (*Collinsia childii);* bird's-beak (*Cordylanthus rigidus*); eriastrum (*Eriastrum densifolium);* splendid gilia *(Gilia splenden);* iris (*Iris hartwegii);* whisker brush *(Linanthus ciliatus);* phacelia *(Phacelia imbricata);* campion *(Silene lemmoneii);* Laguna Mountains jewelflower *(Streptanthus bernardinus)* and violet *(Viola purpurea).* Other species include native perennial grasses like California brome *(Bromus carinatus* var. *carinatus),* brome *(B. orcuttianus),* melic *(Melica imperfecta),* and bluegrass *(Poa scabrella)*. Other common understory species include: western dwarf mistletoe *(Arceuthobium campylopodum);* Indian milkweed *(Asclepias eriocarpa);* desert Indian paintbrush *(Castilleja angustifolia);* pincushion *(Chaenactis santolinoides);* little

prince's-pine (*Chimaphila menziesii);* Johnston's bedstraw (Galium johnstonii); monkeyflower *(Mimulus johnstonii);* beardtongue *(Penstemon grinnellii);* and *P. labrosus*, snowplant *(Sarcodes sanguinea);* and squirreltail *(Elymus elymoides* ssp. *elymoides)* (Thorne 1976; Thorne 1977).

Two unique species occurrences may fall within lower montane coniferous forest, knobcone pine *(Pinus attenuata)* and Tecate cypress *(Cypressus forbesii)*. Knobcone pine is found in the Santa Ana mountains in the vicinity of Pleasants Peak and from Sugarloaf Peak (Thorne 1977, Vogl 1976). The closed-cone knobcone pine also is known from the south face of the San Bernardino Mountains (Thorne 1977) and along Hwy 84 below Idyllwild. Trees are short-lived and occur in even-aged stands (Vogl 1976). Another unique species occurrence is that of Tecate cypress which occurs on the northwest slopes of Sierra Peak (Vogl 1976).

PHYSICAL ENVIRONMENT

Average precipitation in the lower montane zone is between 65 and 200 cm and the growing season is between four to seven months (Munz and Keck 1949). Yearly maximum temperatures are between 27°C and 34°C and minima are between –5°C and 1°C (Munz and Keck 1949). According to Sawyer and Keeler-Wolf (1995), this general Habitat occurs most commonly in shallow soils on well-drained slopes of any aspect, between 900 and 2200 m. Lower montane coniferous forest typically occurs between 1525 and 2500 m in the San Jacinto Mountains (Vogl 1976). This Habitat occurs on ridgetopes, knolls, and southern exposures above chaparral but below higher coniferous forest types (Vogl 1976).

Elevations for the Coulter pine association stretch from 700 to 2000 m over the state (Sawyer and Keeler-Wolf 1995). Coulter pine stands generally occur on shallow, well-drained soils on all slope aspects (Sawyer and Keeler-Wolf 1995). In the San Jacinto Mountains, this lower zone may occur as low as 600 m. Dense brush and oak-*Ceanothus* chaparral, typical of the lowest part of this area, occur on dry, steep slopes on southern exposures. The upper zones, often dominated by ponderosa pine, as described by Thorne (1976), occur on mesic slopes, between 1,375 and 2,135 m (Thorne 1977).

The knobcone pine occurrence in the Santa Ana Mountains occurs on hydrothermally-modified serpentinite (Vogl 1976). It is thought that the characteristics of the tree, including "scattered growth, multiple-trunked trees, spreading crowns, and medium-length needles, contribute to the maintenance of the pines by enhancing their ability to intercept marine air and produce considerable fog drip which is readily held by the soil (Vogl 1976)." The knobcone pines have a closed-cone habit which requires periodic fires for shedding of the seed (Vogl 1976).

Similarly, Tecate cypress cones generally remain closed until a fire (Vogl 1976). Tecate cypress occurs on eroded clay, shales, sandstone, and conglomerate soils (Vogl 1976).

ECOSYSTEM PROCESSES

Ponderosa pine groves show signs of surviving lightning and past fires, although knowledge concerning the effects of fire or other ecosystem processes is not well developed. Coulter pine forests are adapted for rapid regeneration following fires (Stephenson and Calcarone 1999). However, in the Santa Ana mountains, Vogl (1976) observed that Coulter pines do not compete well with manzanitas after a burn. This is despite several adaptations to fire including semi-serotinous cones and relatively short life-span, which allow it to readily reseed burn sites and grow quickly after crown fires (Vogl 1976, Stephenson and Calcarone 1999). Vogl (1976) hypothesizes that the trees may require a specific natural fire frequency and intensity and may suffer from fire suppression activity, as evidenced by Vale (1979).

THREATS

Vogl (1976) warns that fire suppression activities, which cause the excessive accumulation of dead chaparral whitethorn, also may result in burns which may be “abnormally hot and destroy the pines and reduce the oaks, thereby raising the lower limits of the treeline” (Vogl 1976). The USDA (1999) identifies the largest threat to Coulter pine as multiple fires in short succession (e.g., less than twenty-five years). If trees are killed before an adequate seed crop has developed, the Habitat may revert to chaparral.

Insect and disease also threaten the Coulter pine (Stephenson and Calcarone 1999). An example of insect threats to Coulter pine was the loss of nearly 70 percent of overstory Coulter pine at Palomar Mountain in the late 1980's due to a bark beetle epidemic (Stephenson and Calcarone 1999). Coulter and ponderosa pines may be susceptible to pitch canker fungus *(Fusarium subglutinans* ssp. *pini)*, a relative new fungal pathogen in the southwestern region of the United States (Stephenson and Calcarone 1999). The western dwarf mistletoe *(Arceuthobium campylopodum*) infects both ponderosa and Coulter pines in this Habitat. Mistletoe is managed mainly through the pruning and removal of infected trees (Stephenson and Calcarone 1999). Bark beetles in southern California are generally of the genera *Dedroctonus* and *Ips*, with the western pine beetle *(Dendroctonus brevicomis)* causing widespread Coulter pine mortality during the early 1990's (Stephenson and Calcarone 1999). Ponderosa pines are attacked by ponderosa pine beetle *(Dendroctonus ponderosae)*. When the populations of these beetles are high, often during or following a drought, they may kill even healthy trees (Stephenson and Calcarone 1999).

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). In (1976), Vogl observed that a considerable portion of the Coulter pines in the Santa Ana mountains had been cut for sanitation, fire control, and reforestation.

Ponderosa pines have been shown to suffer foliage damage from ozone (Stephenson and Calcarone 1999). The highest rates of mortality occur when ozone damage occurs during a drought and trees cannot withstand attacks by bark beetles (Stephenson and Calcarone 1999). Forest areas exposed to heavy air pollution are most susceptible to this injury. Nitrogen deposition is thought to occur in those areas of high air pollution as well. Although it has some positive effects, e.g., increased soil fertility and surface litter decomposition rates, negative effects of nitrogen deposits include nutrient deficiencies, soil acidification, altered species composition (i.e., increase in white fir understory), decreases in mycorrhizal root symbiosis, and elevated nitrate in the soil (Stephenson and Calcarone 1999). Ponderosa pine is also susceptible to smog damage which resulted in clear-felling of dying stands in the San Bernardino Mountains (Thorne 1977).

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