

RESOURCE INVENTORY

PLANT LIFE
BIG BASIN REDWOODS STATE PARK
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BIG BASIN REDWOODS STATE PARK PLANT LIFE SECTION

INTRODUCTION

Roy W. Martin, Associate Resource Ecologist, prepared the Plant Life Section of the Big Basin Redwoods State Park Resource Inventory. This work is based on a review of pertinent literature, communications with local experts, and qualitative field investigations during the spring and summer of 1995, 1996, 1997, and 1998. Literature and personal communications cited throughout the text, as well as other relevant references can be found at the end of the section. Scientific nomenclature used in this inventory follows Hickman (1993), unless otherwise noted.

TERRESTRIAL FLORA

Big Basin Redwoods State Park lies within the Central Coast Region of the California Floristic Province (Stebbins and Major 1965, Raven 1988). The Central Coast Region is characterized by relatively long, dry summers and short, wet winters. Although summer rainfall is minimal, maritime influence and fog moderate the effects of this Mediterranean climate. Climatic moderation is less evident on the upper slopes and ridges of the park, which can be hot and dry during the summer.

California is one of the most important centers of endemism in the world, with about 1525 or 30.2% of the vascular plant species being endemic (Raven 1988). Of 863 native genera, 19 are endemic to California. Many of these endemics are relict species (paleoendemics) representing a portion of a flora that was more widespread during the mesic Tertiary Period.

The Central Coast Region has a great variety of habitats and was not glaciated; because of this, and the relative stability of the climate, the Central Coast Region is one of the richer areas in endemic taxa in California (Stebbins and Major 1965, Raven 1988). Big Basin Redwoods State Park is within the Santa Cruz Mountains local endemic area recognized by Stebbins and Major. Twenty-seven species or infraspecific taxa are endemic to the Santa Cruz Mountains, constituting 1.5 percent of the total number of vascular plants within this area (Thomas 1961).

Some of the Santa Cruz Mountains endemics are closely restricted to certain geological formations (Thomas 1961). For example, Santa Cruz cypress (*Cupressus abramsiana*), are restricted to four locations on soils derived from Butano or Vaqueros sandstone formations. The largest group of endemics restricted to certain soil types are those confined more or less to serpentine. A list of plant species found in Big Basin Redwoods State Park is included in Appendix PL-1.

Special Plants

Special plants are listed annually on the California Department of Fish and Game's Special Plant List. Those species listed by the U.S. Fish and Wildlife Service, the California Department of Fish and Game, and the California Native Plant Society (CNPS) as rare, threatened, or endangered are a subset of the Special Plant List. Other species, locally sensitive and important to the management of park units are considered of special interest and are discussed in the Special Interest Plants subsection. Distributional information for special plants was researched through the California Department of Fish and Game's Natural Diversity Data Base (NDDDB) and CNPS.

A total of 58 rare, threatened or endangered plant species have been identified in Santa Cruz County by CNPS (Skinner and Pavlik 1994). There are 59 species identified for adjacent San Mateo County. Several sources have reported the occurrence of 14 of these species in Big Basin Redwoods State Park. One of these, Santa Cruz microseris, may be based on an erroneous report. Another 6 species may be present, since suitable habitat exists in the park and known locations are nearby.

Some, but not all of the plants listed for these two counties have legal status as rare, threatened, or endangered under applicable state and/or federal laws. CNPS has established five list categories to describe the state's rare, threatened, and endangered vascular plants. List 1A is composed of plant species presumed to be extinct in California because they have not been seen or collected in the wild for many years. Plant species listed as 1B are considered as rare, threatened, or endangered throughout their range, and with few exceptions are endemic to California. Plants have been placed on this list due to circumstances of potential or present vulnerability (including limited habitat), low numbers of individuals per population, or limited number of populations. Plants listed as 1A or 1B are eligible for state listing under California law and are protected as such. It is mandatory that they be fully considered during preparation of environmental documents relating to the California Environmental Quality Act (CEQA).

Species appearing on List 2 are considered rare, threatened, or endangered in California, but are more common elsewhere. Because they are common in other states or countries, they are not eligible for consideration under provisions of the federal Endangered Species Act. However, under California law plants on this list are eligible for state listing and must be addressed during preparation of environmental documents relating to CEQA.

CNPS List 3 is composed of plant taxa that lack the necessary information to assign them to other lists or to reject them. Plants on List 4 comprise a watch list of

plant taxa that are of limited distribution in California. They are considered uncommon enough to have their status regularly monitored, but vulnerability or susceptibility to threat appears low at this time. List 4 plants should be considered during preparation of environmental documents relating to CEQA.

CNPS has further defined special plant species by the development of a numerical code (R-E-D) based on the three components of rarity, endangerment, and distribution. The rarity (R) component describes the plant in terms of numbers and the nature and extent of distribution. Endangerment (E) indicates the plant's status with respect to potential extinction. The general range of the plant is addressed by the distribution (D) component. Each component is assigned a numerical value of 1, 2, or 3, with larger numbers denoting more critical concern. For example, the CNPS List 1B plant, Santa Cruz manzanita (*Arctostaphylos andersonii*), has an R-E-D Code of 2-2-3, which indicates a plant distributed in a limited number of occurrences that is endangered in a portion of its range and is endemic to California. A complete definition of the R-E-D Code and state and federal designation codes for listed special plant species are presented in Appendix PL-3.

Legal protection is afforded some of the CNPS listed plants under provisions of the 1977 California Native Plant Protection Act and the 1984 California Endangered Species Act (Skinner and Pavlik 1994). There are three categories for state listing of plants: rare (SR), threatened (ST), and endangered (SE). In addition, "candidate" species categories have been established for those plants under review for possible listing as endangered or threatened. Similarly, a federal program to protect special plant species has been in effect since passage of the Endangered Species Act in 1973. Under this program, there are two categories of federally listed plants, threatened (FT) and endangered (FE). There are also categories for proposed endangered and threatened (FPE and FPT). Proposed species are granted limited protection, while candidate species do not enjoy any protection, although some federal agencies accord limited protection or management considerations. More detailed information on the state and federal rare, threatened, and endangered species programs are in Skinner and Pavlik (1994). Definitions for state listing of plants can be found in Sections 1901, 2062, and 2067 of the California Department of Fish and Game Code.

Field surveys of the flora of Big Basin Redwoods State Park were conducted in the spring and summer of 1995-1997 in order to coincide with peak blooming periods. Particular emphasis was placed on locating populations of the 19 special plant species known or suspected to occur in the park (Appendix PL-2). Known locations were revisited to ascertain size and health of populations. Other areas likely to support special plant species known to occur in the general area of the park were investigated. Disjunct parcels of state park property in the Scott Creek drainage were not explored because of access difficulties.

The following descriptions of the aforementioned 19 special plant species are arranged alphabetically by their scientific name. Listed habitat types in which these plants occur are those described and defined by CNPS (Skinner and Pavlik 1994).

Blasdale's bent grass (*Agrostis blasdalei*) is a perennial grass species found in coastal prairie and coastal bluff scrub from Santa Cruz County to Mendocino County. It is known from fewer than 15 occurrences, including a population on a coastal terrace that is located several miles south of the park. Suitable habitat exists for this species at the mouth of Waddell Creek, although no plants were found during a field search in the spring of 1997. Blasdale's bent grass is a CNPS List 1B plant whose subspecific taxon (*A. blasdalei* var. *marinensis*) is state listed as rare.

The perennial herb coast rock cress (*Arabis blepharophylla*) is a CNPS List 4 plant of coastal prairie, coastal scrub, and broad-leaved upland forest. It ranges from Sonoma County south through Santa Cruz County. Coast rock cress is sometimes an associate of Santa Cruz cypress, the latter species occurring in the Eagle Rock area of the park. Currently, coast rock cress has not been found at this location, but its possible occurrence warrants additional surveys.

Santa Cruz Mountains manzanita (*Arctostaphylos andersonii*) is an evergreen shrub that is endemic to the Santa Cruz Mountains. As a CNPS List 1B plant it is eligible for state listing under California law, and is protected as such. This species inhabits chaparral, redwood forest, north coast coniferous forest, and broad-leaved upland forest. Several populations have been located in the park, although none have been thoroughly surveyed. One of these occurs in an ecotone between open chaparral and redwood/mixed evergreen forest at the junction of Highway 236 and the China Grade Road. This population numbers at least a few dozen plants. Another smaller population consists of several plants adjacent to the lower end of the dirt access road leading to Eagle Rock. Vegetation associated with this second population is primarily chaparral. Vegetation surveys in 2001 have identified additional locations in the park.

Like the preceding species, Schreibers manzanita (*Arctostaphylos glutinosa*) is a CNPS List 1B plant that is endemic to the Santa Cruz Mountains and is eligible for state listing. This species is found on diatomaceous shale in chaparral and closed cone coniferous forest. The California Department of Fish Game's NDDDB has mapped locations of Schreibers manzanita in an area a couple miles south of Eagle Rock. The mapped population is relatively large and includes a portion of state park lands, as well as adjoining private property. A cursory field survey by state park staff has identified some plants on park property that are probably the taxon in question, but verification is still needed by botanists with taxonomic expertise. Access to this location is somewhat difficult, requiring a key from adjacent landowners for passage through a usually locked gate. Suitable habitat occurs in

the “Chalks” area of the park, and this area should be surveyed for potential occurrences of Schreibers manzanita.

Brewer’s calandrinia (*Calandrinia breweri*) is a CNPS List 4 plant that inhabits chaparral and coastal scrub, especially on disturbed sites such as burns. This annual herb was reported in the park along the Skyline-to-the Sea trail in 1974 at a location burned the previous year. It undoubtedly occurs in other locations of the park.

A 1973 survey of the Waddell Creek drainage by researchers from the University of California, Santa Cruz (Hecht and Rusmore 1973) found Monterey Indian paintbrush (*Castilleja latifolia*) growing on slopes above the mouth of the creek. This CNPS List 4 perennial herb occupies sandy places of coastal dunes, coastal strand, and coastal scrub along the coast of Monterey and Santa Cruz Counties. Any other occurrences in the park would be limited to the most coastal locations in the park.

Sandy places in lower montane coniferous forest is the preferred habitat for Ben Lomond spineflower (*Chorizanthe pungens* var. *hartwegiana*), a CNPS List 1B plant. It is listed as endangered by the federal government. This small annual herb is endemic to the Santa Cruz Mountains and has an extremely limited distribution. Within the park it is known only from the Slippery Rock area near Sempervirens Falls. Plants at this location occur in small pockets of sandy soil on the edges of sandstone outcrops. This population is estimated to be in excess of a thousand individuals in a wet year. It is apparent that the spineflower is competing for the limited habitat with annual grasses and forbs, many of which are non-native. Surrounding the mostly open site is a redwood/Douglas-fir forest. There is a potential for some visitor impact to the spineflower population since it is near the relatively popular Sempervirens Falls.

San Francisco collinsia (*Collinsia multicolor*) is an annual herb of moist, shady locations in coastal scrub and closed cone coniferous forest. This CNPS List 1B plant ranges from San Francisco to the Monterey Peninsula. In the park, a small population occurs alongside the trail between Rancho Del Oso and the Alder Trail Camp. A non-specific location in Waddell Creek has been reported in the Flora of the Santa Cruz Mountains of California (Thomas 1961). It is unknown whether these two occurrences are coincident.

Branching beach aster (*Corethrogyne leucophylla*), a CNPS List 3 plant, has been reported from the park. It is a perennial herb of coastal strand, coastal dunes, and closed cone coniferous forest in Santa Cruz, Monterey, and San Luis Obispo Counties. A single occurrence has been recorded at an elevation of 600 feet near the mouth of Waddell Creek. This site has not been visited recently because the abandoned access road is overgrown with poison oak.

Santa Cruz cypress (*Cupressus abramsiana*) is a Santa Cruz Mountains endemic of extremely limited distribution. This CNPS List 1B evergreen tree occurs in chaparral and a type of closed cone coniferous forest, and is known from fewer than 10 occurrences. It is listed as endangered by both the state of California and the federal government. Portions of some of the known groves have been destroyed or are threatened by residential/commercial development, agricultural conversion, logging, and/or alteration of the requisite natural fire regime. Three small groves occur in the Eagle Rock portion of Big Basin Redwoods State Park.

Researchers from the University of California, Santa Cruz, noted an occurrence of San Francisco wallflower (*Erysimum franciscanum*) on the coastal strand at the mouth of Waddell Creek (Hecht and Rusmore 1973). Field surveys in 1996 and 1997 were unsuccessful in locating this CNPS List 4 perennial herb at the Waddell site. It can be found in coastal dunes, coastal scrub, and valley-foothill grassland from Sonoma County south through Santa Cruz and Santa Clara Counties.

Another CNPS List 4 plant, stinkbells (*Fritillaria agrestis*), may occur in the vicinity of the mouth of Waddell Creek. It is a perennial bulb plant that can be found in chaparral, cismontane woodland, and valley-foothill grassland from Mendocino County to San Luis Obispo County, and in the Central Valley.

Santa Cruz Mountains beardtongue (*Penstemon rattanii* var. *kleei*) is a CNPS List 1B plant of chaparral, lower montane coniferous forest, and north coast coniferous forest. This perennial herb is endemic to the Santa Cruz Mountains and a non-specific location in the Waddell Creek drainage has been noted by Thomas (1961). It has not been discovered in the park during recent field surveys.

White-rayed pentachaeta (*Pentachaeta bellidiflora*) is an annual herb of coastal scrub, coastal prairie, and valley-foothill grassland. It is one of the rarest plants in California, and is listed as endangered by both the state and the federal government. The California Native Plant Society places white-rayed pentachaeta on its List 1B, and notes that it is currently known from only one extended occurrence bisected by I-280 in the Woodside area. However, a local, respected botanist located this plant during a 1984/85 field trip just north of Eagle Rock on property now owned by DPR. Although the exact location was never recorded, this author suspects that it inhabits one or both of the nearly inaccessible Santa Cruz cypress stands downslope from Eagle Rock. Also, the California Department of Fish Game's NDDDB has a record of a 1955 occurrence on private property approximately a mile west of Eagle Rock. This occurrence may still be extant.

The CNPS List 4 Gairdner's yampah (*Perideridia gairdneri* ssp. *gairdneri*) can be found in wet places of chaparral, valley-foothill grassland, broad-leafed upland forest, and vernal pools. It is a perennial herb that is endemic to California and endangered in a portion of its range. There is a pre-1945 record of a non-specific

occurrence in Opal Creek, whose drainage is entirely within the boundaries of the park. No other park sightings of Gairdner's yampah have been reported.

Monterey pine (*Pinus radiata*) is a CNPS List 1B tree of a closed cone coniferous forest type that is endemic to California. There are only three native mainland populations of Monterey pine, although it has been introduced in many areas of the state and outside this country. A small portion of the northernmost population falls within the boundaries of the park at the mouth of Waddell Creek. All populations of Monterey pine in the state are threatened with a potentially lethal pine pitch canker disease that has infected some trees in the Santa Cruz County population. Further decline in native populations due to disease and/or habitat loss may precipitate the listing of this species by government agencies.

The CNPS List 4 white-flowered rein orchid (*Piperia candida*) can be found along the Pine Mountain Trail in Big Basin Redwoods State Park, and possibly occurs in other areas of the park. It is a perennial herb of lower montane and north coast coniferous forests that is sometimes found on serpentinite.

A small population of San Francisco campion (*Silene verecunda* ssp. *verecunda*) occupies steep eroding slopes alongside the trail between Rancho Del Oso and the Alder Trail Camp. A survey of this site by state park staff in the spring of 1998 located less than a half dozen plants on a precarious slope that precluded an intensive search. This CNPS List 1B perennial herb is known from fewer than 20 occurrences ranging from San Francisco to northern Santa Cruz County. It occurs in many different habitats, including sand hills and dunes, coastal prairie, valley-foothill grassland, coastal scrub, coastal strand, and chaparral.

Like the preceding species, Santa Cruz microseris (*Stebbinsoseris decipiens*) is a CNPS List 1B plant of limited distribution, but capable of growing in many types of habitat. This annual herb occurs in open areas of coastal prairie, coastal scrub, chaparral, closed cone coniferous forest, and broad-leafed upland forest. It is known from fewer than 20 occurrences ranging from Marin County through Monterey County, although most occurrences are located a few miles south of the park. A site within park boundaries located 0.2 mile south of Waddell Creek was recorded in 1950, but not rediscovered during field surveys in 1996 and 1997.

Plants of Special Interest

Plants of special interest are species of scientific, educational or interpretive value, and include plants that are uncommon, at the extent of their native range, of unusual size, form, color or beauty, or have important and unusual relationships with animal

life. A large number of species in Big Basin Redwoods State Park fit one or more of these criteria.

Perhaps the most recognizable of these species is the coast redwood (*Sequoia sempervirens*), a long-lived conifer of potentially great size and esthetic and scientific significance (Cooper 1965; Simmons 1975; Zinke 1988). The park was originally established to protect a remnant of the old growth redwood forests that covered much of the Santa Cruz Mountains prior to widespread logging. Many fine examples of old growth redwood forest exist in the park, including the area surrounding park headquarters. In addition to their notable esthetic significance, the park's old growth redwood forests support an unknown number of nesting marbled murrelets, a rare seabird that is listed as endangered by the state of California and as threatened by the federal government.

Other species are of interest because they are growing near the limits of their natural distribution. The Santa Cruz Mountains provide habitat for a large number of plant species that reach their natural limits of southern or northern coastal distribution, which indicates an area of important transition. Here there is a mixing of north and central coast floral elements, although these mountains have a greater affinity with plant communities of the north coast. The Santa Cruz Mountains support extensive stands of north coast coniferous forest, a vegetation type composed of several communities. In contrast, there are occurrences of a few species such as black sage (*Salvia mellifera*) and hedge nettle (*Stachys bullata*) that are plants common in southern California communities. At least 55 species reported from the park meet the aforementioned distributional limits criteria. Those species that occur in the park and reach their southern limits of Coast Range distribution in the Santa Cruz Mountains are listed in Table PL-1 (Thomas 1961).

Table PL-1. Plant Species That Reach Their Southern Distributional Limits in the Santa Cruz Mountains

<u>Scientific Name</u>	<u>Common Name</u>
<i>Adenocaulon bicolor</i>	Trail plant
<i>Anemone oregana</i>	Western wood anemone
<i>Arctostaphylos nummularia</i>	Ft. Bragg manzanita
<i>Asarum caudatum</i>	Wild ginger
<i>Blechnum spicant</i>	Deer fern
<i>Calamagrostis rubescens</i>	Pine grass
<i>Calochortus tolmiei</i>	Pussy ears
<i>Calochortus umbellatus</i>	Oakland star-tulip
<i>Carex deweyana</i> ssp. <i>leptopoda</i>	Short-scaled sedge
<i>Carex nudata</i>	Torrent sedge
<i>Carex vesicaria</i> var. <i>major</i>	Western inflated sedge

<i>Corylus cornuta</i> var. <i>californica</i>	California hazelnut
<i>Delphinium hendersonii</i>	Henderson's shooting star
<i>Dicentra formosa</i>	Bleeding heart
<i>Dudleya cymosa</i>	Live-forever
<i>Equisetum hyemale</i> ssp. <i>affine</i>	Common scouring rush
<i>Euonymus occidentalis</i> var. <i>occidentalis</i>	Western burning bush
<i>Erysimum franciscanum</i>	San Francisco wallflower
<i>Fremontodendron californicum</i> ssp. <i>californicum</i>	Flannel bush
<i>Galium triflorum</i>	Sweet-scented bedstraw
<i>Goodyera oblongifolia</i>	Rattlesnake plantain
<i>Iris macrosiphon</i>	Slender-tubed iris
<i>Leymus mollis</i> ssp. <i>mollis</i>	Sea lyme grass
<i>Meconella californica</i>	California meconella
<i>Phacelia suaveolens</i> var. <i>suaveolens</i>	Sweet-scented phacelia
<i>Pleuricospora fimbriolata</i>	Fringed pine-sap
<i>Polypodium californicum</i>	California polypody
<i>Polypodium scouleri</i>	Leather-leaf fern
<i>Rhododendron macrophyllum</i>	California rose-bay
<i>Ribes menziesii</i>	Canyon gooseberry
<i>Romanzoffia californica</i>	None
<i>Rubus spectabilis</i>	Salmonberry
<i>Sambucus racemosa</i> var. <i>racemosa</i>	Coastal red elderberry
<i>Scoliopus bigelovii</i>	Slink pod
<i>Sedum spathulifolium</i>	Pacific stonecrop
<i>Senecio aronicoides</i>	California butterweed
<i>Tiarella trifoliata</i> var. <i>unifoliata</i>	Sugar-scoop
<i>Torreya californica</i>	California nutmeg
<i>Trifolium albopurpureum</i> var. <i>dichotomum</i>	Branched Indian clover
<i>Trisetum cernuum</i>	Nodding trisetum
<i>Urtica dioica</i> ssp. <i>gracilis</i>	American stinging nettle
<i>Vaccinium parvifolium</i>	Red huckleberry

Those species that occur in the park and reach their northern limits of Coast Range distribution in the Santa Cruz Mountains are listed in Table PL-2.

Table PL-2. Plant Species That Reach Their Northern Distributional Limits in the Santa Cruz Mountains

<u>Scientific Name</u>	<u>Common Name</u>
<i>Antirrhinum multiflorum</i>	Withered snapdragon
<i>Arctostaphylos tomentosa</i> ssp. <i>crustacea</i>	Brittle-leaved manzanita
<i>Ceanothus papillosus</i> var. <i>papillosus</i>	Warty-leaved ceanothus

<i>Chorizanthe diffusa</i>	Diffuse spineflower
<i>Chorizanthe pungens</i> var. <i>hartwegiana</i>	Ben Lomond spineflower
<i>Collinsia multicolor</i>	San Francisco collinsia
<i>Cordylanthus rigidus</i> ssp. <i>rigidus</i>	Bird's-beak
<i>Malacothamnus fasciculatus</i>	Chaparral mallow
<i>Pinus radiata</i>	Monterey pine
<i>Plagiobothrys chorisianus</i> var. <i>hickmanii</i>	Popcorn flower
<i>Plagiobothrys collinus</i> var. <i>californicus</i>	Popcorn flower
<i>Salvia mellifera</i>	Black sage
<i>Stachys bullata</i>	Hedge nettle

The large number of species that reach their natural limits of coastal distribution in the Santa Cruz Mountains indicates an area of important transition. Here there is a mixing of north and central coast floral elements, although this range has a greater affinity with plant communities of the north coast. It supports the southernmost stands of north coast coniferous forest, a vegetation type composed of several communities. In contrast, a few resident species such as black sage and hedge nettle are plants common in southern California communities.

Exotic Species

Big Basin Redwoods State Park has experienced considerable human disturbance. Activities such as logging, mining, road development, and home-site construction that preceded park acquisition have resulted in the introduction of invasive exotic plant species. Even after the removal of the disturbance, these species have continued to spread and replace native plants, causing degradation of habitat.

The Santa Cruz Mountains have a climate that is favorable for many exotic plants. Abundant rainfall and mild temperatures promote heavy growth. In addition, the same geography that encourages a high degree of native plant biodiversity also allows for a diverse assemblage of exotic plants.

Fortunately, extensive efforts have been made to control or eradicate exotic plants in the park. An exotic plant control and plant community restoration project funded through the Natural Heritage Stewardship Program has made significant progress toward solving exotic plant problems in the park. This project was initiated in the 92/93 fiscal year and continued through the 96/97 fiscal year. Much of the work has focused on removing the two most widely distributed exotic species in the park, French broom (*Genista monspessulana*) and pampas grass (*Cortaderia jubata*). Work crews have concentrated these removal efforts along roads and trails where disturbance is greatest.

Another priority has been the eradication of the fast-spreading plant German ivy (*Senecio mikanoides*) from the Rancho Del Oso portion of the park. An equally invasive plant, European beachgrass (*Ammophila arenaria*), has been removed from the park. It formerly covered about one acre on the beach at the mouth of Waddell Creek. Additional site visits will be necessary to dig out any stems which may have sprouted from below-ground nodes.

A limited amount of time has been spent on removing periwinkle (*Vinca major*). Currently it inhabits locations downstream from the forks of Waddell Creek. Like the preceding two species, periwinkle is very invasive and capable of spreading. This plant is typically an escape from historic home sites. No other exotic plants are known to be causing serious problems in the park at this time.

TERRESTRIAL VEGETATION

Communities

A narrative description and areal extent within the unit is given for each identified plant community. A plant community map (PL-1) at a scale of 1:24000 has been prepared from an earlier delineation of vegetation types described in the 1984 resource inventory for the park (on file at the Northern Service Center). The earlier delineation has been substantially revised to conform to current park boundaries and a plant community classification system described by Sawyer and Keeler-Wolf in the authoritative A Manual of California Vegetation (1995). Modifications or changes to the original map are based on aerial photo interpretation and ground-truthing.

Descriptions of plant community composition are primarily based on field observations by the author, Hecht and Rusmore (1973), Holland (1986), California Department of Parks and Recreation (1984), and Langenheim et al (1983), and to a lesser extent Burns (1983) and Eyre (1980). The publication by Hecht and Rusmore describes the environment, including flora and fauna, of the Waddell Creek drainage, which includes the majority of the park. Table PL-3 provides a list of communities that occur within Big Basin State Park.

Table PL-3. Plant Communities of Big Basin Redwoods State Park

Upland Redwood Forest
Alluvial Redwood Forest
Mixed Evergreen Forest
Interior Live Oak Woodland
Central Coast Arroyo Willow Riparian Forest* (not described in this section)

Red Alder Riparian Forest*
Monterey Pine Forest*
Knobcone Pine Forest*
Northern Interior Cypress Forest*
Northern Mixed Chaparral
Northern Coastal Scrub
Northern Foredunes
Coastal Brackish Marsh/Coastal and Valley Freshwater Marsh*
Non-native Grassland/Bald Hills Prairie*

Holland (1986) states that natural communities are recurring combinations of species that reflect parallel responses to similar environmental conditions. The Department of Fish and Game Natural Diversity Data Base (NDDDB) inventories those natural communities which are rare in the California landscape. Some of these, freshwater marsh and vernal pool communities for example, were once common but are now rare because of habitat loss. Others, such as serpentine outcrops, have never been extensive and have persisted because they occur on sites economically marginal for development or exploitation. Plant community names used in this inventory are derived from the NDDDB natural community classification system. The eight communities in Table 1 marked by an asterisk (*) are considered by the NDDDB to be rare natural communities of high inventory priority. This designation qualifies this community for special management attention by the Department.

The term “natural community” used by the NDDDB is equivalent to “plant community” as used in this document. Nomenclature follows that used by Holland (1986), except as otherwise noted. Please note that there are other vegetation classification systems utilized by government agencies, academia, various professionals. Prime among these other systems is the vegetation nomenclature described by Sawyer and Keeler-Wolf in the authoritative [A Manual of California Vegetation](#) (1995). Future updates of this inventory will provide a crosswalk between the communities described here and the Sawyer and Keeler-Wolf equivalencies.

Of special note is the possible occurrence of Sudden Oak Death Syndrome in Big Basin Redwoods State Park. Over the past few years a newly described plant pathogen, *Phytophthora ramorum*, has been identified as a primary cause of mortality for tanoaks (*Lithocarpus densiflorus*), coast live oaks (*Quercus agrifolia*), and California black oaks (*Quercus kelloggii*) in the central coast of California. Continuing research has shown that this fungus is rapidly spreading to additional locations in the state, and is infecting or capable of infecting many different genera and plant families. Not all hosts are being killed by this fungus, but the damage has been staggering in some areas, with extensive die-off of oaks in Marin and Sonoma

County locations. Numerous tanoaks in the park are dead or dying, although the *Phytophthora* pathogen has not been confirmed as the causative agent.

Upland and Alluvial Redwood Forests

Redwood forest communities cover extensive areas of the park. These forests are the primary reason for establishment of Big Basin Redwoods State Park in the early 1900's. Redwood forests in the park can be differentiated into a widespread Upland Redwood Forest type and a very narrowly distributed Alluvial Redwood Forest type. Together, these very similar communities cover more than 50% of the park.

Upland Redwood Forest occurs in moist locations primarily at low to middle elevations of the park, especially in drainages with a permanent water source. In deeper canyons and ravines redwoods grow in nearly pure stands, and in drier areas in association with Douglas-fir (*Pseudotsuga menziesii*) and other arboreal species.

More moist sites vegetated with Upland Redwood Forest are dominated by redwood (*Sequoia sempervirens*), with scattered Douglas-fir and tanoak. In drier locations, redwood, Douglas-fir, and tanoak are co-dominants in the canopy, with fewer numbers of madrone (*Arbutus menziesii*). Commonly encountered species in the understory are California huckleberry (*Vaccinium ovatum*), thimbleberry (*Rubus parviflorus*), chain fern (*Woodwardia fimbriata*), western sword fern (*Polystichum munitum*), creeping snowberry (*Symphoricarpos mollis*), and California hazelnut (*Corylus cornuta* var. *californica*). Poison oak (*Toxicodendron diversilobum*) and blue blossom (*Ceanothus thyrsiflorus*) are found in drier or more open areas.

The herbaceous layer can include five-finger fern (*Adiantum aleuticum*), wild ginger (*Asarum caudatum*), redwood sorrel (*Oxalis oregana*), hedge nettle (*Stachys bullata*), slinkpod (*Scoliopus bigelovii*), red clintonia (*Clintonia andrewsiana*), redwood violet (*Viola sempervirens*), trail plant (*Adenocaulon bicolor*), western wake-robin (*Trillium ovatum*), false Solomon's seal (*Smilacina racemosa*), fairy bells (*Disporum hookeri*), striped coral root (*Corallorhiza striata*), spotted coral root (*Corallorhiza maculata*), and yerba de selva (*Whipplea modesta*).

In drier locations of the park Upland Redwood Forest intergrades with Northern Mixed Chaparral and Knobcone Pine Forest. The juxtaposition with these communities is unusual and of special interest, because an essentially wet community borders a dry community with little or no transition. However, in these dry areas the redwood stands are always adjacent to drainages, since available moisture is a limiting factor for this community. Upland Redwood Forest

intergrades with Mixed Evergreen Forest and White Alder Riparian Forest in moister areas.

Alluvial Redwood Forest is not well represented in the park and is poorly developed when compared to more northern locations in the state. Within Big Basin Redwoods State Park it is restricted to the lower reaches of Waddell Creek. A local, more representative example of this community occurs in nearby Henry Cowell Redwoods State Park along the San Lorenzo River. Alluvial Redwood Forest occurs along permanent streams away from the immediate coast (Holland 1986). It grows on alluvial flats with deep, well-drained soils and is subject to periodic flooding in winter. This community is best-developed on larger streams, such as the Smith, Klamath, Eel, and Russian Rivers of northern California. It is less diverse than Upland Redwood Forest, and in many locations is composed of pure stands of redwood. The understory composition is primarily western sword fern and redwood sorrel. Alluvial Redwood Forest intergrades with Upland Redwood Forest and White Alder Riparian Forest.

From central Mendocino County north, redwood forests on more coastal sites intergrade with Sitka Spruce-Grand Fir Forest and Western Hemlock Forest communities as described by Holland (1986). On interior and drier locations they intergrade with Douglas Fir Forest, Mixed Evergreen Forest, or Northern Mixed Chaparral.

Many authors characterize redwood forest as a climax community, while others submit it is a fire-dependent climax type which would be replaced by more shade tolerant species such as western hemlock, Sitka spruce, and tanoak in the absence of fire (Cooper 1965; Eyre 1980; Stone and Vasey 1968; Stone et al. 1969). Using age distribution data Veirs (1980) concluded that redwood and certain associated coniferous species are shade tolerant and continuously regenerate under their own canopy. Conversely, Douglas-fir became established following fire. Of course, other types of disturbances such as windthrow or landsliding can create pioneer conditions suitable for colonization by a host of species, including Douglas-fir.

Redwood forests have an accumulation of biomass equal to or greater than any plant community on Earth. Redwoods are the tallest known trees in the world and are exceeded in bulk only by giant sequoia (*Sequoiadendron giganteum*), a closely related species. They are also extremely long-lived, with some individuals exceeding 2000 years in age.

Species richness in redwood forests is typically poor because of several factors. These include deep shade produced by a dense canopy, very thick duff and humus layers, and acidic soils resulting from decaying litter.

The distribution of redwood forests is closely related to and probably dependent on a humid, maritime climate. Runoff, perennial streams, summer fog, or a

combination of the three maintains the humid microclimate of a redwood forest. A high degree of soil moisture is necessary for establishment and perpetuation of redwood forests. However, redwoods are not tolerant of salt spray and those growing near the coast are protected from ocean winds by other tree species or landforms. Summer fog appears to be more important than the amount of precipitation in determining the extent of redwood (Eyre 1980; Fowells 1965). During the dry summer months fog greatly reduces water loss due to evapotranspiration and adds to soil moisture. On more interior sites and at the southern extent of its range, redwood are confined to northern exposures and canyon bottoms.

Redwoods range from two stands on the Chetco River in extreme southwestern Oregon to the Santa Lucia Mountains of southern Monterey County (Eyre 1980; Griffin and Critchfield 1976). It is an irregular and narrow coastal strip about 450 miles in length and from 5 to 35 miles in width. Redwoods range in elevation from sea level to about 3000 feet, although some individuals grow as high as 3500 feet. Most redwoods are found between 100 and 2500 feet.

Mixed Evergreen Forest

Mixed Evergreen Forest covers less than 20% of Big Basin Redwoods State Park. According to Langemheim et al (1983), this community is most often found on east and south aspects in the 400-800 feet and 2000-2400 feet elevation bands of the park. It typically borders Upland Redwood Forest on mesic sites and Knobcone Pine Forest/Northern Mixed Chaparral on drier sites. On sites with a mature forest canopy closure is total or near total.

Douglas-fir dominates the canopy species in wetter locations, forming nearly pure stands on steep, more sheltered slopes (Hecht and Rusmore 1973). Other important components of the canopy are tanoak, madrone, California bay (*Umbellularia californica*), interior live oak (*Quercus wislizenii*), canyon live oak (*Quercus chrysolepis*), coast live oak, and giant chinquapin (*Chrysolepis chrysophylla* var. *minor*). Big-leaf maple (*Acer macrophyllum*) is a minor constituent in the canopy of moist areas. Tanoak, madrone, and giant chinquapin replace Douglas-fir on drier, shallower soils on the higher, more exposed ridgetops where runoff and insolation are greatest.

The shrub layer of locations dominated by Douglas-fir includes thimbleberry, huckleberry, and California blackberry (*Rubus ursinus*). Drier areas support common snowberry (*Symphoricarpos albus* var. *laevigatus*), poison oak, blue blossom, creeping snowberry, bush monkey flower (*Mimulus aurantiacus*), and hairy honeysuckle (*Lonicera hispidula* var. *vacillans*). California hazelnut (*Corylus cornuta* var. *californica*) occurs in scattered locations of wetter areas.

Commonly encountered herbaceous species include redwood sorrel, wild ginger, western sword fern, redwood violet, western wake-robin, false Solomon's seal, fairy bells, striped coral root, spotted coral root, miner's lettuce (*Claytonia perfoliata*), Fremont's star lily (*Zigadenus fremontii*), hedge nettle (*Stachys bullata*), milk maids (*Cardamine californica*), mountain iris (*Iris douglasiana*), slender-tubed iris (*Iris macrosiphon*), and yerba de selva. This list is representative of the whole spectrum of Mixed Evergreen Forest sites ranging from dry to wet.

There is some variability in the structure and composition of Mixed Evergreen Forest in the park, although it is more pronounced across the breadth of its statewide distribution (Sawyer et al 1988). This community is typified by the broad-leaved, sclerophyllous nature of the dominant species. Leaves have growth forms consistent with summer drought, and are flat, thick and evergreen with well-developed cuticles. Cool winter temperatures and reduced moisture levels in mid to late summer limit plant growth.

Sawyer et al (1988) define "mixed evergreen forest" in broader terms than described above. Their description includes a distinctive set of coastal California mountain communities that in some cases are functionally equivalent to community phases described by this author. Distribution ranges from southwestern Oregon into the Klamath Mountains and through the California Coast Ranges in varying forms to San Diego County. It is more or less continuous from the Santa Lucia Range north, whereas south of this range it is restricted to mesic sites.

Sawyer et al (1988) differentiate Mixed Evergreen Forest into *Pseudotsuga*-Hardwood Forests and Mixed Hardwood Forests. *Pseudotsuga*-Hardwood Forests are found in the Klamath Mountains and the North Coast Ranges. Because of differences in forest patterns, it is necessary to subdivide these two mountain provinces. *Pseudotsuga*-Hardwood Forests in the North Coast Ranges form extensive mosaics with Northern Oak Woodland and Coastal Prairie communities. In the Klamath Mountains they form a more or less continuous belt, and the forests may be closed rather than open woodlands frequently encountered in the North Coast Ranges. Several types or phases of *Pseudotsuga*-Hardwood Forests are described by the authors for different parent materials, soil conditions, and moisture regimes. The most important tree species in the *Pseudotsuga*-Hardwood Forests of northern California are madrone, tanoak, and Douglas-fir.

Mixed Hardwood Forests occupy the mountains of southern California and the South Coast Ranges (Sawyer et al 1988). Three phases are recognized in the mixed hardwood category. These are a low elevation *Quercus agrifolia*-*Arbutus* forest, a redwood border *Lithocarpus*-*Arbutus*-*Quercus* forest, and a montane *Quercus chrysolepis*-*Pinus coulteri* forest. Douglas-fir is either absent or only a minor component of these forests.

The *Pseudotsuga*-Hardwood Forest described above is equivalent to the Douglas-fir--Tanoak--Pacific Madrone forest cover type 234 designated in Eyre (1980). The distributional range is basically the same, except for an additional location in the north central Sierra Nevada Mountains. Stand structure is not environmentally controlled, but is a result of various kinds of disturbances that result in different species combinations and successional stages. In the Coast ranges the northern limit of its distribution coincides with the natural limit of tanoak. South of Mendocino County tanoak, canyon live oak, and madrone are the dominant canopy species, and Douglas-fir becomes less important. This "phase" forms mosaics with coastal prairie, oak woodlands, chaparral, and gray pine (*Pinus sabiniana*).

Red Alder Riparian Forest

The California Department of Fish Game's NDDDB has designated Red Alder Riparian Forest as a rare natural community. This community is limited to Waddell Creek, extending from the marsh near its mouth upstream to the forks of the creek, and continuing a short distance up each fork. It is composed of mostly deciduous trees that form a dense, shady canopy over the stream in the spring and summer. It is well developed along the lowest reaches of Waddell Creek, exceeding 100 feet in width on each side of the stream. This community can be partly inundated during periods of heavy runoff. Cultivated areas and ruderal fields border a portion of the Red Alder Riparian Forest along the lowest section of Waddell Creek. It intergrades with Upland Redwood Forest along the middle and upper sections of the creek.

Dominant species in the upper canopy are red alder (*Alnus rubra*), big leaf maple, box elder (*Acer negundo* var. *californicum*), and black cottonwood (*Populus balsamifera* ssp. *trichocarpa*). The mid-canopy is dominated by arroyo willow (*Salix lasiolepis*) and red willow (*Salix laevigata*).

Shrubs commonly found in the understory are California blackberry, coastal red elderberry (*Sambucus racemosa* var. *racemosa*), blue elderberry (*Sambucus mexicana*), thimbleberry, salmonberry (*Rubus spectabilis*), chain fern, canyon gooseberry (*Ribes menziesii*), and straggly gooseberry (*Ribes divaricatum*). Plants that comprise the herbaceous layer include mugwort (*Artemisia douglasiana*), yarrow (*Achillea millefolium*), poison hemlock (*Conium maculatum*), elk clover (*Aralia californica*), stinging nettle (*Urtica dioica*), periwinkle (*Vinca major*), miner's lettuce (*Claytonia perfoliata*), shining chickweed (*Stellaria nitens*), coltsfoot (*Petasites frigidus* var. *palmaris*), common scouring rush (*Equisetum hyemale* ssp. *affine*), and giant horsetail (*Equisetum telmateia* ssp. *braunii*).

Red Alder Riparian Forest exhibits a change in species composition where it intergrades with redwood forests. Here there is a decrease in the deciduous canopy, and the understory may include plants that are more closely associated with redwoods (Hecht and Rusmore 1973). These understory species are western azalea (*Rhododendron occidentale*), redwood ivy (*Vancouveria planipetala*), western burning bush (*Euonymus occidentalis* var. *occidentalis*), leopard lily (*Lilium pardalinum* ssp. *pardalinum*), five-finger fern (*Adiantum aleuticum*), and alum root (*Heuchera micrantha*).

Site factors favored by stands of Red Alder Riparian Forest include moist, rich soils along streams or seepy hillsides, especially bottomland locations (Holstein 1984, Holland 1986). Some stands occur on the edges of marshes, indicating a tolerance of poorly aerated, marshy soils. Typically red alder form dense, near pure stands on sites near streams, although those stands along Waddell Creek mostly share canopy dominance amongst several species, as noted above.

Red Alder Riparian Forest ranges along the immediate coast from northernmost San Luis Obispo County to the Alaskan panhandle (Griffin and Critchfield 1976; Holstein 1984). Holland (1986) reports that this community may occur up to 50 miles inland from the Eel River region of Humboldt County northward to Oregon and in moist areas away from streambanks.

Monterey Pine Forest

Monterey Pine Forest is designated as a rare natural community by the California Department of Fish Game's NDDDB. Only three natural populations of this unique community occur in California. Approximately 116 acres of the northernmost population (Año Nuevo population) of Monterey pine is within the boundaries of Big Basin Redwoods State Park. Here it occupies the ridges flanking both sides and the mouth of Waddell Creek, extending to the north onto private property. This forest appears to be restricted to more exposed, coast-facing ridges and slopes, and is replaced by Douglas-fir and redwood in protected ravines and gullies. On drier sites it intergrades with Knobcone Pine Forest.

The canopy is dominated by Monterey pine (*Pinus radiata*), with some coast live oak, Douglas-fir, and knobcone pine. Shrubs commonly found in the understory include California coffeeberry (*Rhamnus californica*), poison oak, California blackberry, canyon gooseberry, blue blossom, toyon, oceanspray (*Holodiscus discolor*), yerba santa (*Eriodictyon californicum*), and bush monkey flower. The diverse herbaceous layer includes giant wake-robin (*Trillium chloropetalum*), milk maids, rigid hedge nettle (*Stachys ajugoides* var. *rigida*), blue witch (*Solanum umbelliferum*), yerba buena (*Satureja douglasii*), goose grass (*Galium aparine*), American vetch (*Vicia americana* var. *americana*), bracken fern (*Pteridium*

aquilinum var. *pubescens*), coastal wood fern (*Dryopteris arguta*), goldback fern (*Pentagramma triangularis* ssp. *triangularis*), and California maiden-hair fern (*Adiantum jordanii*).

Unlike some closed cone pines, fire is not necessary to open the cones of Monterey pine (Vogl et al 1988). Cones remain attached to the tree for years, but they open and close many times during this period, producing a meager but constant source of seeds. However, optimum conditions for reproduction and enhancement of vigor and growth occur with fire. Interestingly, ground fires more often produce optimum reproduction than the catastrophic types common to other closed cone pines.

There has been a great deal of speculation but few studies to define the factor or factors restricting the range of Monterey Pine Forest in California. The limiting factor most often enumerated is the inland reach of summer fog (McDonald 1959; Forde 1966). All of the Monterey pine stands in California occur within 5 miles of the coast, suggesting this plays an important role in limiting distribution. (Roy 1966). Other factors have been suggested as limiting distribution, including soil type (McDonald 1959; Roy 1966).

Of concern for all Monterey pine populations is the introduction into the state of the exotic fungus that causes pine pitch canker disease (Owen 1998). Since first discovered in California in 1986, this often fatal disease has spread by insect vectors to all three native Monterey pine populations. Pine pitch canker has the potential to infect all Monterey pines, although disease-resistant individuals have been discovered. Currently, there is no known treatment that is effective against this disease, and the timely removal and proper disposal of diseased material is recommended by the Pine Pitch Canker Task Force. A local landowner adjacent to the park has noticed infected trees on his property (personal communication 1998).

Interior Live Oak Woodland

Interior Live Oak Woodland is not extensive in the park. It can be found at middle to upper elevations of the park on gentle to moderately steep slopes. The greatest expanse occurs in the eastern part of the park adjacent to or near the China Grade Road. It typically forms an ecotone of varying size with Mixed Evergreen Forest, Upland Redwood Forest, Northern Mixed Chaparral, and Knobcone Pine Forest. It shares several species in common with these communities, especially Northern Mixed Chaparral and Mixed Evergreen Forest.

The canopy of Interior Live Oak Woodland is dominated by interior live oak and canyon live oak. Less common in the canopy are coast live oak, knobcone pine (*Pinus attenuata*), and California bay laurel. Canopy closure is less than 75% on some sites. The understory is usually sparse and open, but can include bush

monkey flower, chamise (*Adenostoma fasciculatum*), mountain iris, brittle-leaved manzanita, and various ferns. As noted by Holland (1986), persistent leaf litter precludes the development of a rich herbaceous layer.

Distribution of Interior Live Oak Woodland is limited to California and northern Baja California (Holland 1986). It is fairly extensive in northern California from Shasta County south through the Coast Ranges to Sonoma and Lake Counties, and through the Sierra foothills to the Kern River. In southern California distribution is scattered in the Peninsular, Transverse, and south Coast Ranges (including the Santa Cruz Mountains). Bigcone Douglas-fir (*Pseudotsuga macrocarpa*) is a secondary dominant in the Peninsular and Transverse Ranges.

Knobcone Pine Forest

Knobcone Pine Forest is a rare natural community, designated as such by California Department of Fish Game's NDDDB. It covers extensive portions of the park at middle to upper elevations, especially on shallow, ridgetop soils derived from Santa Cruz mudstone. One of the largest expanses of Knobcone Pine Forest occupies ridgetops in the western part of the park known as "The Chalks." This named location refers to the chalky appearance of exposed areas of soil and rock (Santa Cruz mudstone).

Knobcone Pine Forest usually intergrades with Northern Mixed Chaparral, with which it shares many common species. Hecht and Rusmore (1984), as well as the 1984 DPR resource inventory, describe knobcone pine as a component of chaparral. This author recognizes a distinct knobcone pine community type apart from the chaparral. However, because of difficulties in differentiating these two communities from aerial photographs, they are mapped as a single entity (Map PL-1).

The very open canopy of Knobcone Pine Forest is dominated by knobcone pine, the largest of the closed cone pines in California. On better sites knobcone pines grow to about 82 to 90 feet in height and 25 inch d.b.h (diameter at breast height). Scattered canyon live oak form a minor component of the canopy. The understory is mostly comprised of brittle-leaved manzanita, chamise, giant chinquapin, yerba santa, and bush monkey flower. The herbaceous layer is practically nonexistent in this community. Leaf litter and woody debris are substantial in most locations supporting knobcone pine, reflecting an absence of recent fires. A prime example is the summit area of Pine Mountain, where there is a tremendous accumulation of woody debris, including many senescent, downed trees.

Knobcone pines typically form dense stands on poor and/or rocky sites (Holland 1986; Horton 1960; Vogl et al 1988). Because of a patchy distribution, knobcone pine communities characteristically intermix with and are surrounded by another

community (e.g. chaparral). Many stands grow on infertile soils derived from serpentinite, and they are more tolerant of these harsh conditions than surrounding vegetation. The stands in Big Basin Redwoods State Park are growing on soils derived primarily from sedimentary rocks.

Most locations supporting knobcone pine are exposed to varying amounts of moist, marine air (Vogl 1973; Vogl et al 1988). Undoubtedly this moisture tempers the harsh growing conditions of some areas, especially the more inland sites. Vogl (1973) has described morphological and stand characteristics of knobcone pine and associated topographical features that promote fog drip and moisture condensation in stands located in the Santa Ana Mountains of southern California.

Knobcone Pine Forest is a community requiring periodic fires for stand renewal. These stand-replacing fires usually kill most of the trees, resulting in new stands of knobcone pine that are typically even-aged (Holland 1986; Vogl et al 1988). Fire is usually necessary to open the cones of knobcone pine and to create the pioneer conditions of bare mineral soil and full sun that are critical for seedling establishment. Fire releases mineral nutrients from the standing vegetation and litter, thus making this available for the new trees. In addition, the heavy, flashy fuels produced by mature stands of knobcone pine serves to burn up competition (Gray 1998, personal communication). Knobcone pine stands that grow on better soils require more frequent fires in order to survive replacement by another vegetation type (Eyre 1980). Continued fire exclusion from knobcone pine stands in Big Basin Redwoods State Park will add to the buildup of woody material on the ground, potentially contributing to catastrophic fires.

Knobcone pines have a short life span, typically less than 100 years (Horton 1960; Vogl 1973; Vogl et al 1988). Trees that are over 50 years old show signs of deterioration and senescence, and death occurs at about 75 years of age. Recurring fires usually reduce this life span. Early and widespread senescence, dry sites, and proximity to other fire type communities lead to fuel conditions that favor fire. It is estimated that the fire return interval for the Knobcone Pine Forest is 33 to 50 years.

Knobcone pine range in distribution from the Cascade Range in central Oregon to northern Baja California (Eyre 1980; Holland 1986). Away from the immediate coast it is abundant in the Siskiyou and Klamath Mountains of southwestern Oregon and Coast Ranges of northern California. Another area of abundance occurs in the Santa Cruz Mountains. Knobcone pine grow on the western slopes of the Sierra Nevada Mountains from Sierra to Mariposa Counties. The largest concentrations are in the American and Merced River drainages at elevations between about 1900 and 5000 feet. In southern California knobcone pines occur naturally at only three areas, near Cuesta Pass in San Luis Obispo County, in the San Bernardino Mountains, and in the Santa Ana Mountains.

Northern Interior Cypress Forest

Northern Interior Cypress Forest is designated as a rare natural community by the California Department of Fish Game's NDDDB. Three small groves constituting a single population occur in the Eagle Rock portion of Big Basin Redwoods State Park. The smallest of the park's groves is located within a few hundred feet of the Eagle Rock lookout. Two other groves lie downslope of the lookout to the north and northeast. This community is very similar to Knobcone Pine Forest, but is dominated by Santa Cruz cypress, a species listed as endangered by the Federal government and the state of California. It has an open canopy and intergrades readily with Northern Mixed Chaparral and Knobcone Pine Forest, having several species in common with these two communities.

In addition to Santa Cruz cypress, other species occurring in the canopy are knobcone pine and interior live oak. Shrub species commonly encountered in the understory include chamise, brittleleaf manzanita, birch-leaf mountain mahogany (*Cercocarpus betuloides* var. *betuloides*), warty-leaved ceanothus (*Ceanothus papillosus* var. *roweanus*), black sage, coast whitethorn (*Ceanothus incanus*), and buckbrush (*Ceanothus cuneatus* var. *cuneatus*). In the typically sparse herbaceous may be found Indian warrior (*Pedicularis densiflora*), Henderson's shooting star (*Dodecatheon hendersonii*), common monkey flower (*Mimulus guttatus*), and Fremont's star lily (*Zigadenus fremontii*).

There are only five known populations of Santa Cruz cypress, all occurring in the Santa Cruz Mountains (U.S. Fish and Wildlife Service 1996). As described by Libby (1979), these populations are relictual islands of a flora that was widespread during glacial times. All five populations occur on or near dry ridges above the fog belt. The Eagle Rock groves occupy the highest known elevations for the species, ranging from approximately 1800 to 2500 feet (Griffin and Critchfield 1972). They occur on a xerorthents-rock outcrop complex soil type derived from the underlying sandstone. These soils are shallow, porous, well-drained, and low in nutrients.

Fire is not required for regeneration of Santa Cruz cypress, but periodic fires do promote stand vitality (Lyons 1988). As noted by the U.S. Fish and Wildlife Service (1996), the release of seeds from dispersed cones is not dependent on fire, although fire is commonly the agent for seed dispersal. Fires also create the pioneer conditions of bare mineral soil and full sun that are critical for seedling establishment. However, too frequent fires (e.g. less than 10 years) create a risk of extirpation because the stand is prevented from reaching reproductive age.

Northern Mixed Chaparral

Northern Mixed Chaparral is the second most extensive community in the park. It is located on more xeric sites, especially on upper slopes and ridgetops underlain by Santa Cruz mudstone. Not surprisingly, the location of chaparral stands in the park is largely controlled by soil type, which in turn is an important factor in determining available soil moisture. As described above, chaparral is often intermixed with Knobcone Pine Forest, consequently the ecotone between the two communities is not well defined. Northern Mixed Chaparral also intergrades with Mixed Evergreen Forest, Interior Live Oak Woodland, and Upland Redwood Forest. The transition between chaparral and these three communities is often quite abrupt, reflecting a change in soil substrate and/or a greater availability of water. For example, approximately one mile west of the intersection of the China Grade road and Highway 236 are a few isolated stands of small redwoods surrounded by chaparral. These stands occupy the bottom of intermittent, small drainages that supply sufficient moisture for redwood survival.

Northern Mixed Chaparral, like other forms of chaparral, is a dense, single-layered community composed primarily of evergreen woody shrubs. In mature stands, such as found in the park, the canopy forms an impenetrable barrier with few or no openings. The composition of chaparral in the park is not homogeneous, but variable across the extent of its distribution. Slope aspect is the most important selective factor in determining the local composition of a chaparral stand (Hanes 1974).

Most of the chaparral stands in Big Basin Redwoods State Park are dominated by chamise and either brittle-leaved manzanita or Ft. Bragg manzanita (*Arctostaphylos nummularia*). Chamise is most dominant on the hottest, driest slopes (e.g. south-facing slopes). Associated trees and shrubs include canyon live oak, knobcone pine, warty-leaved ceanothus, toyon (*Heteromeles arbutifolia*), yerba santa, giant chinquapin, bush monkey flower, bush poppy (*Dendromecon rigida*), and California huckleberry. The latter two species are common components of chaparral in the "Chalks" area of the park. Santa Cruz manzanita (*Arctostaphylos andersonii*), a plant eligible for listing by the state, occurs in the ecotone of a few chaparral sites adjacent to the China Grade Road.

On a typical site there is an accumulation of leaf litter and very little undergrowth. The absence of an herbaceous layer is quite evident on sites dominated by chamise and manzanita. This is partly due to phenolic toxins produced by these shrubs that find their way into the soil and inhibit the germination of herbaceous species (Chou and Muller 1972; Christensen and Muller 1975).

As noted by Hecht and Rusmore (1973), a more diverse chaparral occupies Eagle Rock and vicinity, although some stands here are heavily dominated by chamise. These stands include the aforementioned species as well as such shrubs as golden fleece (*Ericameria arborescens*), golden yarrow (*Eriophyllum confertiflorum* var. *confertiflorum*), black sage, birch-leaf mountain mahogany, buck brush, coast

whitethorn, and virgin's bower (*Clematis lasiantha*). The herbaceous layer can include Henderson's shooting star, Indian warrior, live-forever (*Dudleya cymosa*), coyote mint (*Monardella villosa*), scarlet larkspur (*Delphinium nudicaule*), and Pacific stonecrop (*Sedum spathulifolium*).

Horton (1960) and Wilson and Vogl (1965) have described a manzanita-chamise form of manzanita chaparral whose physiognomy is similar to some stands of chaparral found in the park. This type of chaparral has been called "cold chaparral" since most of its precipitation is in the form of fog drip, freezing moisture, and snow. Like the park's stands, the dominant shrubs are manzanita and chamise.

California chaparral occurs in areas with a Mediterranean climate, although there is some climatic variation resulting from differences in elevation, latitude, and nearness to the coast (Hanes 1965, 1988). Characteristically, winters are wet and moderate, and summers are hot and dry. However, the close proximity of the Pacific Ocean to the park ameliorates temperatures and summer fog provides some moisture during the summer. Unquestionably, chaparral stands in the park receive more precipitation than most other areas of chaparral in the state, especially southern California.

Chaparral shrubs possess morphological and physiological features that suit them to their environment. They have an extensive lateral root system that efficiently utilizes surficial moisture and a deep primary root system that is suited to summer drought (Hellmers et al 1955). Leaves are typically small, thick, stiff and hard, which provides protection from herbivory, promotes water conservation, and protection from overheating during the summer (Hanes 1974; Mooney et al 1974). Chaparral plants have a physiological capacity for dormancy during periods of scarce moisture, such as occurs regularly during the summer (Hanes 1974; Lewis 1961). Hence, California chaparral is winter active and summer dormant, with most growth occurring during the cooler and wetter part of the year.

Fire is an important natural process in the development and maintenance of healthy chaparral communities. As noted by Hanes (1988), fire is "a powerful force in the total ecology of California chaparral." California chaparral is one of the most fire susceptible vegetation types in the world largely due to its density, extreme dryness during summer and fall drought, and presence of volatile substances in its leaves (Biswell 1974; Hanes 1974; Lewis 1961). Fire is inevitable in all stands of chaparral, and has a typical return interval of 10 to 40 years. About half of the chaparral species are rootcrown sprouters.

Successional patterns of chaparral are quite similar throughout California (Hanes 1974, 1988). Herbs and forbs dominate chaparral stands for a few years following a fire, although seedlings and root crown sprouters of woody shrubs are also present. Within 2 to 5 years these shrubs begin to dominate by virtue of a water and

light monopoly. Some of these shrubs, such as chaparral pea and *Ceanothus* spp., are intermediate-lived pioneer species that gradually die out as the stand matures.

Chaparral is the most extensive vegetation in the state, covering about 8.5% of California (Hanes 1974, 1988). It ranges from southern Oregon through the Coast and Sierra Nevada Ranges to the Transverse and Peninsular Ranges of southern California and northern Baja California. Chaparral is most fully developed in southern California, where it generally grows from 1000 to 5000 feet in elevation. In the northerly portions of its range chaparral occurs from 500 to 3000 feet in elevation. At lower elevations chaparral is contiguous with annual grasslands, coastal sage scrub, and various woodland communities. Mixed Evergreen Forest and various coniferous communities border chaparral at higher elevations.

Of the more than 25 chaparral communities described by Holland (1986), Northern Mixed Chaparral is one of the most widely distributed in the state. It is found from the Klamath Mountains south through the Coast Ranges to the Peninsular and Transverse Ranges of southern California. This community also occurs in the foothills of the Sierra Nevada Mountains. Typical sites are dry, rocky, often steep slopes with little soil. Many of the chaparral locations in the park fit this generic description.

Northern Coastal Scrub

This community is confined to the immediate coastal portions of the park, i.e. in the vicinity of the mouth of Waddell Creek. It ranges from nearly sea level to about the 500-foot elevation, where it intergrades with Monterey Pine Forest, Northern Mixed Chaparral, and Upland Redwood Forest. The ecotone between coastal scrub and these communities is quite narrow, reflecting the abrupt change in vegetation types.

Northern Coastal Scrub is a shrub-dominated community that reaches about six feet in height at maturity. It is highly sculptured by wind, and is nearly impenetrable to large mammals. As described by Holland (1986), it has a patchy distribution from southern Oregon to Point Sur in Monterey County along a fairly narrow coastal strip. Holland (1986) recognizes three types of Northern Coastal Scrub based on the most dominant shrub species. Northern Coyote Brush Scrub is the Holland type that best describes the physiognomy of the park's coastal scrub. Similarly, two distinct phases of northern coastal scrub, one dominated by coyote brush and the other by bush lupine, have been described in Heady et al (1988). The coyote brush phase corresponds to the coastal scrub community found in the park and is equivalent to Northern Coastal Scrub of Holland (1986).

The shrub component of the park's stands of coastal scrub includes coyote brush (*Baccharis pilularis*), California sagebrush (*Artemisia californica*), poison oak, California blackberry, yellow bush lupine (*Lupinus arboreus*), California coffeeberry,

blue elderberry, blue blossom, coast buckwheat (*Eriogonum latifolium*), bush monkey flower, and California man-root (*Marah fabaceus*). Fern species commonly encountered are bracken fern, goldback fern, western sword fern, coastal wood fern, California polypody (*Polypodium californicum*), and leather-leaf fern (*Polypodium scolieri*). A relatively diverse herbaceous layer can include stinging nettle, rigid hedge nettle, poison hemlock, Monterey Indian paintbrush (*Castilleja latifolia*), lizard tail (*Eriophyllum staechadifolium*), California figwort (*Scrophularia californica*), cow parsnip (*Heracleum lanatum*), climbing bedstraw (*Galium porrigens*), American vetch, and powdery dudleya (*Dudleya farinosa*).

Herbaceous species predominate in some locations of the park, presumably from greater available moisture and more protection from the wind and salt spray. A large patch of this herbaceous-dominated scrub occurs on steep slopes alongside the Rancho del Oso access road and across from a finger of marshland. However, the majority of coastal scrub in the park is dominated by coyote brush.

An attempt to document north-south gradients of northern coastal scrub has been described in Heady et al (1988). In this superficial study 8 sites were vegetatively sampled between the Little Sur River in Monterey County and Stuarts Point in Sonoma County. The researchers drew several tentative conclusions, including the observation that coyote brush is the only dominant taxon continuous through the northern range of northern coastal scrub. They also suggested that the components of coyote brush-dominated coastal scrub are found in and possibly derived from adjacent vegetation types, such as coastal sage scrub, closed-cone pine forest (e.g. Monterey Pine Forest), and chaparral. Certainly this is substantiated by an examination of the coastal scrub in the park, which shares many species with the surrounding communities of redwood forest, chaparral, and Monterey pine.

Northern Foredunes

This community is poorly developed in Big Basin Redwoods State Park. It is restricted to a narrow zone along the immediate coast between Highway 1 and the beach at the mouth of Waddell Creek. Never very extensive at this location, it has been impacted by construction and maintenance of Highway 1, including placement of spoils along the west side of the highway. This community does not extend upcoast from the Waddell Creek beach parking lot because the mean high tide line is very close to the Highway 1 road base.

Northern Foredunes is a mostly herbaceous community dominated by perennial grasses, perennial herbs, and subshrubs. In the park it exhibits a great deal of heterogeneity, with hummocky areas dominated by grasses and more level areas dominated by perennial herbs. Hecht and Rusmore (1973) have identified this

community as Coastal Strand, which is a more generalized vegetation type described earlier by Munz and Keck (1959).

The most commonly encountered plants are pink sand verbena (*Abronia umbellata* ssp. *umbellata*), beach strawberry (*Fragaria chiloensis*), California seaside plantain (*Plantago maritima*), sea rocket (*Cakile maritima*), California cord grass (*Spartina foliosa*), saltgrass (*Distichlis spicata*), beach primrose (*Camissonia cheiranthifolia*), and seaside daisy (*Erigeron glaucus*). Many of these plants are suited to growing in the saline conditions resulting from continual salt spray of the adjacent ocean. Some have growth forms which stabilize shifting sands, such as the rhizomes of the saltgrass or the spreading prostrate stems of the pink sand verbena.

Northern Foredunes occurs along the California coast where sandy beaches are present from the about the Oregon border south to Point Concepcion.

Coastal Brackish Marsh/Coastal and Valley Freshwater Marsh

Two marsh complexes occur at the mouth of Waddell Creek. The larger of the two marshes is located along Waddell Creek from the Highway 1 bridge upstream for a distance of about 700 to 800 feet. Its greatest width is about the same distance, being confined by roads to the north and south. The other marsh, known as the "Turtle Pond", is about a 2 acre artificial construct from a formerly wet meadow that is replenished by springs. It is about 200 feet south of the mouth of Waddell Creek and is bounded by the Rancho Del Oso Visitor Center access road on its north and east sides and by Highway 1 on its south side.

The large marsh complex is vegetated with species that are common to both Coastal Brackish Marsh and Coastal and Valley Freshwater Marsh plant communities described by Holland (1986). Studies by Smith et al (1997) document the dynamic nature of this marsh, with changes in water salinity fluctuating from freshwater to a stratified system of fresh water above and saline conditions on the bottom, i.e. brackish conditions. These fluctuations in salinity can occur annually, and are the result of several factors, including storm events, tides, seasonal stream flows, and the development of a sandbar at the mouth of the creek.

Both plant communities mentioned above have been designated as rare natural communities by the California Department of Fish Game's NDDDB. The common species of the larger marsh are three square (*Scirpus americanus*), Pacific Coast bulrush (*Scirpus robustus*), slough sedge (*Carex obnupta*), broad-leaved cattail (*Typha latifolia*), tall cyperus (*Cyperus eragrostis*), arroyo willow, toad rush (*Juncus bufonius*), Mexican rush (*Juncus mexicanus*), common rush (*Juncus patens*), marsh baccharis (*Baccharis douglasii*), saltgrass, Pacific silverweed (*Potentilla*

anserina ssp. *pacifica*), water smartweed (*Polygonum punctatum*), and brass buttons (*Cotula coronopifolia*).

The smaller marsh is supplied with only freshwater, hence its vegetation can be classified as Coastal and Valley Freshwater Marsh. It has a less diverse flora that consists of common tule (*Scirpus acutus* var. *occidentalis*), California bulrush (*Scirpus californicus*), and arroyo willow.

Although distributed along the length of the California coast, the Coastal Brackish Marsh and Coastal and Valley Freshwater Marsh communities have been subject to severe degradation and destruction in the last 100 years. Other more inland locations have suffered a similar fate.

Bald Hills Prairie/Non-native Grassland

Grassland communities in the park are limited in acreage, and confined to the lowest reach of Waddell Creek and a few scattered locations in the northeastern part of the park near park housing and the park maintenance facilities. Grasslands at the mouth of Waddell Creek are composed of mostly ruderal, non-native species and can best be characterized as Non-native Grassland. The other grassland locations have a more native species composition, and are best defined as Bald Hills Prairie in the classification system of Holland (1986). Functionally, the two grassland communities are equivalent ecosystems, although the native Bald Hills Prairie provides greater value as wildlife habitat. They are mapped as a single entity on the Plant Communities Map PL-1.

Most of the grasslands at the mouth of Waddell Creek occupy private property adjacent to the park. These ruderal grasslands are composed various species of *Hordeum*, *Avena*, *Festuca*, and *Danthonia* (Hecht and Rusmore 1973). Associated forbs include common fiddleneck (*Amsinckia menziesii* var. *intermedia*) and the non-natives, English plantain (*Plantago lanceolata*), cut-leaved geranium (*Geranium dissectum*), and long-beaked filaree (*Erodium botrys*). It is hypothesized by this author that most if not all of the grasslands at this location are artificial and result from land clearance for agricultural purposes. Cleared areas were probably previously vegetated with either riparian or forest communities.

The grasslands (i.e. Bald Hills Prairie) in the more inland areas of the park can include non-native annual bluegrass (*Poa annua*), and natives such as short-scaled sedge (*Carex deweyana* ssp. *leptopoda*), slender-tubed iris, and blue-eyed grass (*Sisyrinchium bellum*). These more inland grasslands are small herbaceous islands surrounded by forest communities, but they appear to be formed by natural processes.

Community Dynamics

Succession

A classic definition of plant succession is a directional, cumulative change in the species that occupy a given area, through time (Barbour et al. 1987). Primary succession is the community formation that begins on substrates that have never before supported vegetation (Mueller-Dombois and Ellenberg 1974). In Castle Rock State Park areas of flood-deposited sediments and bare sandstone are substrates available for primary succession. The colonizing plants themselves modify their habitat. Shading lowers soil surface temperature and root systems change soil chemistry, enhance water-holding capacity, and improve soil texture. In time, other species may invade this altered habitat.

Secondary succession occurs on lands where the previous vegetation has been destroyed by natural or human disturbances such as fire, landsliding, logging, or cultivation. Each of these disturbances has occurred in the park at some time in the past. Both fire and landsliding will continue to play important roles in the ecology of the park's plant communities.

The rate of secondary succession is often five to ten times greater than primary succession due to the presence of spores and seeds, and because much of the soil remains (Mueller-Dombois and Ellenberg 1974).

The classical ecological paradigm of plant succession defines "climax communities" as those communities that perpetuate themselves in a given habitat in the absence of disturbances from outside forces (Barbour et al 1987). Mature redwood forests are generally considered to be climax communities. Communities that exhibit cumulative, non-random changes in species composition in a period of 1 to 500 years are said to be "successional" or "seral". Plant communities subject to periodic or cyclical change are said to exist as a "disclimax". Under natural conditions and processes (e.g. natural fire regime) Knobcone Pine Forest can be classified as a disclimax community.

More recent research questions this deterministic theory of plant succession (Christensen 1988). Identification of stable climax communities in the field is difficult, especially in areas subject to periodic or cyclical change. Natural disturbance has an important regulatory role in nearly all ecosystems. Random events are being shown to have a major influence on the response of vegetation following disturbance. Perhaps because of this, it has not been possible to develop a unified theory replacing the succession paradigm. Classical theories of succession discussed here should be considered to be descriptive rather than predictive.

Precise information on the composition of vegetation within park boundaries prior to EuroAmerican settlement is not available. Paleoecological studies, using pollen profiles for example, would be necessary to reconstruct vegetation structure and composition of pre-European vegetation. However, existing vegetation and knowledge of natural processes and other environmental factors are useful in determining past vegetation structure and composition. Also, some areas of the park contain mature vegetation nearly undisturbed by EuroAmerican settlement. For example, there are a few thousand acres of ancient redwood forests in the heart of the park.

A discussion of the general responses of existing vegetation to some disturbances is presented below.

Disturbances

Fire

Fire has been a significant factor in the California environment for about two million years (Hanes 1971). Fire has been, and will continue to be, a major factor in the ecology of the Santa Cruz Mountains.

A detailed discussion of the fire history and fire potential in Big Basin Redwoods State Park is available in Langenheim et al (1983). In this study, fire frequency, living and dead biomass, and vegetation were inventoried at 400 sites in the park. They determined that most of the park had not burned since the establishment of effective fire suppression in the 1920's. Utilizing various sources of data, they calculated the average interval (AI), in years, since the last fire for each vegetation type in the park. The AI was not significantly different between vegetation types, with means ranging from 45 years for chaparral to 61 years for Monterey pine. A strong correlation between slope position and soil fertility was determined. For most of the park's vegetation, higher AI's were found on fertile soils at lower slope positions, which corresponds to locations with more mesic conditions. Interestingly, for Monterey pine the higher AI's were found on higher, less fertile sites.

Langenheim et al (1983) also developed a second index, the MFI (mean fire interval), that indicates the average period of years between each known fire by vegetation type prior to the last recorded fire. In general, this index was found to increase with elevation for all vegetation types except for Monterey pine. Like the AI index, aside from ignition availability and location, the major factors determining MFI are slope position and soil fertility. In the park, MFI's ranged from 20.4 for Monterey pine sites to 70.9 for redwood sites.

Recognizing the importance of fire in the natural ecosystems of Big Basin Redwoods State Park, the district has an ongoing prescribed fire program. Approximately 310 acres of primarily ancient redwood forest between Opal Creek and Rodgers Creek were prescribed burn in October 1997. Subsequent prescribed burns have been conducted in the park. A small wildfire occurred in the Sunset Camp area in 1999, burning in the adjacent knobcone pine forest/chaparral communities.

Fire Effects in Selected Communities

A generalized discussion of the reaction of fire in some plant communities found in Big Basin Redwoods State Park follows.

Fire is well documented to be a key element of the life cycle of chaparral (Biswell 1974; Hanes 1971, 1974, 1988; Lewis 1961). Fires have burned through chaparral and other California vegetation for at least 100,000 years (Jepson 1925). The susceptibility of California chaparral to fire is primarily a result of its density, extreme dryness during summer and fall drought, and presence of volatile substances in its leaves (Biswell 1974; Hanes 1974; Lewis 1961). Over time the ratio of dead to live material increases significantly in the absence of fire.

Periodic fire is inevitable for all stands of chaparral, and the typical fire return interval is 20 to 40 years (Sweeney 1956; Muller et al. 1968; Byrne 1978). McBride and Jacobs (1981) state that the fire return interval for chamise chaparral in southern California is 16 years. The fire frequency for manzanita chaparral is considerably less. Vogl and Schorr (1972) have speculated that the natural fire frequency in upper elevation manzanita chaparral of southern California is one or two times per century.

Some maintain that fire frequency in chaparral is a deterministic process driven by fuel load, whereas others argue that chaparral has evolved in an environment where fire frequency has been influenced by unpredictable sources of ignition and other random factors (Keeley et al 1989). Keeley et al (1989) conclude that these two mechanisms are not mutually exclusive, but may act as complementary mechanisms which are partially responsible for the diversity and stability of chaparral vegetation.

Fire is the primary cause of secondary succession in California chaparral communities, which are all fire-dependent (Biswell 1974; Hanes 1971, 1974, 1988; Lewis 1961). Fire creates the pioneer conditions necessary for seedling establishment, including the removal of competing vegetation and destroying phytotoxic substances in the soil. Much of California chaparral is in some stage of secondary succession, and what appears to be a stable community is just a phase

in a larger cycle of growth, maturation, removal, and regrowth. Hanes (1971) refers to this process as “autosuccession”, wherein chaparral succeeds itself rather than being preceded by a series of intermediate vegetative types or seres. This process does not conform to the classical model of plant succession. Vogl (1982) notes that changes following fire usually result in a rapid return to predisturbance composition and structure. Initially there is a dramatic increase in herbaceous plant taxa after a fire, but seedlings and sprouts of woody species begin to dominate within 2 to 5 years (Hanes 1974,1988; Vogl 1982).

The species that dominate chaparral communities utilize a few adaptive strategies to respond to recurrent fires (Biswell 1974; Hanes 1974,1988; Lewis1961). Seed production is initiated by most chaparral species within 3 to 5 years of a fire. Seeds of many species can remain dormant and viable for long periods of time in the soil. Some species produce fire-dependent seeds or fire-resistant seeds, the former requiring heat to stimulate germination. Others produce large numbers of seeds, assuring that some will survive the potentially fatal temperatures of a fire event. About half of the woody species are rootcrown sprouters. Chamise, one of the dominant chaparral species in Big Basin Redwoods State Park, has a dual strategy for survival; it produces prodigious amounts of seeds and is a vigorous sprouter.

Knobcone Pine Forest is dependent on fire for survival, but unlike chaparral, fire is not necessarily inevitable (Eyre 1980; Vogl 1973; Vogl et al 1988). Intense heat is usually required to open the cones of knobcone pine. In addition, fire creates pioneer conditions necessary for seeding establishment and releases mineral nutrients from standing vegetation and litter. Fire rarely consumes the cones or damages the seeds.

Some researchers refer to Knobcone Pine Forest as a “fire type” or “fire subclimax” community (Eyre 1980). Knobcone pines can’t compete successfully with other vegetation and are not able to reproduce without periodic fires. Fire frequency in the Knobcone Pine Forest is much less than chaparral communities, perhaps once every 33 to 50 years (Vogl et al 1988). More frequent burning is necessary for the perpetuation of this community on better soils where competition is greater.

Knobcone pine is a short-lived species that rarely lives beyond 80 years (Eyre 1980; Vogl et al 1988). They occur in even-aged stands that originate after fire and in the absence of fire become decadent. Decadent stands are mostly composed of senescent or dying trees that eventually are replaced with less seral vegetation.

Many of the dominant trees comprising the Mixed Evergreen Forest and Interior Live Oak Woodland communities of the park have adaptations which allow them to withstand fire or to recover quickly from a burn. Oaks tend to have fewer volatile substances, a lower proportion of dead to live fuel, and higher, green fuel moisture than chaparral (Green 1980). Heat readily kills leaves, buds, and twigs, but many parts of the cambium of branches and stems survive. Young trees are more

susceptible to fire than old trees, although the ability of mature trees to survive fire is variable amongst oak species. The trunks and branches of live oaks are protected by a corky bark that develops a complex, multi-layered structure as the tree matures. All of the oak species that inhabit Big Basin Redwoods State Park have the ability to sprout from the base. Even heavily charred trees and young, topkilled trees have been shown to sprout (Plumb 1980).

California bay laurel has thin bark and is easily topkilled by fire. It sprouts readily from root collar, stump, and trunk wherever a canopy opening admits strong light (Fowells 1965). Tanoak sprout vigorously under a variety of conditions. They sprout after minor basal injuries, after the bark has been stripped for tannin extraction, or when the aerial portion of the tree has been destroyed by fire or logging. The resulting sprouts grow rapidly in good light and can pose serious competition to regenerating conifers such as Douglas-fir (Eyre 1980; Fowells 1965). Tanoak also regenerates well from seed, germinating rapidly in well-lit areas on mineral soils. Madrone, like the other hardwoods of Mixed Evergreen Forest, is a vigorous sprouter.

The effects of fire in redwood forests is dependent on several factors, including stand age, adjacent vegetation type, and fire weather. Young redwood stands can be killed outright by fire. The bark of young trees is thin and frequently more litter resides on the ground and the microclimate is drier than in mature stands (Fowells 1965). However, even small seedlings can sprout following topkill. Mature redwoods, with their dense, nonresinous, fibrous bark, are well suited to withstand moderate fires. Understory vegetation of old growth redwood groves on mesic sites is often sparse and does not carry ground fires well. Redwood litter is flammable, however, and will carry a fire when dry. Fire can enter a grove when a very hot crown fire, which has started in adjacent vegetation such as chaparral, is carried into the stand by strong wind. Redwoods may burn under these conditions. Fires can reduce the thickness of the protective fibrous bark or produce basal wounds through which heart rot may enter the tree. Large basal cavities called "goose pens" can result from repeated fires and rot. Mature trees may be so weakened mechanically that they fall (Fowells 1965).

Redwoods sprout readily from root crowns following fire. If the crown of a redwood is destroyed by fire, numerous dormant buds along almost the entire trunk are stimulated and produce new foliage (Eyre 1980; Fowells 1965). Sprouts use already established root systems and can quickly overtop other tree species, although they soon develop their own root systems. Redwood seeds germinate more readily in humus-free soils that have been exposed by fire (Bakker 1984).

Although redwoods exhibit several adaptations to fire, composition of stands may be changed by fire. Severely disturbed sites, such as occurs after a hot crown fire, may become dominated by shrubs or non-coniferous species such as tanoak (Burns 1983).

Fire return intervals for redwood forests vary considerably depending on site and stand characteristics, short and long term weather patterns, and management practices such as fire suppression. In general, there is an increase in fire frequency and intensity from more mesic areas near the coast to drier locations in the interior. Mean fire return intervals which existed in the Santa Cruz Mountains prior to Native American influence were shortened by aboriginal burning and restored by modern management practices (Greenlee 1983). Veirs (1980) studied stump-top fire scars in Redwood National Park and concluded that the mean fire return interval ranged from 50 years on upslope inland sites to 500 years on mesic, coastal sites. A mean fire return interval of 8.3 years in the period from 1664 to 1962 was determined for two redwood stands near Redwood National Park using a variety of dendrochronological techniques (Brown 1989). Based on evidence from scars and basal sprouting origins, a mean fire return interval of 13 to 31 years was determined for the Bull Creek alluvial flat in Humboldt Redwoods State Park (Stuart 1987).

Fire frequency may alter the relative proportion of grassland, chaparral, and forest communities. Generally, frequent fires tend to favor an increase in grasslands at the expense of other vegetation types. Fire also favors oak woodlands over adjacent areas of Mixed Evergreen Forest. Over time fire exclusion can favor more shade tolerant species such as Douglas-fir and tanoak to the detriment of oaks. Native Americans probably burned frequently to maintain grasslands and oak woodlands, since these locations were prime sources for game and other foodstuffs.

Although considered fire-dependent communities, Knobcone Pine Forest and Northern Mixed Chaparral in the park are largely edaphically controlled, and likely will not be replaced by other vegetation types. In the short term, chaparral may replace some areas of knobcone pine, but eventually fire will return to these areas and improve the health of both communities.

Precise prediction of vegetation response following fire requires consideration of many factors such as site aspect, substrate, availability of moisture, and microclimate. One also needs information about the seasonality, intensity, and extent of the fire as well as the burn.

Floods

Floods are an important feature of the riparian areas of Big Basin Redwoods State Park. Floods typically occur when drainage basins are subjected to unusually heavy or intense precipitation, which is a relatively common occurrence during the winter in the Santa Cruz Mountains. Removal of vegetation by fire in conjunction with the high erosion potential of the area magnifies the effects of flooding. Floodwaters often carry large amounts of sediment and mudflows can result from sites denuded by fire.

Most large volume flows are of short duration and are a response to a particular storm event. However, the constrained channels and steep topography characteristic of most of the park's streams increase the severity of floods. Loss of streamside vegetation is possible during intense and/or prolonged precipitation. The Red Alder Riparian Forest along the lower reaches of Waddell Creek is remarkably resilient to flooding. However, undercutting of trees along steep banks is possible, and individual trees have been lost. Redwoods, Douglas-firs, and other tree species adjacent to riparian locations in more inland areas of the park have succumbed to flood events when undercut.

Communities of Special Interest

The following plant communities found at Big Basin Redwoods State Park are rare enough to be considered of high inventory priority by the California Department of Fish and Game Natural Diversity Data Base.

- Red Alder Riparian Forest
- Monterey Pine Forest
- Knobcone Pine Forest
- Northern Interior Cypress Forest
- Coastal Brackish Marsh/Coastal and Valley Freshwater Marsh
- Bald Hills Prairie

Each of these communities has been described in the Communities subsection of this inventory.

MANAGEMENT RECOMMENDATIONS

1. When possible, field searches for special plant species suspected to occur in the park should be made during appropriate flowering periods. Currently, 19 special plant species are known or suspected to occur in the park. Areas of the park that have been inadequately surveyed, or not all, include the “Chalks”, the Eagle Rock parcel, and the disjunct parcels in the Scott and Mill Creek drainages.
2. Palaeocology -- The composition of the vegetation in the Santa Cruz Mountains at the time of Euroamerican settlement is not completely known. Developing pollen profiles and use of other palaeocological techniques would augment the available knowledge of pre-Euroamerican vegetation. Such studies would add scope to options for vegetation management in the park.
3. A program of prescribed burning in appropriate areas of the park should be continued and expanded as determined by the district ecologist. Quantitative studies of stand composition for those plant communities where prescribed burning is necessary and/or appropriate would yield valuable management information, especially for restoration. Restoration of fire benefits the overall health of park ecosystems and reduces the buildup of fuels that could lead to catastrophic fire conditions.
4. Control and/or eradication programs for exotic species of most concern should be continued, with periodic field inspections of past eradication efforts to insure there are no re-infestations. Eradication programs should be included as a part of a unitwide vegetation management plan, with a prioritization component. Past and current volunteer efforts are beneficial and commendable, and should be continued.

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APPENDIX PL-1: PLANT SPECIES OF BIG BASIN REDWOODS STATE PARK

DIVISION	CLASS	FAMILY	SPECIES	COMMON NAME	SOURCES	COMMENTS
Calamophyta	Equisetinae	Equisetaceae	<i>Equisetum arvense</i>	Common horsetail	BB	Native
Calamophyta	Equisetinae	Equisetaceae	<i>Equisetum hyemale</i> ssp. <i>affine</i>	Common scouring rush	BB, JT, WC	Native
Calamophyta	Equisetinae	Equisetaceae	<i>Equisetum telmateia</i> ssp. <i>braunii</i>	Giant horsetail	BB, WC	Native
Pterophyta	Filicinae	Blechnaceae	<i>Blechnum spicant</i>	Deer fern	BB, JT	Native
Pterophyta	Filicinae	Blechnaceae	<i>Woodwardia fimbriata</i>	Chain fern	BB, JT, RWM, WC	Native
Pterophyta	Filicinae	Dennstaedtiaceae	<i>Athyrium filix-femina</i> var. <i>cyclosorum</i>	Western lady fern	BB, JT	Native
Pterophyta	Filicinae	Dennstaedtiaceae	<i>Pteridium aquilinum</i> var. <i>pubescens</i>	Bracken fern	BB, RM, RWM, WC	Native
Pterophyta	Filicinae	Dryopteridaceae	<i>Cystopteris fragilis</i>	Brittle fern	JT	Native
Pterophyta	Filicinae	Dryopteridaceae	<i>Dryopteris arguta</i>	Coastal wood fern	BB, JT, RM, WC	Native
Pterophyta	Filicinae	Dryopteridaceae	<i>Polystichum californicum</i>	California shield fern	BB	Native
Pterophyta	Filicinae	Dryopteridaceae	<i>Polystichum dudleyi</i>	Dudley's shield fern	JT	Native
Pterophyta	Filicinae	Dryopteridaceae	<i>Polystichum munitum</i>	Western sword fern	BB, JT, RM, RWM, WC	Native
Pterophyta	Filicinae	Polypodiaceae	<i>Polypodium californicum</i>	California polypody	BB, JT, RM, WC	Native
Pterophyta	Filicinae	Polypodiaceae	<i>Polypodium scoleri</i>	Leather-leaf fern	BB, WC	Native
Pterophyta	Filicinae	Pteridaceae	<i>Adiantum aleuticum</i>	Five-finger fern	BB, JT, WC	Native
Pterophyta	Filicinae	Pteridaceae	<i>Adiantum jordanii</i>	California maiden-hair fern	BB, JT, WC	Native
Pterophyta	Filicinae	Pteridaceae	<i>Pentagramma triangularis</i> ssp. <i>triangularis</i>	Goldback fern	BB, JT, RM, RWM, WC	Native
Coniferophyta	N/A	Cupressaceae	<i>Cupressus abramsiana</i>	Santa Cruz cypress	GC, JT, RM, RWM, WC	Native
Coniferophyta	N/A	Pinaceae	<i>Pinus attenuata</i>	Knobcone pine	BB, GC, JT, RM, RWM, WC	Native
Coniferophyta	N/A	Pinaceae	<i>Pinus radiata</i>	Monterey pine	BB, GC, JT, RWM	Native
Coniferophyta	N/A	Pinaceae	<i>Pseudotsuga menziesii</i>	Douglas-fir	BB, GC, JT, RM, RWM, WC	Native
Coniferophyta	N/A	Taxaceae	<i>Torreya californica</i>	California nutmeg	BB, JT, RM, WC	Native
Coniferophyta	N/A	Taxodiaceae	<i>Metasequoia glyptostroboides</i>	Dawn redwood	BB	Introduced
Coniferophyta	N/A	Taxodiaceae	<i>Sequoia sempervirens</i>	Coast redwood	BB, GC, RM, RWM,	Native

					WC	
Coniferophyta	N/A	Taxodiaceae	Sequoiadendron giganteum	Giant sequoia	BB	Introduced
Anthophyta	Dicotyledoneae	Aceraceae	Acer macrophyllum	Big-leaf maple	BB, RWM, WC	Native
Anthophyta	Dicotyledoneae	Aceraceae	Acer negundo var. californicum	California box elder	BB, WC	Native
Anthophyta	Dicotyledoneae	Anacardiaceae	Toxicodendron diversilobum	Poison oak	BB, RM, RWM, WC	Native
Anthophyta	Dicotyledoneae	Apiaceae	Anthriscus caucalis	Bur-chervil	BB	Introduced
Anthophyta	Dicotyledoneae	Apiaceae	Conium maculatum	Poison hemlock	BB, WC	Introduced
Anthophyta	Dicotyledoneae	Apiaceae	Daucus pusillus	Rattlesnake weed	BB, RM	Native
Anthophyta	Dicotyledoneae	Apiaceae	Heracleum lanatum	Cow parsnip	BB, RM, WC	Native
Anthophyta	Dicotyledoneae	Apiaceae	Lomatium dasycarpum ssp. dasycarpum	Lace parsnip	RM	Native
Anthophyta	Dicotyledoneae	Apiaceae	Lomatium macrocarpum	Sheep parsnip	RM	Native
Anthophyta	Dicotyledoneae	Apiaceae	Oenanthe sarmentosa	Pacific oenanthe	RWM	Native
Anthophyta	Dicotyledoneae	Apiaceae	Osmorhiza chilensis	Sweey cicely	BB, JT, WC	Native
Anthophyta	Dicotyledoneae	Apiaceae	Perideridia gairdneri	Yampah	BB, JT	Native
Anthophyta	Dicotyledoneae	Apiaceae	Sanicula crassicaulis	Pacific sanicle	BB, RM, WC	Native
Anthophyta	Dicotyledoneae	Apocynaceae	Vinca major	Periwinkle	BB, JT, RWM	Introduced
Anthophyta	Dicotyledoneae	Araliaceae	Aralia californica	Elk clover	BB, WC	Native
Anthophyta	Dicotyledoneae	Aristolochiaceae	Asarum caudatum	Wild ginger	BB, WC	Native
Anthophyta	Dicotyledoneae	Asteraceae	Achillea millefolium	Yarrow, milfoil	BB, RM	Native
Anthophyta	Dicotyledoneae	Asteraceae	Adenocaulon bicolor	Trail plant	BB, WC	Native
Anthophyta	Dicotyledoneae	Asteraceae	Anaphalis margaritacea	Pearly everlasting	BB	Native
Anthophyta	Dicotyledoneae	Asteraceae	Anthemis cotula	Mayweed, dog-fennel	BB	Introduced
Anthophyta	Dicotyledoneae	Asteraceae	Arnica discoidea	Rayless arnica	JT, RM	Native
Anthophyta	Dicotyledoneae	Asteraceae	Artemisia californica	California sagebrush	BB, WC	Native
Anthophyta	Dicotyledoneae	Asteraceae	Artemisia douglasiana	Mugwort	BB, JT	Native
Anthophyta	Dicotyledoneae	Asteraceae	Aster chilensis	Common California aster	JT	Native
Anthophyta	Dicotyledoneae	Asteraceae	Aster radulinus	Broad-leaved aster	JT, RM	Native
Anthophyta	Dicotyledoneae	Asteraceae	Baccharis douglasii	Marsh baccharis	JT	Native
Anthophyta	Dicotyledoneae	Asteraceae	Baccharis pilularis	Coyote brush	BB, JT, RM, WC	Native
Anthophyta	Dicotyledoneae	Asteraceae	Centaurea melitensis	Tocalote	BB	Introduced
Anthophyta	Dicotyledoneae	Asteraceae	Cirsium arvense	Canada thistle	BB	Introduced
Anthophyta	Dicotyledoneae	Asteraceae	Cirsium occidentale var.	Venus thistle	BB	Native

			venustum			
Anthophyta	Dicotyledoneae	Asteraceae	Cirsium vulgare	Bull thistle	BB, RWM, WC	Introduced
Anthophyta	Dicotyledoneae	Asteraceae	Cotula australis	Australian cotula	JT	Introduced
Anthophyta	Dicotyledoneae	Asteraceae	Cotula coronopifolia	Brass buttons	BB, WC	Introduced
Anthophyta	Dicotyledoneae	Asteraceae	Erechtites minima	Toothed coast fireweed	JT	Introduced
Anthophyta	Dicotyledoneae	Asteraceae	Ericameria arborescens	Golden fleece	JT, RM, WC	Native
Anthophyta	Dicotyledoneae	Asteraceae	Erigeron glaucus	Seaside daisy	BB, RWM, WC	Native
Anthophyta	Dicotyledoneae	Asteraceae	Eriophyllum confertiflorum var. confertiflorum	Golden yarrow	BB, RM, WC	Native
Anthophyta	Dicotyledoneae	Asteraceae	Eriophyllum staechadifolium	Lizard tail	WC	Native
Anthophyta	Dicotyledoneae	Asteraceae	Euthamia occidentalis	Western goldenrod	JT	Native
Anthophyta	Dicotyledoneae	Asteraceae	Filago californica	California filago	RM	Native
Anthophyta	Dicotyledoneae	Asteraceae	Gnaphalium stramineum	Cotton-batting plant	BB	Native
Anthophyta	Dicotyledoneae	Asteraceae	Grindelia stricta var. angustifolia	Marsh gum plant	RWM	Native
Anthophyta	Dicotyledoneae	Asteraceae	Hemizonia corymbosa	Coast tarweed	JT	Native
Anthophyta	Dicotyledoneae	Asteraceae	Heterotheca sessiliflora ssp. echioides	Golden aster	RM	Native
Anthophyta	Dicotyledoneae	Asteraceae	Hieracium albiflorum	Hawkweed	BB	Native
Anthophyta	Dicotyledoneae	Asteraceae	Hypochaeris glabra	Smooth cat's ear	BB	Introduced
Anthophyta	Dicotyledoneae	Asteraceae	Lasthenia californica	Goldfields	RWM	Native
Anthophyta	Dicotyledoneae	Asteraceae	Madia elegans	Common madia	BB, JT, WC	Native
Anthophyta	Dicotyledoneae	Asteraceae	Madia exigua	Small tarweed	JT, RM	Native
Anthophyta	Dicotyledoneae	Asteraceae	Madia gracilis	Slender tarweed	BB	Native
Anthophyta	Dicotyledoneae	Asteraceae	Madia madioides	Woodland madia	BB, JT, RM	Native
Anthophyta	Dicotyledoneae	Asteraceae	Petasites frigidus var. palmatus	Coltsfoot	BB, RWM, WC	Native
Anthophyta	Dicotyledoneae	Asteraceae	Senecio aronicoides	California butterweed	BB	Native
Anthophyta	Dicotyledoneae	Asteraceae	Senecio flaccidus var. douglasii	Shrubby butterweed	BB	Native
Anthophyta	Dicotyledoneae	Asteraceae	Solidago californica	California goldenrod	JT	Native
Anthophyta	Dicotyledoneae	Asteraceae	Soliva sessilis	Common soliva	JT	Introduced
Anthophyta	Dicotyledoneae	Asteraceae	Taraxacum officinale	Common dandelion	BB	Introduced
Anthophyta	Dicotyledoneae	Asteraceae	Uropappus lindleyi	Silver puffs	JT	Native
Anthophyta	Dicotyledoneae	Berberidaceae	Berberis nervosa	Oregon grape	BB, JT	Native
Anthophyta	Dicotyledoneae	Berberidaceae	Berberis pinnata ssp. pinnata	Coast barberry	JT	Native

Anthophyta	Dicotyledoneae	Berberidaceae	Vancouveria planipetala	Redwood ivy	BB, WC	Native
Anthophyta	Dicotyledoneae	Betulaceae	Alnus rubra	Red alder	BB, GC, JT, WC	Native
Anthophyta	Dicotyledoneae	Betulaceae	Corylus cornuta var. californica	California hazelnut	BB, RM, RWM, WC	Native
Anthophyta	Dicotyledoneae	Boraginaceae	Amsinckia menziesii var. intermedia	Common fiddleneck	JT, WC	Native
Anthophyta	Dicotyledoneae	Boraginaceae	Amsinckia spectabilis	Seaside amsinckia	JT	Native
Anthophyta	Dicotyledoneae	Boraginaceae	Cryptantha clevelandii	Cleveland's cryptantha	RM	Native
Anthophyta	Dicotyledoneae	Boraginaceae	Cryptantha micromeres	Small-flowered cryptantha	RM	Native
Anthophyta	Dicotyledoneae	Boraginaceae	Cryptantha muricata	Prickly cryptantha	JT	Native
Anthophyta	Dicotyledoneae	Boraginaceae	Cynoglossum grande	Western hound's tongue	BB, RM, WC	Native
Anthophyta	Dicotyledoneae	Boraginaceae	Plagiobothrys chorisianus var. hickmanii	Popcorn flower	JT	Native
Anthophyta	Dicotyledoneae	Boraginaceae	Plagiobothrys collinus var. californicus	Popcorn flower	JT	Native
Anthophyta	Dicotyledoneae	Brassicaceae	Arabis blepharophylla	Coast rock cress	RM	Native
Anthophyta	Dicotyledoneae	Brassicaceae	Athysanus pusillus	Dwarf athysanus	RM	Native
Anthophyta	Dicotyledoneae	Brassicaceae	Barbarea orthoceras	Winter cress	RM	Native
Anthophyta	Dicotyledoneae	Brassicaceae	Cakile edentula	Sea rocket	JT	Introduced
Anthophyta	Dicotyledoneae	Brassicaceae	Cakile maritima	Sea rocket	BB, RWM, WC	Introduced
Anthophyta	Dicotyledoneae	Brassicaceae	Cardamine californica	Milk maids, toothwort	BB, RM, WC	Native
Anthophyta	Dicotyledoneae	Brassicaceae	Cardamine oligosperma	Bitter-cress	BB, RM	Native
Anthophyta	Dicotyledoneae	Brassicaceae	Erysimum franciscanum	San Francisco wallflower	BB, WC	Native
Anthophyta	Dicotyledoneae	Brassicaceae	Guillenia lasiophylla	CALifornia mustard	JT, RM	Native
Anthophyta	Dicotyledoneae	Brassicaceae	Rorippa nasturtium-aquaticum	Water cress	BB	Native
Anthophyta	Dicotyledoneae	Brassicaceae	Thysanocarpus laciniatus	Fringepod	JT	Native
Anthophyta	Dicotyledoneae	Campanulaceae	Campanula prenanthoides	California harebell	BB, JT	Native
Anthophyta	Dicotyledoneae	Campanulaceae	Githopsis specularioides	Common blue-cup	BB, RM	Native
Anthophyta	Dicotyledoneae	Campanulaceae	Triodanus biflora	Small Venus' looking-glass	JT, RM	Native
Anthophyta	Dicotyledoneae	Caprifoliaceae	Lonicera hispidula var. vacillans	Hairy honeysuckle	BB, RM, WC	Native
Anthophyta	Dicotyledoneae	Caprifoliaceae	Lonicera involucrata	Twinberry	BB	Native
Anthophyta	Dicotyledoneae	Caprifoliaceae	Sambucus mexicana	Blue elderberry	BB, WC	Native
Anthophyta	Dicotyledoneae	Caprifoliaceae	Sambucus racemosa var. racemosa	Coastal red elderberry	BB, JT, WC	Native
Anthophyta	Dicotyledoneae	Caprifoliaceae	Symphoricarpos albus var.	Common snowberry	BB	Native

			laevigatus			
Anthophyta	Dicotyledoneae	Caprifoliaceae	Symphoricarpos mollis	Creeping snowberry	BB, JT, RM, WC	Native
Anthophyta	Dicotyledoneae	Caryophyllaceae	Cerastium glomeratum	Mouse-ear chickweed	BB	Native
Anthophyta	Dicotyledoneae	Caryophyllaceae	Minuartia douglasii	Douglas' sandwort	JT	Native
Anthophyta	Dicotyledoneae	Caryophyllaceae	Sagina decumbens ssp. occidentalis	Western pearlwort	RM	Native
Anthophyta	Dicotyledoneae	Caryophyllaceae	Silene antirrhina	Sleepy catchfly	BB	Native
Anthophyta	Dicotyledoneae	Caryophyllaceae	Silene verecunda ssp. verecunda	San Francisco campion	DW, RWM	Native
Anthophyta	Dicotyledoneae	Caryophyllaceae	Stellaria nitens	Shining chickweed	BB, RM, RWM	Native
Anthophyta	Dicotyledoneae	Celastraceae	Euonymus occidentalis var. occidentalis	Western burning bush	BB, JT, WC	Native
Anthophyta	Dicotyledoneae	Chenopodiaceae	Atriplex leucophylla	Beach saltbush	JT	Native
Anthophyta	Dicotyledoneae	Cistaceae	Helianthemum scoparium	Peak rush-rose	BB, JT, WC	Native
Anthophyta	Dicotyledoneae	Convolvulaceae	Calystegia occidentalis ssp. occidentalis	Bush morning-glory	BB, WC	Native
Anthophyta	Dicotyledoneae	Convolvulaceae	Calystegia soldanella	Beach morning-glory	JT	Native
Anthophyta	Dicotyledoneae	Cornaceae	Cornus sericea ssp. sericea	American dogwood	JT	Native
Anthophyta	Dicotyledoneae	Crassulaceae	Crassula connata	Pigmy weed	RM	Native
Anthophyta	Dicotyledoneae	Crassulaceae	Dudleya cymosa	Live-forever	WC	Native
Anthophyta	Dicotyledoneae	Crassulaceae	Dudleya farinosa	Powdery dudleya	BB, WC	Native
Anthophyta	Dicotyledoneae	Crassulaceae	Sedum spathulifolium	Pacific stonecrop	BB, JT, RM, WC	Native
Anthophyta	Dicotyledoneae	Cucurbitaceae	Marah fabaceus	California man-root	BB, WC	Native
Anthophyta	Dicotyledoneae	Cuscutaceae	Cuscuta subinclusa	Canyon dodder	BB	Native
Anthophyta	Dicotyledoneae	Ericaceae	Arbutus menziesii	Pacific madrone	BB, JT, RM, RWM, WC	Native
Anthophyta	Dicotyledoneae	Ericaceae	Arctostaphylos andersonii	Santa Cruz manzanita	BB, JT, RM, RWM, WC	Native
Anthophyta	Dicotyledoneae	Ericaceae	Arctostaphylos nummularia	Ft. Bragg manzanita	BB, JT, WC	Native
Anthophyta	Dicotyledoneae	Ericaceae	Arctostaphylos tomentosa ssp. crustacea	Brittle-leaved manzanita	BB, JT, RM, WC	Native
Anthophyta	Dicotyledoneae	Ericaceae	Gaultheria shallon	Salal	BB	Native
Anthophyta	Dicotyledoneae	Ericaceae	Hemitomes congestum	Gnome plant	BB, JT	Native
Anthophyta	Dicotyledoneae	Ericaceae	Pleuricospora fimbriolata	Fringed pine-sap	JT	Native
Anthophyta	Dicotyledoneae	Ericaceae	Pyrola picta	White-veined wintergreen	BB, JT	Native

Anthophyta	Dicotyledoneae	Ericaceae	Rhododendron macrophyllum	California rose-bay	BB, JT	Native
Anthophyta	Dicotyledoneae	Ericaceae	Rhododendron occidentale	Western azalea	BB, JT, WC	Native
Anthophyta	Dicotyledoneae	Ericaceae	Vaccinium ovatum	California huckleberry	BB, JT, RWM, WC	Native
Anthophyta	Dicotyledoneae	Ericaceae	Vaccinium parvifolium	Red huckleberry	JT	Native
Anthophyta	Dicotyledoneae	Euphorbiaceae	Eremocarpus setigerus	Turkey mullein	BB	Native
Anthophyta	Dicotyledoneae	Fabaceae	Acacia decurrens	Green wattle	BB, JT	Introduced
Anthophyta	Dicotyledoneae	Fabaceae	Hoita orbicularis	Round-leaved psoralea	JT	Native
Anthophyta	Dicotyledoneae	Fabaceae	Lathyrus odoratus	Common sweet pea	JT	Introduced
Anthophyta	Dicotyledoneae	Fabaceae	Lathyrus torreyi	Redwood pea	JT	Native
Anthophyta	Dicotyledoneae	Fabaceae	Lathyrus vestitus var. vestitus	Common Pacific pea	BB, RM	Native
Anthophyta	Dicotyledoneae	Fabaceae	Lotus crassifolius var. crassifolius	Broad-leaved trefoil	WC	Native
Anthophyta	Dicotyledoneae	Fabaceae	Lotus humistratus	Short-podded trefoil	RM	Native
Anthophyta	Dicotyledoneae	Fabaceae	Lotus junceus	N/A	BB, JT	Native
Anthophyta	Dicotyledoneae	Fabaceae	Lotus micranthus	N/A	BB, RM	Native
Anthophyta	Dicotyledoneae	Fabaceae	Lotus purshianus var. purshianus	Spanish clover	BB	Native
Anthophyta	Dicotyledoneae	Fabaceae	Lotus scoparius	Deerweed	BB, RM	Native
Anthophyta	Dicotyledoneae	Fabaceae	Lotus wrangelianus	N/A	RM	Native
Anthophyta	Dicotyledoneae	Fabaceae	Lupinus arboreus	Yellow bush lupine	BB, WC	Native
Anthophyta	Dicotyledoneae	Fabaceae	Lupinus nanus	Sky lupine	JT	Native
Anthophyta	Dicotyledoneae	Fabaceae	Pickeringia montana var. montana	Chaparral pea	BB, RM, WC	Native
Anthophyta	Dicotyledoneae	Fabaceae	Trifolium albopurpureum var. dichotomum	Branched Indian clover	JT	Native
Anthophyta	Dicotyledoneae	Fabaceae	Trifolium barbigerum var. andrewsii	Gray's clover	JT	Native
Anthophyta	Dicotyledoneae	Fabaceae	Trifolium ciliolatum	Tree clover	JT	Native
Anthophyta	Dicotyledoneae	Fabaceae	Trifolium microcephalum	Small-headed clover	BB	Native
Anthophyta	Dicotyledoneae	Fabaceae	Trifolium oliganthum	Few-flowered clover	JT	Native
Anthophyta	Dicotyledoneae	Fabaceae	Trifolium subterraneum	Subterranean clover	JT	Introduced
Anthophyta	Dicotyledoneae	Fabaceae	Trifolium variegatum	White-tipped clover	BB	Native
Anthophyta	Dicotyledoneae	Fabaceae	Trifolium willdenovii	Tomcat clover	BB	Native
Anthophyta	Dicotyledoneae	Fabaceae	Vicia americana var. americana	American vetch	WC	Native
Anthophyta	Dicotyledoneae	Fabaceae	Vicia gigantea	Giant vetch	BB	Native
Anthophyta	Dicotyledoneae	Fagaceae	Chrysolepis chrysophylla var. minor	Giant chinquapin	BB, WC	Native

Anthophyta	Dicotyledoneae	Fagaceae	Lithocarpus densiflorus var. densiflorus	Tanbark oak	BB, JT, RM, RWM, WC	Native
Anthophyta	Dicotyledoneae	Fagaceae	Quercus agrifolia	Coast live oak	BB, RM, RWM, WC	Native
Anthophyta	Dicotyledoneae	Fagaceae	Quercus chrysolepis	Canyon live oak	BB, JT, RM, RWM, WC	Native
Anthophyta	Dicotyledoneae	Fagaceae	Quercus dumosa	Scrub oak	BB, JT	Native
Anthophyta	Dicotyledoneae	Fagaceae	Quercus X morehus	Oracle oak	RM	Native
Anthophyta	Dicotyledoneae	Fagaceae	Quercus wislizenii	Interior live oak	BB, JT, RM, RWM, WC	Native
Anthophyta	Dicotyledoneae	Garryaceae	Garrya elliptica	Coast silk tassel	BB, JT, RM, WC	Native
Anthophyta	Dicotyledoneae	Geraniaceae	Erodium botrys	Long-beaked filaree	RWM	Introduced
Anthophyta	Dicotyledoneae	Geraniaceae	Geranium dissectum	Cut-leaved geranium	RWM	Introduced
Anthophyta	Dicotyledoneae	Grossulariaceae	Ribes divaricatum	Straggly gooseberry	BB, WC	Native
Anthophyta	Dicotyledoneae	Grossulariaceae	Ribes menziesii	Canyon gooseberry	BB, WC	Native
Anthophyta	Dicotyledoneae	Grossulariaceae	Ribes sanguineum var. glutinosum	Red flowering currant	BB	Native
Anthophyta	Dicotyledoneae	Hippocastanaceae	Aesculus californica	California buckeye	BB, WC	Native
Anthophyta	Dicotyledoneae	Hydrophyllaceae	Emmenanthe penduliflora	Whispering bells	JT	Native
Anthophyta	Dicotyledoneae	Hydrophyllaceae	Eriodictyon californicum	Yerba santa	BB, JT, RM, RWM, WC	Native
Anthophyta	Dicotyledoneae	Hydrophyllaceae	Nemophila parviflora var. parviflora	Small-flowered nemophila	JT	Native
Anthophyta	Dicotyledoneae	Hydrophyllaceae	Phacelia malvifolia	Stinging phacelia	JT	Native
Anthophyta	Dicotyledoneae	Hydrophyllaceae	Phacelia suaveolens var. suaveolens	Sweet-scented phacelia	JT	Native
Anthophyta	Dicotyledoneae	Hydrophyllaceae	Romanzoffia californica	N/A	JT	Native
Anthophyta	Dicotyledoneae	Lamiaceae	Lepechinia calycina	Pitcher sage	BB, RM, WC	Native
Anthophyta	Dicotyledoneae	Lamiaceae	Marrubium vulgare	Horehound	BB	Introduced
Anthophyta	Dicotyledoneae	Lamiaceae	Monardella odoratissima ssp. pallida	Mountain monardella	BB	Native
Anthophyta	Dicotyledoneae	Lamiaceae	Monardella villosa	Coyote mint	BB, JT, RM, WC	Native
Anthophyta	Dicotyledoneae	Lamiaceae	Salvia mellifera	Black sage	RM, WC	Native
Anthophyta	Dicotyledoneae	Lamiaceae	Satureja douglasii	Yerba buena	BB, RM, WC	Native
Anthophyta	Dicotyledoneae	Lamiaceae	Scutellaria tuberosa	Skullcap	RM	Native
Anthophyta	Dicotyledoneae	Lamiaceae	Stachys ajugoides var. rigida	Rigid hedge nettle	BB, WC	Native

Anthophyta	Dicotyledoneae	Lamiaceae	Stachys bullata	Hedge nettle	BB, RM, WC	Native
Anthophyta	Dicotyledoneae	Lamiaceae	Trichostemma lanceolatum	Vinegar weed	BB, JT	Native
Anthophyta	Dicotyledoneae	Lauraceae	Umbellularia californica	California bay	BB, RM, WC	Native
Anthophyta	Dicotyledoneae	Malvaceae	Malacothamnus fasciculatus	Chaparral mallow	BB, JT	Native
Anthophyta	Dicotyledoneae	Myricaceae	Myrica californica	Wax myrtle	BB, JT, WC	Native
Anthophyta	Dicotyledoneae	Nyctaginaceae	Abronia umbellata ssp. umbellata	Pink sand verbena	BB, WC	Native
Anthophyta	Dicotyledoneae	Nymphaeaceae	Nuphar luteum ssp. polysepalum	Yellow water lily	JT	Native
Anthophyta	Dicotyledoneae	Onagraceae	Camissonia cheiranthifolia	Beach primrose	BB, WC	Native
Anthophyta	Dicotyledoneae	Onagraceae	Camissonia hirtella	Evening primrose	JT	Native
Anthophyta	Dicotyledoneae	Onagraceae	Clarkia amoena ssp. amoena	Farewell-to-spring	BB	Native
Anthophyta	Dicotyledoneae	Onagraceae	Clarkia unguiculata	Elegant clarkia	BB	Native
Anthophyta	Dicotyledoneae	Onagraceae	Epilobium canum	California fuchsia	BB, RM	Native
Anthophyta	Dicotyledoneae	Onagraceae	Epilobium ciliatum ssp. ciliatum	California willow herb	JT	Native
Anthophyta	Dicotyledoneae	Onagraceae	Epilobium ciliatum ssp. watsonii	San Francisco willow-herb	BB	Native
Anthophyta	Dicotyledoneae	Onagraceae	Epilobium minutum	Minute willow herb	JT, RM	Native
Anthophyta	Dicotyledoneae	Orobanchaceae	Boschniakia strobilacea	California ground-cone	BB, RM	Native
Anthophyta	Dicotyledoneae	Orobanchaceae	Orobanche bulbosa	Chaparral broomrape	JT	Native
Anthophyta	Dicotyledoneae	Orobanchaceae	Orobanche fasciculata	Clustered broom-rape	BB	Native
Anthophyta	Dicotyledoneae	Orobanchaceae	Orobanche uniflora	Naked broom-rape	BB, JT, RM	Native
Anthophyta	Dicotyledoneae	Oxalidaceae	Oxalis oregana	Redwood sorrel	BB, WC	Native
Anthophyta	Dicotyledoneae	Papaveraceae	Dendromecon rigida	Bush poppy	BB, JT, WC	Native
Anthophyta	Dicotyledoneae	Papaveraceae	Dicentra formosa	Bleeding heart	BB, JT, WC	Native
Anthophyta	Dicotyledoneae	Papaveraceae	Eschscholzia californica	California poppy	BB	Native
Anthophyta	Dicotyledoneae	Papaveraceae	Meconella californica	California meconella	BB, JT	Native
Anthophyta	Dicotyledoneae	Philadelphaceae	Whipplea modesta	Yerba de selva	BB, JT, RM, WC	Native
Anthophyta	Dicotyledoneae	Plantaginaceae	Plantago erecta	California plantain	BB	Native
Anthophyta	Dicotyledoneae	Plantaginaceae	Plantago lanceolata	English plantain	WC	Introduced
Anthophyta	Dicotyledoneae	Plantaginaceae	Plantago maritima	California seaside plantain	BB, WC	Native
Anthophyta	Dicotyledoneae	Polemoniaceae	Collomia heterophylla	Varied-leaved collomia	JT, RM	Native
Anthophyta	Dicotyledoneae	Polemoniaceae	Gilia clivorum	N/A	JT	Native
Anthophyta	Dicotyledoneae	Polemoniaceae	Linanthus androsaceus	Common linanthus	BB, JT	Native
Anthophyta	Dicotyledoneae	Polemoniaceae	Linanthus pygmaeus ssp. continentalis	Pigmy linanthus	RM	Native

Anthophyta	Dicotyledoneae	Polemoniaceae	Navarretia atractyloides	Holly-leaved navarretia	JT	Native
Anthophyta	Dicotyledoneae	Polemoniaceae	Navarretia mellita	Honey-scented navarretia	JT	Native
Anthophyta	Dicotyledoneae	Polemoniaceae	Navarretia squarrosa	Skunkweed	BB, RM	Native
Anthophyta	Dicotyledoneae	Polygalaceae	Polygala californica	Milkwort	BB, JT, WC	Native
Anthophyta	Dicotyledoneae	Polygonaceae	Chorizanthe diffusa	Diffuse spineflower	JT	Native
Anthophyta	Dicotyledoneae	Polygonaceae	Chorizanthe pungens var. hartwegiana	Ben Lomond spineflower	JT, RM, RWM	Native
Anthophyta	Dicotyledoneae	Polygonaceae	Eriogonum latifolium	Coast buckwheat	BB, WC	Native
Anthophyta	Dicotyledoneae	Polygonaceae	Polygonum punctatum	Water smartweed	BB, WC	Native
Anthophyta	Dicotyledoneae	Polygonaceae	Pterostegia drymarioides	Pterostegia	JT	Native
Anthophyta	Dicotyledoneae	Polygonaceae	Rumex salicifolius var. crassus	Willow dock	JT	Native
Anthophyta	Dicotyledoneae	Portulacaceae	Calandrinia breweri	Brewer's calandrinia	BB	Native
Anthophyta	Dicotyledoneae	Portulacaceae	Claytonia perfoliata	Miner's lettuce	BB, RM, WC	Native
Anthophyta	Dicotyledoneae	Portulacaceae	Montia parvifolia	Small-leaved montia	BB, JT, RM	Native
Anthophyta	Dicotyledoneae	Primulaceae	Anagallis arvensis	Scarlet pimpernel	BB	Introduced
Anthophyta	Dicotyledoneae	Primulaceae	Dodecatheon hendersonii	Henderson's shooting star	BB, RM, WC	Native
Anthophyta	Dicotyledoneae	Primulaceae	Trientalis latifolia	Pacific starflower	BB	Native
Anthophyta	Dicotyledoneae	Ranunculaceae	Anemone oregana	Western wood anemone	BB	Native
Anthophyta	Dicotyledoneae	Ranunculaceae	Clematis lasiantha	Virgin's bower	RM, WC	Native
Anthophyta	Dicotyledoneae	Ranunculaceae	Delphinium nudicaule	Red larkspur	BB, RM, WC	Native
Anthophyta	Dicotyledoneae	Ranunculaceae	Isopyrum occidentale	Western rue anemone	JT	Native
Anthophyta	Dicotyledoneae	Rhamnaceae	Ceanothus cuneatus var. cuneatus	Buck brush	BB, RM, WC	Native
Anthophyta	Dicotyledoneae	Rhamnaceae	Ceanothus incanus	Coast whitethorn	JT, RM, WC	Native
Anthophyta	Dicotyledoneae	Rhamnaceae	Ceanothus papillosus var. papillosus	Warty-leaved ceanothus	BB, JT, RM, RWM, WC	Native
Anthophyta	Dicotyledoneae	Rhamnaceae	Ceanothus thyrsoiflorus	Blue blossom	BB, RWM, WC	Native
Anthophyta	Dicotyledoneae	Rhamnaceae	Rhamnus californica	California coffeberry	BB, RM, WC	Native
Anthophyta	Dicotyledoneae	Rosaceae	Adenostoma fasciculatum	Chamise	BB, RM, RWM, WC	Native
Anthophyta	Dicotyledoneae	Rosaceae	Amelanchier utahensis	Utah service-berry	RM	Native
Anthophyta	Dicotyledoneae	Rosaceae	Aphanes occidentalis	Western lady's mantle	BB	Native
Anthophyta	Dicotyledoneae	Rosaceae	Cercocarpus betuloides var. betuloides	Birch-leaf mountain mahogany	RM, RWM, WC	Native
Anthophyta	Dicotyledoneae	Rosaceae	Fragaria chiloensis	Beach strawberry	BB, JT, WC	Native
Anthophyta	Dicotyledoneae	Rosaceae	Fragaria vesca	Wood strawberry	BB	Native

Anthophyta	Dicotyledoneae	Rosaceae	Heteromeles arbutifolia	Toyon	BB, RM, WC	Native
Anthophyta	Dicotyledoneae	Rosaceae	Holodiscus discolor	Oceanspray	BB, RM, WC	Native
Anthophyta	Dicotyledoneae	Rosaceae	Malus sylvestris	Apple	BB	Introduced
Anthophyta	Dicotyledoneae	Rosaceae	Oemleria cerasiformis	Oso berry	BB, WC	Native
Anthophyta	Dicotyledoneae	Rosaceae	Potentilla anserina ssp. pacifica	Pacific silverweed	BB, WC	Native
Anthophyta	Dicotyledoneae	Rosaceae	Rosa californica	California rose	BB	Native
Anthophyta	Dicotyledoneae	Rosaceae	Rosa gymnocarpa	Wood rose	BB, RM	Native
Anthophyta	Dicotyledoneae	Rosaceae	Rosa spithamea	Ground rose	BB	Native
Anthophyta	Dicotyledoneae	Rosaceae	Rubus parviflorus	Thimbleberry	BB, WC	Native
Anthophyta	Dicotyledoneae	Rosaceae	Rubus spectabilis	Salmonberry	WC	Native
Anthophyta	Dicotyledoneae	Rosaceae	Rubus ursinus	California blackberry	BB, RM, WC	Native
Anthophyta	Dicotyledoneae	Rubiaceae	Galium aparine	Goose grass	BB, RM, WC	Native
Anthophyta	Dicotyledoneae	Rubiaceae	Galium californicum ssp. californicum	California bedstraw	BB, JT, RM	Native
Anthophyta	Dicotyledoneae	Rubiaceae	Galium porrigens	Climbing bedstraw	BB, RM, WC	Native
Anthophyta	Dicotyledoneae	Rubiaceae	Galium triflorum	Sweet-scented bedstraw	BB	Native
Anthophyta	Dicotyledoneae	Salicaceae	Populus balsamifera ssp. trichocarpa	Black cottonwood	BB, WC	Native
Anthophyta	Dicotyledoneae	Salicaceae	Salix laevigata	Red willow	BB	Native
Anthophyta	Dicotyledoneae	Salicaceae	Salix lasiolepis	Arroyo willow	BB, WC	Native
Anthophyta	Dicotyledoneae	Salicaceae	Salix scouleriana	Scouler's willow	BB, JT	Native
Anthophyta	Dicotyledoneae	Saxifragaceae	Boykinia occidentalis	Coast boykinia	BB, JT	Native
Anthophyta	Dicotyledoneae	Saxifragaceae	Heuchera micrantha	Alum root	BB, WC	Native
Anthophyta	Dicotyledoneae	Saxifragaceae	Lithophragma affine	Woodland star	BB	Native
Anthophyta	Dicotyledoneae	Saxifragaceae	Lithophragma heterophyllum	Hill star	JT, RM	Native
Anthophyta	Dicotyledoneae	Saxifragaceae	Saxifraga californica	California saxifrage	BB, RM	Native
Anthophyta	Dicotyledoneae	Saxifragaceae	Tiarella trifoliata var. unifoliata	Sugar-scoop	BB, JT	Native
Anthophyta	Dicotyledoneae	Scrophulariaceae	Antirrhinum kelloggii	Lax snapdragon	JK	Native
Anthophyta	Dicotyledoneae	Scrophulariaceae	Antirrhinum multiflorum	Withered snapdragon	BB, JT	Native
Anthophyta	Dicotyledoneae	Scrophulariaceae	Castilleja affinis ssp. affinis	Indian paintbrush	BB	Native
Anthophyta	Dicotyledoneae	Scrophulariaceae	Castilleja densiflora ssp. densiflora	Owl's clover	BB	Native
Anthophyta	Dicotyledoneae	Scrophulariaceae	Castilleja foliolosa	Wooly Indian paintbrush	BB, JT, RM, RWM, WC	Native
Anthophyta	Dicotyledoneae	Scrophulariaceae	Castilleja latifolia	Monterey Indian paintbrush	BB, WC	Native

Anthophyta	Dicotyledoneae	Scrophulariaceae	<i>Collinsia multicolor</i>	San Francisco collinsia	JT, JK	Native
Anthophyta	Dicotyledoneae	Scrophulariaceae	<i>Cordylanthus rigidus</i> ssp. <i>rigidus</i>	Bird's-beak	JT	Native
Anthophyta	Dicotyledoneae	Scrophulariaceae	<i>Digitalis purpurea</i>	Foxglove	BB	Native
Anthophyta	Dicotyledoneae	Scrophulariaceae	<i>Keckiella corymbosa</i>	Redwood penstemon	RM	Native
Anthophyta	Dicotyledoneae	Scrophulariaceae	<i>Mimulus aurantiacus</i>	Bush monkey flower	BB, RM, RWM, WC	Native
Anthophyta	Dicotyledoneae	Scrophulariaceae	<i>Mimulus douglasii</i>	Purple mouse-ears	BB	Native
Anthophyta	Dicotyledoneae	Scrophulariaceae	<i>Mimulus guttatus</i>	Common money flower	BB, RM, RWM	Native
Anthophyta	Dicotyledoneae	Scrophulariaceae	<i>Mimulus moschatus</i>	Musk monkey flower	BB	Native
Anthophyta	Dicotyledoneae	Scrophulariaceae	<i>Pedicularis densiflora</i>	Indian warrior	BB, RWM, WC	Native
Anthophyta	Dicotyledoneae	Scrophulariaceae	<i>Penstemon rattanii</i> var. <i>kleei</i>	Santa Cruz Mountains beardtongue	JT	Native
Anthophyta	Dicotyledoneae	Scrophulariaceae	<i>Scrophularia californica</i>	California figwort	WC	Native
Anthophyta	Dicotyledoneae	Solanaceae	<i>Solanum umbelliferum</i>	Blue witch	BB, WC	Native
Anthophyta	Dicotyledoneae	Sterculiaceae	<i>Fremontodendron californicum</i> ssp. <i>californicum</i>	Flannel bush	BB, JT	Native
Anthophyta	Dicotyledoneae	Urticaceae	<i>Urtica dioica</i> ssp. <i>gracilis</i>	American stinging nettle	BB, RWM, WC	Native
Anthophyta	Dicotyledoneae	Urticaceae	<i>Urtica dioica</i> ssp. <i>holosericea</i>	Hoary nettle	BB, RM	Native
Anthophyta	Dicotyledoneae	Valerianaceae	<i>Plectritis congesta</i>	Sea bush	BB, RM	Native
Anthophyta	Dicotyledoneae	Violaceae	<i>Viola ocellata</i>	Western heart's ease	BB, RM	Native
Anthophyta	Dicotyledoneae	Violaceae	<i>Viola sempervirens</i>	Evergreen violet	BB, WC	Native
Anthophyta	Dicotyledoneae	Viscaceae	<i>Phoradendron villosum</i>	Oak mistletoe	BB	Native
Anthophyta	Monocotyledoneae	Cyperaceae	<i>Carex deweyana</i> ssp. <i>letopoda</i>	Short-scaled sedge	JT, RWM	Native
Anthophyta	Monocotyledoneae	Cyperaceae	<i>Carex globosa</i>	Round-fruited sedge	JT	Native
Anthophyta	Monocotyledoneae	Cyperaceae	<i>Carex nudata</i>	Torrent sedge	JT	Native
Anthophyta	Monocotyledoneae	Cyperaceae	<i>Carex obnupta</i>	Slough sedge	JT	Native
Anthophyta	Monocotyledoneae	Cyperaceae	<i>Carex vesicaria</i> var. <i>major</i>	Western inflated sedge	JT	Native
Anthophyta	Monocotyledoneae	Cyperaceae	<i>Cyperus eragrostis</i>	Tall cyperus	SH	Native
Anthophyta	Monocotyledoneae	Cyperaceae	<i>Scirpus acutus</i> var. <i>occidentalis</i>	Common tule	JT, WC	Native
Anthophyta	Monocotyledoneae	Cyperaceae	<i>Scirpus americanus</i>	Three square	JT	Native
Anthophyta	Monocotyledoneae	Cyperaceae	<i>Scirpus californicus</i>	California bulrush	JT, RWM, WC	Native
Anthophyta	Monocotyledoneae	Cyperaceae	<i>Scirpus cernuus</i>	Low club rush	JT	Native
Anthophyta	Monocotyledoneae	Cyperaceae	<i>Scirpus microcarpus</i>	Panicled bulrush	BB, JT	Native
Anthophyta	Monocotyledoneae	Cyperaceae	<i>Scirpus robustus</i>	Pacific Coast bulrush	SH	Native

Anthophyta	Monocotyledoneae	Iridaceae	<i>Iris douglasiana</i>	Mountain or Douglas' iris	BB, JT, WC	Native
Anthophyta	Monocotyledoneae	Iridaceae	<i>Iris macrosiphon</i>	Slender-tubed iris	BB, JT, RM, WC	Native
Anthophyta	Monocotyledoneae	Iridaceae	<i>Sisyrinchium bellum</i>	Blue-eyed grass	BB	Native
Anthophyta	Monocotyledoneae	Juncaceae	<i>Juncus bufonius</i>	Toad rush	BB	Native
Anthophyta	Monocotyledoneae	Juncaceae	<i>Juncus lesuerii</i>	Salt rush	RWM	Native
Anthophyta	Monocotyledoneae	Juncaceae	<i>Juncus mexicanus</i>	Mexican rush	SH	Native
Anthophyta	Monocotyledoneae	Juncaceae	<i>Juncus patens</i>	Common rush	BB, JT	Native
Anthophyta	Monocotyledoneae	Juncaceae	<i>Juncus xiphioides</i>	Iris-leaved rush	JT	Native
Anthophyta	Monocotyledoneae	Juncaceae	<i>Luzula comosa</i>	Common wood rush	BB, RM	Native
Anthophyta	Monocotyledoneae	Liliaceae	<i>Brodiaea terrestris</i> ssp. <i>terrestris</i>	Dwarf brodiaea	JT, RM	Native
Anthophyta	Monocotyledoneae	Liliaceae	<i>Calochortus albus</i>	White globe lily, fairy lantern	BB, RM, WC	Native
Anthophyta	Monocotyledoneae	Liliaceae	<i>Calochortus tolmiei</i>	Pussy ears, hairy star tulip	BB, JT	Native
Anthophyta	Monocotyledoneae	Liliaceae	<i>Calochortus umbellatus</i>	Oakland star tulip	BB	Native
Anthophyta	Monocotyledoneae	Liliaceae	<i>Chlorogalum pomeridianum</i>	Amole, soap plant	BB, RM	Native
Anthophyta	Monocotyledoneae	Liliaceae	<i>Clintonia andrewsiana</i>	Red clintonia	BB, WC	Native
Anthophyta	Monocotyledoneae	Liliaceae	<i>Disporum hookeri</i>	Fairy bells	BB, RM, WC	Native
Anthophyta	Monocotyledoneae	Liliaceae	<i>Fritillaria affinis</i> var. <i>affinis</i>	Checker lily	BB, RM, WC	Native
Anthophyta	Monocotyledoneae	Liliaceae	<i>Lilium pardalinum</i> ssp. <i>pardalinum</i>	Leopard lily	BB, JT, WC	Native
Anthophyta	Monocotyledoneae	Liliaceae	<i>Scoliopus bigelovii</i>	Slink pod	BB, JT, WC	Native
Anthophyta	Monocotyledoneae	Liliaceae	<i>Smilacina racemosa</i>	False Solomon's seal	BB, WC	Native
Anthophyta	Monocotyledoneae	Liliaceae	<i>Smilacina stellata</i>	False Solomon's seal	BB, RM	Native
Anthophyta	Monocotyledoneae	Liliaceae	<i>Trillium chloropetalum</i>	Giant Wake-robin	WC	Native
Anthophyta	Monocotyledoneae	Liliaceae	<i>Trillium ovatum</i>	Western wake-robin	BB, WC	Native
Anthophyta	Monocotyledoneae	Liliaceae	<i>Triteleia laxa</i>	Ithuriel's spear	BB	Native
Anthophyta	Monocotyledoneae	Liliaceae	<i>Xerophyllum tenax</i>	Bear grass	JT	Native
Anthophyta	Monocotyledoneae	Liliaceae	<i>Zigadenus fremontii</i>	Fremont's star lily	BB, RM, WC	Native
Anthophyta	Monocotyledoneae	Orchidaceae	<i>Calypso bulbosa</i>	Fary slipper	BB	Native
Anthophyta	Monocotyledoneae	Orchidaceae	<i>Cephalanthera austini</i>	Phantom orchid	JT	Native
Anthophyta	Monocotyledoneae	Orchidaceae	<i>Corallorhiza maculata</i>	Spotted coralroot	BB, JT, WC	Native
Anthophyta	Monocotyledoneae	Orchidaceae	<i>Corallorhiza striata</i>	Striped coralroot	BB, JT, WC	Native
Anthophyta	Monocotyledoneae	Orchidaceae	<i>Epipactis helleborine</i>	Hellebore orchid	BB	Introduced
Anthophyta	Monocotyledoneae	Orchidaceae	<i>Goodyera oblongifolia</i>	Rattlesnake plantain	BB	Native
Anthophyta	Monocotyledoneae	Orchidaceae	<i>Piperia candida</i>	White-flowered rein orchid	RM	Native

Anthophyta	Monocotyledoneae	Orchidaceae	<i>Piperia elegans</i>	Elegant piperia	BB, JT	Native
Anthophyta	Monocotyledoneae	Orchidaceae	<i>Piperia transversa</i>	Rein orchid	RM	Native
Anthophyta	Monocotyledoneae	Poaceae	<i>Aira caryophylla</i>	Silver European hairgrass	BB	Introduced
Anthophyta	Monocotyledoneae	Poaceae	<i>Ammophila arenaria</i>	European beachgrass	BB, JT, RWM, WC	Introduced
Anthophyta	Monocotyledoneae	Poaceae	<i>Briza maxima</i>	Large quaking grass	RWM	Introduced
Anthophyta	Monocotyledoneae	Poaceae	<i>Bromus carinatus</i>	California brome	JT	Native
Anthophyta	Monocotyledoneae	Poaceae	<i>Bromus vulgaris</i>	Narrow-flowered brome grass	BB, JT, RM	Native
Anthophyta	Monocotyledoneae	Poaceae	<i>Calamagrostis koelerioides</i>	Tufted pine grass	JT	Native
Anthophyta	Monocotyledoneae	Poaceae	<i>Calamagrostis nutkaensis</i>	Pacific reedgrass	BB	Native
Anthophyta	Monocotyledoneae	Poaceae	<i>Calamagrostis rubescens</i>	Pine grass	JT, RM	Native
Anthophyta	Monocotyledoneae	Poaceae	<i>Deschampsia danthonioides</i>	Annual hairgrass	BB	Native
Anthophyta	Monocotyledoneae	Poaceae	<i>Deschampsia elongata</i>	Slender hair grass	JT	Native
Anthophyta	Monocotyledoneae	Poaceae	<i>Distichlis spicata</i>	Saltgrass	BB, WC	Native
Anthophyta	Monocotyledoneae	Poaceae	<i>Elymus glaucus</i>	Blue wildrye	RM	Native
Anthophyta	Monocotyledoneae	Poaceae	<i>Festuca californica</i>	California fescue	RM	Native
Anthophyta	Monocotyledoneae	Poaceae	<i>Festuca occidentalis</i>	Western fescue	BB, JT, RM	Native
Anthophyta	Monocotyledoneae	Poaceae	<i>Gastridium ventricosum</i>	Nit grass	BB	Introduced
Anthophyta	Monocotyledoneae	Poaceae	<i>Hierochloe occidentalis</i>	Western vanilla grass	BB	Native
Anthophyta	Monocotyledoneae	Poaceae	<i>Holcus lanatus</i>	Velvet grass	BB	Introduced
Anthophyta	Monocotyledoneae	Poaceae	<i>Leymus mollis</i> ssp. <i>mollis</i>	Sea lyme grass	JT	Native
Anthophyta	Monocotyledoneae	Poaceae	<i>Melica imperfecta</i>	Small-flowered melica	RM	Native
Anthophyta	Monocotyledoneae	Poaceae	<i>Melica torreyana</i>	Torrey's melica	BB, RM	Native
Anthophyta	Monocotyledoneae	Poaceae	<i>Poa annua</i>	Annual bluegrass	RWM	Introduced
Anthophyta	Monocotyledoneae	Poaceae	<i>Poa howellii</i>	Howell's bluegrass	RM	Native
Anthophyta	Monocotyledoneae	Poaceae	<i>Poa secunda</i> ssp. <i>secunda</i>	One-sided bluegrass	RM	Native
Anthophyta	Monocotyledoneae	Poaceae	<i>Polypogon monspeliensis</i>	Rabbit's foot grass	BB	Introduced
Anthophyta	Monocotyledoneae	Poaceae	<i>Spartina foliosa</i>	California cord grass	BB, WC	Native
Anthophyta	Monocotyledoneae	Poaceae	<i>Trisetum cernuum</i>	Nodding trisetum	JT	Native
Anthophyta	Monocotyledoneae	Poaceae	<i>Vulpia bromoides</i>	Six-weeks fescue	BB	Introduced
Anthophyta	Monocotyledoneae	Poaceae	<i>Vulpia microstachys</i> var. <i>ciliata</i>	Eastwood's fescue	JT	Native
Anthophyta	Monocotyledoneae	Poaceae	<i>Vulpia microstachys</i> var. <i>microstachys</i>	Nuttall's fescue	RM	Native
Anthophyta	Monocotyledoneae	Poaceae	<i>Vulpia myuros</i> var. <i>hirsuta</i>	Western six-weeks fescue	RWM	Introduced

Anthophyta	Monocotyledoneae	Poaceae	<i>Vulpia octoflora</i>	Slender fescue	JT, RM	Native
Anthophyta	Monocotyledoneae	Typhaceae	<i>Typha angustifolia</i>	Narrow-leaved cattail	BB	Native
Anthophyta	Monocotyledoneae	Typhaceae	<i>Typha latifolia</i>	Broad-leaved cattail	BB, WC	Native

APPENDIX PL-2: SENSITIVE PLANT SPECIES, BIG BASIN REDWOODS STATE PARK

1. Blasdale's bent grass (*Agrostis blasdalei*)
Habitat: coastal bluff scrub, coastal prairie
Blooming: May-July
Possible Park Location: near coast, near mouth of Waddell Creek
Habit: perennial grass, densely tufted, 1-1.5 dm. high
CNPS List: 1B

2. Coast rock cress (*Arabis blepharophylla*)
Habitat: coastal prairie, coastal scrub, and broad-leaved upland forest
Blooming: February-April
Possible Park Location: in Santa Cruz cypress groves, Eagle Rock area
Habit: perennial herb, 0.5-2 dm. high, sepals purplish and petals rose-purple
CNPS List: 4

3. Santa Cruz Mts. manzanita (*Arctostaphylos andersonii*)
Habitat: chaparral, north coast coniferous and broad-leaved upland forests, and redwood forest
Blooming: November-April
Known Park Location: along the shoulder of China Grade Road adjacent to and upslope of Highway 236
Habit: evergreen shrub, 1-4 m. high, white or pink flowers
CNPS List: 1B

4. Schreiber's manzanita (*Arctostaphylos glutinosa*)
Habitat: chaparral and closed cone coniferous forest on diatomaceous shale
Blooming: March-April
Possible Park Location: Scott Creek drainage adjacent to Last Chance Road, in the vicinity of Eagle Rock, S-shaped piece of property east of Scott Creek
Habit: evergreen round shrub, 6-12 dm. high, pinkish-white flowers
CNPS List: 1B

5. Brewer's calandrinia (*Calandrinia breweri*)
Habitat: disturbed sites and burns in chaparral, coastal scrub
Blooming: March-June
Known Park Location: reported in 1974 along Skyline-to-Sea Trail in 1973 burn
Habit: annual herb, prostrate, 1-4 dm. long, rose-red flowers
CNPS List: 4

6. Monterey Indian paintbrush (*Castilleja latifolia*)
Habitat: sandy places in coastal dunes, coastal strand, and coastal scrub
Blooming: February-September
Known Park Location: on slopes above the mouth of Waddell Creek

Habit: perennial herb, 3-5 dm. long, yellow calyx and red corolla
CNPS List: 4

7. Ben Lomond spineflower (*Chorizanthe pungens* var. *hartwegiana*)

Habitat: maritime ponderosa pine sandhills

Blooming: April-July

Known Park Location: near headquarters at "Slippery Rock"

Habit: annual herb, prostrate or ascending stems 1-3 dm. long, pink to purple involucre margins and white to rose perianth

CNPS List: 1B

8. San Francisco collinsia (*Collinsia multicolor*)

Habitat: moist, shady locations in coastal scrub, closed cone coniferous forest

Blooming: March-May

Known Park Location: reported from Waddell Creek (no specific location) in Flora of Santa Cruz Mountains

Habit: annual herb 30-60 cm. high, lavender to bluish purple flowers

CNPS List: 4

9. Branching beach aster (*Corethrogyne leucophylla*)

Habitat: coastal strand, dunes, pine woods (i.e. closed cone coniferous forest)

Blooming: July-October

Known Park Location: just north of Waddell Creek at about 600 feet in elevation, not easily accessible because the fire road is now overgrown with poison oak.

Habit: perennial herb, 2-5 dm. high, violet ray flowers, yellow disk flowers

CNPS List: 4

10. Santa Cruz cypress (*Cupressus abramsiana*)

Habitat: closed cone coniferous forest on soils derived from sandstone or granite

Known Park Location: Eagle Rock and vicinity

Habit: Evergreen Tree, to 10 m. high

CNPS List: 1B

11. San Francisco wallflower (*Erysimum franciscanum*)

Habitat: coastal dunes, coastal scrub, and valley-foothill grassland

Blooming: March-June

Known Park Location: reported on coastal strand at mouth of Waddell Creek by UCSC in Waddell report

Habit: perennial herb 0.5-4 dm. high, yellow to cream flowers

CNPS List: 4

12. Stinkbells (*Fritillaria agrestis*)

Habitat: chaparral, cismontane woodland, and valley-foothill grassland

Blooming: March-April

Possible Park Location: mouth of Waddell Creek and vicinity

Habit: perennial, from a bulb, 3-6 dm. high, flowers greenish-white outside, purplish-brown inside, with obnoxious odor

CNPS List: 4

13. Santa Cruz Mountains beardtongue (*Penstemon rattanii* var. *kleei*)

Habitat: sandy soil in chaparral, lower montane coniferous forest, and north coast coniferous forest

Blooming: May-June

Known Park Location: reported from Waddell Creek (no specific location) in Flora of Santa Cruz Mountains

Habit: perennial herb 3-12 dm. high, pale lavender to red-purple or violet- purple flowers

CNPS List: 1B

14. White-rayed pentachaeta (*Pentachaeta bellidiflora*)

Habitat: coastal prairie, valley-foothill grassland, coastal scrub

Blooming: March-May

Possible Park Locations: Eagle Rock and vicinity, S-shaped piece of property east of Scott Creek; reported from west of Eagle Rock in Rarefind

Habit: annual herb, 6-20 cm. high, ray flowers white or purplish-tinged, disk flowers yellow

CNPS List: 1B

15. Gairdner's yampah (*Perideridia gairdneri* ssp. *gairdneri*)

Habitat: wet places in various communities, including chaparral, valley-foothill grassland, broad-leaved upland forest, etc.

Blooming: June-October

Known Park Location: a pre-1945 report from Opal Creek

Habit: slender perennial herb, 3-12 dm. high, inconspicuous white flowers

CNPS List: 4

16. Monterey pine (*Pinus radiata*)

Habitat: closed cone coniferous forest

Blooming: N/A

Known Park Location: reported from Waddell Creek north to Ano Nuevo

Habit: Evergreen tree, 15-35 m high

CNPS List: 1B

17. White-flowered rein orchid (*Piperia candida*)

Habitat: lower montane coniferous forest

Blooming: May-August

Known Park Location: along the Pine Mountain Trail and possibly other locations

Habit: perennial herb, 10-55 cm. high, flowers white with green midvein

CNPS List: 4

18. San Francisco campion (*Silene verecunda* ssp. *verecunda*)
Habitat: sand hills and dunes, coastal prairie, valley-foothill grassland, coastal scrub, coastal strand, and chaparral
Blooming: March-June
Known Park Location: mouth of Waddell Creek and vicinity; alongside the trail, up canyon from Rancho del Oso
Habit: perennial herb, 1-3 dm. high, pink to rose flowers
CNPS List: 1B

19. Santa Cruz microseris (*Stebbinsoseris decipiens*)
Habitat: open areas in coastal prairie, chaparral, coastal scrub, closed cone coniferous forest, broad-leafed upland forest
Blooming: April-May
Reported Park Location: 0.2 mile south of the mouth of Waddell Creek, back of beach; however, believed to be an erroneous report
Habit: annual herb, 10-40 cm. high, yellow ligulate flowers
CNPS List: 1B

APPENDIX PL-3

Special Plant Status Codes

CNPS R-E-D CODE

R (Rarity)*

- 1- Rare, but found in sufficient numbers and distributed widely enough that the potential for extinction or extirpation is low at this time
- 2- Occurrence confined to several populations or to one extended population
- 3- Occurrence limited to one or a few highly restricted populations, or present in such small numbers that it is seldom reported

E (Endangerment)*

- 1- Not endangered
- 2- Endangered in a portion of its range
- 3- Endangered throughout its range

D (Distribution)

- 1- More or less widespread outside California
- 2- Rare outside California
- 3- Endemic to California

STATE LISTED PLANTS

SE State-listed, endangered

SR State-listed, rare

ST State-listed, threatened*

SCE State Candidate for listing, endangered

SCT State Candidate for listing, threatened

FEDERAL CANDIDATES AND FEDERALLY LISTED PLANTS

FE Federally-listed, endangered

FT Federally-listed, threatened*

FPE Federally-proposed, endangered

FPT Federally-proposed, threatened

* The CNPS definitions of the terms “rare” and “endangered” are basically consistent with those used in the Native Plant Protection Act (Sect. 1900, California Department of Fish and Game Code), as well as those in the California Endangered Species Act (CESA, Sect. 2050-2098). The definition of “threatened” found in CESA is essentially equivalent to its definition in the federal Endangered Species Act, Section 3. According to the California Department of Fish and Game Endangered Plant Program, plants listed under CNPS List 1 and 2 are presumed to meet these criteria and are treated as candidate species for listing purposes.