

**Methods Used to Survey the Vegetation of
Orange County Parks and
Open Space Areas and
The Irvine Company Property**

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February 10, 1993

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INTRODUCTION

This report describes the methods used by Jones & Stokes Associates to map vegetation (habitat types) in Orange County parks and open space areas and on The Irvine Company property. The report is divided into five sections. The first section, "Field Survey Methods", describes the on-ground mapping methods used by survey crews. The second section, "Habitat Identification Guidelines", describes general and specific guidelines used by field botanists to differentiate habitat types and subtypes. The third section, "Multiple Habitat Categories", explains decision-making methods used when habitats were not clearly distinguishable. The fourth section, "Habitat and Land Cover Descriptions", provides descriptions of each habitat type and subtype and nonhabitat land covers used to identify habitats and land covers during field surveys. The final section, "Dichotomous Key to Scrub and Chaparral Habitats", provides the key that field botanists used to differentiate the subtypes of scrub and chaparral habitats and their ecotones.

The habitat descriptions and classification system were developed based on field experience of botanists from Jones & Stokes Associates, Dames & Moore, and David Bramlet working in Orange County and not from any numeric ordination data. The need to identify suitable habitat for California gnatcatcher (*Polioptila californica* spp. *californica*), a bird proposed for listing as endangered under the federal Endangered Species Act (56 FR 47053) and the focus species in a Natural Community Conservation Plan for coastal sage scrub (California Fish and Game Code, Section 2800), was an important consideration in developing coastal scrub habitat subtypes. The habitat data will be used in conjunction with California gnatcatcher location data to assess California gnatcatcher habitat preferences. Because California gnatcatcher appears to prefer habitats that support *Artemisia californica*, the presence of *Artemisia californica* was considered an important parameter in distinguishing subtypes of scrub habitat and scrub-chaparral ecotones. Scrub habitat subtypes and ecotones were defined such that the presence of *Artemisia californica* as a dominant or codominant element could be ascertained in future analyses.

The classification system evolved during the survey period in spring and summer 1992. Some mapping differences occurred between spring surveys of The Irvine Company property and the summer surveys of Orange County parks and open space areas. For example, the scrub-grassland ecotone habitats were added in early summer by David Bramlet, consulting biologist for Orange County. These sites were mapped as grassland, using the 20% shrub cover rule, on most of The Irvine Company property.

The habitat data have been entered into a geographic information system (GIS). Methods for data entry into the GIS are not discussed in this report.

Vegetation surveys were conducted within park and open space area boundaries provided by Orange County and within the historical boundaries of the Irvine Ranch. The U.S. Fish and Wildlife Service reviewed the December 11, 1992 draft of this report and their comments were incorporated into this final version (Roberts pers. comm.).

FIELD SURVEY METHODS

Jones & Stokes Associates botanists conducted field vegetation mapping surveys in March, April, May, June, and July 1992 for The Irvine Company and Orange County. Field mapping was conducted on clear acetate topographic overlays (1 inch = 500 feet) with partially rectified true-color aerial photographs of the same scale provided by Orange County. Discrete polygon boundaries were drawn around habitat types and subtypes identified in the field. Each polygon was labeled according to habitat subtype, using the number coding system of the Orange County Land Cover/Habitat Classification System (Dames & Moore 1992) as expanded and modified by Jones & Stokes Associates. Boundaries were topographically rectified when information was transferred from the aerial photographs to the topographic overlays; rectification was accomplished using identifiable correlations between vegetation boundaries and changes in slope. Jones & Stokes Associates' field-verified boundary delineations were recorded in red ink to differentiate this information from prefield mapping recorded in blue ink by Dames and Moore. Ground truthing revealed that a significant portion of the prefield mapping required remapping. In most cases, all of the blue ink prefield mapped boundaries were removed and remapped in the field.

Field surveys were conducted from four-wheel-drive vehicles on all passable roads. As needed, botanists walked into vegetation bordering roads to assess habitat type and subtype. Sites inaccessible by vehicle were mapped by walking to the site or by viewing the site through binoculars from distant vantage points. Inaccessible areas were delineated and mapped from at least two vantage points where possible. Mapping was discontinued when low-angle sunlight made discerning plant species from a distance difficult, generally within 2 hours before sundown, and these areas were revisited at a later time. Vegetation that could not be accessed or viewed from a distance (e.g., slopes in inaccessible areas facing away from viewing points) were mapped in the field based on aerial photograph signatures of vegetation in the immediate vicinity and recurring patterns of vegetation (e.g., slope-related alternating patches of sagebrush-buckwheat scrub with chamise chaparral).

All values of absolute or relative percent cover used were based on visual estimates by field botanists. Botanists standardized cover estimation by working together on initial field visits or by teaming new botanists with experienced botanists. Botanists worked in teams of two, which were rotated each day to reduce variation in mapping decisions.

HABITAT IDENTIFICATION GUIDELINES

Jones & Stokes Associates botanists used the following guidelines, in conjunction with habitat descriptions and the dichotomous key to scrub and chaparral habitats, to assign habitat type and subtype categories to vegetation polygons. Habitat types and subtypes are described in depth below under "Habitat and Land Cover Descriptions", and the dichotomous key to scrub and chaparral habitats is provided below under "Dichotomous Key to

Scrub and Chaparral Habitats". The numbers in parentheses correspond to Orange County's hierarchical numbering classification system.

Dune (1.0)

Dune habitats were delineated where sparse to dense stands of annual and perennial herbs, grasses, or shrubs occurred on sand dunes along the coast. Identification of subtypes was based on the condition of the dune (stabilized or unstabilized) and the dominant species comprising the community.

Scrub (2.0)

Scrub habitat boundaries with grassland or scrub-grassland ecotone/sere were delineated where shrubs exceeded 20% cover. Scrub habitat was characterized by 80% or greater relative shrub cover by scrub species where the community intergraded with chaparral. Table 1 lists shrub species considered characteristic of scrub and chaparral.

Subtypes of scrub were identified based on the dominant shrub species or two or three codominant species. For example, sites supporting *Artemisia californica* and *Eriogonum fasciculatum* as the species with the two highest cover values were delineated as sagebrush-buckwheat scrub. Where one of these species exceeded 80% relative cover, however, the site was delineated as sagebrush scrub or buckwheat scrub. Methods for dividing scrub into subtypes are provided below under "Dichotomous Key to Scrub and Chaparral Habitats".

Occurrences of *Malosma laurina* proved problematic in assigning sites to habitat types because it occurs in a variety of habitats. *Malosma laurina* is a large, evergreen, deep-rooted shrub, similar to shrub species that characterize chaparral habitats; however, *Malosma laurina* is more commonly found in association with small, drought-deciduous shrubs characteristic of scrub habitats (Table 1). *Malosma laurina* is common in scrub habitats, ranging from a minor to a codominant component. *Malosma laurina* often reaches high densities in narrow valley bottoms. On moist slopes near the coast, *Malosma laurina* forms dense, closed-canopy stands, often in association with *Heteromeles arbutifolia*. *Malosma laurina* also occurs in savanna habitats. In scrub habitats, the occurrence of *Malosma laurina* was not taken into account in determining the scrub subtype. The other shrubs present were used to determine the scrub classification. Where *Malosma laurina*, in association with *Heteromeles arbutifolia*, formed a dense, closed-canopy habitat that had little or no understory shrub cover, the site was delineated as toyon-sumac chaparral. Sites supporting *Malosma laurina* in scattered stands over grassland were delineated as laurel sumac savanna.

Table 1. Characteristic Plant Species of Orange County's
Coastal Scrub and Chaparral Communities

Common Name	Scientific Name
Coastal Scrub	
California sagebrush	<i>Artemisia californica</i>
California buckwheat	<i>Eriogonum fasciculatum</i>
Black sage	<i>Salvia mellifera</i>
White sage	<i>Salvia apiana</i>
Purple sage	<i>Salvia leucophylla</i>
Orangebush monkeyflower	<i>Mimulus aurantiacus</i>
Bush mallow	<i>Malacothamnus fasciculatus</i>
Coastal prickly pear	<i>Opuntia littoralis</i>
Coyote brush	<i>Baccharis pilularis</i> ssp. <i>consanguinea</i>
Sawtooth goldenbush	<i>Haplopappus squarrosus</i>
Chaparral	
Chamise	<i>Adenostoma fasciculatum</i>
Scrub oak (coastal)	<i>Quercus dumosa</i>
Scrub oak (interior)	<i>Quercus berberidifolia</i>
Snowball ceanothus	<i>Ceanothus crassifolius</i>
Bigpod ceanothus	<i>Ceanothus megacarpus</i>
Toyon	<i>Heteromeles arbutifolia</i>
Eastwood manzanita	<i>Arctostaphylos glandulosa</i>
Parry's bear-grass	<i>Nolina cismontana</i>
Lemonade berry	<i>Rhus integrifolia</i>
Coastal Scrub and Chaparral ("insensitive" species)	
Laurel sumac	<i>Malosma laurina</i>

Scrub-Grassland Ecotone/Sere (2.8)

Sites supporting grassland with scattered scrub shrubs between 5% and 20% cover were identified as scrub-grassland ecotone/sere. Subtypes were identified by the shrub species with the greatest cover value. The scrub-grassland ecotone/sere category was incorporated into the classification system only after most of The Irvine Company property had been mapped by Jones & Stokes Associates in spring 1992. Therefore, sites on The Irvine Company property that supported scrub-grassland ecotone/sere were mapped as grassland habitat.

Scrub-Eucalyptus Planting (2.9)

Sites that supported any subtype of scrub habitat, were planted throughout with *Eucalyptus* spp. (usually *Eucalyptus globulus* or *Eucalyptus camaldulensis*), and were usually laced with irrigation piping were mapped as scrub-eucalyptus planting.

Chaparral (3.0)

Sites were delineated as chaparral habitat where more than 50% of the shrub cover was composed of characteristic chaparral shrub species (Table 1). Identification of chaparral subtype was based on the one or two most dominant species. Chaparral subtype classification methods are described below under "Dichotomous Key to Scrub and Chaparral Habitats".

Scrub-Chaparral Ecotone/Sere (3.1)

Sites supporting 20-50% relative shrub cover by chaparral shrub species and 50-80% relative shrub cover by scrub shrub species (Table 1) were delineated as scrub-chaparral ecotone/sere. Subtypes were determined based on the chaparral and scrub species with the highest cover values. Subtyping focused on identifying whether *Artemisia californica* was present. The scrub-chaparral ecotone/sere classification method is described below under "Dichotomous Key to Scrub and Chaparral Habitats".

Grassland (4.0)

Sites supporting low herbaceous vegetation dominated by grasses were mapped as grassland. Subtypes were distinguished by the relative cover of annual and perennial grass species. Areas with widely scattered oaks or sumac in grassland habitat were classified as savanna.

Seasonal Wetlands (5.0)

Sites characterized by seasonal inundation or saturated soils and dominated by herbaceous hydrophytic vegetation were mapped as vernal pool, alkali meadow, freshwater seep, or freshwater swale. Subtypes were distinguished based on dominant vegetation, depth and period of inundation, substrate characteristics, and basin attributes (e.g., shape and size). Most of these wetland features were too small to map (<1 acre) and do not appear in the data.

Marsh (6.0)

Seasonally or permanently flooded sites dominated by persistent hydrophytic vegetation were mapped as marsh habitats. Subtypes were identified based on the dominant species, which reflect salinity, alkalinity, and hydrologic regime.

Riparian (7.0)

Seasonally flooded herb, shrub, and forest habitats associated with streams were mapped as riparian habitats. Vegetation occurred within the streambed, along the banks and in the floodplain. Riparian subtypes were identified based on the dominant species, with tallest species in a multilayered canopy taking precedence, and on percent aerial cover of dominant species.

Stands of *Quercus agrifolia* that occurred along rivers, streams, creeks, and drainages were classified as oak riparian, whereas *Quercus agrifolia* stands situated away from watercourses were labeled oak woodland (8.1) or oak forest (9.1). Watercourses were identified visually in the field and with the aid of topographic lines on the acetate overlays. Separation of oak riparian (7.5) from oak woodland (8.1) and oak forest (9.1) was based on rather arbitrary field interpretation by individual botanists and was not consistent throughout the survey area. As a general rule, if a stream channel was indicated by red lines on the topographic overlay, associated oaks were mapped as oak riparian. These data could be made more consistent by reinterpreting the habitat designations through a comparison of occurrences of oak dominated habitat patches with U.S. Geological Survey slope and stream channel data and setting standardized type determination and boundary criteria based on these data. This analysis could be efficiently conducted using the GIS.

Mixed riparian habitat consisting of *Quercus* spp. and *Platanus racemosa* was mapped as sycamore riparian if 20% or more of the relative tree cover was *Platanus racemosa*.

Woodland (8.0)

Habitats were mapped as woodlands where the tree cover was 20-80%. Subtypes were identified based on the single most dominant species. Most woodlands mapped were coast live oak woodland. Differentiation of coast live oak woodland (8.1) and coast live oak forest (9.1) were not always consistent in the field. Many sites supporting *Quercus agrifolia* at greater than 80% cover may have been mapped as woodland rather than forest.

Forest (9.0)

Closed-canopy, tree-dominated sites were mapped as forest habitats. Subtypes were identified based on the single most dominant species.

Separation of coast live oak forest and coast live oak woodland was based on absolute cover. During field surveys, many sites that might have been technically classified as coast live oak forest (9.1) were categorized as coast live oak woodland (8.1).

Cliff and Rock (10.0)

This habitat type consists of large cliffs or areas of rock outcrops. Because of the vertical nature of cliff faces, cliff habitats were not often mapped as they were not evident on aerial photographs. Only rock outcrops greater than 1 acre were mapped. In many cases, rock outcrops occurred within a larger vegetation polygon. Rock outcrops that were mapped in the field as a multiple habitat category because a vegetation-dominated habitat was also present (see "Multiple Habitat Categories" below) were classified as the vegetation-dominated habitat when entered into GIS. For example, a mosaic of rock outcrops (10.3) and chamise chaparral (3.3) was mapped as "3.3/10.3" on the acetate overlay but as chamise chaparral (3.3) in the GIS database and on the final GIS-produced maps.

Marine and Estuarine (11.0)

Marine and estuarine areas mapped included coastal kelp beds (11.1.1), estuaries (11.2), rocky shore (11.3), sandy beach (11.4), and mudflats (11.5). Subtypes were distinguished based on location in relation to the ocean, relative protection from tides and winds, and the presence of macroalgae, microalgae, or vascular plants.

Lakes, Reservoirs, and Basins (12.0)

Natural and artificial lakes, reservoirs, and basins were mapped. Vegetated shorelines were differentiated from more permanently inundated areas. Lakes and reservoirs were mapped to the highest water level indicated on aerial photographs or interpreted in the field.

Watercourses (13.0)

Watercourses were not mapped in the field unless the unvegetated streambed was wide enough to create a habitat polygon at a scale of 1 inch = 500 feet and greater than 1 acre. The survey was dependent on U.S. Geological Survey (USGS) data and solid and dashed blue line streams to differentiate between perennial and intermittent streamcourses. Vegetated watercourses were classified as a riparian habitat based on the dominant vegetation (see "Riparian" above).

Agriculture (14.0)

Agricultural fields were mapped as necessary. They were mapped, for instance, where they were surrounded by or bordered natural habitats. Subtypes were distinguished based on the crop grown.

Developed (15.0)

Developed sites include urban areas, paved roads, parks, and sites cleared and graded for development. Developed sites were mapped as necessary. They were mapped, for instance, where they were surrounded by or bordered natural habitats. Subtypes were distinguished based on the type of development or use.

Disturbed (16.0)

Disturbed sites include areas that have been cleared of natural vegetation by human or natural means, such as clearing and grading or fire. Subtypes were identified based on the type of disturbance. In burned areas, the habitat that existed before the burn or the habitat recovering from the burn was assessed where possible and a multiple habitat classification with burned areas (16.3) was assigned on the acetate overlay (see "Multiple Habitat Categories" below). The preburn or postburn habitat type was entered into GIS.

MULTIPLE HABITAT CATEGORIES

When habitat polygons identified in the field exhibited characteristics of two or more habitat types or subtypes that could not be categorized into one classification unit, these polygons were mapped with more than one code number as multiple habitats. These areas were either characterized by a mosaic of habitat types with less than 1-acre patches or possessed attributes of two or more habitat types. For the purpose of GIS entry, one habitat type was selected to label the polygon (Table 2). The habitat type chosen for GIS entry either had the highest percent cover, defined the highest layer in a multilayered vegetation unit, or was a vegetation-dominated habitat where the other habitats were unvegetated.

For example, sites supporting a mosaic of sagebrush-buckwheat scrub and rock outcrops (2.3.1/10.3) were designated sagebrush-buckwheat scrub (2.3.1) to indicate the vegetated habitat present (Table 2). Sites with both sycamore riparian and mulefat scrub (7.4/7.3) were labeled sycamore riparian because of the habitat value of the *Platanus racemosa* overstory (Table 2).

Ecotone designations were given to sites supporting coastal scrub and chaparral characteristics. For example, sites supporting characteristics of toyon-sumac chaparral and sagebrush-black sage scrub (3.12/2.3.8) were designated scrub-chaparral ecotone/sere (3.1).

In some instances, multiple-habitat designation resulted in two or more separate polygons being consolidated. For example, sites supporting a mosaic of rock outcrops and chamise chaparral were ultimately mapped as chamise chaparral to distinguish the dominant vegetative cover present, even though vegetation was sparse or patchy. Mosaics of rock outcrops and chamise chaparral (10.3/3.3) that were delineated on the acetate overlays from areas with chamise chaparral (3.3) were consolidated during the GIS mapping stage into a larger polygon classified as chamise chaparral (3.3).

The decision to map multiple habitat polygons according to the most common or most important habitat avoided the need to develop an excessive number of new habitat categories. The original acetate overlays used in field mapping provide a record of polygons that were given multiple habitat identifications. If necessary, these data could be recovered and reinterpreted in a manner other than that given in Table 2.

HABITAT AND LAND COVER DESCRIPTIONS

The following habitat and land cover descriptions were used in the field to differentiate habitat types. These descriptions represent the combined efforts of Jones & Stokes Associates, Dames & Moore, and David Bramlet. Former or alternative habitat names are given in parentheses in the habitat descriptions.

Table 2. Multiple Habitat Categories¹

Multiple Habitats Identified on <u>Mylar Overlays in Order Listed</u>			Habitat Designation on GIS	Rationale for Conversion
First	Second	Third		
2.3.1	3.12		2.3.1	Sagebrush-buckwheat scrub with sumac common
2.3.6	2.3.10		2.3.10	Mix of scrub species
2.3.8	7.3	7.4	7.4	Sycamore overstory
2.4	2.3.1		2.4	Cactus important cover
2.4	2.3.8		2.4	Cactus important cover
2.6	7.4		2.6	Scalebroom scrub dominant
2.8.2	2.8.3		2.8.2	Buckwheat more common
3.11	2.3.8		3.1	Chaparral/scrub mix
3.11	2.4		3.1	Chaparral/scrub mix
3.12	2.3.1		3.1	Chaparral/scrub mix
3.12	2.3.10		3.1	Chaparral/scrub mix
3.12	2.3.4		3.1	Chaparral/scrub mix
3.12	2.3.5		3.1	Chaparral/scrub mix
3.12	2.3.8		3.1	Chaparral/scrub mix
3.12	2.4		3.1	Chaparral/scrub mix
3.12	2.8.1		3.1	Chaparral/scrub mix
3.12	2.8.5		3.1	Chaparral/scrub mix
3.1.2	2.3.1		3.1.2	Chaparral/scrub mix
3.2	2.3		3.1	Chaparral/scrub mix
3.2	2.6		2.6	In floodplain
3.2	3.11		3.0	Two chaparral types
3.2.1	3.12		3.1	Chaparral/scrub mix
3.3	2.3.8		3.0	Black sage in chaparral
3.3	3.1.5		3.1	Chaparral/scrub mix
3.4	3.3		3.0	Two chaparral types
3.7	3.3		3.0	Two chaparral types
4.0	3.2		3.0	Sparse chaparral
4.1	2.3.1		2.8	Grassland/scrub mix
4.1	2.8		2.8	Grassland/scrub mix
4.3	2.4		2.4	Cactus scrub in grassland
4.3	4.1		4.3	Needlegrass codominant
4.6	2.3.1		2.8	Grassland/scrub mix
4.8	2.3.5		2.3.5	Sumac in white sage
4.8	4.5		4.8	Sparse sumac savanna
5.0	4.1		5.0	Wetland/grassland mix
7.1	4.6		7.1	Degraded riparian
7.1	7.2		7.2	Willow overstory
7.1	7.3		7.3	Mulefat overstory
7.2	2.3.9		7.2	Willow overstory
7.2	4.6		7.2	Willow overstory
7.2	6.4		7.2	Willow overstory
7.2	7.1		7.2	Willow overstory
7.2	7.3	6.4	7.2	Willow overstory
7.2	7.3		7.2	Willow overstory
7.3	2.6		7.3	Mulefat overstory
7.3	3.2		7.3	Mulefat overstory
7.3	4.6		7.3	Mulefat overstory
7.3	6.4		7.3	Mulefat overstory
7.3	7.1		7.3	Mulefat dominant
7.3	7.2		7.3	Mulefat dominant

Table 2. Continued

Multiple Habitats Identified on Mylar Overlays in Order Listed			Habitat Designation on GIS	Rationale for Conversion
First	Second	Third		
7.4	7.2		7.4	Sycamore overstory
7.4	7.3		7.4	Sycamore overstory
7.4	7.3	2.6	7.4	Sycamore overstory
7.4	7.5		7.4	Sycamore overstory
7.5	7.3		7.5	Oak overstory
7.5	7.4		7.5	Oak dominant
7.6	6.4	2.7	7.6	Willow overstory
7.6	7.2		7.2	Willow mix
7.6	7.3		7.6	Willow overstory
7.7	7.2		7.7	Black willow dominant
7.7	7.3		7.7	Black willow overstory
7.8	6.4		7.8	Cottonwood overstory
7.8	6.4	7.7	7.8	Cottonwood/willow mix
8.1	2.3.10		8.1	Oak overstory
8.1	3.2		8.1	Oak overstory
8.1	3.3		8.1	Oak overstory
9.5	3.2.1		9.5	Cypress overstory
9.5	3.3	3.11	9.5	Cypress overstory
9.5	3.3		9.5	Cypress overstory
10.1	3.2		3.2	Identify vegetation
10.1	9.5		9.5	Identify vegetation
10.2	2.1		2.1	Identify vegetation
10.3	2.3.1		2.3.1	Identify vegetation
10.3	2.4		2.4	Identify vegetation
10.3	3.12		3.12	Identify vegetation
10.3	3.2		3.2	Identify vegetation
10.3	4.1		4.1	Identify vegetation
13.2	2.3.8		2.3.8	Identify vegetation
13.2	3.12		3.12	Identify vegetation
13.2	7.2		7.2	Identify vegetation
13.2	7.4		7.4	Identify vegetation
13.2	7.6		7.6	Identify vegetation
15.1	15.5		15.1	Urban dominant
15.1	16.1		15.1	Urban under construction
15.5	15.1		15.0	Landscaping dominant
15.5	2.3.1		2.9	Eucalyptus in scrub
15.5	2.3.8		2.9	Eucalyptus in scrub
15.5	2.4		2.9	Eucalyptus in scrub
15.5	4.1		15.5	Landscaping dominant
16.1	14.1		16.1	Barren dominant
16.1	2.3.1		2.3.1	Degraded scrub
16.1	4.6		16.1	Sparse ruderals
16.3	2.3.1		2.3.1	Burned scrub
16.3	3.12		3.12	Burned chaparral
16.3	3.2		3.2	Burned chaparral
16.3	3.5		3.5	Burned chaparral

¹ Some multiple habitat groupings were mapped once and others several to many times.

1.0. Dune

Dune habitats consist of sparse to dense vegetation growing in aeolian (wind-blown) sand deposits, primarily along the coast. The vegetation usually consists of annual and perennial herbs and grasses, and shrubs adapted to low soil moisture conditions and shifting sand.

1.1. Foredune

Foredune (southern coastal foredunes) consists of unstabilized dunes with sparse vegetative cover, typically just inland of the open beach, and is dominated by *Abronia maritima*, *Cakile maritima*, *Camissonia cheiranthifolia* ssp. *suffruticosa*, *Carpobrotus aequilaterus*, *Carpobrotus edulis*, *Mesembryanthemum* spp., *Calystegia soldanella*, *Cardionema ramosissima*, and *Ambrosia (Franseria) chamissonis*. Representative examples occur at Seal Beach, Bolsa Chica, Upper Newport Bay, and San Mateo Marsh.

1.2. Dune Scrub

Dune scrub (southern dune scrub) occurs on stabilized dunes inland of the fore-dune community with shrubs and herbs of foredune community and includes *Isocoma (Haplopappus) veneta* var. *vernonioides*, *Opuntia littoralis* var. *littoralis*, *Baccharis emoryi*, *Salix lasiolepis*, *Ambrosia chamissonis*, *Nemacaulis denudata*, *Rhus integrifolia*, and *Lotus scoparius*. Representative examples occur at Bolsa Chica, Huntington Beach, Upper Newport Bay, and Trestles Beach.

2.0. Scrub

Scrub vegetation consists of drought-deciduous, low, soft-leaved shrubs and herbs, and is often gray-green. Scrub occupies gentle to steep slopes with shallow or heavy soils mostly at elevations below 3,000 feet.

2.1. Coastal Bluff

Coastal bluff scrub (southern coastal bluff scrub) consists of low prostrate plants that are often gray. Coastal bluff scrub occurs on exposed bluffs and cliffs immediately adjacent to the ocean and often receives salt spray. Common and characteristic plants include *Rhus integrifolia*, *Opuntia prolifera*, *Euphorbia misera*, *Dudleya* spp., *Carpobrotus* spp., *Isomeris arborea*, *Encelia californica*, *Lycium californicum*, *Eriogonum parvifolium*, *Baccharis pilularis*

ssp. *consanguinea*, and *Artemisia californica*. Representative examples are found at Headlands of Dana Point, Laguna Beach, Crystal Cove State Park (SP), and San Clemente.

2.2. Maritime Succulent Cactus

Maritime succulent cactus scrub (maritime succulent scrub) occurs on exposed slopes near the coast and is dominated by cacti and coastal sage scrub species. Common and characteristic species of maritime succulent cactus scrub consist of *Opuntia littoralis*, *Opuntia prolifera*, *Opuntia oricola*, *Encelia californica*, *Artemisia californica*, *Lycium californicum*, *Rhus integrifolia*, *Eriogonum fasciculatum*, *Oligomeris linifolia*, *Draba cuneifolia*, and *Isomeris arborea*. The understory is composed of *Stipa lepida* and *Agrostis* spp. Representative examples occur at Upper Newport Bay and Laguna Beach.

2.3. Sagebrush and Sage

Sagebrush scrub (Venturan-Diegan transitional coastal sage scrub) vegetation consists of low, drought-deciduous and evergreen shrubs that occur on steep to moderate slopes mostly below 3,000 feet in elevation. They occur in shallow and rocky to heavy soils.

The Venturan-Diegan coastal sage scrub is considered a transitional association that contains elements of two recognized geographical associations of sage scrub, Venturan and Diegan.

2.3.1. Sagebrush-Buckwheat. Sagebrush-buckwheat scrub (California sagebrush-California buckwheat scrub) is dominated by *Artemisia californica* and *Eriogonum fasciculatum*, with *Salvia apiana*, *Salvia mellifera*, *Mimulus aurantiacus*, *Encelia californica*, *Lotus scoparius*, *Isocoma veneta*, *Rhus integrifolia*, *Elymus condensatus*, *Baccharis pilularis* spp. *consanguinea*, and *Malacothamnus fasciculatus*, and an understory of *Stipa lepida*, *Vulpia* spp., *Bromus* spp., *Gnaphalium bicolor*, *Dichelostemma pulchellum*, *Microseris* spp., and *Galium* spp. It occurs throughout the low foothills, such as the Anaheim, San Joaquin, and Sheep Hills; Fremont-Weir and Gypsum-Coal Canyons area; Loma Ridge; and Canada Gobernadora area.

2.3.2. Sagebrush-Monkeyflower. Sagebrush-monkeyflower scrub (California sagebrush-orangebush monkeyflower scrub) is dominated by *Artemisia californica* and *Mimulus aurantiacus*, with *Baccharis pilularis* ssp. *consanguinea*, *Baccharis emoryi*, *Elymus condensatus*, *Toxicodendron diversilobum*, *Isocoma veneta*, *Sambucus mexicana*, and *Salvia apiana*. It occurs on mesic foothill slopes below 1,000 feet.

2.3.3. Purple Sage. Purple sage scrub is dominated by *Salvia leucophylla* or supports *Salvia leucophylla* and *Artemisia californica* as codominants. Also occurring are *Isocoma veneta*, *Eriogonum fasciculatum*, *Mimulus aurantiacus*, *Salvia apiana*, *Salvia mellifera*, and *Sambucus mexicana*. It occurs on foothill slopes between 500 and 1,500 feet elevation in the Chino Hills and Loma Ridge.

2.3.4. Black Sage. Black sage scrub is dominated by *Salvia mellifera* with *Eriogonum fasciculatum*, *Artemisia californica*, *Malacothamnus fasciculatus*, *Opuntia littoralis*, *Malosma laurina*, *Galium angustifolium*, *Salvia apiana*, *Stipa coronata*, and *Yucca whipplei*. It occurs on slopes below 1,000 feet elevation.

2.3.5. White Sage. White sage scrub is dominated by *Salvia apiana* or an even mix with *Artemisia californica*. Also occurring are *Eriogonum fasciculatum*, *Lotus scoparius*, *Malacothamnus fasciculatus*, *Isocoma veneta*, *Yucca whipplei*, *Malosma laurina*, *Mimulus aurantiacus*, and *Galium angustifolium*. It occurs on slopes and flats below 3,000 feet elevation and intergrades with grassland and chaparral. In the higher elevations it is often found as large inclusions within chaparral areas. These slopes often contain *Cordylanthus filifolius*, *Frasera parryi*, *Stipa coronata*, and *Castilleja foliolosa*. Representative examples occur in the Santa Ana Mountains.

2.3.6. Sagebrush. Sagebrush scrub is dominated almost exclusively by *Artemisia californica*. Sagebrush scrub occurs usually as small patches within grassland or with other scrub subtypes that support *Artemisia californica* codominant with other shrubs.

2.3.7. Buckwheat. Buckwheat scrub is characterized by nearly pure stands of *Eriogonum fasciculatum*, with *Artemisia californica* not present. Other species that may occur at low densities are *Salvia apiana*, *Salvia mellifera*, *Mimulus aurantiacus*, *Encelia californica*, *Isocoma veneta*, *Rhus integrifolia*, *Elymus condensatus*, *Baccharis pilularis* ssp. *consanguinea*, and *Malacothamnus fasciculatus*. The understory typically supports *Stipa lepida*, *Vulpia* spp., *Bromus* spp., *Gnaphalium bicolor*, *Lotus* spp., *Dichelostemma pulchellum*, *Microseris* spp., and *Galium* spp. It occurs throughout the foothills and mountains of Orange County and is likely seral to sagebrush-buckwheat scrub and other communities. It is most often found on slopes that have been disturbed within the last 10 years.

2.3.8. Sagebrush-Black Sage. Sagebrush-black sage scrub is dominated by *Artemisia californica* and *Salvia mellifera*. Other scrub species may also comprise an important part of the total cover.

2.3.9. Coyote Brush. Coyote brush scrub is dominated by *Baccharis pilularis* ssp. *consanguinea*. It usually occurs on flats and gentle slopes that have been disturbed in the last 20 years.

2.3.10. Mixed. Mixed scrub (coastal sage scrub) is dominated by an even mix of each four or more of *Eriogonum fasciculatum*, *Salvia* spp., *Encelia californica*, *Malosma laurina*, *Mimulus* spp., and *Opuntia* spp. *Artemisia californica* can occur but is not an important species in this community.

2.3.11. Bush Mallow. Bush mallow scrub occurs on steep to moderate slopes in heavy soils. It is dominated by *Malacothamnus fasciculatus* or other mallow species. *Salvia mellifera* often occurs as a codominant. Other coastal sage scrub species may be codominants or subdominants.

2.3.12. Sagebrush-Coyote Brush. Sagebrush-coyote brush scrub is dominated by *Artemisia californica* and *Baccharis pilularis* ssp. *consanguinea*. Other species are only subdominants.



2.3.12 *Encelia californica*

2.4. Southern Cactus

Southern cactus scrub consists of scrub vegetation dominated by cacti and coastal sage scrub species. The presence of *Opuntia littoralis* and/or *Opuntia oricola* at 20% or more relative cover defines this community. In coastal areas, *Opuntia prolifera* may be a common element, while *Opuntia parryi* may occur in some of the interior areas. Other codominants or subdominants include *Encelia californica*, *Artemisia californica*, *Eriogonum fasciculatum*, *Salvia mellifera*, and *Sambucus mexicana*. The understory is composed of *Stipa lepida* and *Agrostis* spp. and a variety of forb species.

Southern cactus scrub occurs primarily on south-facing slopes on low foothills away from the immediate coast. It is common on Loma Ridge and the San Joaquin Hills. The habitat classification numbering system is misleading in separating southern cactus scrub (2.4) from other sagebrush and sage scrubs (2.3). Except for the codominant to dominant status of cactus species, this community differs little in vegetative composition from and intergrades with sagebrush-buckwheat, sagebrush-black sage, and mixed scrub types. Southern cactus scrub would be more accurately classified as 2.3.13, but completed and ongoing field studies have already used the 2.4 classification extensively.

2.5. Brittlebush-Buckwheat

Brittlebush-buckwheat scrub (Riversidian coastal sage scrub) is an inland, high-elevation scrub dominated by *Encelia farinosa* with *Eriogonum fasciculatum* ssp. *foliolosum*, *Mimulus longiflorus*, *Atriplex canescens*, and *Bebbia juncea*. It occurs on south-facing slopes of the Santa Ana River Canyon. In some areas, brittlebush stands may be artifacts of previous revegetation efforts.

2.6. Scalebroom

Scalebroom scrub (floodplain sage scrub) consists of phreatophytic and upland shrubs that occupy infrequently flooded and scoured habitats, such as floodplains and alluvial fans. Scalebroom scrub is dominated by a shrub cover of *Lepidospartum squamatum* with *Eriogonum fasciculatum*, *Brickellia californica*, *Artemisia californica*, *Baccharis salicifolia*, *Isocoma veneta*, *Ericameria pachylepis*, *Malosma laurina*, *Bebbia juncea*, *Heterotheca echioides* (*Chrysopsis villosa*), *Yucca whipplei*, *Senecio douglasii*, and *Romneya coulteri*. Some scattered *Platanus racemosa* are also present in these wash areas. Common forbs, grasses, and subshrubs include *Artemisia dracunculus*, *Croton californicus*, *Lotus scoparius*, *Gnaphalium* spp., *Chaenactis glabriuscula*, *Opuntia parryi*, *Elymus condensatus*, and *Lasthenia californica*.

It occurs in Coal Canyon, Santiago Canyon Creek, San Juan Creek, Santa Ana River, Upper Aliso Creek, and Arroyo Trabuco.

2.7. Quail Brush

Quail brush scrub (chenopod scrub) consists primarily of scattered to dense areas of *Atriplex lentiformis*. Other species often found in quail brush scrub include *Isocoma veneta*, *Baccharis pilularis*, *Melilotus indica*, *Atriplex semibaccata*, *Bromus rubens*, and *Mesembryanthemum crystallinum*. It typically occurs in lowland areas and along the coast, including Newport Back Bay, Dana Point, and San Clemente.

2.8. Sage Scrub-Grassland Ecotone/Sere

Sage scrub-grassland ecotone/sere is an open shrub/grassland with 5-20% shrub cover. Common shrubs include *Isocoma veneta*, *Artemisia californica*, *Ericameria palmeri*, and *Eriogonum fasciculatum*. Subshrubs and forbs are a very important and representative species and include *Corethrogyne filaginifolia*, *Ericameria pachylepis*, *Gutierrezia bracteata*, *Lotus purshianus*, *Brassica geniculata*, *Gnaphalium* spp., *Lotus scoparius*, and *Eriogonum elongatum*. Grasses often dominate the cover in these habitats and the dominant species are *Avena* spp., *Bromus* spp., *Hordeum leporinum*, *Vulpia myuros*, and *Stipa pulchra*. It occurs in many areas of the county below 1,000 feet.

2.8.1. Sagebrush-Grassland. An open cover of *Artemisia californica* is found in this grass-shrubland.

2.8.2. Buckwheat-Grassland. An open cover of *Eriogonum fasciculatum* is found in this grass-shrubland.

2.8.3. Coastal Goldenbush-Grassland. An open cover of *Isocoma veneta* is found in this grass-shrubland.

2.8.4. Box Springs Goldenbush-Grassland. An open cover of *Ericameria palmeri* is found in this grass-shrubland.

2.8.5. Mixed Sage Scrub-Grassland. This grass-shrubland has an open cover of sage scrub species with no clear dominants.

2.9. Scrub-Eucalyptus Planting

A new category, scrub-eucalyptus planting, was added to identify sites that will likely not be scrub in the near future. These sites support scrub habitat, but have been planted with rows of eucalyptus trees and laced with irrigation pipe to water the trees. In

10-20 years, the eucalyptus trees will overtop the scrub, and the scrub habitat will slowly disappear from the site.

3.0 Chaparral

Chaparral consists of evergreen, dark green sclerophyll-leaved, medium-height to tall shrubs that are preadapted to occasional wildfires.

3.1. Scrub-Chaparral Ecotone/Sere

Scrub-chaparral ecotone/sere (coastal sage-chaparral scrub) represents a gradation and intermingling of coastal sage scrub types and chaparral types. These represent ecotonal areas between chaparral and scrub communities with component species of both or seral sites and are usually patches of scrub with a strong component of chaparral species within a chaparral matrix.

3.1.1. Chamise-Sagebrush. Chamise-sagebrush is dominated by *Adenostoma fasciculatum* and *Artemisia californica*.

3.1.2. Chamise-Sage Scrub (Previously Chamise-Mixed Scrub). Chamise-sage scrub is dominated by *Adenostoma fasciculatum* and coastal scrub species other than *Artemisia californica*.

3.1.3. Scrub Oak-Sagebrush. Scrub oak-sagebrush is dominated by *Quercus berberidifolia* and *Artemisia californica*.

3.1.4. Scrub Oak-Sage Scrub (Previously Scrub Oak-Mixed Scrub). Scrub oak-sage scrub is dominated by *Quercus berberidifolia* and coastal scrub species other than *Artemisia californica*.

3.1.5. Maritime Chaparral-Sagebrush. Maritime chaparral-sagebrush scrub is dominated by *Cneoridium dumosum*, *Quercus dumosa*, and *Artemisia californica* with other scrub species as subdominants.

3.1.6. Maritime Chaparral-Sage Scrub (Previously Maritime Chaparral-Mixed Scrub). Maritime chaparral-sage scrub is dominated by *Cneoridium dumosum*, *Quercus dumosa*, and scrub species other than *Artemisia californica*.

3.2. Mixed Mid-Elevation

Mixed mid-elevation chaparral (southern mixed chaparral) consists of a mix of chaparral species and generally occurs between 1,000 and 3,000 feet in the Santa Ana

Mountains. Dominants include *Adenostoma fasciculatum*, *Malosma laurina*, *Ceanothus* spp., *Arctostaphylos* spp., *Rhamnus ilicifolia*, *Salvia mellifera*, *Mimulus aurantiacus*, *Keckiella antirrhinoides*, *Yucca whipplei*, and *Eriogonum fasciculatum*.

3.3. Chamise

Chamise chaparral is dominated by *Adenostoma fasciculatum* with *Salvia mellifera*, *Rhus ovata*, *Malosma laurina*, *Ceanothus* spp., *Eriogonum fasciculatum*, *Stipa coronata*, and *Yucca whipplei*. It occurs on xeric slopes on very shallow soils in the Santa Ana Mountains, Fremont-Gypsum-Weir Canyon area, and Loma Ridge.

3.4. Snowball Ceanothus

Snowball ceanothus (thick-leaved lilac) chaparral (*Ceanothus crassifolius* chaparral) is dominated by *Ceanothus crassifolius* with *Adenostoma fasciculatum*. Other species include *Cercocarpus betuloides*, *Rhus ovata*, *Malosma laurina* (in lower elevations), *Holodiscus discolor*, *Salvia mellifera*, and *Quercus berberidifolia*. It occurs on xeric slopes of the Santa Ana Mountains.

3.5. Bigpod Ceanothus

Bigpod ceanothus (lilac) chaparral (*Ceanothus megacarpus* chaparral) is similar to snowball ceanothus chaparral but occurs at lower elevations and is dominated by *Ceanothus megacarpus* with *Adenostoma fasciculatum*, *Cercocarpus betuloides*, *Rhus integrifolia*, *Malosma laurina*, *Malacothamnus fasciculatus*, *Yucca whipplei*, and *Rhamnus ilicifolia*. It occurs on xeric slopes in Coal-Gypsum Canyons.

3.6. Maritime

Maritime chaparral (southern maritime chaparral) consists of a diverse mix of broad-leaved evergreen shrubs characterized by occurrences of southern species with northern limits in Orange County. Maritime chaparral is dominated by *Quercus dumosa*, *Cneoridium dumosum*, *Comarostaphylis diversifolia*, *Cercocarpus minutiflorus*, *Rhamnus crocea*, and *Verbesina dissita*. Other common shrubs include *Encelia californica*, *Ribes speciosum*, *Ceanothus megacarpus*, *Ceanothus spinosus*, *Rhus integrifolia*, *Rhamnus ilicifolia*, *Adenostema fasciculatum*, *Isomeris arborea*, and *Opuntia littoralis*. It occurs at low elevations on north-facing slopes of canyons in Laguna Beach, Niguel Hill, and Aliso Canyon.

3.7. Scrub Oak

Scrub oak chaparral is dominated by *Quercus (dumosa) berberidifolia* with *Ceanothus* spp., *Cercocarpus betuloides*, *Heteromeles arbutifolia*, *Malosma laurina*, *Rhamnus californica*, *Fraxinus dipetala*, *Rhamnus californica*, and *Rhamnus ilicifolia*. Understory components include *Symphoricarpos* spp., *Elymus condensatus*, *Toxicodendron diversilobum*, *Solidago californica*, and *Penstemon heterophyllus*. It occurs on north-facing slopes in the Santa Ana Mountains, Silverado Canyon, and Upper Santiago Canyon.

3.8. Interior Live Oak

Interior live oak chaparral is dominated by *Quercus wislizenii* and *Ceanothus integerrimus*. It occurs on north-facing slopes in the Santa Ana Mountains, Upper Trabuco Canyon, Munshall Saddle, and Silverado Canyon.

3.9. Manzanita

Manzanita chaparral is dominated by *Arctostaphylos glandulosa* with *Adenostoma fasciculatum* and *Quercus berberidifolia*. It occurs at moderate to high elevations in the Santa Ana Mountains.

3.10. Montane

Montane chaparral (mixed montane chaparral) consists of low to tall shrubs dominated by *Arctostaphylos glandulosa*, *Garrya* spp., *Rhus ovata*, *Ceanothus leucodermis*, *Ceanothus integerrimus*, *Quercus berberidifolia*, *Quercus wislizenii*, and *Holodiscus* spp. It occurs at moderate to high elevations in the Santa Ana Mountains.

3.11. Nolina

Nolina chaparral is dominated by *Nolina cismontana* with *Adenostoma fasciculatum*, *Quercus berberidifolia*, *Salvia mellifera*, *Eriogonum fasciculatum*, *Eriodictyon crassifolium*, *Ceanothus crassifolius*, *Stipa coronata*, *Malosma laurina*, *Yucca whipplei*, and *Bothriochloa barbinodis*. It occurs on steep slopes in heavy but young soils between 1,000 and 3,000 feet in the Santa Ana Mountains, mostly in the frost-free zone. Stands of nolina chaparral are known from the upper end of Santiago Canyon and eastward.

3.12. Toyon-Sumac

Toyon-sumac chaparral is dominated by *Heteromeles arbutifolia*, *Malosma laurina*, and *Rhus integrifolia* in dense stands often on mesic north-facing slopes near the coast.

Other species include *Rhamnus ilicifolia*, *Ribes speciosum*, and occasionally *Quercus berberidifolia* or *Quercus dumosa*. A sparse understory of coastal sage scrub species may be present, but is nearly or completely excluded by the shade of the taller evergreen shrubs.


4.0. Grassland

Grassland consists of low herbaceous vegetation dominated by grasses. It grows in deep, well-developed soils on gentle slopes and flats, mostly at low elevations.

4.1. Annual

Annual grassland is dominated by annual grasses that are primarily Mediterranean in origin. Dominant genera include *Bromus*, *Avena*, *Vulpia*, and *Hordeum*. Many species of native forbs and bulbs, as well as naturalized annual forbs, are found in annual grassland. Floristic richness is affected to a high degree by land use activity, such as intensity and duration of grazing. Heavily grazed grasslands have lower species richness. Common forbs include *Amsinckia intermedia*, *Cryptantha* spp., *Erodium* spp., *Brassica* spp., *Centaurea melitensis*, *Hemizonia fasciculata*, *Cynara cardunculus*, *Silybum marianum*, *Lepidium* spp., *Eremocarpus setigerus*, and *Medicago polymorpha*. Other less disturbed grasslands often contain a predominance of native forbs, including *Orthocarpus purpurascens*, *Plagiobothrys* spp., *Pectocarya* spp., *Gilia angelensis*, *Sisyrinchium bellum*, *Lupinus* spp., *Calochortus* spp., *Lasthenia* spp., *Corethrogyne filaginifolia*, and *Dichelostemma pulchellum*. Annual grassland occurs on gradual slopes with deep soils below 3,000 feet elevation.

4.2. Wild Rye

 Wild rye grassland (*Elymus* grassland) consists of dense, often clonal, stands of *Elymus triticoides*, often with sycamore riparian vegetation. It is found in moist, often alkaline areas at seeps and bottomlands and occurs in Laguna, Coyote, Bonita, and Gabino Canyons and Arroyo Trabuco.

4.3. Needlegrass

Needlegrass grassland (southern coastal needlegrass grassland) is a grassland with 10% or more cover of *Stipa pulchra* and/or other *Stipa* spp. It is associated with *Agrostis diegoensis*, *Koeleria macrantha*, *Vulpia megalura*, *Bromus* spp., *Sisyrinchium bellum*, *Dichelostemma pulchellum*, *Calochortus* spp., *Bloomeria crocea*, *Hypochoeris glabra*, and *Dodecatheon clevelandii*. It is found as small pockets within coastal sage scrub areas or in annual grassland areas and occurs in the San Joaquin Hills; Talega Reserve; San Juan Creek basin; Santa Ana Mountains; Starr Ranch; Caspers Park; Plano Trabuco; and Gabino, LaPaz, Talega, and Verdugo Canyons.

4.4. Deergrass

Deergrass grassland is dominated by *Muhlenbergia rigens* with *Stipa pulchra*, *Sisyrinchium bellum*, *Juncus mexicanus*, *Carex teneraeformis*, *Clarkia purpurea*, *Sidalcea malvaeflora*, and *Euthamia (Solidago) occidentalis*. It is often associated with live oak riparian. It occurs in open grassland areas along streams in the Santa Ana Mountains.

4.5. Oak Savanna

Oak savanna (coast live oak savanna) consists of annual or needlegrass grassland with widely scattered trees (less than 10-20% canopy cover). The dominant tree is *Quercus agrifolia*. It occurs in open grassland areas near coast live oak forest/woodland in the Santa Ana Mountains.

4.6. Ruderal

Ruderal grassland (ruderal) consists of early successional grassland dominated by pioneering herbaceous plants that readily colonized disturbed ground. Ruderal grassland is dominated by many grassland species and species of the genera *Centaurea*, *Brassica*, *Malva*, *Salsola*, *Eremocarpus*, *Amaranthus*, *Atriplex*. Ruderal grassland occurs scattered throughout the county at any site that has been disturbed by either natural or human causes.

4.7. Mixed Perennial

Mixed perennial grassland is similar to needlegrass grassland except that it is dominated by a mix of perennial grass species of the genera *Poa*, *Sitanion*, *Stipa*, *Melica*, and *Koeleria*. It usually occurs at slightly higher elevations, above 1,000 feet.

4.8. Sumac Savanna

Sumac savanna consists of annual or needlegrass grassland with widely scattered laurel sumac (5-15% canopy cover).

5.0. Seasonal Wetlands

Seasonal wetlands (vernal pools, seeps, and wet meadows) consist of seasonally flooded or saturated sites dominated by nonpersistent and persistent annual and perennial herbs.

5.1. Vernal Pool

Vernal pools (southern hardpan vernal pool) are low depressions that typically are flooded and saturated above a hardpan or claypan for several weeks to a few months in winter and spring. They are vegetated primarily by annual wetland plants such as *Psilocarphus tenellus*, *Crassula (aquatica) connata*, *Callitriche* spp., *Elatine* spp., *Lythrum* spp., and small obligate perennials, such as *Eleocharis* spp., *Pilularia americana*, *Ophioglossum californicum*, *Marsilea vestita*, and *Brodiaea jolonensis*. Vernal pool plants are nonpersistent and are generally not evident during summer and fall. Vernal pools are often barren during summer or may be invaded by upland annuals after the soils have dried out. Vernal pools are known from Whiting Ranch and O'Neil Park, and formerly from Laguna Lakes.

5.2. Alkali Meadow

Alkali meadow consists of seeps and permanently or seasonally wet sites that occur in low-lying alkaline or saline soils. It is dominated by annual and perennial hydrophytes such as *Distichlis spicata*, *Bassia hyssopifolia*, *Frankenia salina*, *Malvella leprosa*, *Atriplex rosea*, *Arthrocnemum [Salicornia] subterminale*, *Aster subulatus*, *Anemopsis californica*, *Juncus mexicanus*, *Hemizonia australis*, *Cressa truxillensis*, and *Salsola australis*. Alkali meadow is usually found in inland areas with internal drainage or soils high in salts.

Meadow areas with less alkaline or saline soils are dominated by *Elymus glaucus*, *Artemisia dracuncululus*, *Melilotus albus*, *Helianthus annuus*, *Carex* spp., *Juncus mexicanus*, *Picris echioides*, and *Ambrosia psilostachya*. Other species often occur in disturbed meadow sites, such as *Lolium multiflorum*, *Sorghum halepense*, *Setaria* spp., *Bromus unioloides*, *Paspalum* spp., *Diplachne (Leptochloa) uninerva*, *Phalaris* spp., *Xanthium* spp., *Epilobium* spp., *Lactuca serriola*, and *Hemizonia australis*. Meadow habitats occur in Upper Newport Bay Ecological Reserve, San Clemente, Aliso Creek, Chino Hills, Laguna Canyon, and Santiago Canyon.

5.3. Freshwater Seep

Freshwater seep maintained by seasonal water consists of herbaceous annual and perennial hydrophytes. Water is generally present during winter and spring and may extend into summer during above-normal rainfall years. Freshwater seep is often associated with earth slumping where large blocks of earth on slopes fail and slump off downslope in generally intact units. Seasonal seeps often develop at the toe of these slump blocks and allow wetland vegetation to become established; the seeps are also characterized by rock outcrops and fault lines. Many seasonal seeps dry up during drought periods. Freshwater seep is dominated by *Polypogon* spp., *Juncus* spp., *Carex* spp., *Apium graveolens*, *Typha* spp., *Pluchea* spp., and *Elymus* spp., with *Lolium* and *Paspalum* spp. in disturbed sites. Seeps are known at Upper Newport Bay, Laguna Canyon, and Santiago Canyon.

5.4. Freshwater Swale

Freshwater swales are broad drainages that do not have clear beds and banks and are vegetated across the bottom. The vegetation is predominantly annual facultative and facultative wetland species that are often also found in vernal pools. Typical vernal swale species include *Lolium multiflorum* and *Hordeum depressum*.

6.0. Marsh

Marsh habitats consist of permanently or seasonally flooded or saturated sites dominated by persistent herbaceous plants. Marsh habitats consist of permanently, seasonally, regularly, or tidally flooded or saturated sites dominated by perennial obligate hydrophytes.

6.1. Salt Marsh

Salt marsh (southern coastal salt marsh) consists of halophytic perennial herbs and low shrubs that occur on regularly (or historically) flooded or saturated clay and silt soils that are high in salts. Salt marsh emergent wetland is dominated by *Spartina foliosa* (in low intertidal areas), *Salicornia virginica*, *Distichlis spicata*, *Monanthochloe littoralis*, *Jaumea carnosa*, *Batis maritima*, *Frankenia salina*, *Limonium californicum*, *Atriplex* spp., and *Suaeda* spp. Salt marsh occurs along the coast in estuarine habitats that are (or were historically) tidally influenced. It is found at Anaheim Bay, Bolsa Chica, and Upper Newport Bay.

6.2. Brackish Marsh

Brackish marsh (coastal brackish marsh) consists of tules and bulrushes (*Scirpus* spp.) that occur in brackish water or alkaline soils.

6.3. Alkali Marsh

Alkali marsh (cismontane alkali marsh) consists of wet or inundated areas dominated by emergent halophilic hydrophytes, such as *Scirpus robustus*, *Juncus acutus* ssp. *sphaerocarpus*, *Juncus mexicanus*, *Carex praegracilis*, *Typha domingensis*, *Anemopsis californica*, *Salicornia virginica*, *Distichlis spicata*, and *Frankenia salina*. It is found in Canada Chiquita, Lower Aliso Canyon, and Upper Newport Bay Ecological Reserve.

6.4. Freshwater Marsh

Freshwater marsh (coastal freshwater marsh) consists of seasonally or permanently flooded low-lying areas dominated by *Typha* spp. and *Scirpus* spp. with *Pluchea purpurascens*,

Polygonum lapathifolium, *Cotula coronopifolia*, *Epilobium* spp., *Pulicaria paludosa*, *Mimulus guttatus*, and *Veronica* spp. Upper marsh areas contain *Scirpus americanus*, *Cyperus* spp., *Apium graveolens*, *Conium maculatum*, *Picris echioides*, *Pulicaria* spp., *Conyza* spp., *Aster modestus*, *Paspalum* spp., *Polygonum* spp., and *Diplachne (Leptochloa) uninerva*. Freshwater marsh emergent wetland occurs in San Joaquin Marsh, Bonita Canyon Reservoir, Peters Canyon, Laguna Canyon, Santa Ana River, Upper Newport Bay, San Juan Creek, and San Juan Canyon Reservoir.

7.0. Riparian

Riparian habitats consist of trees, shrubs, or herbs that occur along watercourses and water bodies. The vegetation is adapted to flooding and soil saturation during at least a portion of its growing season.

7.1. Herbaceous

Herbaceous riparian (riparian herb) vegetation is an early successional stage of riparian scrub and forest. Flooding (or other disturbance factors) often scours woody riparian vegetation away and the site is rapidly colonized by pioneer wetland herbaceous plants such as *Verbena* spp., *Artemisia douglasiana*, *Melilotus* spp., *Paspalum* spp., *Echinochloa crusgalli*, *Cynodon dactylon*, *Typha* spp., *Cyperus* spp., *Epilobium* spp., *Oryzopsis miliacea*, *Polypogon monspeliensis*, *Diplachne (Leptochloa) uninerva*, *Xanthium* spp., *Polygonum lapathifolium*, *Sorghum halepense*, *Ambrosia psilostachya*, *Brassica* spp., *Raphanus sativa*, *Melilotus* spp., and *Veronica* spp. Flooding in these areas is frequent.

7.2. Willow Riparian Scrub

Willow riparian scrub (southern willow scrub) is dominated by willow species and saplings of riparian forest. Common willow scrub dominants include *Salix lasiolepis* and *Salix hindsiana* with lesser amounts of *Baccharis salicifolia* and *Salix gooddingii*.

7.3. Mulefat Scrub

Mulefat scrub consists of dense stands of *Baccharis salicifolia* with lesser amounts of *Salix* spp. It usually occupies intermittent streambeds, seeps, and the toe of landslides (where local seeps develop). Other associated species include *Cynodon dactylon*, *Artemisia douglasiana*, *Chenopodium* spp., *Ambrosia psilostachya*, *Solanum* spp., *Ricinus communis*, *Xanthium* spp., *Polypogon* spp., *Paspalum* spp., *Echinochloa* spp.

7.4. Sycamore Riparian Woodland

Sycamore riparian woodland (southern sycamore riparian woodland) consists of open to dense woodlands dominated by *Platanus racemosa* with *Quercus agrifolia* and scalebroom scrub, mulefat scrub, or willow riparian scrub as an understory, as well as *Rhamnus ilicifolia*, *Rhamnus californica*, *Malosma laurina*, *Sambucus mexicana*, *Ribes speciosum*, *Heteromeles arbutifolia*, *Toxicodendron diversilobum*, *Elymus condensatus*, *Elymus triticoides*, and *Rhus integrifolia*. Large grassland areas dominated by *Bromus* are often present. Examples are found on large intermittent streams throughout the county, including Santiago Creek, Arroyo Trabuco, Aliso Creek, and San Juan Creek.

7.5. Coast Live Oak Riparian Forest

Coast live oak riparian forest (southern coast live oak riparian forest) is dominated by *Quercus agrifolia* with *Platanus racemosa*, *Sambucus mexicana*, and *Juglans californica*. Common understory shrubs include *Rhamnus ilicifolia*, *Baccharis salicifolia*, *Toxicodendron diversilobum*, *Heteromeles arbutifolia*, *Rhamnus californica*, *Isocoma veneta*, *Malosma laurina*, and *Solanum* spp. It is found in large intermittent drainages and creeks. In the smaller drainages, it is often found in narrow ravines in which it intergrades with the oak woodland community. Examples of this community are found along Santiago Creek, Aliso Creek, Arroyo Trabuco, and San Juan Creek.

7.6. Arroyo Willow Riparian Forest

Arroyo willow riparian forest (southern arroyo willow forest) has a closed canopy of *Salix lasiolepis* in arborescent form. The understory is similar in composition to the black willow forest. The forest occurs on floodplains along major streams and rivers. Examples are found on the banks of the Santa Ana River, Santiago Creek, and San Juan Creek.

7.7. Black Willow Riparian Forest

Black willow riparian forest (southern black willow forest) is a multilayered forest with a canopy dominated by *Salix gooddingii* with some *Salix laevigata* and *Salix lasiolepis*. The subcanopy layer contains *Salix lasiolepis* and *Baccharis salicifolia*. *Quercus agrifolia* and *Platanus racemosa* are occasionally present on the outer margins of this forest. The understory is composed of different associations of species such as *Urtica dioica*, *Toxicodendron diversilobum*, *Artemisia douglasiana*, *Ambrosia psilostachya*, *Rumex* spp., *Brassica* spp., *Solanum* spp., *Conium maculatum*, *Silybum marianum*, and *Rubus ursinus*. The habitat develops on floodplains along major rivers and streams. Examples of this community are found along the Santa Ana River, Santiago Creek, and San Juan Creek.

7.8. Cottonwood-Willow Riparian Forest

Cottonwood-willow riparian forest (southern cottonwood-willow riparian forest) is a multilayered forest community dominated by cottonwoods and willows with other tree species at low numbers and percent cover. It is typically lower on the floodplain than the other forest types. Cottonwood-willow riparian forest is dominated by *Salix gooddingii*, *Populus fremontii*, *Populus trichocarpa*, and *Salix laevigata*. A second canopy layer of *Salix lasiolepis*, *Baccharis salicifolia*, *Toxicodendron diversilobum*, *Amorpha fruticosa*, and *Vitis girdiana* is often found. The understory is composed of *Urtica (holosericea) dioica*, *Phacelia ramosissima*, *Rumex* spp., and *Rubus ursinus*. Several invasive weedy species, principally *Arundo donax*, *Ricinus communis*, and *Nicotiana glauca*, are often found within or beside these forest areas. This community is found on floodplains of major rivers and streams. Examples are found on the Santa Ana River, Santiago Creek (Villa Park Dam), and San Juan Creek.

7.9. White Alder Riparian Forest

White alder riparian forest is a montane riparian community found along perennial streams at elevations over 4,000 feet. The riparian forest is dominated by *Alnus rhombifolia* with *Salix laevigata* and occasionally *Populus trichocarpa*, *Umbellularia californica*, and *Acer macrophyllum*. *Artemisia douglasiana*, *Rosa californica*, and *Rubus ursinus* typically occur in the understory layer.

7.10. Canyon Live Oak Ravine Forest

Canyon live oak ravine forest is a montane riparian community of steep headwaters of mainstreams and is dominated by *Quercus chrysolepis*, *Acer macrophyllum*, *Quercus agrifolia*, *Umbellularia californica*, *Pseudotsuga macrocarpa*, and *Quercus wislizenii*. This community is typically a montane riparian forest found in the steep headwaters of streams in the Santa Ana Mountains, including Maple Springs, Bear Springs, Pine Canyon, and Upper Trabuco Canyon.

7.11. Bramble Thicket

Bramble thicket is dominated by perennial vines and bushes, such as *Rubus ursinus* and *Rosa californica*. Scattered willow and cottonwood saplings and shrubs can occur as well but must be less than 20% cover. Bramble thickets occurring under a tree canopy should be mapped as riparian forest.

8.0. Woodland

Woodland (woodland habitats) consists of a multilayered vegetation with a canopy that is 20-80% tree cover (see "9.0. Forest" for denser canopy cover types).

8.1. Coast Live Oak Woodland

Coast live oak woodland is dominated by *Quercus agrifolia* with associated shrubs such as *Quercus berberidifolia*, *Rhamnus ilicifolia*, *Rhamnus californica*, *Heteromeles arbutifolia*, *Ribes* spp., *Sambucus mexicana*, *Symphoricarpos* spp., and *Toxicodendron diversilobum*. The herbaceous layer is composed of *Solidago californica*, *Elymus glaucus*, *Elymus condensatus*, *Melica* spp., *Stellaria* spp., *Claytonia* spp., *Bromus diandrus*, *Marah* spp., *Solanum* spp., *Phacelia* spp., and *Eucrypta crysantha*. It is found in foothills throughout Orange County, including the Gypsum-Fremont Canyon area, Loma Ridge, Santa Ana Mountains, Rancho Mission Viejo, and the Talega Reserve area.

8.2. California Walnut Woodland

California walnut woodland (walnut woodland) is dominated by *Juglans californica* with less dominant species of *Quercus agrifolia* and *Sambucus mexicana*. The understory consists of annual grassland species, such as *Avena* spp., *Galium aparine*, *Brassica* spp., *Elymus* spp., and *Bromus* spp. California walnut woodland typically occurs on inland foothills along gradual to moderate slopes. Examples are located in the Chino Hills, Tonner Canyon, Brea, and Santa Ana Canyon.

8.3. California Juniper Woodland

California juniper woodland (cismontane juniper woodland) is an open woodland dominated by *Juniperus californica* with an understory of coastal sage vegetation. The woodland develops on xeric slopes above 500 feet elevation. It has been located only at the Rancho Mission Viejo TRW site and the Claymine leasehold.

8.4. Mexican Elderberry Woodland

The Mexican elderberry woodland is an open woodland found on stream benches characterized by *Sambucus mexicana*. Scattered *Malosma laurina*, *Heteromeles arbutifolia*, and *Rhus integrifolia* may be found on these open grassy benches. It is found in foothill areas throughout the county and on the upper benches of streamcourses and is often associated with sycamore riparian woodland.

9.0. Forest

Forest (forest habitats) consists of multilayered vegetation with a closed, dense tree canopy.

9.1. Coast Live Oak Forest

Coast live oak forest is similar in composition to the coast live oak woodland described above, but with an 80% or greater canopy cover. The forest develops on moist, north-facing slopes in foothill portions of the county. Representative examples are found in the San Joaquin Hills, Loma Ridge, and the Santa Ana Mountains.

9.2. Canyon Live Oak Forest

Canyon live oak forest is similar in composition to the coast live oak forest, but is dominated by *Quercus chrysolepis*. The habitat occurs in the Santa Ana Mountains.

9.3. Coulter Pine Forest

Coulter pine forest is characterized as an open forest of *Pinus coulteri* with an understory of *Arctostaphylos* spp., *Adenostoma fasciculatum*, and *Ceanothus* spp. The forest develops on xeric mountain and foothill slopes above 2,000 feet elevation. It occurs in the Santa Ana Mountains.

9.4. Knobcone Pine Forest

Knobcone pine forest is dominated by *Pinus attenuata* with *Ceanothus papillosus*, *Arctostaphylos glandulosa*, *Ribes malvaceum*, *Adenostoma fasciculatum*, and *Heteromeles arbutifolia*. Knobcone pine forest occurs on serpentinite on Pleasants Peak in the Santa Ana Mountains.

9.5. Tecate Cypress Forest

Tecate cypress forest (southern interior cypress forest) is characterized by dense stands of *Cupressus guadalupensis*. A variety of shrub species are found in the understory, including *Salvia mellifera*, *Lepechinia cardiophylla*, *Rhamnus californica*, *Arctostaphylos glauca*, *Ceanothus crassifolius*, *Nolina cismontana*, *Ceanothus tomentosus*, *Yucca whipplei*, and *Eriodictyon crassifolium*. Tecate cypress forest is found on xeric slopes in Coal-Gypsum Canyons and Fremont Canyon.

9.6. Bigcone Spruce Forest

Bigcone spruce forest (bigcone spruce-canyon live oak forest) is dominated by *Pseudotsuga macrocarpa* and *Quercus chrysolepis* with lesser amounts of *Quercus wislizenii*, *Quercus agrifolia*, *Acer macrophyllum*, *Umbellularia californica*, and *Fraxinus dipetala*. The forest develops in steep canyons, above 2,000 feet elevation in the Santa Ana Mountains.

9.7. Interior Live Oak Forest

Interior live oak forest is similar to canyon live oak forest but is dominated by *Quercus wislizenii*. It typically occurs at elevations above 2,000 feet in the Santa Ana Mountains.

10.0. Cliff and Rock

Cliff and rock habitats are characterized by an assortment of vascular plants and lichens. The vegetation composition depends on the amount of water and site conditions of a particular cliff habitat.

10.1. Xeric

Xeric cliffs (xeric cliff faces) are dominated by a mix of vascular plant and lichen species. The habitat typically develops on inland, south- or southwest-facing slopes, and coastal bluffs. Examples are found in the Santa Ana Mountains, Santiago Canyon, Modjeska Peak, Upper Holy Jim Canyon, and Silverado Canyon.

10.1.1. Vascular Plant. Vascular plants of xeric cliff habitats include *Brickellia californica*, *Eriogonum elongatum*, *Salvia columbariae*, *Selaginella bigelovii*, *Pellaea mucronata*, *Phacelia minor*, *Dudleya* spp., *Muhlenbergia microsperma*, *Filago californica*, *Lupinus excubitus*, *Yucca whipplei*, *Stipa coronata*, *Lotus strigosus*, *Streptanthus heterophyllus*, *Eriastrum sapharinum*, *Chaenactis artemisiaefolia*, and *Gnaphalium bicolor*.

10.1.2. Lichen. Lichen xeric cliff and rock faces are dry, south-facing exposures of consolidated substrates that are dominated by crustose- and foliose-type lichens and have no or only widely scattered vascular plants.

10.2. Mesic

Mesic cliffs (mesic cliff faces) are dominated by a mix of vascular plants and lichen and moss species. This habitat typically occurs in moist canyons and ravines near a perennial water source. Examples are found in the Santa Ana Mountains, Loma Ridge, the San Joaquin Hills, Laguna Beach, Gypsum-Fremont-Weir Canyons, San Juan Canyon, Hot

9.0. Forest

Forest (forest habitats) consists of multilayered vegetation with a closed, dense tree canopy.

9.1. Coast Live Oak Forest

Coast live oak forest is similar in composition to the coast live oak woodland described above, but with an 80% or greater canopy cover. The forest develops on moist, north-facing slopes in foothill portions of the county. Representative examples are found in the San Joaquin Hills, Loma Ridge, and the Santa Ana Mountains.

9.2. Canyon Live Oak Forest

Canyon live oak forest is similar in composition to the coast live oak forest, but is dominated by *Quercus chrysolepis*. The habitat occurs in the Santa Ana Mountains.

9.3. Coulter Pine Forest

Coulter pine forest is characterized as an open forest of *Pinus coulteri* with an understory of *Arctostaphylos* spp., *Adenostoma fasciculatum*, and *Ceanothus* spp. The forest develops on xeric mountain and foothill slopes above 2,000 feet elevation. It occurs in the Santa Ana Mountains.

9.4. Knobcone Pine Forest

Knobcone pine forest is dominated by *Pinus attenuata* with *Ceanothus papillosus*, *Arctostaphylos glandulosa*, *Ribes malvaceum*, *Adenostoma fasciculatum*, and *Heteromeles arbutifolia*. Knobcone pine forest occurs on serpentinite on Pleasants Peak in the Santa Ana Mountains.

9.5. Tecate Cypress Forest

Tecate cypress forest (southern interior cypress forest) is characterized by dense stands of *Cupressus guadalupensis*. A variety of shrub species are found in the understory, including *Salvia mellifera*, *Lepechinia cardiophylla*, *Rhamnus californica*, *Arctostaphylos glauca*, *Ceanothus crassifolius*, *Nolina cismontana*, *Ceanothus tomentosus*, *Yucca whipplei*, and *Eriodictyon crassifolium*. Tecate cypress forest is found on xeric slopes in Coal-Gypsum Canyons and Fremont Canyon.

9.6. Bigcone Spruce Forest

Bigcone spruce forest (bigcone spruce-canyon live oak forest) is dominated by *Pseudotsuga macrocarpa* and *Quercus chrysolepis* with lesser amounts of *Quercus wislizenii*, *Quercus agrifolia*, *Acer macrophyllum*, *Umbellularia californica*, and *Fraxinus dipetala*. The forest develops in steep canyons, above 2,000 feet elevation in the Santa Ana Mountains.

9.7. Interior Live Oak Forest

Interior live oak forest is similar to canyon live oak forest but is dominated by *Quercus wislizenii*. It typically occurs at elevations above 2,000 feet in the Santa Ana Mountains.

10.0. Cliff and Rock

Cliff and rock habitats are characterized by an assortment of vascular plants and lichens. The vegetation composition depends on the amount of water and site conditions of a particular cliff habitat.

10.1. Xeric

Xeric cliffs (xeric cliff faces) are dominated by a mix of vascular plant and lichen species. The habitat typically develops on inland, south- or southwest-facing slopes, and coastal bluffs. Examples are found in the Santa Ana Mountains, Santiago Canyon, Modjeska Peak, Upper Holy Jim Canyon, and Silverado Canyon.

10.1.1. Vascular Plant. Vascular plants of xeric cliff habitats include *Brickellia californica*, *Eriogonum elongatum*, *Salvia columbariae*, *Selaginella bigelovii*, *Pellaea mucronata*, *Phacelia minor*, *Dudleya* spp., *Muhlenbergia microsperma*, *Filago californica*, *Lupinus excubitus*, *Yucca whipplei*, *Stipa coronata*, *Lotus strigosus*, *Streptanthus heterophyllus*, *Eriastrum sappharinum*, *Chaenactis artemisiaefolia*, and *Gnaphalium bicolor*.

10.1.2. Lichen. Lichen xeric cliff and rock faces are dry, south-facing exposures of consolidated substrates that are dominated by crustose- and foliose-type lichens and have no or only widely scattered vascular plants.

10.2. Mesic

Mesic cliffs (mesic cliff faces) are dominated by a mix of vascular plants and lichen and moss species. This habitat typically occurs in moist canyons and ravines near a perennial water source. Examples are found in the Santa Ana Mountains, Loma Ridge, the San Joaquin Hills, Laguna Beach, Gypsum-Fremont-Weir Canyons, San Juan Canyon, Hot

Springs Canyon, Trabuco Canyon, Santiago Canyon, Spruce Canyon, Laurel Canyon, and Aliso Canyon.

10.2.1. Vascular Plant. Vascular plants found on mesic cliffs include *Mirabilis californica*, *Selaginella bigelovii*, *Phacelia* spp., *Pellaea andromedaefolia*, *Dudleya lanceolata*, *Antirrhinum* spp., *Polypodium californicum*, *Pityrogramma triangularis*, *Notholaena newberryi*, and *Pterostegia drymarioides*. Species of lichens and mosses and liverworts may also be present.

10.2.2. Lichen and Moss. Lichen and moss mesic cliffs occur on north-facing slopes and are often associated with seasonal seeps. This habitat is dominated by foliose- and crustose-type lichens, mosses, and liverworts. The mosses and liverworts may appear only seasonally.

10.3. Rock Outcrops

Rock outcrops are similar to xeric vascular plant cliffs but occur on gentler slopes dominated by different combinations of *Ericameria pinifolia*, *Plantago erecta*, *Vulpia megallura*, *Croton californicus*, *Calycadenia tenella*, *Dudleya multicaulis*, *Chorizanthe staticoides*, *Euphorbia albomarginata*, *Crassula erecta*, *Eriastrum sappharinum*, *Selaginella bigelovii*, and species of *Aristida*, *Micropus*, *Stylocline*, *Filago*, and *Cryptantha*. Rock outcrops occur in the Santa Ana Mountains, Loma Ridge, the San Joaquin Hills, and Gypsum-Fremont-Weir Canyons.

11.0. Marine and Estuarine

Marine and estuarine (marine and coastal) habitats occur along the coastal shore (marine) and inland areas where saltwater mixes with freshwater (estuarine).

11.1. Marine Subtidal and Open Water

11.1.1. Algal. The most conspicuous algal subtidal communities are the giant kelp forests, which consist of *Nereocystis*, *Macrocystis*, and *Pelagophycus* at the uppermost layer. Other species, including *Pterygophora*, *Calliathron*, and *Plocamium*, form a lower canopy layer. Filamentous green algae and encrusting coralline algae cover the bottom substrate. Phytoplankton, diatoms, and blue-green algae are found in the open water areas.

11.2. Estuarine

11.2.1. Algal. These sheltered waters contain a great diversity of phytoplankton and filamentous blue-green and green algae.

11.2.2. Vascular Plant. These sheltered waters often contain large beds of *Zostera marina*. Channels within the estuary may also contain *Ruppia maritima*.

11.3. Rocky Intertidal

11.3.1. Algal. Algal habitats contain red, green, blue-green, and brown algae species. High intertidal genera include *Endocladia*, *Pelvetia*, and *Fucus*. The genera *Caldophora*, *Polysiphonia*, *Iridaea*, *Corallina*, *Egregia*, and *Halosaccion* are found in the midtidal zone. The low-tide zone includes species of the genera *Laminaria*, *Prionitis*, *Postelsia*, and *Iridaea* with *Cystoseira*, *Gelidium*, and *Eisenia* being found at the lowest levels.

11.3.2. Vascular Plant. Vascular plant habitat of intertidal areas is composed of *Phyllospadix* spp.

11.4. Beach (Sand)

11.4.1. Algal. The beach areas contain several species of diatoms and some filamentous blue-green and green algae.

11.5. Tidal Flats (Mud)

11.5.1. Algal. Algal habitats within the intertidal mudflats are dominated by dense stands of diatoms and mats of filamentous blue-green and green algae (*Enteromorpha*).

11.5.2. Vascular Plant. Subtidal to the intertidal zone, they contain areas dominated by *Zostera marina* along with several algal species.

12.0. Lakes, Reservoirs, and Basins

Lakes, reservoirs, and basins are bodies of open water that may support vegetation tolerant of or requiring permanently flooded conditions.

12.1. Open Water

These bodies of water often contain several phytoplankton species and filamentous blue-green and green algae. In shallow water, vascular species including *Zannichellia palustris*, *Azolla filiculoides*, and *Lemna* spp. may be found floating on the water surface. Other taxa may include species of *Potamogeton*, *Myriophyllum*, *Elatine*, or *Najas guadalupensis*.

12.2. Fluctuating Shorelines

The margins of the shorelines may contain occasional *Salix lasiolepis* or *Baccharis salicifolia* and some marsh species exist, such as species of *Juncus*, *Scirpus*, *Cyperus*, *Eleocharis*, *Typha*, and *Rumex*. Often there may be areas supporting invasive grasses and forbs, including *Cynodon dactylon*, *Diplachne uninervia*, *Echinochloa* spp., *Crypsis schoenoides*, *Lippia* spp., *Rumex* spp., *Polygonum lapathifolia*, *Setaria* spp., *Chenopodium* spp., *Malvella leprosa*, and *Amaranthus* spp.

12.3. Basins

Drying basins often contain vegetation similar to the herbaceous riparian community (7.1) or fluctuating shorelines (12.2). Some areas can develop a ruderal type of vegetation (4.6).

13.0. Watercourses

Water courses include flood control channels, streams, and rivers.

13.1. Perennial Rivers and Streams

See riparian habitats 7.1 through 7.10 for descriptions of vegetated portions of channels.

13.2. Intermittent Streams and Creeks

See riparian habitats 7.1 through 7.10 for descriptions of vegetated portions of channels.

13.3. Ephemeral Drainages and Washes

See riparian habitats 7.1 through 7.5, and 7.10, and scalebroom scrub (2.6).

13.4. Flood Control Channels

Flood control channels are usually unvegetated, but vary greatly and may support riparian habitats 7.1 through 7.3.

14.0. Agriculture

Agriculture consists of annual crops, vineyards, orchards, dairies, and stockyards.

14.1. Dryland Crops

Dryland crops (dryland field crops) consist of planted crops, annual grasses, and forbs harvested for livestock feed. Planted genera include species of *Hordeum*, *Avena*, and *Trifolium*. This type of dryland farming occurs throughout the low-lying foothill and valley portions of the county.

14.2. Irrigated

Irrigated crops (irrigated row and field crops) are scattered throughout nonmountainous portions of the county.

14.3. Orchard and Vineyard

Orchards and vineyards are scattered throughout bottomland portions of the county and include a variety of fruit and nut trees and vines.

14.4. Dairies, Stockyards, and Stables

Dairies and stockyards are areas that hold a concentrated number of livestock. Stockyards have zero to low vegetation cover.

14.5. Other

Other (other agriculture) includes all livestock and farming activities not mentioned above.

14.6. Nurseries

Nursery operations are found in lowland areas throughout the county.

15.0. Developed

Developed sites include urban areas, roads, parks, and clear and graded sites.

15.1. Urban and Commercial

Urban and commercial include all building, pavement, and highway rights-of-way (except freeways and arterial highways, see Section 15.4 "Transportation") throughout incorporated portions of the county.

15.2. Rural

Rural (rural residential) areas are characterized as scattered buildings in the fringes of urban areas and throughout unincorporated portions of the county.

15.3. Nonurban Commercial/Industrial/Institutional

These include scattered commercial/industrial buildings or such institutional facilities, such as sewage treatment plants outside any existing urban zone.

15.4. Transportation

Freeways and the arterial highway system are mapped in this category.

15.5. Ornamental Landscaping

Ornamental landscaping (parks and ornamental plantings) consists of introduced trees, shrubs, flowers, and turf grass. Ornamental landscaping occurs in greenbelts, parks, and horticultural plantings throughout the county.

15.6. Other Developed Areas

Other developed areas are developed sites that do not fall under one of the categories described above.

16.0. Disturbed

16.1. Disturbed or Barren

Disturbed or barren (cleared or graded) areas either lack vegetation or are dominated by a sparse cover of ruderal vegetation, such as *Centaurea melitensis*, *Avena fatua*, *Brassica nigra*, *Sonchus asper*, and *Lactuca serriola*.

16.2. Other Disturbed Areas

Other disturbed areas are sites that have disturbed soil but do not fall under the disturbed or barren category.

16.3. Burned Areas

This is used to characterize all recently burned areas found in the county. This is used as a "dual" mapping unit, noted by this unit plus an estimate of the vegetation unit that existed before the burn occurred or recovering following the burn.

16.4. Mined Areas

These areas are disturbed by sand and gravel or other mining projects.

DICHOTOMOUS KEY TO SCRUB AND CHAPARRAL HABITATS

The following key to sagebrush and sage scrub and chaparral communities was prepared by Jones & Stokes Associates to assist in field identification of habitats during surveys conducted at parks, open space areas, and The Irvine Company property in Orange County. Infrequently encountered near-coast habitats are not included in the key; these are dune scrub (1.2), coastal bluff scrub (2.1), and maritime succulent scrub (2.2). Scalebroom scrub (2.6) and quail brush scrub (2.7) also are not included in the key. The key, in conjunction with habitat descriptions, provided guidance for Jones & Stokes Associates field botanists during mapping efforts in spring and summer 1992. Species considered characteristic chaparral and scrub shrubs are identified in Table 1.

SCRUB, CHAPARRAL, AND ECOTONES

- 1) Chaparral shrub species comprising more than 50% of the shrub cover . . . (B)
Chaparral (3.0)

- 1) Chaparral shrub species comprising less than 50% cover of the shrub cover with more than 50% cover of coastal scrub species . . . 2
- 2) Chaparral shrub species comprising more than 20% of the shrub cover . . . **Scrub-Chaparral Ecotone/Sere (3.1)**
- 2) Chaparral shrubs comprising less than 20% cover of the shrub cover with more than 80% cover by coastal scrub shrubs . . . **(A) Coastal Scrub (2.0)**

(A) SCRUB (2.0)

- 1) *Opuntia* spp. comprises more than 20% of shrub cover . . . **Cactus Scrub (2.4)**
- 1) Less than 20% percent cover by cactus species . . . 2
- 2) *Artemesia californica* the dominant or a codominant species . . . 3
- 3) *Artemesia californica* comprises more than 80% of shrub cover . . . **Sagebrush Scrub (2.3.6)**
- 3) *Artemesia californica* comprises less than 80% of shrub cover . . . 4
- 4) *Salvia* spp. present as dominant or codominant shrub with sagebrush . . . 5
- 5) *Salvia mellifera* and *Artemesia californica* codominant . . . **Sagebrush-Black Sage Scrub (2.3.8)**
- 5) *Salvia mellifera* not a codominant . . . 6
- 6) *Salvia leucophylla* dominant or codominant with *Artemesia californica* and other coastal scrub species . . . **Purple Sage Scrub (2.3.3)**
- 6) *Salvia apiana* dominant or *Salvia apiana* and *Artemesia californica* codominant . . . **White Sage Scrub (2.3.5)**
- 4) *Salvia* spp. not dominant and not the second highest cover value . . . 7
- 7) *Eriogonum fasciculatum* and *Artemesia californica* codominants . . . **Sagebrush-Buckwheat Scrub (2.3.1)**

- 7) *Eriogonum fasciculatum* not codominant . . . 8
 - 8) *Mimulus aurantiacus* and *Artemisia californica* codominants . . . **Sagebrush-Monkeyflower Scrub (2.3.2)**
 - 8) *Baccharis pilularis* var. *consanguinea* and *Artemisia californica* codominant . . . **Sagebrush-Coyote Brush Scrub (2.3.12)**
- 2) *Artemisia californica* not a dominant or codominant species . . . 9
 - 9) *Eriogonum fasciculatum* the dominant species or codominant with *Encelia farinosa* . . . 10
 - 10) *Eriogonum fasciculatum* comprises more than 80% of shrub cover with *Artemisia californica* not present . . . **Buckwheat Scrub (2.3.7)**
 - 10) *Encelia farinosa* the dominant species or codominant with *Eriogonum fasciculatum* . . . **Brittlebush-Buckwheat Scrub (2.5)**
 - 9) *Eriogonum fasciculatum* not the dominant species or codominant with *Encelia farinosa* . . . 11
 - 11) *Malacothamnus fasciculatus* the dominant species or codominant with *Salvia mellifera*. . . **Bush mallow scrub (2.3.1.)**
 - 11) *Malacothamnus fasciculatus* not the most dominant or second most dominant species . . . 12
 - 12) *Salvia mellifera* or *Baccharis pilularis* var. *consanguinea* clearly the dominant species . . . 12
 - 13) *Salvia mellifera* the dominant species with *Artemisia californica* not a codominant and *Artemisia californica* comprising less than 20% of shrub cover . . . **Black Sage Scrub (2.3.4)**
 - 13) *Baccharis pilularis* var. *consanguinea* the dominant species with *Artemisia californica* not a codominant and *Artemisia californica* comprising less than 20% of shrub cover . . . **Coyote Brush Scrub (2.3.9)**
- 12) No clearly dominant species, the shrub cover an even mix of four or more coastal sage scrub species with *Artemisia californica* not a codominant or present at less than 20% cover;

in some instances, *Encelia californica* may be the dominant shrub . . . **Mixed Scrub (2.3.10)**

(B) CHAPARRAL (3.0)

- 1) *Nolina cismontana* occurring as part of the dominant cover, at greater than 20% cover . . . **Nolina Chaparral (3.11)**
- 1) *Nolina cismontana* not part of the dominant cover . . . 2
- 2) *Adenostema fasciculatum*, *Arctostaphylos* spp., or *Ceanothus* spp. present as dominant shrubs . . . 3
- 3) *Adenostema fasciculatum* the dominant species, at greater than 50% cover . . . **Chamise Chaparral (3.3)**
- 3) *Adenostema fasciculatum* not the dominant species, at less than 50% cover . . . 4
- 4) Cover a mix of shrubs with manzanita important to the total cover . . . 5
- 5) *Arctostaphylos* spp. the dominant species, at greater than 50% cover . . . **Manzanita Chaparral (3.9)**
- 5) *Arctostaphylos* spp. codominant with a mix of other chaparral shrubs . . . 6
- 6) Even mix of *Adenostema fasciculatum*, *Malosma laurina*, *Ceanothus* spp., and Manzanita, usually between 1,000 and 3,000 feet elevation . . . **Mixed Mid-Elevation Chaparral (3.2)**
- 6) *Arctostaphylos* spp. codominant with *Adenostema fasciculatum*, and *Quercus berberidifolia* at mid-elevations to high elevations . . . **Montane Chaparral (3.10)**
- 4) Cover dominated by *Ceanothus* spp., with *Ceanothus* spp. at greater than 50% cover . . . 7
- 7) *Ceanothus crassifolius* the dominant species at over 50% cover . . . **Snowball (*Ceanothus*) Chaparral (3.4)**
- 7) *Ceanothus megacarpus* the dominant species at over 50% cover . . . **Bigpod (*Ceanothus*) Chaparral (3.5)**

- 2) *Adenostema fasciculatum*, *Arctostaphylos* spp., or *Ceanothus* spp. not dominant . . . 8
- 8) Shrubby *Quercus* spp. the dominant cover . . . 9
 - 9) *Quercus berberidifolia* the dominant species . . . **Scrub Oak Chaparral (3.7)**
 - 9) *Quercus berberidifolia* not the dominant species . . . 10
 - 10) *Quercus dumosa* the dominant species or codominant in a mix of coastal chaparral species . . . **Maritime Chaparral (3.6)**
 - 10) *Quercus wislizenii* var. *frutescens* the dominant species . . . **Interior Live Oak Chaparral (3.8)**
- 8) *Heteromeles arbutifolia* or a mix of *Heteromeles arbutifolia* and *Malosma laurina* forming the dominant cover in dense stands . . . **Toyon-Sumac Chaparral (3.12)**

(C) SCRUB-CHAPARRAL ECOTONE/SERE (3.1)

- 1) *Artemisia californica* part of the dominant cover of the ecotone/sere . . . 2
- 2) *Adenostema fasciculatum* present as the most important chaparral species . . . **Chamise-Sagebrush (3.1.1)**
- 2) *Adenostema fasciculatum* not present as the most important chaparral species . . . 3
- 3) Shrubby *Quercus* spp. present as the most important chaparral species . . . 4
 - 4) *Quercus berberidifolia* present as the most important chaparral species . . . **Scrub Oak-Sagebrush (3.1.3)**
 - 4) *Quercus dumosa* present as the most important chaparral species . . . **Maritime Chaparral-Sagebrush (3.1.5)**
- 3) Other chaparral species present as the dominant chaparral component (e.g., *Heteromeles arbutifolia*, *Arctostaphylos* spp., *Ceanothus* spp.) . . . **Scrub-Chaparral Ecotone/Sere (3.1)**
- 1) *Artemisia californica* not part of the dominant cover of the Ecotone/Sere . . . 2

- 2) *Adenostema fasciculatum* present as the most important chaparral species . . . **Chamise-Sage Scrub (3.1.2)**
- 2) *Adenostema fasciculatum* not present as the most important chaparral species . . . 3
- 3) Shrubby *Quercus* spp. present as the most important chaparral species . . . 4
 - 4) *Quercus berberidifolia* present as the most important chaparral species . . . **Scrub Oak-Sage Scrub (3.1.4)**
 - 4) *Quercus dumosa* present as the most important chaparral species . . . **Maritime Chaparral-Sage Scrub (3.1.6)**
- 3) Other chaparral species present as the dominant chaparral component (e.g., *Heteromeles arbutifolia*, *Arctostaphylos* spp., *Ceanothus* spp.) . . . **Scrub-Chaparral Ecotone/Sere (3.1)**

CITATIONS

Printed References

Dames & Moore and David Bramlet Consulting Biologist. 1992. Habitat classification system: Orange County natural resources geographic information system (GIS) project. Prepared for the County of Orange Environmental Management Agency, Santa Ana, CA.

Personal Communications

Roberts, Fred. Biologist. U.S. Fish and Wildlife Service, Carlsbad, CA. January 14, 1993 - telephone conversation discussing USFWS comments on draft vegetation survey methods and habitat descriptions for Orange County.