SAN DIEGO
NATIVE VEGETATION
MAPPING PROJECT

Prepared for:

California Department of Fish and Game
Endangered Plant Program

May, 1985

Vegetation Mapping and Text - Teresa M. Polanski

Cartography - Karen Collins
- Susan Walter
- Teresa M. Polanski

Contract Admininistator - Dr. Barbara Fredrich
Department of Geography
San Diego State University

For copies or information on maps, contact:

California Department of Fish and Game
Endangered Plant Program
1416 9th Street
Sacramento, CA 95814
(916) 324-3814

SAN DIEGO NATIVE VEGETATION
MAPPING PROJECT

TABLE OF CONTENTS

INTRODUCTION

A. Background

The City of San Diego is the nation's seventh largest city in area. As of July 1, 1984, it contained 207,199 acres, or 323.8 square miles of land. An additional 3,956 acres, located in the Otay Mesa area, was annexed in early 1985. Currently, 64 percent of the city's total area is urbanized and projections indicate that within the next twenty years, the majority of the remaining land will be urbanized.

The City of San Diego is located in what is called the coastal province of San Diego County. This region's unique topography, in combination with local climatic factors and soil types, enable the area to support a variety of vegetation associations, including some localized plant communities, such as Vernal Pools and Torrey Pine Woodlands. The region also harbors many endemic plant species, and several state and federally listed endangered or rare plant species.

In order to determine the best areas to protect for state and federally listed plant species, the California Department of Fish and Game Endangered Plant Program contracted with San Diego State University for a project which involved mapping the extent of native vegetation that remains in the City of San Diego and vicinity. The resulting vegetation maps were produced to be used in conjunction with the Department's Natural Diversity Data Base (NDDB) endangered species distribution maps to determine biologically appropriate areas needing preservation. The maps will also be made available to other agencies and planners wanting information on local vegetation.

B. Summary of Project Results

The results of this project are a set of 1 inch = 2,000 feet (1:24,000) scale mylar maps showing the extent of natural vegetation which remains in the City of San Diego and vicinity. Vegetation was mapped according to its general type using the NDDB plant community list, other plant community lists, and information from local biologists as a guide. Eight vegetation associations are shown on the maps. A text describing each of the vegetation types and discussing the methods and sources of information used to map the vegetation is provided.

I. VEGETATION MAPS

A. Methods

All preliminary mapping of vegetation was done on 1 in. = 2,000 ft. scale blueline copies of county regional base maps. Information on vegetation was gathered from various sources, and initial mapping was done with colored pencils using different colors to represent the plant communities. For the final mapping, vegetation boundaries were directly transferred to an identical mylar copy of the base map by tracing. Vegetation associations were then labled with a two letter abbreviation, using rub-on 10 point zipatone letters.

The San Diego County regional base maps were selected for use, rather than the USGS 7.5 minute topographic maps and the City 1 in. = 800 ft. scale maps provided at the beginning of the project, for several reasons.

The County regional maps, which are produced and available through the County General Services Mapping Division, are periodically updated to reflect current changes in urbanization. The set of quads 13, 18, and 19 used for this project are dated 6/24/82. These maps also show more detail regarding streets, roads and municipal boundary lines.

Since the county maps are the same size and scale as the USGS maps, they can be used with the NDDB endangered species overlay maps. Additionally, they do not have any coloring or shading which may be distracting with the use of overlays. A scale of 1 in. = 2,000 ft. was chosen because it was more practical then the 1 inch = 800 feet scale maps for a vegetation mapping project of this size within the time frame available.

Mylar copies of the vegetation maps were chosen as the final product since these can be reproduced a number of ways--blueline, black-line, or photocopying--thus, making them easily available to other persons or agencies interested in information about local vegetation. The mylars themselves can later be added to or altered if needed and, thus, be kept updated.

B. Information Sources

Areas of vegetation were mapped by utilizing information from various sources. These included Environmental Impact Reports (EIRs), mapping previously done by other persons or agencies, aerial photographs, and the author's personal observation. The vegetation maps are the result of a compilation of available information from these sources. The following is a brief discussion of the sources used and the quality of information obtained from them.

1. Environmental Impact Reports

Vegetation maps and information from the biology sections of several EIRs were incorporated into the preparation of the preliminary maps. Environmental Impact Reports and their associated biology reports are important sources of information on vegetation in San Diego. Vegetation mapping for an EIR is usually done with a field survey and is more detailed than other maps; and biology reports contain much information about local vegetation communities, sensitive species, and other aspects of the ecology of an area.

It was initially proposed that the vegetation mapping done for local EIRs would form a basis for the project maps. There were several problems, however, in utilizing EIRs for a project of this size and scope.

Not every area of native vegetation has been subject to an EIR, and not all EIRs have biology sections or vegetation maps. Those EIRs that do have them can vary significantly in style, quality and detail depending on who prepared the EIR and for what purpose it was done. Also, since EIRs are primarily done for land development projects, the mapped vegetation may or may not still exist depending on when the mapping was done and the current disposition of the project.

Vegetation maps from EIRs were often at a different scale than the county base map, or on a project map which may or may not have had contour lines or other points of reference. Some maps, after being reduced and reproduced in a report were difficult to interpret.

Another factor limiting the use of EIRs was the time frame allowed for completion of the project. The initial scope of work assumed EIRs to be more readily available then they actually were. Not every EIR was easily obtainable. Also, an index of completed EIRs by area does not exist and a great deal of time would have been necessary to locate and inspect every EIR done in the city of San Diego.

2. Mapping Done By Other Persons or Agencies

Another important information source on local vegetation was mapping that had previously been done by other persons or agencies. The most valuable maps used during this project were the vegetation maps prepared by Thomas Oberbauer of the County Department of Planning and Land Use. These maps were prepared between 1975 and 1979 from aerial photographs and field visits, and they show the general vegetation communities of most areas of the county. They are the only other known effort at mapping the vegetation of San Diego. Mr. Oberbauer's maps were used for areas where more detailed information was not available, and portions of the project maps reflect his work.

Other vegetation maps used for the preliminary mapping included maps from the California Department of Parks and Recreation, County Parks Department, CALTRANS, and private companies.

3. Aerial Photographs

Aerial photographs of San Diego were used extensively as a source of infomation in both the initial vegetation mapping stage and for verification of mapping. For some areas, aerial photos were the only available source of information on the local vegetation.

Color aerial photos were available for use through the county Mapping Division. These aerials were flown in 1978 and are at a scale of 1"=1,000'. Used to a lesser extent were ortho-topographic photos. These were also available through the county mapping section, as blueline prints and at a scale of 1"=200'.

The 1984-85 edition of the Aerial Foto-Map Book: San Diego County, was purchased from the Aerial Graphics Company. It was used to update the maps with regard to current levels of development and disturbance, and in checking the final maps. The photographs in this map book are in black and white and were taken during January and February of 1984. They are at a scale of 1"=2,000', the same scale as the base maps.

Although aerial photos were a valuable information source, there were limitations to their use. The level of interpretation of vegetation types was restricted to some extent by several factors, such as the scale of the photo, the quality of the print, season in which the photo was taken, or time of day that it was taken. Some areas, such as inner-city canyons, fallow agricultural fields, and grouped tree plantings, may look similar to native vegetation in photos, but may actually be composed of mostly non-native species.

4. Personal Observation

A major effort towards mapping of vegetation and the verification of vegetation type by on-site visits was not attempted for this project due to the time frame, the size of the area involved, and restricted access to some areas. The field mapping that was done for the project was mainly of areas that could be observed from major roads or freeways.

C. Discussion of Map Results

The vegetation maps are the result of combining the available data from the sources described above. Each of these sources had differing amounts of detail, usable information, and certain limitations. An effort was made during the mapping to integrate these differences and maintain consistency.

The preliminary vegetation mapping was verified whenever possible, through discussion with local biologists familiar with the area or by comparing with aerial photographs. It is believed, that the maps show a reasonable representation of what remains of the natural vegetation in the City of San Diego and vicinity, as of March 1984.

Vegetation associations shown on the maps represent general conditions and an area may have small pockets of different plant communities within it that were too small to locate or map on a practical basis.

II. VEGETATION ASSOCIATIONS

A. General Discussion

There are eight vegetation associations shown on the maps. The vegetation was mapped according to its most general characteristics, as discussed below. The vegetation associations used incorporate information taken from the NDDB list, Cheatham and Haller (1975), Thorne (1976), input from local biologists, and the author's field observations.

There are some problems in the labeling of plant communities or associations. A plant community can be defined as an assemblege of plant species that is characterized by the presence of one or more dominant species. These assembleges are subject to numerous environmental influences, including each other, and frequently do not follow the descriptions set by human definition. This is especially true in San Diego where soil composition, local topography, microclimate, distance from the coast, history of disturbance and human impact all have an important influence on vegetation patterns. There are many areas with a mixture of species representative of two or more different plant communities, or plant assembleges that do not fit into any of the defined plant communities. In reality, the boundaries between the different vegetation associations are not so sharply defined. Vegetation types intergrade into each other and differ from location to location in density and species diversity depending on the local environmental conditions and disturbances.

The extent and quality of many of the vegetation associations in San Diego has been significantly reduced in recent historic times. The primary cause for this has been the rapid rate of land development and the myriad of associated impacts which accompany urbanization. Other causes include agricultural clearing, livestock grazing, sand and gravel extraction, and flood control projects.

1. COASTAL SAGE SCRUB (CS)

Coastal sage scrub or "soft chaparral" is a widely distributed and somewhat diverse vegetation type in San Diego. It forms an open to continuous layer of mostly shallow-rooted, drought deciduous shrubs under two meters tall with an understory of introduced annuals and native ephemerals. A few sclerophyllous species also occur in coastal sage, but do not dominate it.

Coastal sage scrub typically occurs on the driest sites, such as steep slopes, southern exposures, and on thin, rocky, or poorly developed soils. Many of the coastal sage scrub plants are opportunists and coastal sage scrub often occurs as a seral community on burns, abandoned land clearings, and other disturbances.

In most areas, coastal sage scrub is dominated by a few species of shrubs, but the dominant species or mixture of species can often differ from one slope to the next.

Typical species which occur in coastal sage include: Artemisia californica, Eriogonum fasciculatum, Rhus integrifolia, Malosma laurina, Salvia spp., Lotus scoparius, Viguiera laciniata, Encelia californica, Haplopappus spp., Baccharis spp., Opuntia spp., Ferocactus viridescens, and Yucca schidigera.

Diegan sage scrub (Axelrod, 1978) or maritime desert scrub (Thorne, 1976) is sometimes recognized as a distinct phase of coastal sage scrub. It has greater diversity and a number of unique species associated with it. In addition to the usual coastal sage scrub species, many succulents, cacti and other desert associated plants occur there including: Agave shawii, Euphorbia misera, Croton californicus var. californicus, Lycium californicum, Simmondsia chinensis, Salvia munzii, Bergerocactus emoryi, Mamillaria dioica, Dudleya spp., Atriplex spp., and Encelia farinosa. In San Diego, it seems to occur along the coastal strip and in the southern portion of the city where the average amount of rainfall is lower. More research and fieldwork would be needed to map its actual extent. Locations where it is known to occur are Torrey Pines State Reserve, Point Loma, the Border Field area, and portions of Otay Mesa. Diegan sage scrub is not shown on the vegetation maps.

In the southern portion of the city, particularly in the Otay Mesa area, mima mounds and their associated vernal pools also occur. These vernal pools are different from the Kearney Mesa vernal pools and are considered unique in terms of their plant species and the condition under which these pools occur (Oberbauer, 1976; Beauchamp, 1978; Balko, 1979).

2. MIXED CHAPARRAL (MC)

Mixed chaparral or broadleaf chaparral, is a community of deep rooted, evergreen, sclerophyllous shrubs which grow from 1 to 4 meters high. On undisturbed areas, it often forms a dense thicket with little understory. It occurs on more mesic sites--in sheltered canyon areas, and on north and east facing slopes.

Typical mixed chaparral species include: Heteromeles arbutifolia, Ceanothus spp., Adenostoma fasiculatum, Quercus dumosa, Xylococcus bicolor, Rhamnus crocea, Prunus illicifolia, Mimulus puniceus, and Marah macrocarpus. Mixed chaparral varies in species composition from area to area.

A local phase of mixed chaparral, called coastal mixed chaparral, occurs from La Jolla to Oceanside and usually occurs within two miles of the coast. It is typically found on sandy soils of coastal

TABLE 1. *Comparison of some classifications of coastal sage vegetation*

Munz and Keck (1949)	Heady and others (1977); Mooney (1977)	Thorne (1976)	Kirkpatrick and Hutchinson (1977)	Axelrod (1950), and this report
Northern coastal scrub	Northern coastal scrub	Northern coastal scrub	Northern coastal scrub	Northern coastal sage Franciscan sage Lucian sage Diablan sage
Coastal sage scrub	Southern coastal scrub	Southern coastal sage scrub	Southern coastal scrub	Southern coastal sage
	Coastal sage scrub	a. Sea-bluff succulent b. Maritime sage scrub c. Inland sage scrub	. . . Venturan sage . . . . Riversidian sage	Venturan sage Riversidian sage
	Succulent scrub	Maritime desert scrub	San Diegan sage	Diegan sage

the taxa avoid the longer period of summer drought by shedding their leaves, or by storing water in their stems (Mooney et al., 1970; Mooney and Harrison, 1972; Mooney, 1977).

Ecologic occurrence—Over much of its area coastal sage occupies sites that recently were grassland. This is evident in the region from Del Norte and Mendocino counties southward into Monterey County, areas where grassland ("coastal prairie") adjacent to conifer forest and mixed evergreen forest has patches of sage. The relation is seen also in the central Coast Ranges, where coastal sage has a patchy distribution in grassland and alternates on slopes with patches of live oak woodland-grass, digger pine-oak woodland-grass, closed-cone pine forest, or chaparral. Similarly, in southern California coastal sage regularly occurs in grassland adjacent to oak woodland-grass or walnut woodland-grass and at levels below chaparral where rainfall is lower. Even in areas where it appears to be "climax" vegetation, as on the coast south of Monterey, in central Ventura County east of Ojai, or in northern Baja California, coastal sage covers slopes in terrains where relict patches of grassland are confined to relatively deep soils on the crests of the ridges and spurs. Such occurrences are well documented on the original vegetation maps of the California Forest and Range Experiment Station made in the 1930's.

There are important exceptions to the frequent occurrence of coastal sage scrub in grassland areas. It also inhabits terrains that are largely covered with woodland, or woodland-grass, or forest. There it is confined to the driest sites, as steep south slopes, areas with thin or little (or no) soil, or especially well-drained sandy or gravelly substrates (dunes, river terraces, marine terraces). From San Diego County southward into Baja California coastal sage dominates two major terrains—broad coastal terraces and steep slopes carved into the granitic-metamorphic basement rocks. The coastal terraces, composed of coarse conglomerate or conglomeratic sandstone, provide a substrate too dry for a grassy turf, as do the steep slopes in basement rocks. There is little or no soil to support a turf of grass because the area has been repeatedly burned and stripped of soil by erosion, and overgrazing has resulted in further severe erosion. Even within this highly disturbed landscape relict patches of grassland still occur in local areas, as near San Vicente and in the mountains east of Santo Tomas. In addition, along the highway south of Manadero relict *Quercus agrifolia* woodland-grass vegetation implies that wider grasslands were there prior to clearing and cultivation. Finally, there is one other, more localized occurrence for coastal sage. This is in stabilized dune terrains scattered along the coast, as in the hills south of Morro Bay, on the Lompoc plain, the Santa Maria plain, and elsewhere as discussed by Barbour and Johnson (1977). Dune sage vegetation grades seaward to coastal-bluff sage or to beach vegetation and many species are common to them. Dune sage scrub is therefore no more than the seaward or maritime edge of coastal sage scrub, changing composition southward along the coastal strip with it.

Communities—Coastal sage vegetation is represented by several major associations (Table 1). I prefer the geographic (regional) designation because the name calls to mind the area and nature of the environment in which each lives, and avoids the confusion that now exists in the similarity of terminology that has been proposed. The major types cannot be designated by species that distinguish them because each one has several communities that differ in composition depending on exposure, soil depth, successional relations, and local climate. The diverse communities are shown on the vegetation maps made

mesas and slopes and contains a large number of endemic species of plants including: Arctostaphylos glandulosa ssp. crassifolia, Ceanothus verrucosus, Cneoridium dumosum, Salvia clevelandii, Pinus torreyana, Baccharis vanessae, Coreopsis maritima, Corethrogyne filaginifolia var. linifolia, and Dichondra occidentalis. Coastal mixed chaparral is not shown on the project maps.

3. CHAMISE CHAPARRAL (CC)

Chamise chaparral, or narrowleaf chaparral, is chaparral which is dominated by Adenostoma fasciculatum. It occurs on drier exposed sites and on poorly developed soils, and reaches a height of 1 to 3 meters at maturity. It forms a dense to sparse vegetation cover. In dense stands there is little or no herbaceous understory, but on more open sites, such as on the mesas, it is interspersed with areas of herbaceous annuals, grassland, and coastal sage.

Other species which occur in chamise chaparral include: Rhus integrifolia, Malosma laurina, Xylococcus bicolor, Yucca schidigera, Lotus scoparius, and Selaginella cinerascens.

Although chamise chaparral itself is usually low in species diversity, within it occur some interesting plant associations. On certain mesas, mima mounds and vernal pools are found. These areas usually contain several rare or endangered plant species. The vernal pool acreage in the City of San Diego is rapidly decreasing, since it occurs on the most profitable sites for building. It has been estimated that 94 % of the vernal pool area in San Diego has been destroyed (Oberbauer and Evans, 1981).

4. RIPARIAN (RP)

Riparian associations occur where there is an adequate year round supply of water available. This is a very diverse catagory, ranging from freshwater marsh to willow thickets to oak woodlands. Species composition and diversity, cover density, and habitat quality vary depending on local conditions, amount of water available, age of stand, and human impact and alteration.

Riparian woodland areas are composed mostly of winter deciduous trees with an herbaceous understory of native and non-native species. Typical native species include Salix spp., Platanus racemosa, Populus fremontii, Alnus rhombifolia, Baccharis glutinosa, and Toxicodendron diversilobum.

In addition to the above species, some of the larger canyons have Quercus agrifolia intergrading with or growing adjacent to the riparian woodland community. Examples of this can be seen in San Cle-

mente, Lopez, and Penasquitos Canyons. A freshwater marsh community usually develops where water is ponded up by natural or artificial means. Genera found here include: Juncus, Scirpus, Typha, and Eleocharis.

Riparian associations are one of the most limited and regionally significant habitats in San Diego. Less than two percent of the county's vegetation is composed of riparian habitat (Oberbauer, 1978).

5. NON-NATIVE GRASSLAND (NG)

The original extent of native grassland areas in San Diego is not known. The grasslands that remain today are dominated by non-native annual weeds such as Avena, Bromus, Hordeum, Festuca, Erodium, and Brassica.

There is a tendency for "grasslands" to increase in abundance on any type of soil following a major disturbance and they often occur as a successional stage to other vegetation types. Disturbances such as fire, livestock grazing, and vegetation clearing have probably enlarged the extent of non-native grasslands in San Diego. Most of these grasslands consist of large connected areas on mesa tops or in canyons and valleys, which are surrounded by shrub vegetation.

In addition to areas dominated by grasses, this category on the maps also includes areas which are dominated by non-native herbaceous dicots, heavily disturbed areas where the shrub cover appeared to be very sparse, and possibly some agricultural fields.

6. COASTAL BLUFF SCRUB (CB)

This plant community occurs at localized sites along the coast on exposed headlands and sea bluffs. Soils are usually sandy, poorly developed and subject to erosion. The plants are mostly succulents and low growing shrubs, which are sometimes prostrate due to the exposure to wind and salt spray. In less exposed situations, coastal bluff vegetation usually intergrades with coastal sage scrub. Examples of this vegetation type occur at Torrey Pines State Reserve, on the bluffs of Crest Canyon, and at Point Loma.

Because of the limited information available, only those areas known to have coastal bluff scrub were mapped. It is likely that there are more. Additional fieldwork and research would be needed to determine the actual extent of this vegetation type.

Characteristic plants which occur here include: Carpobrotus spp., Gasoul spp., Coreopsis maritima, Dudleya spp., Opuntia littoralis, Encelia californica, Haplopappus spp., Rhus integrifolia, and assorted weedy annuals.

7. TORREY PINES WOODLAND (TP)

The Torrey pine is California's most restricted pine species and is becoming increasingly more restricted in San Diego. It occurs north of San Diego near Del Mar at scattered locations along the coast, in shallow sandy soils on eroded coastal bluffs, ridgetops, and mesas. The trees are usually widely dispersed or occur in small open groves, and the associated vegetation is a sparse coastal sage or coastal chaparral.

Common vegetation associates include: Adenostoma fasciculatum, Artemisia californica, Rhus integrifolia, Quercus dumosa, Cneoridium dumosum, Arctostaphylos glandulosa ssp. crassifolia, Xylococcus bicolor, and Dendromecon rigida.

8. COASTAL MARSH (CM)

This category includes coastal salt marsh, coastal brackish marsh and tidal mudflats. There is very little area with these habitat types left in San Diego, and what remains is largely disturbed or altered.

Coastal salt marsh occurs in areas with tidal influence, and the vegetation is composed of mostly low growing halophytic succulents. Common plant species are Salicornia spp., Frankenia grandiflora, Jaumea carnosa, Batis maritima, Suaeda californica and Limonium californicum. At the lowest elevations in tidally flushed wetlands Spartina foliosa can be found.

Coastal brackish marsh is similar to salt marsh, but the salinity may vary considerably with the amount of freshwater input. The vegetation is often a combination of salt marsh and freshwater marsh species.

Because the emphasis of this project was on terrestrial plant communities, not much time was spent in trying to map the actual extent of coastal marsh vegetation. However, because of their rarity and biological importance, most of the remaining coastal marsh areas in San Diego have been studied and/or mapped by other persons or agencies.

9. AGRICULTURE/URBANIZED (AU or Crosshatching)

This includes areas that are graded, developed, converted to agricultural uses, planted with non-native species such as eucalyptus groves, extremely disturbed to where the vegetation is non-existent, golf courses, parks, sand and gravel operations, and other similar type areas which are devoid of native vegetation.

Unfortunately, not all of these areas are reflected on the project final maps since the acreage that can be added to this category increases daily.

REFERENCES CITED

Axelrod, Daniel I., The Origin of Coastal Sage Vegetation Alta and Baja California, American Journal of Botany, Vol. 65 No. 10, 1978.

Balko, Mary Lee, The Biological Evaluation of Vernal Pools in the San Diego Region, City of San Diego Environmental Quality Division, December, 1979.

Beauchamp, R. Mitchel, San Diego Vernal Pool Study, California Department of Fish and Game, 1978.

California Department of Fish and Game, Natural Diversity Data Base Natural Communities, 1983.

Cheatham, N.H., and J.R. Haller, An Annotated List of California Habitat Types, University of California Natural Land and Water Reserve System, 1975.

Munz, P.A., A Flora of Southern California, University of California Press, Berkeley, 1974.

Oberbauer, Thomas A., Preservation of Vernal Pools on Otay Mesa, County of San Diego Integrated Planning Office, 1976.

Distribution of Dynamics of San Diego County Grasslands, Masters Thesis, San Diego State University, Biology Department, 1978

San Diego County Vegetation Description, unpublished paper, 1978a

Oberbauer, Thomas A., and Michael Evans, The Challenge of Vegetation Management at the Local Level, presented at the Symposium on Dynamics and Management of Mediterranean Type Ecosystems, San Diego State Univesity, 1981.

Thorne, R.F., The Vascular Plant Communities of California, The Symposium Proceedings: Plant Communities of Southern California, May 4, 1974, California Native Plant Society Special Publication No. 2, CNPS, Berkeley, 1976.