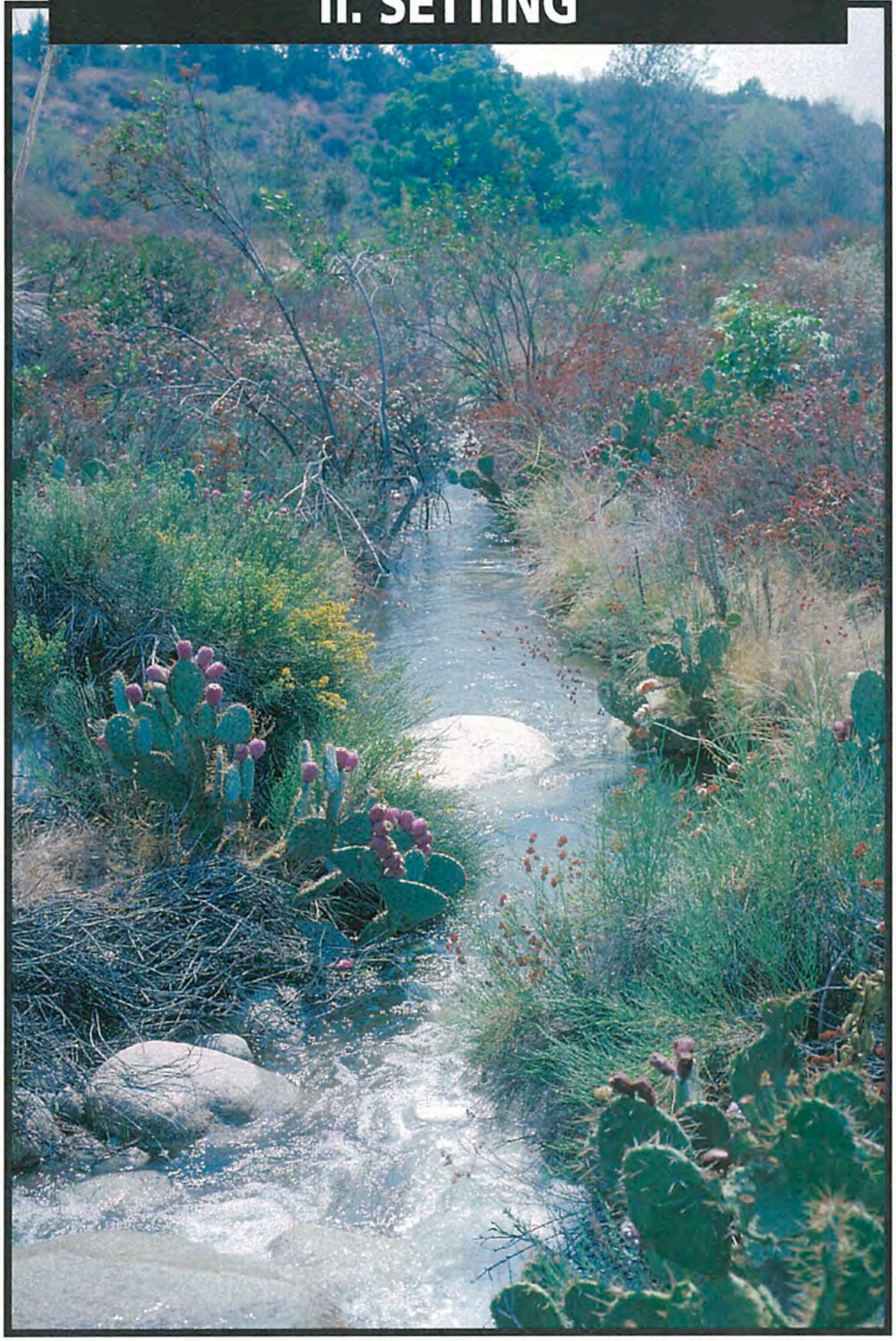
II. SETTING



California, San Bernardino County: Santa Ana River Wash

ENVIRONMENTAL SETTING

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INTRODUCTION

California is a state of many contrasts and contraditions. Within its borders are the highest mountain (4420 m [14495 ft]) in the lower 48 states, Mt. Whitney, and the lowest point on the continent, 85 m (276 ft) below sea level at Death Valley. The Modoc Plateau in northeastern California is a region of extremely low population density; southwestern California is one of the most densely populations regions in the world. Native American cultures were among the most diverse and complex in North America before European contact; today the state's population harbors is reputed to be the most culturally diverse in the Union. With regard to its biotic reputation, California harbors one of the richest floras in the world and a fish fauna notably depauperate. Both flora and fauna, however, are renown for their high endemism.

The study region includes the coastal boundary at Point Conception (in Santa Barbara County) between northern and southern California biogeographic provinces, which contributes to the many contrasts that affect wetlands. These contrasts include, for example, differences between and among: (1) northern cool/moist and southern warm/dry Mediterranean climates; (2) Mediterranean and arid climates; (3) cold, high elevations and mild, low elevations; (4) interior and coastal locations; (5) chemically-affected (salt, alkali, sulfur, petroleum) habitats; (6) aeolian, fluvial, glacial, arid, volcanic, and structural processes; (7) oceanic and terrestrial processes; (8) intermittent and perennial water bodies; (9) widespread and narrowly-restricted habitats and organisms; (10) coarse-scale and fine-scale sites; (11) historic and current land use practices; (12) natural and artificial landforms; (13) pristine and degraded habitats; and (14) wilderness and urbanized regions.

Thus it is with this frame of reference -- diversity, anomaly, and contrast -- that the study region and its wetland resources are presented. As representative of California as a whole, the central and southern coast and coastal watersheds illustrate the complexity of the state's physical

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and biological diversity, without which the rich wetland heritage of California would not exist.

Geologic History

As is true for other physical features of the state, California's geology is complex, consisting of rocks as ancient as 1800 million years old, found in the San Gabriel and San Bernardino Mountains of the study area, to Recent rocks and sediments forming today through continued volcanic activity (e.g., in Klamath Region to the north) and depositional processes.

During the Mesozoic Era (235 to 65 mya), most of the study region did not exist. The northern portion could be found on an above-water superterrane of unknown size on a subducting oceanic plate. Thus from the Cretaceous onward, most of the study area was built by terrane accretion. This includes the Coast, Transverse, and Peninsular Ranges (Shaffer 1993).

California during the Paleogene Period (65 to 42 mya), which began with the close of the Cretaceous Period, was characterized by relatively low relief and fewer habitats. As with the Mesozoic Era, most of the study area was not in existence. However, by the end of the Paleogene Period, ancestral forms of the Coast Ranges and the Santa Lucia Range appeared.

The Neogene Period (24 to 1.5 mya) marks the beginning of the modern California landscape (Shaffer 1993). A narrow portion of the Farallon Plate had been totally subducted under the North American Plate, creating the beginnings of the San Andreas Fault system, and thus the Pacific Plate directly contacted the North American Plate for the first time. The San Andreas Fault proper did not develop until 12 mya.

The South Coast Ranges were shorter and wider than during this period in California's geologic history, and could be found approximately in the region of the Transverse Ranges today, whereas the Transverse Ranges occupied a region now belonging to the Peninsular Ranges (Shaffer 1993). The early San Andreas Fault system continued moving eastward during the Neogene, causing the lands west of the fault to sink below the Pacific Ocean. During a period 16-12 mya, the South Coast Ranges continued moving northward while the Transverse Ranges were fragmented and rotated by faulting activity, resulting in their east-west orientation (Shaffer 1993). Between 5 and 3 mya, the present Coast, Transverse, and Peninsular Ranges were formed as a result of a change in the movement of the Pacific Plate. The diverse Recent terrain, with the many opportunities for the formation of wetlands, has developed and continues to develop as a result of tremendous tectonic forces.

The Ice Age (2.4 to 13,000 mya) affected the movement and distribution of California's flora, and affected the coastal areas through a drop in sea level by the formation of continental ice. For example, during the Tioga glaciation the sea level dropped approximately 120 m (360 ft), creating the superisland Santarosae from the present-day Northern Channel Islands. Periods of glaciation contributed to the formation of wetlands in the San Bernardino Mountains Figs. IX-11, IX-12), and post-glacial periods such as now have been affected by a rise in sea level and a drowning of river and canyon mouths and coastal valleys, resulting in the formation of estuaries. Goleta Slough and Carpinteria Salt Marsh (Figs. VI-37, VI-38) are flooded structural basins (a graben and a syncline, respectively), whereas the Tijuana, Ventura, and Santa Clara estuaries are drowned river mouths. A rise in sea level also has caused the landward migration of dune systems, which as resulted in the formation of dune swales (e.g., at San Antonio Terrace Dunes in Santa Barbara County; Fig. I-4) and coastal ponds such as the "Dune Lakes" near Nipomo Mesa in San Luis Obispo County (Fig IX-13).

Currently the Peninsular Ranges and the South Coast Ranges are moving northward with the continued northly movement of the Pacific Plate. Other current geologic trends affecting the study area include increasing aridity with uplift, and cold/warm climatic cycles (Shaffer 1993). The geologic processes that have formed the study region also have contributed to the formation of specialized landscape features such as hot and sulfur springs, petrochemical seeps, fault sag-ponds (e.g., I-5), fault escarpment seeps, limestone outcrops, and serpentine soils.

Geography

The study region (see Fig. I-1) falls within two broadly defined geomorphic provinces, the Southern Provinces and the Coast Ranges, that are themselves, inclusive of smaller, well-defined geomorphic units (i.e., physiographic provinces). The Southern Provinces, for example, consist of the Transverse Ranges and Peninsular Ranges, bounding the Los Angeles Basin (Norris and Webb 1990). The Coast Ranges are found west of the Great Valley, and extend 880 km (550 mi) from the Oregon border along the Pacific Coast to the Santa Ynez River. They consist of a series of north-south trending mountain systems, such as the Mendocino Range, Diablo Range, Santa Cruz Mountains, Gabilan Range, and Santa Lucia Mountains (Norris and Webb 1990). This series of north/south-tending mountains are geographically interrupted by the San Francisco Bay, marking the northern border of the South Coast Ranges and the southern border of the North Coast Ranges. Many of the South Coast Ranges (e.g., Gabilan Range, La Panza Range, Temblor Range) lie to the interior of the coastal crest formed by the Santa Lucia and Caliente Mountains, therefore falling outside of the study region.

The study region falls within the **cismontane** region of central and southern California. Cismontane is used to refer to the western slope of the Transverse and Penninsular Ranges, in contrast to the **transmontane**, or eastern slope of these mountains.

Coast Ranges. The South Coast Ranges are characterized by drainages controlled by synclinal folds and fault zones (Norris and Webb 1990). Rocks of the Coast Ranges consist of two unlike basement formations that align along a series of major longitudinal faults. One formation is the Franciscan subduction complex, derived from erosion of volcanic highlands and deposited in deep marine basins (Norris and Webb 1990). No top or bottom of the Franciscan formation has been determined, despite a thickness of more than 15,000 m (50,000 ft). Franciscan rocks have been intruded by ultrabasic igneous rocks that are considered serpentinized. Seeps from serpentine outcrops, such as in San Luis Obispo County, are one specialized wetland type of the study region.

The other basement complex of the Coast Ranges is known as the Salinian Basement, a younger formation located between the San Andreas and Nacimiento Faults in the South Coast Ranges. The Salinian Basement consists primarily of a commonly occurring association of metamorphic rocks and granitic plutons (Norris and Webb 1990). Its southern terminus is marked by Mt. Pinos, which lies along the eastern crest of the study region. Mt. Pinos approaches elevations of 3000 m (9000 ft), and supports montane wetlands not found elsewhere in the South Coast Ranges in the study region.

Lying above the Franciscan and Salinian Basement Formation are largely younger sedimentary rocks. For example, during the early Miocene, a sea covered most of the South Coast Ranges, forming deep-water sediments in off-shore elongate basins. These sediments were first uplifted during the last 10 million yrs, and being reasonably young, soft and unstable, they are relatively rapidly eroded by wave action.

Coastal terraces formed by wave action and uplift of the land relative to sea level are evident in rocky headland areas. For example, in the Palos Verde region of Los Angeles County in southern California, thirteen terraces can be seen (Schoenherr 1992). Five to seven terraces typically are visible at any one point along the south coast. At some locations along the coast in Central California (e.g., San Simeon in San Luis Obispo County) and in southern California (Goleta in Santa Barbara County and Camp Pendleton in San Diego County), vernal pools, a form of seasonal wetland restricted to regions with Mediterranean climates, have formed on nearly level coastal terraces.

The most well-known range of the South Coast Ranges is the Santa Lucia Range, beginning at Big Sur, Monterey County, and extending to the Cuyama River, Ventura County. It is anomalous in that "... as a topographic feature, [it] does not correspond closely to the underlying lithology and structure....This lack of a close match between present topography and structure is additional evidence for very young orogenic activity in the southern Coast Ranges...." (Norris and Webb 1990:386-387). Other landforms of this province that are partially or entirely within the study region include Cuesta Ridge, Caliente Range, Sierra Madre, and San Rafael Mountains. In valleys between these ridges, the Cuyama, Santa Maria, and Santa Ynez rivers flow westward to the coast. Watersheds associated with these rivers support many types of riverine, lacustrine, and palustrine wetlands.

Southern Provinces. The Southern Provinces consist of the physiographic regions known as the Transverse Ranges and the Peninsular Ranges. The Transverse Ranges extend from the Santa Ynez Mountains, and trending from west to east, include the Santa Ynez, Santa Susana, Santa Monica, San Gabriel, and San Bernardino Mountains. The Channel Islands represent an extention of the main ridge system of the Santa Monica Mountains (Schoenherr 1992). Two additional rivers, the Ventura and Santa Clara rivers drain much of the region. The dramatic geological processes of the region are particularly well demonstrated in the Ventura River watershed, which is the most rapidly emerging and evolving landscape in the entire Pacific Basin (see Section X).

In the southern portion of the study region, another series, The Peninsular Ranges, begin in Riverside County. From north to south, the main ridge includes the San Jacinto, Santa Rosa, and Laguna Mountains. On the west, however, these mountains are separated from the Santa Ana Mountains by Elsinore and Hemet Valleys. The Santa Ana Mountains join the Laguna Mountains by a series of smaller ranges, such as the Agua Tibia Range. The second highest peak in southern California, Mount San Jacinto (3293 m, 10,805 ft) forms the dramatic summit of the San Jacinto Mountains. The Los Angeles Basin, considered a portion of the Peninsular Province was formed by sediment derived from the Transverse Ranges as well as the Peninsular Ranges. Before agricultural and urban development, the basin is believed to have consisted of an extensive mosaic of palustrine and riverine wetlands based on alluvium up to 4200 m (14,000 ft) thick.

The basin is drained by the extensive Los Angeles and Santa Ana river systems, whose watersheds extend to the crest of the study area. Some of the interior valleys are structural basins with little historic external drainage, and thus also accumulate salts and form special chemically-affected wetlands such as at Mystic Lake (Fig. VIII-2) in the San Jacinto Valley. The San Jacinto

River now drains artificially to the into the Santa Ana River system, but the valley still supports extensive aalkali wetlands. In contrast to this topography and history, a portion of the adjacent San Bernardino Mountains, the San Gorgonio Wilderness Area, was glaciated during the Pleistocene and today supports wetland habitats (e.g. glacial ponds; Figs. IX-11, IX-12) found only in topography formed by glacial processes. Other coastal rivers that drain this portion of the coast include, for example, the Santa Margarita, San Luis Rey, San Dieguito, San Diego, and Tijuana rivers. Much of the Peninsular Ranges physiographic province, however, lies to the south in Baja California, outside California as well as the study area (Norris and Webb 1990).

Climate

"California has a greater climatic diversity than any other state, and its vegetational diversity is reflective of this varied climate" (Holland and Keil 1989). Although in many regions latitude is a major factor in determining climate, in California the physiography of the state is the major determinant of climate (Holland and Keil 1989). However, latitude is of some importance, for example the biogeographic boundary at Point Conception (Barbour et al. 1975), given that California extends over a greater range of latitude than any other state in the Union except Alaska. Cowardin et al. (1979), from which we have produced our modified classification, follow Bailey (1976) for the delineation of ecoregions of the United States. Bailey includes the entire terrestrial portion of the study region within the California Chaparral Province, of the Mediterranean (Dry-Summer Subtropical) Division, within the Prairie Domain. Cowardin et al. create provinces for the marine and estuarine wetland systems. They include these wetlands in the Californian Province, which they indicate, "...extends along the Pacific Coast from Mexico northward to Caape Mendocino. The shoreline is strongly influenced by coastal mountains and the coasts are rocky. Freshwater runoff is limited. In the southern part volcanic sands are present; marshes and swamps are scarce throughout the province. The climate is Mediterranean and is influenced by the California Current. The biota is temperate, and includes well-developed offshore kelp beds. The tidal range is moderate."

The study region includes various types of both Mediterranean and desert climates, according to the Köppen's climatic types (Holland and Keil 1989). Mediterranean climates in the region typically can be characterized by warm, dry summers and mild, wet winters, but important climatic variants that affect the development of wetland types include: (1) Mediterranean warm (hot) summer; (2) Mediterranean cool (warm) summer; and, (3) Mediterranean cool (warm) summer with fog. Thus the major difference among these types is the presence (or absence) of summer fog and summer temperatures (Holland and Keil 1989). California has one of the foggiest coast in the world, and northern coastal portions of the study region immediately south of Monterey Bay are characterized by this climate. The first variant, Mediterranean warm summer, is found in the interior foothills of southern California, while Mediterranean cool summer (2) characterizes the high elevations in the mountains and the maritime regions immediately along the coast. The third Mediterranean variant, cool summer with fog, is distinguished from the others by the presence of dense fog for more than 30 days of the year.

The other Köppen climatic zone in the study region that is not Mediterranean is a variation of the dry [arid] climate -- i.e., steppe. Major (1988) refers to this climatic zone as hot desert, which extends from the Colorado Desert westward to the coastal region dominated by the Mediterranean climatic regime. The Santa Ana River system drains portions of the San Andreas Fault Rift that extend to the east side of the San Gabriel Mountains, thus including some of the Mojave Desert within the coastal watershed zone! Many of the eastern-most portions of larger watersheds (e.g., the Santa Clara, Los Angeles, and Santa Ana Rivers, drain areas that are perhaps better classified as arid rather than Mediterranean.

The climate has profound effects on the diversity of wetlands of the region. There are many types of intermittent streams, rivers (e.g., Figs. VII-9, VII-11, VII-12), and lakes (e.g., Figs VIII-2, VIII-3). Seasonally-flooded wetlands such as palustrine vernal pools (e.g., Figs. IX-34 through IX-37), ponds (e.g., Figs. IX15, IX-16), and lakes (e.g., Fig. X-11) are characteristic of the Mediterranean climate and support unque species that can tolerate flooding and desiccation. Estuaries receive little year-round freshwater runoff and thus tend to support few brackish marshes but often can be euryhaline or hyperhaline. Summer drought and evaporation tends to concentrate terrestrially-derived salts in poorly drained areas, often producing alkali and saline wetlands in interior valleys. The high elevations of some mountains receive more rainfall as well as lower temperatures than other sites, resulting in the formation of wet meadows and coniferous forested wetlands. In contrast, rain shadow effects from some mountains can reduce rainfall at higher elevations, as exemplified by the natural intermittent lacustrine wetlands at Baldwin Lake (Figs. VIII-9, VIII-10, VIII-11) on the crest of the San Bernardino Mountains. The steep watersheds of some watersheds, combined with major storms, result in sporatic catastrophic flooding events that can cause severe erosion and sedimentation and form the natural destruction and creation of wetlands or the conversion of one wetland type to another. The effects of climate and topography have contributed to the formation of the fluvial, arid, and past glacial erosion cycles of the region, which in turn have helped form and maintain the region's wetlands.

Vegetation

The vegetation of the study area includes many of the major ecosystems of the California Floristic Province. For example, closed-cone pine and cypress forests, oak woodlands, southern coastal scrub, coastal salt marsh, beach and dune, and vernal pools represent major plant formations in a variety of geologic and geomorphic contexts, each appearing distinctly different from the next. Although various researchers have treated wetlands as separate from upland vegetation (see Section III, Classification), others have recognized similar coarse-scale formations or types. Küchler's (1977) map of the natural vegetation of California, for example, designates a total of eighteen (18) natural vegetation types in seven of the nine plant formations found within the state (Table II-1). We have identified numerous wetland types within these formations, occurring within five major systems (marine, estuarine, riverine, lacustrine, and palustrine) of wetland types. The biotic classes of vegetation within these systems include aquatic-bed (submerged and floating herbaceous; Fig. VIII-18), emergent (emergent herbaceous; Figs. IX-17, IX-18, IX-19), scrub-shrub (Figs. IX-42 through IX-48), and forested wetland (Fig. IX-51) (Cowardin et al. 1979).

Land Use History

Native American Use. The study area encompasses, from north to south, the Native American California tribes or portions of the following tribal territories: Costanoan, Esselen, Salinan, Chumash, Tataviam, Gabrielino, Luiseño, Serrano, Cahuilla, Cupeno, Ipai, and Tipai (Heiser 1978). Early Californians took advantage of the exceptionally diverse wetland resources of central and southern coastal California. Those tribes that lived along the coast exploited the rich fish and shellfish of the Marine System, and many plant species of the Palustrine, Estuarine, Riverine, and Lacustrine Systems. Most common employed were tules (*Scirpus* spp.), willow (*Salix* spp.), and nettle (*Urtica dioica* ssp. *holoracea*) for construction of canoes, domiciles, baskets, and cordage.

Costanoans. The name Coastanoan derives from the Spanish *Costaños*, meaning "coast people." The Costanoan-speaking people lived in approximately 50 separate and politically autonomous tribelets by 1770, and although they shared linguistic affinities, the Costanoans were not a homogenous tribe (Levi 1978). It is believed that this ethnic group arrived in the Monterey area in approximately 500 A.D., and migrated from the Sacramento-San Joaquin River Delta. The Rumsen tribelet, one of two most southerly within the Costanoan tribe, had at least one permanent settlement along the lower Carmel, Sur, and the lower Salinas Rivers (Levy 1978).

TABLE II-1. Natural Vegetation Formations Found Within the Study Region (from Küchler 1977).

VEGETATION FORMATION	NATURAL VEGETATION
I. Needle-leaved Evergreen Formations	A. Redwood Forest (*Pseudotsuga-Sequoia*) B. Southern Jeffrey Pine Forest (*Pinus jeffreyi*) C. Coastal Cypress and Pine Forests (*Cupressus, Pinus*) D. Juniper-Pinyon Woodland (*Juniperus-Pinus*) E. Southern Montane-Subalpine Forest (*Abies-Pinus*)
II. Mixed Broad-Leaved and Needle-Leaved Formations	A. Mixed Hardwood Forest (*Arbutus-Quercus*) B. Mixed Hardwood and Redwood Forest (*Arbutus-Quercus-Sequoia*) C. Blue-oak-Digger Pine Forest (*Quercus-Pinus*) D. Coulter Pine Forest (*Pinus coulteri*)
III. Broad-Leaved Forest Formations	A. Southern Oak Forest (*Quercus agrifolia*)
IV. Shrub Formations	A. Chaparral (*Adenostoma-Arctostaphylos-Ceonothus*) B. Coastal Sagebrush (*Artemisia-Eriogonum-Salvia*)
V. Savanna Formations	A. Valley Oak Savannah (*Quercus-Nasella [Stipa]*)
VI. Graminoid Formations	A. California Prairie (*Nasella [Stipa]* spp.) B. Coastal Saltmarsh (*Salicornia-Spartina*)
VII. Scrub Formations	None
VIII. Formations of Coastal Complexes	A. Northern Seashore Communities (*Elymus-Baccharis*) B. Southern Seashore Communities (*Abronia-Haplopappus*) C. Coastal Prairie-Scrub Mosaic (*Baccharis-Danthonia-Festuca*)
IX. Deserts	None

Costanoan influence on the wetlands of their region included the hunting of waterfowl and fish. Waterfowl believed to be a significant part of the Costanoan diet included Canada goose (*Branta canadensis*), American widgeon (*Anas americana*), shoveler (*Anas clypeata*), among others. Steelhead (*Salmo gairdneri)*, salmon, sturgeon (*Acipenser* sp.), and lamprey (*Entosphenus tridentatus*) were the most important fish. Molluscs figured in the diet of coastal Costanoans, including mussels, abalone, octopus, and other unidentified species (Levy 1978).

Tules (*Scirpus* spp). were used extensively by the Costanoans for a variety of purposes. The common tule (*S. acutus*) was formed into balls, baked and eaten, while various *Scirpus* species were used in the construction of baskets, mats, and canoes. Willow species (*Salix* spp.) also were used in the construction of domiciles and baskets.

Esselen. The Esselen tribe are among the least-known aboriginal groups within California. The inhabitated the Coast Ranges south of the modern Monterey, extending to Point Lopez -- an area of approximately 580 sq. mi. Little is known of their impact on their environment, although as with many tribes, tules were used in the construction of mats, baskets, and as foundation materials. Hester (1978a) suggests that tule reed rafts were the only watercraft used by the Esselen until the dugout canoe was introduced by Europeans.

Salinan. The Salinan tribe was bounded on the north by the Esselen stock, and therefore were settled along the headwaters of the Salinas River (outside the study area), extending over the crest of the Coast Ranges to the coast. Yokuts were found to the east, and the Chumashan people to the south (Hester 1978b). The Salinan tribe was involved in extensive trading with surrounding peoples, exchanging shell beads of mussel and abalone (the basis of Salinan currency) and unworked shells for a variety of food and construction items. Abalone (*Haliotus* spp.) also were used for ear ornaments. Although little survives of the Salinan culture, Hester (1978b) reports that their houses were constructed as a domed pole frame and covered with tule (*Scirpus* spp.) or rye grass (*Leymus* spp.?).

Chumash. Although the Chumash were known to early investigators as the Santa Barbara Indians, geographically the Chumash occupied the region from San Luis Obispo to Malibu Canyon on the coast, and inland, to the edge of the San Joaquin Valley. They also occupied the Santa Barbara (Northern) Channel Islands. Coastal Chumash used shells extensively, particularly that of the abalone. The interior mother-of-pearl was cut into various shapes to attach to various garmets. Circular fishhooks were made from the shell, and the entire shell was used as an bowl, with the holes plugged with asphaltum (Grant 1978). Other marine species exploited by the Coastal

Chumash included the keyhole limpet (*Megathura* sp.), used for a hair ornament, and the univalve (*Olivella* sp.), which was widely used to make beads. The endangered Pismo clam (*Tivela stultorum*) was ground into beads and disks for currency. The clam sometimes was worn by either sex in the pierced nasal septum (Grant 1978).

Molluscs also were exploited for food. Exceptionally large shell middens, consisting primarily of the California mussel (*Mytilus* sp.), horse clam (*Tresus* sp.), jacknife clam (*Tagelus californianus*), as well as the crustacean, gooseneck barnacle (*Mitella* sp.) can be found along the mainland of the Santa Barbara Channel. Other marine food resources included the shark, bonito, yellowtail, sea bass, rockfish, halibut, anchovy, and barracuda (Grant 1978). Wetland plant resources used by the Chumash included carrizo grass (*Phragmites communis*), used as the mainshaft of a two-piece arrow, and nettle (*Urtica* sp) for cordage.

<u>Tataviam</u>. The Tataviam lived mainly in the upper reachs of the Santa Clara River east of Piru Creek, possibly extending north to the edge of the study area to the southwestern border of Antelope Valley (King and Blackburn 1978). The name "Tataviam" translates roughly to 'people facing the sun' or the 'people of the south-facing slope', which describes the steep terrain of the upper watershed of the Santa Clara River. However, there is some confusion over the Mojave name for the Tataviam, a name translated as 'they who sleep in the high tules'. However, very little is known about this California tribe, and their impact on their wetland resources is poorly documented.

<u>Gabrielino</u>. The Gabrielino are considered to be one of the most interesting, least known, wealthiest, and powerful ethnic groups in aboriginal southern California (Bean and Smith 1978a). They are believed to have lived within the watersheds of the Los Angeles, San Gabriel, and Santa Ana Rivers, within the smaller stream and river systems of the Santa Monica and Santa Ana Mountains, all of the Los Angeles Basin, and on the Southern Channel Islands of Santa Catalina, San Nicolas, and San Clemente. As with other coastal tribes, the Gabrielino exploited the rich marine resouces of fish, shellfish, sharks, sea mammals, and waterfowl. Willow species (*Salix* spp.) were used not only for construction, but the inner bark provided aprons for women, the major clothing worn by Gabrielino females. Baskets were made from typical wetland plant species, such as rushes (*Juncus* spp.) and some grass (e.g., *Muhlenbergia rigens*).

<u>Luiseño</u>. The Luiseño were bounded with the Cahuilla and Cupeño on the east, the Gabrielino to the north, the Pacifica to the west, and the Ipai on the south. They occupied approximately 1500 sq mi within the lower and middle reaches of Aliso Creek, San Juan Creek, the Santa Margarita River, the San Luis Rey River, and Agua Hedionda (Bean and Shipek 1978).

Inland the territory occupied continued east to Santiago Peak, along the Elsinore Fault Valley, and to the region around Mt. Palomar. As is true from virtually all of the tribal groups within the study region, the Luiseño established villages in the valley bottoms, along streams, coves, canyons, and coastal strands where the village was reasonably defensible and the water in good supply. The major impact to the Wetlands of southern California was their subsistence exploitation of marine fish and shellfish.

Serrano. The name 'serrano' derives from the Spanish term for 'mountaineer', referring to the mountainous area east of Los Angeles in which this tribal group lived. Thus the Serrano lived within the headwater regions of the Santa Ana River, and eastward beyond the study area (Bean and Smith 1978). They were hunter-gatherers like many of the tribes in Southern California, but occasionally fished for subsistence. Impact of the Serrano on the wetland resources of the study region is not well documented.

Cahuilla. As with the Serrano, the Cahuilla occupied a southeasternly portion of the study area, within the crest of the San Bernardino Mountains in the north to the Chocolate Mountains in the south, and eastward to portions of the Colorado Desert (Bean 1978). The fisheries were not developed by the Cahuilla, as they were primarily hunters, gatherers, and engaged in some marginal agriculture. Wetland plant resources, such as willows (*Salix* spp.) were used for making bows, and *Juncus robustus* (Fig. IX-2) were exploited for basketry and for dying.

Cupeño. The Cupeño numbered less than 750 people and therefore constituted one of the smaller linguistic groups in Southern California (Bean and Smith 1978b). They occupied a region about 10 mi in diameter in the headwaters of the San Luis Rey River. They lived primarily on small game and various plant resources, and although not well documented, littled exploited their wetland resources.

Tipai-Ipai. The Tipai-Ipai territory historically extended from Agua Hedionda in the north, eastward beyond the study area to the San Hills of Imperial County, south into northern Baja California, and west to the coast below Todos Santos Bay, Mexico. This southern most portion of the study area has been occupied over 20,000 yrs, as extensive shell middens can be found along the coast. In addition to the exploitation of marine wetland resources, wetland plant species were also utilized for food and construction (Luomala 1978). For example, the seeds of *Cyperus erythrorhizos* and *Atriplex torreyi* were ground into flour. And addition, the Tipai-Ipai engaged in rudimentary horticulture, planting maize, beans, and melons on newly flooded land (Luoma).

The great importance of wetland resources to Native Americans is underscored by the use of the cultural value category in the socio-economic value assessment of wetlands. Many wetland resources such as some native hydrophytes (e.g., *Anemopsis californica*, Yerba Mansa) are declining resources because of the loss of wetland habitat. Thus impacts to the cultural value of wetlands also is an important aspect of the classification and assessment process.

European and Modern Influence. Ferren (1985) summarized from various sources the events that marked important changes in land ownership and land use. In 1542, Juan Rodriguez Cabrillo sailed up the coast of California, anchored off the coast of what is now Carpinteria in Santa Barbara County, and described a densely populated region (the area was populated with Barbareno Chumash) that had many oak trees. In 1769, Gaspar de Portola and Father Juan Crespi traveled through the region to establish a series of missions during the first Spanish expedition of the mainland. Portola claimed California for the King of Spain during this expedition. Native Americans lacked immunity to European diseases and many died; others fled Spanish influence or were assimilated into the Euro-American culture. After the ouster of Spanish rule in Mexico in 1822 and the formation of the Republic of Mexico, Mission Pueblo Lands that had been granted by Spain were secularized by the Mexican government in 1834. After secularization, lands under Mission control were deeded to families who had been loyal to the Mexican government. Following the defeat of Mexico by the United States, California became a state in 1850. The U.S. government formed land commission to decide the validity of claims to land under Mexican deeds. In 1853, a maps of Pueblo Lands were drawn up to establish ownership. The remaining land was open to homesteading under the National Homestead Act of 1862.

During the second half of the 19th century and into the early 20th century, considerable change occurred to the landscape of the study region as a result of the expansion of agriculture, urbanization (e.g., residential, commercial, industrial, utility, transportation, military, and institutional development), and the exploitation of natural resources. Some of these changes have been described for particular wetlands such as Del Sol Vernal Pools (Ferren and Pritchett 1988), Carpinteria Salt Marsh (Ferren 1985), Devereux Slough (Ferren et al. 1987), Ventura River Estuary (Ferren et al. 1990), and Tijuana Estuary (Zedler and Nordby 1986). Other impacts have been discussed for ecosystems in general, including estuaries (J. Zedler 1982), vernal pools (P. Zedler 1987), and riparian corridors (Faber et al. 1989). Examples of categories of impacts all of which affect wetlands in the study region include, but are not limited to: filling, diking, fragmenting (e.g., Fig. VI-8), and excavating habitats; diverting, impounding (e.g., Figs. VII-9, VII-9), polluting, and altering water bodies and natural hydrology; extracting physical resources such as minerals, petrochemicals, salts, and water; refuse landfilling; deforestation (e.g., Fig. IX-7); harvesting biological resources such as aquatic plants, trees, fish, and shell fish (e.g., Fig. V-5); grazing of livestock; introduction of invasive exotic plants and feral animals; vector control practices (e.g., Figs. IX-13, IX-14); flood control practices; shoreline protection devices; unfocused recreational access; and reduction of biological diversity including impacts to endangered species. Many of these impacts also are associated with important socio-economic uses of wetlands.

An understanding of land use practices and the resulting landscape changes and impacts to natural resources is essential for the classification of wetlands and an assessment of their ecosystem functions and socio-economic values. Examples of situations that affect classification include, for example, the difference between (1) natural ponds/lakes and artificial ponds/reservoirs (e.g., Figs. VIII-3, VIII-8); (2) natural fault-sag-ponds and artificial agricultural ponds; (3) natural hydrology and artificially maintained hydrology; (4) natural and diked or drained wetlands (e.g., FIg. IX-8); and, (5) natural versus enhanced, restored, recreated, or created habitats (e.g., Figs. IX-9, IX-10). Many of these situations are discussed or illustrated for each wetland system in the subsequent sections of this volume.