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Vegetation Studies On Vandenberg Air Force Base, California

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Vegetation Studies On Vandenberg Air Force Base, California

Paul A. Schmalzer, Ph.D.,
Diana E. Hickson,
and
C. Ross Hinkle, Ph.D.

The Bionetics Corporation, John F. Kennedy Space Center, Florida

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ABSTRACT

Vandenberg Air Force Base, located in coastal central California with an area of 98,400 ac (39822 ha), contains resources of considerable biological significance. In this report, available information on the vegetation and flora of Vandenberg is summarized and new data collected in this project are presented.

A bibliography of 621 references dealing with vegetation and related topics related to Vandenberg was compiled from computer and manual literature searches and a review of past studies of the base.

A preliminary floristic list of 624 taxa representing 311 genera and 80 families was compiled from past studies and plants identified in the vegetation sampling conducted in this project. The actual flora of the base may be substantially larger than this, since no comprehensive, basewide floristic survey has been conducted.

Fifty-two special interest plant species are known to occur or have been suggested to occur on Vandenberg by past studies. Two Category 1 plants and 12 Category 2 plants occur on the base, as well as 23 species listed by the California Native Plant Society. Taxonomic or nomenclatural problems exist with some of these species.

Vegetation was sampled using permanent plots and transects in all major plant communities including chaparral, Bishop pine forest, tanbark oak forest, annual grassland, oak woodland, coastal sage scrub, purple sage scrub, coastal dune scrub, coastal dunes, box elder riparian woodland, willow riparian woodland, freshwater marsh, salt marsh, and seasonal wetlands. Twenty-nine stands were sampled; 15 of these had been sampled by San Diego State University (SDSU) in 1974-75. Comparison of the new vegetation data to the composite SDSU data does not indicate major changes in most communities

since the original study. However, wetlands vegetation on the north side of Barka Slough has deteriorated, dried out, compared to conditions documented in a 1980 survey by the Fish and Wildlife Service. This decline appears to be related to withdrawal of groundwater from the San Antonio aquifer.

Certain plant communities are of particular significance. Tanbark oak forest is a relict community restricted to the Tranquillon Mountain area where frequent fog allows it to persist at the southern extreme of its range. Bishop pine forest is also a relict community, south of its general range. Burton Mesa chaparral is a regionally endemic form of maritime chaparral much reduced from its former extent and poorly represented in nature reserves. Coastal dunes and coastal dune scrub are considered regionally rare and declining plant communities whose extent have been reduced due to development, recreational use, and displacement by exotic species. Riparian wetlands, salt marshes, and other wetlands vegetation are of limited extent in an area of low rainfall, are important animal habitats, and have been greatly reduced on a regional basis by development.

Recommendations are made for additional studies needed to maintain and extend the environmental data base and for management actions to improve resource protection.

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INTRODUCTION

Vandenberg Air Force Base is located on the west coast of south central California in Santa Barbara County and is approximately 275 mi (442 km) south of San Francisco, 140 mi (225 km) northwest of Los Angeles, 55 mi (88 km) northwest of Santa Barbara, and 36 mi (58 km) south of San Luis Obispo. Vandenberg has a land area of 98,400 acres (39,822 ha) and extends along about 35 mi (56 km) of coastline along the Pacific Ocean.

Vandenberg was first acquired by the U.S. Government in 1941 and was used as an artillery training base called Camp Cooke during World War II and the Korean War. In 1957, the northern part of the base was transferred to the Air Force as a missile test facility first termed Camp Cooke Air Force Base but later renamed Vandenberg Air Force Base, and the southern part of the base became the Point Arguello Naval Missile Facility. In 1964, the two parts of the base were united under Air Force jurisdiction. The base has been a very active missile launch facility for the developmental and operational testing of intercontinental ballistic missiles and for satellite launches for the Department of Defense and the National Aeronautics and Space Administration using a variety of launch vehicles. Vandenberg was designated as the west coast launch site for the Space Transportation System although no Space Shuttle launches have occurred from there.

In addition to the active use of Vandenberg by numerous Air Force organizations, other federal agencies, and civilian defense contractors for missile launches and related activites, 37,500 acres (15,054 ha) of the base are maintained in grazing leases. Mineral leases, primarily for oil development, exist for much of the base (URS 1987). A controlled burning program for fuel reduction is also conducted by the base.

The biological importance of Vandenberg has been recognized in a number of past studies (e.g., Coulombe and Cooper 1976, Coulombe and Mahrdt 1976, URS 1987). Vandenberg is located in a region generally considered the ecological transition zone between northern and southern California with many plant and animal species reaching their northern or southern limits in this vicinity (Coulombe and Cooper 1976, Howald et al. 1985). Unique and endemic elements also occur in the vegetation and flora of Vandenberg (e.g., Burton Mesa chaparral, southernmost stands of tanbark oak). Due to the requirements for buffer areas around launch facilities, much of the base has not been extensively developed. These biological resources will become more important as development continues along the California coast.

In recognition of the biological value of Vandenberg and in response to legal requirements for analyzing and minimizing environmental impacts from government projects, numerous studies, environmental impact statements, and environmental assessments (e.g., Coulombe and Cooper 1976, USAF 1978, HDR 1979, Dial 1980, USAF 1983, Howald et al. 1985, URS 1987, and others) have been conducted in recent years. These are reviewed in a later section of this report. However, knowledge of the biota and ecological conditions on Vandenberg required for management decisions has remained fragmentary, since many of the studies have been narrowly focused and no continuous data base of the different studies has been maintained.

The present report is one of several produced for the Biological Monitoring Program for Vandenberg in a project begun in July 1986. The intent of this project has been to compile and extend existing information to provide a better basis for management decisions. This report reviews past studies of the vegetation, special interest plants, and flora of Vandenberg, presents and discusses results of the vegetation sampling conducted during this study, and makes recommendations for further study and management actions based on these results. Other studies in this project include soil erosion (Butterworth 1987, 1988), fire history (Hickson 1987b, 1988), least bell's vireo (Breininger 1988a), wildlife (Breininger 1988b), methods of controlling four exotic plants (Schmalzer and Hinkle 1987b), and preparation of vegetation and land use types maps (Provancha 1988).

THE STUDY AREA

Climate

Vandenberg has a Mediterranean climate with a strong maritime influence. Mean temperatures range from 52°F (11.1°C) in January to 61°F (16.1°C) in September; proximity to the cool California current moderates summer temperatures.

Precipitation is concentrated in the winter months; >90% of annual precipitation falls between November and April. Little measurable precipitation occurs May through September. Precipitation is related to Pacific cold fronts and storms passing inland. Thunderstorms are infrequent; on average only two to three days with thunderstorms occur per year (Wooten et al. 1974).

Average precipitation in the Vandenberg area is about 15 in (38 cm) per year (Muir 1964, Hutchinson 1980). Year to year variability in precipitation in the region is high (Upson and Thomasson 1951). There is a tendency for wet and dry years to be clumped (Wilson 1959).

Land and sea breezes create diurnal wind patterns on Vandenberg (Wooten et al. 1974). For much of the region, prevailing wind directions are northwest from February through November and east-southeast in December and January (USAF 1978). Warm, dry Santa Ana winds occasionally reach the region, increasing fire danger.

Fog frequency increases from winter to summer. Fog is most frequent near the coast on relatively flat topography, since fog originates over the cold coastal waters (Wooten et al. 1974). Fog and cool, humid sea breezes greatly reduce potential evapotranspiration during the dry season (Nixon et al. 1972).

Weather data are collected for the base by Detachment 30, 2nd Weather Squadron, U.S. Air Force (USAF 1978).

Geology

Physiography and surficial geology influence soil formation and hence vegetation patterns. Bedrock geology, mineral resources, fault systems, and other aspects of Vandenberg geology are reviewed elsewhere (e.g., URS 1987, Dames and Moore 1984a, 1985a, b, c). Primary sources of geologic information are the reports and maps by Dibblee (1950) and Woodring and Bramlette (1950).

Vandenberg is situated in a region of complex and varied geology that gives rise to an equally complex pattern of topography and soils. It is located in the Santa Maria Basin between the San Rafael Mountains of the Southern Coastal Ranges province on the north and the Santa Ynez Mountains of the Transverse Ranges province on the south (URS 1987).

The geologic history of the area has been complex. Periods of deposition have alternated with periods of uplift and orogeny since the Jurassic (Dibblee 1950, Page et al. 1951). The most recent uplift occurred in the late Pleistocene and was followed by renewed downcutting of canyons by streams and floodplain formation by lateral erosion along major streams (Dibblee 1950).

Marine terraces formed during the Pleistocene from the interactions of sea level changes and regional uplift or subsidence. Woodring and Bramlette

(1950) found evidence for five separate terraces. Johnson (1983) found multiple marine terraces and multiple stream terraces.

Sand dune formation (or at least aeolian sand deposition) occurred in several intervals during the Pleistocene. Woodring and Bramlette (1950) distinguished three ages of dunes: modern dunes occur nearshore, are composed of white sand, and have sparse vegetation; intermediate age dunes are inland of the modern dunes, have brownish sand, are partially vegetated but have little soil development; old dunes have poorly preserved form due to erosion and are generally covered by vegetation. Johnson (1983) concluded that the intermediate age dunes were probably less than 2000 years old. The old dunes were dated by Johnson (1983) as early- to mid-Holocene based on the limited development of the Oceano soils found on these dunes and the occurrence of a warm-dry interval between ca 7800 to 2300 years before present (Heusser 1978) that would have favored dune formation.

Johnson (1983) distinguished two older periods of dune formation. The first, termed older dunes, have subdued dune morphology and more developed soils with reddish colors and development of a clay-enriched B horizon. These dunes occur on at least part of the Burton Mesa; they probably date from about 125,000 years ago. The last set of dunes, termed ancient dunes, includes the wind-reworked upper portion of the Orcutt sand. These may be more than 200,000 years old. Tangair and Narlon soils have developed on the older and ancient dunes.

Many geologic formations occur in the Vandenberg area. Those characteristic of the Santa Maria Basin are listed in Table 1, and those characteristic of the western Santa Ynez Mountains are in Table 2. Formations range from Jurassic to Recent in age. Above the Jurassic Franciscan formation, are formations that are generally sedimentary in origin that include claystones,

Table 1. Geologic formations occurring in the Santa Maria Basin (modified from Woodring and Bramlette [1950]).

Age	Formation	Member	Maximum Outcrop Thickness	Maximum Subsurface Thickness	Lithology	Outcrops in Vandenberg Area
Recent	Alluvium		20' (6m)	230' (70m)	Sand, gravel, silt	Stream valleys
Recent	Dune sand		100' (30m)	100'(?) (30m)	Well sorted, strongly cross-bedded sand	Coastal strip, San Antonio Terrace
Late Pleistocene	Terrace deposits younger than Orcutt sand		100' (30m)	1000' ± (305m)	Marine sand and gravel, 1-6' thick on marine terraces. Reddish-brown sand, gravel, and rubble (non-marine cover) on marine terraces. Sand and gravel on stream terraces.	Coastal terraces, stream valleys
Late Pleistocene	Orcutt sand		100' (30m)		Reddish brown sand, gravel	Purisima Hills, Burton Mesa, Casmalia Hills, Lompoc Terrace
Late Pliocene and early Pleistocene	Paso Robles formation		2000' (610m)	4500' (1372m)	Sand, gravel, clay, limestone	Purisima Hills, Casmalia Hills
Late Pliocene	Careaga sandstone	Graciosa coarse-grained	425' (130m)	2250' (686m)	Coarse-grained sandstone, conglomerate	Purisima Hills, Casmalia Hills
		Cebada fine-grained	1000' (305m)		Fine-grained sand-stone	

Table 1. (continued).

Age	Formation	Member	Maximum Outcrop Thickness	Maximum Subsurface Thickness	Lithology	Outcrops in Vandenberg area
Middle (?) and late Pliocene	Foxen mudstone		800' (244m)	2750' (838m)	Mudstone, siltstone, fine-grained sand-stone	Purisima Hills, Casmalia Hills
Late Miocene to middle Pliocene	Sisquoc formation	Tinaquaic sandstone	1450' (442m)	3000'(?) (914m)	Sandstone, conglomerate, siltstone	Purisima Hills, Casmalia Hills
		Diatomaceous strata and equivalent ± porcelaneous mudstone	3000'+ (914m)	5000' (1524m)	Diatomaceous mudstone, clayey less diatomaceous mudstone, laminated diatomite, ± porcelaneous mudstone and clay-stone, porcelaneous shale	
Middle and late Miocene	Monterey shale	Upper	1000' (305m)	5000' (1524m)	Porcelaneous shale, laminated diatomite	Purisima Hills, Casmalia Hills
		Middle	250' (76m)		Chert, cherty shale, porcelaneous shale	Lions Head area (sea cliffs and reefs), Casmalia Hills, Purisima Hills
		Lower	900' (274m)		Phosphatic shale, silty shale, ± porcelaneous shale	Lions Head area (sea cliffs and reefs)
Middle Miocene	Point Sal formation		1500' (457m)	3600' (1097m)	Mudstone, siltstone, thin beds of sand-stone	Mt. Lospe (south slope)

Table 1. (continued).

Age	Formation	Member	Maximum Outcrop Thickness	Maximum Subsurface Thickness	Lithology	Outcrops in Vandenberg area
Early Miocene	Lospe formation	Upper	2100' (640m)	2000' ± (610m)	Greenish sandstone, siltstone, and gypsiferous mudstone	Lions Head area, Pt. Sal Ridge-Corralillos Canyon area
		Lower	600' (183m)		Reddish sandstone, conglomerate, and rubble	
Late Jurassic	Knoxville formation		500' ± (152m)	1250' (381m)	Shale, thin-bedded sandstone, conglomerate	Pt. Sal Ridge, Lions Head
Jurassic (?)	Igneous rocks of Franciscan formation		?	?	Basalt, gabbro, periodotite, serpentine	Lions Head area

?-Indicates uncertainty in age or thickness.

Table 2. Geologic formations occurring in the western Santa Ynez Mountains (modified from Dibblee 1950).

Age	Formation	Member	Maximum Thickness	Lithology	Outcrops in Vandenberg area
Recent	Alluvium		100' (30m)	Silts and gravels	Stream valleys
Pleistocene	Terraces		100' (30m)	Gravels	Coastal terraces, stream valleys
Late Miocene	Monterey shale	Upper member	3000' (914m)	Porcelaneous and cherty siliceous shales	Oak Mountain
		Lower member		Organic shales and thin limestones	Oak Mountain
Middle Miocene	Tranquillon volcanics		1200' (366m)	Rhyolite, basalt lava, agglomerate, tuff, bentonite	Tranquillon Mountain
Early Miocene	Rincon claystone		1700' (518m)	Claystone	Jalama Canyon, Tranquillon Mountain
Early Miocene	Vaqueros		900' (274m)	Sandstone and conglomerate	Canada El Morida

Table 2. (continued).

Age	Formation	Member	Maximum Thickness	Lithology	Outcrops in Vandenberg area
Oligocene	Sespe formation		2000' (610m)	Pink to buff sandstone, red and green siltstone	Casmalia Hills
Oligocene	Alegria formation			Gray to buff marine sandstone	La Salle Canyon
Oligocene	Gaviota formation		1600' (488m)	Fossiliferous buff sandstone and siltstone	South Vandenberg Miguelito Road
Upper Eocene	Sacate formation		1500' (457m)	Buff sandstone and clay shale	
Upper Eocene	Cozy Dell shale		2000' (610m)	Brown clay shale	Canada El Morida
	Matilija sandstone		2000' (610m)	Buff arkosic sandstone	Jalama Canyon
Middle Eocene	Anita shale		1000' (305m)	Dark gray clay shale	Jalama Canyon
	Sierra Blanca limestone		50' (15m)	Algal limestone lens	Jalama Canyon

Table 2. (continued).

Age	Formation	Member	Maximum Thickness	Lithology	Outcrops in Vandenberg area
Late Cretaceous	Jalama		2200' (671m)	Buff fine-grained sandstone, gray siltstone, and gray clay shale	Jalama Canyon
Cretaceous	Espada (Knoxville)		6800' (2073m)	Dark greenish brown carbonaceous shales and thin sandstones. Basal pebbly sandstone	Honda Canyon (south side)
Jurassic	Honda		1500' (457m)	Dark greenish brown nodular claystone	Honda Canyon
Jurassic	Franciscan		Unknown	Hard green sand-stone, black shale, and serpentine intrusions	Honda Canyon (north side)

mudstones, siltstones, shales, fine and coarse-grained sandstones, and conglomerates. Volcanics occur in the Tranquillon Mountain area. Unconsolidated sediments include sand, gravel, silt, and clay. These formations provide a variety of materials for soil formation.

Several physiographic divisions occur on Vandenberg; north to south the major sections are: the Casmalia Hills, San Antonio Terrace, San Antonio Valley, Purisima Hills, Burton Mesa, Santa Ynez Valley, Lompoc Terrace, and Santa Ynez Mountains. The Casmalia Hills form the northern part of Vandenberg; elevations range from 300 ft (91 m) to 1300 ft (396 m), and slopes are moderate to steep (URS 1987). These hills formed as part of an anticlinal uplift and expose many of the older rock formations in the region (Table 1) (Woodring and Bramlette 1950). The Point Sal area is of considerable scientific interest to geologists (Michael McElligott, Environmental Task Force, Vandenberg, pers. comm.). Shuman Canyon, formed as a result of movement along the Lions Head fault, separates the Casmalia Hills from the San Antonio Terrace to the south (URS 1987).

San Antonio Terrace is a peneplain of low relief (200 ft, 61 m) extending from Shuman Canyon to San Antonio Creek and from the coast inland to the Purisima Hills (URS 1987). Active sand dunes occur along the coast, and older, fixed dunes occupy the interior sections of the terrace, extending 5.3 mi (8.5 km) inland; the dune complex represents two periods of advance (Cooper 1967). Dune formations are aligned with the prevailing northwest winds. The topography is hummocky, with dune ridges and troughs and localized depressions representing deflation areas (Cooper 1967, URS 1987). Active and stabilized dunes support unique vegetation, several special interest plant species, and important animal habitat (Coulombe and Cooper 1976, URS 1987).

The San Antonio Valley separates the San Antonio Terrace from the Burton Mesa. The valley is considered a synclinal formation and not simply an erosional feature from San Antonio Creek. The western edge of the Purisima Hills occurs within the boundaries of Vandenberg. Elevations range from 700 to 800 ft (213 to 244 m) in these hills and slopes are steep (URS 1987). Woodring and Bramlette (1950) and Dibblee (1950) describe the Purisima Hills as anticlinal in formation while the URS report (1987) states that they are synclinal.

The Burton Mesa extends from the San Antonio Valley to the Santa Ynez River Valley. This peneplain is about 400 ft (122 m) in elevation, and is dissected locally by canyons (Dibblee 1950). Recent sand dunes occur along the coastal part of the Burton Mesa but do not extend as far inland as on the San Antonio Terrace (Cooper 1967). Irregularly hummocky topography covers part of the Burton Mesa (Woodring and Bramlette 1950, Johnson 1983). The Orcutt formation occupies much of the mesa and may be partially aeolian sand in origin but of considerable age (Johnson 1983). Burton Mesa chaparral is a distinct and significant plant community (Hickson 1987a, URS 1987).

The Santa Ynez (or Lompoc) Valley is a broad synclinal valley occupied, in part, by the floodplain of the Santa Ynez River (Dibblee 1950).

The Lompoc Terrace is on the south side of the Santa Ynez Valley. Like the San Antonio Terrace and Burton Mesa, it is probably a marine terrace in origin (URS 1987). Dunes extend only a short distance inland from the coast along this terrace (Cooper 1967).

South of the Lompoc Terrace are the western ("lower") Santa Ynez Mountains (Dibblee 1950). Ridges exceed 2000 ft (610 m) in elevation. The topography is complex, dissected by major canyons including La Salle and Lompoc Canyons that drain north to the Santa Ynez River and Bear Creek, Spring Canyon, Honda Canyon, Gray Canyon, and Red Roof Canyon that drain directly into the ocean (URS 1987).

Soils

Two soil surveys describe parts of Vandenberg. The northern and central parts of the base, as far south as Spring Canyon, were mapped by Shipman (1972); major fieldwork for this map was conducted in 1964. This is a modern survey at a scale of 1:20,000 and uses the current soil taxonomy. The southern part of Vandenberg was mapped as part of an older survey (Cole et al. 1958, fieldwork conducted in 1942 and 1943). The scale of this map is less detailed (1:31,680), and some of the soil classifications are no longer in use. The more recent soil map for the southern part of Santa Barbara County (Shipman 1981, fieldwork completed in 1973) does not include the southern part of Vandenberg.

Soil formation depends on the interaction of several factors: climate, parent material, topography, organisms, and time (Jenny 1941, 1980). Due to the complex topography and geology of Vandenberg, the diverse vegetation, and the variable ages of different landscapes, the resulting soil pattern is complex. The soil map of North and Central Vandenberg (Shipman 1972) contains 111 soil and land types (Table 3); the map for South Vandenberg (Cole et al. 1958) has 106 soil and land types (Table 4). The 56 soil series that form the basic classification for these maps reflect the diversity of parent materials occurring on Vandenberg (Table 5). The series that are classified at higher levels (Table 6) are predominately Mollisols (24) and Entisols (9), with fewer Alfisols (3), Vertisols (3), Ultisols (2), and Inceptisols (1).

Erosion has influenced the present composition of many soils on Vandenberg. On North and Central Vandenberg, 24 eroded soil types (Table 7) are mapped, while on South Vandenberg, 22 eroded types (Table 8) are

Table 3. Soil and Land Types Occurring on North and Central Vandenberg.[1]

Map Symbol	Soil and Land Types
AgA	Agueda silty clay loam (0-2% slopes)
AgC	Agueda silty clay loam (2-9% slopes)
ArD	Arnold sand (5-15% slopes)
ArF	Arnold sand (15-45% slopes)
ArF3	Arnold sand, severely eroded (9-45% slopes)
Bg	Bayshore silty clay loam
BnD2	Betteravia loamy sand, dark variant, eroded (5-15% slopes)
BoA	Botella loam (0-2% slopes)
BoC	Botella loam (2-9% slopes)
BoD2	Botella loam, eroded (2-15% slopes)
BsA	Botella loam, slightly wet (0-2% slopes)
BtA	Botella clay loam (0-2% slopes)
BtA2	Botella clay loam, eroded (0-2% slopes)
BtD2	Botella clay loam, eroded (2-15% slopes)
BtC	Botella clay loam (2-9% slopes)
BwA	Botella clay loam, wet (0-2% slopes)
Ca	Camarillo sandy loam
Cc	Camarillo very fine sandy loam
Cd	Camarillo silty clay loam
CeC	Chamise sandy loam (5-9% slopes)
CfD	Chamise shaly sandy loam (9-15% slopes)
ChD	Chamise shaly loam (9-15% slopes)
ChF	Chamise shaly loam (15-45% slopes)
ChG2	Chamise shaly loam, eroded (30-75% slopes)
CmF	Climara-Toomes complex (15-45% slopes)
CnB	Coastal beaches
CtA	Corralitos sand (0-2% slopes)
CtD	Corralitos sand (2-15% slopes)
CtD2	Corralitos sand, eroded (9-15% slopes)
CuA	Corralitos loamy sand (0-2% slopes)
CuC	Corralitos loamy sand (2-9% slopes)
CuD	Corralitos loamy sand (9-15% slopes)
CwE	Crow Hill loam (15-30% slopes)
CwF	Crow Hill loam (30-45% slopes)
CwG	Crow Hill loam (45-75% slopes)
CwG3	Crow Hill loam, severely eroded (15-75% slopes)
DaD	Diablo silty clay (9-15% slopes)
DaE	Diablo silty clay (15-30% slopes)
DuE	Dune land
EdA2	Elder sandy loam, eroded (0-2% slopes)

[1] Shipman, G.E. 1972 Soil survey of the northern Santa Barbara area, California. USDA Soil Conservation Service. Washington, D.C. 182pp. and maps.

Table 3. (continued).

Map Symbol	Soil and Land Types
EdC2	Elder sandy loam, eroded (2-9% slopes)
EdD2	Elder sandy loam, eroded (9-15% slopes)
EmA	Elder loam (0-2% slopes)
EmC	Elder loam (2-9% slopes)
EnA2	Elder shaly loam, eroded (0-2% slopes)
EnC2	Elder shaly loam, eroded (2-9% slopes)
EnD2	Elder shaly loam, eroded (9-15% slopes)
GmG	Gaviota sandy loam (30-75% slopes)
GsD	Gazos clay loam (9-15% slopes)
GsE	Gazos clay loam (15-30% slopes)
GsF	Gazos clay loam (30-45% slopes)
GsG	Gazos clay loam (45-75% slopes)
GuE	Gullied land
LaF	Landslides
LcE	Linne clay loam (15-30% slopes)
LmG	Lopez shaly clay loam (15-75 % slopes)
LoE	Los Osos clay loam (15-30% slopes)
LoG	Los Osos clay loam (30-75% slopes)
LsE	Los Osos-San Benito clay loams (15-30% slopes)
LsF	Los Osos-San Benito clay loams (30-45% slopes)
MaA	Marina sand (0-2% slopes)
MaC	Marina sand (2-9% slopes)
MaE	Marina sand (9-30% slopes)
MaE3	Marina sand, severely eroded (9-30% slopes)
Mh	Marsh
MnA	Metz loam, sandy (0-2% slopes)
Mu	Mocho fine sandy loam
Mv	Mocho loam
NrB	Narlon sand (0-5% slopes)
NsA	Narlon loamy sand (0-2% slopes)
NsC	Narlon loamy sand (2-9% slopes)
NsD	Narlon loamy sand (9-15% slopes)
NvC	Narlon sand, hardpan variant (2-9% slopes)
OcA	Oceano sand (0-2% slopes)
OcD	Oceano sand (2-15% slopes)
Rs	Riverwash
RuG	Rough broken land
SaA	Salinas loam (0-2% slopes)
SaC	Salinas loam (2-9% slopes)
SdC	Salinas silty clay loam (2-9% slopes)
SeD	Salinas and Sorrento loams (9-15% slopes)
SfD	San Andreas-Tierra complex (5-15% slopes)
SfE	San Andreas-Tierra complex (15-30% slopes)
SfF3	San Andreas-Tierra complex, severely eroded (9-45% slopes)
SfG	San Andreas-Tierra complex (30-75% slopes)

Table 3. (continued).

Map Symbol	Soil and Land Types
Sk	Sandy alluvial land, wet
SmE	Santa Lucia shaly clay loam (15-30% slopes)
SmF	Santa Lucia shaly clay loam (30-45% slopes)
SmF2	Santa Lucia shaly clay loam, eroded (15-45% slopes)
SmG	Santa Lucia shaly clay loam (45-75% slopes)
SpG	Sedimentary rock land
SrE	Shedd silty clay loam (15-30% slopes)
SrF	Shedd silty clay loam (30-45% slopes)
SrG	Shedd silty clay loam (45-75% slopes)
SrG3	Shedd silty clay loam, severely eroded (30-75% slopes)
SsF	Shedd silty clay loam, diatomaceous variant (30-45% slopes)
SzW	Swamp
TaA	Tangair sand (0-2% slopes)
TaC	Tangair sand (2-9% slopes)
TcG	Terrace escarpments, sandy
TdF	Terrace escarpments, loamy
TmE	Tierra loamy sand (9-30% slopes)
TnC	Tierra sandy loam (2-9% slopes)
TnD2	Tierra sandy loam, eroded (9-15% slopes)
TnE2	Tierra sandy loam, eroded (15-30% slopes)
TrC	Tierra loam (2-9% slopes)
TrD	Tierra loam (9-15% slopes)
TrE2	Tierra loam, eroded (15-30% slopes)
TrE3	Tierra loam, severely eroded (5-30% slopes)
TsF	Tierra clay loam (15-45% slopes)
TxG	Toomes-Climara complex (30-75% slopes)

Table 4. Soil and Land Types Occurring on South Vandenberg.[1]

Map Symbol	Soil and Land Types
Aa	Agueda clay loam, gently sloping (3-8% slopes)
Ad	Agueda gravelly clay loam, gently sloping (3-8% slopes)
Ae	Agueda gravelly clay loam, sloping (9-15% slopes)
As	Arguello shaly loam, gently sloping (3-8% slopes)
At	Arguello shaly loam, sloping (9-15% slopes)
Be	Ballard gravelly fine sandy loam, gently sloping (3-8% slopes)
Bk	Baywood loamy fine sand, over Watsonville soils, gently sloping (3-8% slopes)
Bl	Baywood loamy sand, gently sloping (3-8% slopes)
Bn	Baywood loamy sand over Watsonville soils, gently sloping (3-8% slopes)
Bp	Baywood loamy sand, rolling (9-15% slopes)
Br	Botella clay loam, gently sloping, (3-8% slopes)
Bt	Botella clay loam, sloping (9-15% slopes)
Cm	Climax clay (adobe), hilly (16-30% slopes)
Cn	Climax clay (adobe), steep (31-45% slopes)
Co	Coastal beach, sandy
Cp	Coastal beach, stony
Cr	Crow Hill loam, hilly (16-30% slopes)
Cs	Crow Hill loam, hilly, moderately eroded (16-30% slopes)
Ct	Crow Hill loam, sloping (9-15% slopes)
Cv	Crow Hill loam, steep and very steep (31%+ slopes)
Da	Diablo clay (adobe), hilly (16-30% slopes)
Db	Diablo clay (adobe), hilly, moderately eroded (16-30% slopes)
Dc	Diablo clay (adobe), sloping (9-15% slopes)
Dd	Diablo clay (adobe), steep (31-45% slopes)
De	Dune sand
Eb	Elder loam, gently sloping (3-8% slopes)
Ec	Elder shaly clay loam, gently sloping (3-8% slopes)
Ed	Elder shaly loam, sloping (9-15% slopes)
Ee	Elder shaly sandy loam, gently sloping (3-8% slopes)
Ga	Gaviota fine sandy loam, hilly (16-30% slopes)
Gd	Gaviota fine sandy loam, steep (31-45% slopes)
Gk	Gaviota stony soils, undifferentiated, steep and very steep (31%+ slopes)
Ja	Jalama shaly sandy loam, gently sloping and sloping (3-15% slopes)
Jb	Jalama shaly sandy loam, moderately steep (16-30% slopes)
Jc	Jalama stony soils, undifferentiated, hilly and steep (16-45% slopes)
Ka	Kitchen middens, over permeable soil material
Kb	Kitchen middens, over relatively impermeable soil material
La	Landslip, Climax soil material, moderately steep (16-30% slopes)
Lb	Landslip, Diablo soil material, moderately steep and steep (16-45% slopes)

1 Cole, R.C., R.A. Gardner, K.D. Gowans, E.L. Begg, G.L. Huntington, and L.C. Leifer. 1958. Soil survey of the Santa Barbara area, California. USDA Soil Conservation Service. Washington, D.C. 177pp. and maps.

Table 4. (continued).

Map Symbol	Soil and Land Types
Lc	Landslip, Los Osos soil material, moderately steep and steep (16-45% slopes)
Ld	Landslip, Nacimiento soil material, steep (31-45% slopes)
Le	Los Osos clay, hilly (16-30% slopes)
Lf	Los Osos clay, steep (31-45% slopes)
Lg	Los Osos clay, steep, moderately eroded (31-45% slopes)
Lh	Los Osos clay loam, hilly (16-30% slopes)
Lk	Los Osos clay loam, hilly, moderately eroded (16-30% slopes)
Ll	Los Osos clay loam, sloping, moderately eroded (9-15% slopes)
Lm	Los Osos clay loam, steep (31-45% slopes)
Ln	Los Osos clay loam, steep, moderately eroded (31-45% slopes)
Lo	Los Osos clay loam, very steep (46%+ slopes)
Lp	Los Osos stony soils, undifferentiated, steep and very steep (31%+ slopes)
Lr	Los Trancos stony loam, hilly and steep (16-45% slopes)
Ma	Marina sand, gently sloping (3-8% slopes)
MM	Montara stony soils, undifferentiated, hilly and steep (16-45% slopes)
MN	Montezuma clay (adobe), gently sloping (3-8% slopes)
MR	Montezuma clay (adobe), sloping (9-15% slopes)
MV	Montezuma clay loam, gently sloping (3-8% slopes)
Na	Nacimiento clay, hilly (16-30% slopes)
Nd	Nacimiento clay, steep (31-45% slopes)
Ne	Nacimiento clay, steep, moderately eroded (31-45% slopes)
Nf	Nacimiento clay, very steep (45%+ slopes)
Nl	Nacimiento stony soils, undifferentiated, very steep (46%+ slopes)
Ob	Olivenhain fine sandy loam, moderately steep, moderately eroded (16-30% slopes)
Rd	Rough broken and stony land, Montara soil material
Re	Rough broken and stony land, Santa Lucia soil material
Rf	Rough broken and stony land, Los Trancos soil material
Rh	Rough gullied land, Los Osos soil material
Sb	San Andreas fine sandy loam, steep, moderately eroded (31-45% slopes)
Sk	Santa Lucia shaly clay loam, hilly (16-30% slopes)
Sn	Santa Lucia shaly clay loam, sloping (9-15% slopes)
So	Santa Lucia shaly clay loam, steep (31-45% slopes)
Sp	Santa Lucia shaly clay loam, steep, moderately eroded (31-45% slopes)
Sq	Santa Lucia shaly loam, hilly (16-30% slopes)
Sr	Santa Lucia shaly loam, steep (31-45% slopes)
Ss	Santa Lucia shaly loam, very steep (46%+ slopes)
St	Santa Lucia stony clay loam, hilly (16-30% slopes)
Su	Santa Lulcia stony soils, undifferentiated, steep and very steep (31%+ slopes)
SQ	Sorrento loam, gently sloping (3-8% slopes)
Ta	Tangair loamy sand, moderately steep (16-30% slopes)
Tb	Tangair loamy sand, sloping (9-15% slopes)
Tc	Tangair loamy sand, sloping, moderately eroded (9-15% slopes)
Td	Tangair sand, moderately steep (16-30% slopes)

Table 4. (continued).

Map Symbol	Soil and Land Types
Te	Tangair sand, moderately steep, moderately eroded (16-30% slopes)
Tf	Tangair sand, sloping (9-15% slopes)
Tg	Tangair sand, sloping, moderately eroded (9-15% slopes)
Th	Tangair sand, sloping, severely eroded (9-15% slopes)
Tk	Terrace breaks
Tn	Tierra fine sandy loam, hilly, severely eroded (16-30% slopes)
To	Tierra fine sandy loam, sloping, moderately eroded (9-15% slopes)
Wc	Watsonville fine sandy loam, moderately steep (16-30% slopes)
Wf	Watsonville fine sandy loam, sloping (9-15% slopes)
Wh	Watsonville loam, gently sloping (3-8% slopes)
Wl	Watsonville loam, moderately steep, moderately gullied (16-30% slopes)
Wn	Watsonville loam, sloping (9-15% slopes)
Wp	Watsonville sandy loam, gently sloping (3-8% slopes)
Wt	Watsonville soils, undifferentiated, steep (31-45% slopes)
Yd	Yolo loam, channeled, sloping (9-15% slopes)
Ye	Yolo loam, gently sloping (3-8% slopes)
Yg	Yolo loam, nearly level (0-2% slopes)
Za	Zaca clay, hilly (16-30% slopes)
Zd	Zaca clay, steep (31-45% slopes)
Zg	Zaca clay loam, hilly (16-30% slopes)
Zl	Zaca nonstony soils, undifferentiated, very steep (46%+ slopes)
Zm	Zaca shaly clay loam, hilly (16-30% slopes)
Zs	Zaca shaly clay loam, steep (31-45% slopes)
Zv	Zaca stony soils, undifferentiated, steep and very steep (31%+ slopes)

Table 5. Parent Material of Soil Series Occurring on Vandenberg.[1,2]

Soil Series	Parent Material
Agueda	Recent alluvium from sandstone and shale
Arguello	Older alluvial fans
Arnold	Soft sandstone
Ballard	Older, gravelly alluvial deposits
Bayshore	Recent alluvium from calcareous sandstone and shale
Baywood	Windblown deposits
Betteravia	Coarse-textured, wind-modified marine sands
Betteravia, Dark Variant	Alluvium from acid sandstone and diatomaceous shale
Botella	Alluvium from acid sandstone and shale
Camarillo	Recent alluvium from sandstone and shale
Chamise	Terrace deposits-gravelly beds of silt, clay, and sand
Climara-Toomes Complex	Basic igneous bedrock
Climax	White, slightly calcareous volcanic ash
Coastal Beach	Active marine deposits-sand, gravel, and stones
Corralitos	Recent, sandy alluvium
Crow Hill	Diatomaceous shale
Diablo	Calcareous shale or mudstone
Dune Land	Coastal sand dunes
Elder	Alluvium from acid shale and sandstone
Gaviota	Hard, medium-grained sandstone
Gazos	Shale
Gullied Land	Various alluvial, terrace, or upland soils
Jalama	Old, alluvial material
Landslides	Various soils
Linne	Mudstone
Lopez	Siliceous shale
Los Osos	Fine-grained sandstone or shale
Los Trancos	Rhyolite
Marina	Windblown sand
Marsh	Recent alluvium and peat
Metz	Coarse, stratified, calcareous alluvium
Mocho	Recent alluvium
Montara	Serpentinaceous rock
Montezuma	Old terrace deposits of clay loam or clay
Naciemiento	Soft calcareous shale
Narlon	Old marine deposits
Narlon, Hardpan Variant	Wind-modified, sandy, old marine deposits
Oceano	Old coastal sand dunes
Olivenhain	Old terrace material
Riverwash	River channel deposits
Rough Broken Land	Soft sandstone or gravelly sediments
Salinas	Alluvium
San Andreas	Soft sandstone
Santa Lucia	Hard, light colored, siliceous or diatomaceous shale
Sedimentary Rock Land	Sandstone or shale
Shedd	Calcareous shale
Sorrento	Recent alluvium
Swamp	Recent alluvium and peat
Tangair	Old marine terraces or windblown sand on old terraces
Terrace Escarpment, Sandy	Betteravia, Tangair, or Narlon, hardpan variant soils
Terrace Escarpment, Loamy	Mocho, Sorrento, Salinas, or Ballard soils
Tierra	Old terrace deposits
Toomes	Hard, basic, igneous bedrock
Watsonville	Marine terrace deposits
Yolo	Alluvial fans
Zaca	Soft, calcareous shale

1 Cole, R.C., R.A. Gardner, K.D. Gowans, E.L. Begg, G.L. Huntington, and L.C. Leifer. 1958. Soil survey of the Santa Barbara area, California. USDA Soil Conservation Service. Washington, D.C. 177pp. and maps.

2 Shipman, G.E. 1972. Soil survey of the northern Santa Barbara area, California. USDA Soil Conservation Service. Washington, D.C. 182pp. and maps.

Table 6. Classification of Soil Series Occurring on Vandenberg[1].

Soil Series	Family	Subgroup	Order
Agueda[2]	Fine-loamy, mixed, thermic	Calcic Pachic Haploxeroll	Mollisols
Arguello	Not classified because of original broad or vague classification.		
Arnold	Mixed, thermic	Typic Xeropsamment	Entisols
Ballard	Fine-loamy, mixed, thermic	Typic Argixeroll	Mollisols
Bayshore	Fine-loamy, mixed, thermic	Typic Calciaquoll	Mollisols
Baywood	Sandy, mixed, thermic	Entic Haploxeroll	Mollisols
Betteravia	Sandy, mixed, thermic	Haplic Durixeralf	Alfisols
Betteravia, Dark Variant	Coarse-loamy, mixed, thermic	Typic Argixeroll	Mollisols
Botella	Fine-loamy, mixed, thermic	Pachic Argixeroll	Mollisols
Camarillo	Fine-loamy, mixed, calcareous, thermic	Aquic Xerofluvent	Entisols
Chamise	Clayey-skeletal, mixed, thermic	Ultic Argixeroll	Mollisols
Climara	Fine, montmorillonitic, thermic	Chromic Pelloxerert	Vertisols
Climax	Very fine, montmorillonitic, mesic	Typic Chromoxerert	Vertisols
Corralitos	Mixed, thermic	Typic Xeropsamment	Entisols
Crow Hill[3]	Fine-silty, mixed, thermic	Pachic Haploxeroll	Mollisols
Diablo	Fine, montmorillonitic, thermic	Chromic Pelloxerert	Vertisols
Elder	Coarse-loamy, mixed, thermic	Pachic Haploxeroll	Mollisols
Gaviota	Loamy, mixed, nonacid, thermic	Lithic Xerorthent	Entisols
Gazos	Fine-loamy, mixed, thermic	Pachic Haploxeroll	Mollisols
Jalama	Not classified because of original broad or vague classification.		
Linne	Fine-loamy, mixed, thermic	Calcic Pachic Haploxeroll	Mollisols
Lopez	Loamy-skeletal, mixed, thermic	Lithic Haploxeroll	Mollisols
Los Osos	Fine, montmorillonitic, thermic	Typic Argixeroll	Mollisols
Los Trancos	Clayey, montmorillonitic, thermic	Lithic Haploxeroll	Mollisols
Marina	Mixed, thermic	Alfic Xeropsamment	Entisols
Metz	Sandy, mixed, thermic	Typic Xerorthent	Entisols
Mocho	Fine-loamy, mixed, thermic	Calcic Entic Haploxeroll	Mollisols
Montara	Loamy, serpentinitic, thermic	Lithic Haploxeroll	Mollisols
Montezuma	Not classified because of original broad or vague classification.		
Nacimiento	Fine-loamy, mixed, thermic	Calcic Haploxeroll	Mollisols
Narlon	Clayey, montmorillonitic, mesic	Aeric Ochraquult	Ultisols
Narlon, Hardpan Variant	Clayey, montmorillonitic, mesic	Aquic Haploxerult	Ultisols
Oceano	Mixed, thermic	Alfic Xeropsamment	Entisols
Olivenhain	Clayey-skeletal, kaolinitic, thermic	Ultic Palexeralf	Alfsisols
Salinas	Fine-loamy, mixed, thermic	Calcic Pachic Haploxeroll	Mollisols
San Andreas	Coarse-loamy, mixed, thermic	Typic Haploxeroll	Mollisols
Santa Lucia	Clayey-skeletal, mixed, thermic	Pachic Ultic Haploxeroll	Mollisols
Shedd[4]	Fine-loamy, mixed, calcareous, thermic	Typic Xerorthent	Entisols
Sorrento	Fine-loamy, mixed, thermic	Calcic Haploxeroll	Mollisols
Tangair	Mixed, mesic	Typic Psammaquent	Entisols
Tierra	Fine, montmorillonitic, thermic	Mollic Palexeralf	Alfisols
Toomes[5]	Loamy, mixed, thermic	Lithic Haploxeroll	Mollisols
Watsonville	Fine, montmorillonitic, mesic	Aquic Natrixeroll	Mollisols
Yolo	Fine-silty, mixed, thermic	Typic Xerochrept	Inceptisols
Zaca	Fine, montmorillonitic, thermic	Vertic Haploxeroll	Mollisols

1 Sources: Shipman, G.E. 1972. Soil survey of the northern Santa Barbara area, California. USDA Soil Conservation Service. Washington, D.C. 182pp + maps. USDA Soil Conservation Service. 1972. Soil Series of the United States, Puerto Rico, and the Virgin Islands: their taxonomic classification. Washington, D.C.

2 Agueda loam, 0 to 2 percent slopes, is a taxadjunct to the Agueda series because fine sand is at a depth of 30 to 40 inches.

3 Crow Hill loam, 15 to 75 percent slopes severly eroded, is a taxadjunct to the Crow Hill series because the depth to bedrock is 7 to 22 inches.

4 Shedd soils mapped in this area are more moist than is appropriate to the range defined for the Shedd series. Their classification has been changed to Balcom series.

5 Toomes soils mapped in this area are taxadjuncts to the Toomes series because they lack a cambic horizon and have chromas less than 4.

Table 7. Eroded Soil and Land Types Occurring on North and Central Vandenberg.[1]

Map Symbol	Soil and Land Types
ArF3	Arnold sand, severely eroded (9-45% slopes)
BnD2	Betteravia loamy sand, dark variant, eroded (5-15% slopes)
BoD2	Botella loam, eroded (2-15% slopes)
BtA2	Botella clay loam, eroded (0-2% slopes)
BtD2	Botella clay loam, eroded (2-15% slopes)
ChG2	Chamise shaly loam, eroded (30-75% slopes)
CtD2	Corralitos sand, eroded (9-15% slopes)
CwG3	Crow Hill loam, severely eroded (15-75% slopes)
EdA2	Elder sandy loam, eroded (0-2% slopes)
EdC2	Elder sandy loam, eroded (2-9% slopes)
EdD2	Elder sandy loam, eroded (9-15% slopes)
EnA2	Elder shaly loam, eroded (0-2% slopes)
EnC2	Elder shaly loam, eroded (2-9% slopes)
EnD2	Elder shaly loam, eroded (9-15% slopes)
GuE	Gullied land
LaF	Landslides
MaE3	Marina sand, severely eroded (9-30% slopes)
SfF3	San Andreas-Tierra complex, severely eroded (9-45% slopes)
SmF2	Santa Lucia shaly clay loam, eroded (15-45% slopes)
SrG3	Shedd silty clay loam, severely eroded (30-75% slopes)
TnD2	Tierra sandy loam, eroded (9-15% slopes)
TnE2	Tierra sandy loam, eroded (15-30% slopes)
TrE2	Tierra loam, eroded (15-30% slopes)
TrE3	Tierra loam, severely eroded (5-30% slopes)

[1]Shipman, G.E. 1972 Soil survey of the northern Santa Barbara area, California. USDA Soil Conservation Service. Washington, D.C. 182pp. and maps.

Table 8. Eroded Soil and Land Types Occurring on South Vandenberg.[1]

Map Symbol	Soil and Land Types
Cs	Crow Hill loam, hilly, moderately eroded (16-30% slopes)
Db	Diablo clay (adobe), hilly, moderately eroded (16-30% slopes)
La	Landslip, Climax soil material, moderately steep (16-30% slopes)
Lb	Landslip, Diablo soil material, moderately steep and steep (16-45% slopes)
Lc	Landslip, Los Osos soil material, moderately steep and steep (16-45% slopes)
Ld	Landslip, Nacimiento soil material, steep (31-45% slopes)
Lg	Los Osos clay, steep, moderately eroded (31-45% slopes)
Lk	Los Osos clay loam, hilly, moderately eroded (16-30% slopes)
Ll	Los Osos clay loam, sloping, moderately eroded (9-15% slopes)
Ln	Los Osos clay loam, steep, moderately eroded (31-45% slopes)
Ne	Nacimiento clay, steep, moderately eroded (31-45% slopes)
Ob	Olivenhain fine sandy loam, moderately steep, moderately eroded (16-30% slopes)
Rh	Rough gullied land, Los Osos soil material
Sb	San Andreas fine sandy loam, steep, moderately eroded (31-45% slopes)
Sp	Santa Lucia shaly clay loam, steep, moderately eroded (31-45% slopes)
Tc	Tangair loamy sand, sloping, moderately eroded (9-15% slopes)
Te	Tangair sand, moderately steep, moderately eroded (16-30% slopes)
Tg	Tangair sand, sloping, moderately eroded (9-15% slopes)
Th	Tangair sand, sloping, severely eroded (9-15% slopes)
Tn	Tierra fine sandy loam, hilly, severely eroded (16-30% slopes)
To	Tierra fine sandy loam, sloping, moderately eroded (9-15% slopes)
Wl	Watsonville loam, moderately steep, moderately gullied (16-30% slopes)

[1] Cole, R.C., R.A. Gardner, K.D. Gowans, E.L. Begg, G.L. Huntington, and L.C. Leifer. 1958. Soil survey of the Santa Barbara area, California. USDA Soil Conservation Service. Washington, D.C. 177pp. and maps.

mapped. In general, soil types termed eroded (or moderately eroded) have lost 25 to 75% of the original A horizon; severely eroded soils have lost more than 75% of the original A horizon and commonly part of the B horizon. Gullied land is eroded to the point where the original soil profile has been destroyed except in small areas between the gullies (Soil Survey Staff 1951). Soil surveys indicate that erosion has occurred on Vandenberg but do not necessarily represent current key erosion areas since: 1) areas mapped in the surveys may not be currently eroding; 2) some erosion may have occurred since the surveys were completed (1942-43 or 1964); 3) the minimum mapping unit in the surveys is about 5 to 6 ac (ca 2 ha) and key erosion areas may be smaller than this; 4) unmapped inclusions of eroded soils may occur within units not designated as eroded (Butterworth 1988). Current erosion conditions are documented by Butterworth (1987, 1988).

Hydrology

Surface and groundwater hydrology are important to the existence of wetland vegetation in an area of low annual rainfall with an extended dry season. Two major drainages, San Antonio Creek and the Santa Ynez River, extend across Vandenberg. Five minor drainages are present: Shuman Creek, Canada Tortuga Creek, Bear Creek, Canada Honda Creek, and Jalama Creek. Five small freshwater lakes occur: Punchbowl Lake, Mod III Lake, and Upper, Middle, and Lower Canyon Lakes. The Santa Ynez Lagoon is the major lagoonal system; however, a small lagoon occurs at the mouth of San Antonio Creek, and a minor estuarine system occurs at the mouth of Jalama Creek (Mahrdt et al. 1976).

Shuman Creek is the northernmost significant drainage on Vandenberg. The creek has a length of about 9 mi (14.5 km) and a drainage basin of about

21 mi^2 (54.4 km^2) (Mahrdt et al. 1976). The stream drains the Casmalia Hills to the north and east and the San Antonio Terrace to the south. Few data are available on stream flow; three measurements of non-storm flow made during the San Diego State University (SDSU) study in September, January, and March gave values of 1 to 3 ft^3/sec (0.03-0.08 m^3/sec) (Mahrdt et al. 1976).

During the summer, Shuman Creek does not connect to the ocean but forms a small pool of fresh water at its mouth. Riparian woodland occurs along part of the stream (Marhdt et al. 1976). Groundwater in the Shuman Canyon drainage probably occurs only in zones of perched water associated with terrace deposits and in alluvial fill along Shuman Canyon; no known wells are in the area (USAF 1978).

The San Antonio Creek drainage is a major hydrologic feature for surface and groundwaters. The creek is 28 mi (45 km) long with a drainage basin of 154 mi (399 km^2) (Muir 1964); most of this area is outside Vandenberg. Surface flow in San Antonio Creek is intermittent above Barka Slough but perennial below; this is due to a bedrock formation cutting across the San Antonio Valley at Barka Slough. Consolidated Tertiary rocks that are impervious (not water bearing) cut across the valley at shallow depths. These strata force groundwater moving through permeable formations toward the surface. This water then discharges into San Antonio Creek creating a perennial flow from that point to the ocean (Muir 1964). The movement of groundwater toward the surface has also created the Barka Slough wetland (Hutchinson 1980); this wetland is an extremely significant natural resource (Dial 1980, URS 1987).

Muir (1964) estimated that net groundwater pumpage from the San Antonio Basin increased from 1400 ac-ft/yr in 1943 to 2900 ac-ft/yr in 1958; he gave a preliminary estimate of perennial yield of 7000 ac-ft/yr. Between 1958 and 1977, irrigated land in the San Antonio Creek basin doubled (2200 ac to 5000 ac [890 ha to 2023 ha]) and pumpage for irrigation increased to 8480 ac-ft/yr. During the same period, Vandenberg developed a well field in the basin, and pumpage for military purposes increased from 317 to 1829 ac-ft/yr (Hutchinson 1980).

Hutchinson (1980) estimated that the component of perennial yield available for net pumpage was 5500 ac-ft/yr; pumpage above this level would result in reductions in baseflow, evapotranspiration, and groundwater storage. By these criteria, the basin has been in overdraft since 1963; in 1977, the overdraft was 4300 ac-ft. Hutchinson (1980) found that there had been decreases in groundwater storage as indicated by water level declines in the Los Alamos area. Futhermore, there was a decline in the baseflow of San Antonio Creek associated with increased net pumpage.

Hutchinson (1980) predicted that continued increases in net pumpage could reduce the baseflow of San Antonio Creek to zero. Using a simple hydrologic model, Hutchinson (1980) predicted that pumpage of the Vandenberg well field at projected levels would decrease water levels 5 ft (1.5 m) within 0.5 mi (0.8 km) of the center of pumping within five years. This decrease would drop the potentiometric surface below the land surface on the north side of Barka Slough. Increased agricultural pumpage was also predicted to decrease water levels in Barka Slough beginning at the east edge of the wetland. Dial (1980) suggested that the northern part of the slough was drying out.

Plans for a major agricultural development in the Harris Canyon area made a reevaluation of Hutchinson's (1980) predictions necessary. This project planned to irrigate 2500 ac (1012 ha) of vineyards created from formerly unirrigated pasture and to irrigate truck crops on other lands. Total increase in pumpage was estimated as 6640 ac-ft/yr (Mallory 1980). From this development alone, the estimated decrease in water levels in Barka Slough was 0.5 to 1.0 ft (0.15 to 0.30 m) after one year and 4 to 5 ft (1.2 to 1.5 m) after 10 years (Mallory 1980).

A recent estimate of groundwater pumpage from the San Antonio Basin is: current Vandenberg use, 3400 ac-ft/yr; municipal and industrial, 290 ac-ft/yr; agricultural (including Harris Canyon development), 16,000 ac-ft/yr. This exceeds the estimated safe pumpage by 11,000 ac-ft/yr (Dames and Moore 1985a).

The U.S. Geological Survey (USGS) maintains a gauging station on San Antonio Creek downstream of Barka Slough, as well as an upstream station at Los Alamos (Muir 1964). Recent data are presented by URS (1987).

Barka Slough is the major wetland associated with San Antonio Creek (Dial 1980). The mouth of San Antonio Creek is a small lagoon, without direct connection to the ocean much of the year (Mahrdt et al. 1976). Other riparian woodlands and marshes occur between Barka Slough and the ocean (Marhdt et al. 1976).

Burton Mesa and the San Antonio Terrace are underlain by impervious strata. Perched water tables may occur locally in the unconsolidated strata (Orcutt sand, dune sand) (USAF 1978) and support localized wetlands (HDR 1979).

The Santa Ynez River is an important drainage in Santa Barbara County with a length of about 70 mi (113 km) and a drainage basin of 900 mi^2 (2330 km^2) (Mahrdt et al. 1976). Only a small part of the total length of the river is within Vandenberg. Surface flow in the river is regulated by dams. Before the completion of Cachuma Dam in 1953 the river generally had perennial flow, but since that time summer flow has often dropped to zero (Upson and Thomasson

1951, Wilson 1959, Mahrdt et al. 1976). Some surface flow may be maintained in summer, in part by effluent from the sewage treatment plant in Lompoc (URS 1987).

Several gauging stations are maintained on the Santa Ynez River by the USGS; recent data are given by URS (1987). Flow fluctuates greatly year-to-year, seasonally, and with storm events.

The Santa Ynez River terminates in a 58 ac (23.5 ha) lagoon. Surrounding the lagoon is a coastal salt marsh, an uncommon and significant vegetation type in the region (Mahrdt et al. 1976, URS 1987). Freshwater marsh and riparian woodland occur upstream from the salt marsh; outside the boundaries of Vandenberg, agricultural areas predominate (Marhdt et al. 1976).

Groundwater in the Santa Ynez River basin has been studied by Upson and Thomasson (1951), Wilson (1959), and Evenson and Miller (1963). Recent information is summarized by URS (1987). The main aquifer is the alluvium of the Lompoc Plain (Upson and Thomasson 1951). This aquifer is hydrologically connected to the Lompoc Upland to the north and east which serves as a recharge area (Wilson 1959, URS 1987). The Lompoc Terrace to the south is also hydrologically connected to the Lompoc Plain (Evenson and Miller 1963, URS 1987).

Groundwater in the Lompoc Plain is used extensively for irrigation and municipal water supply for Lompoc; Vandenberg also maintains several water supply wells from this aquifer (URS 1987). Declines in groundwater levels under drought conditions were noted in the 1945 to 1951 drought (Wilson 1959). Recent estimates of total withdrawal from the aquifer of 16,000 ac-ft/yr exceed the estimated potential yield of 15,400 ac-ft/yr, indicating overdraft (USAF 1978). Water quality problems have also been noted in some wells, probably as a result of the leaching of irrigation waters, since salt water intrusion has not occurred (Upson and Thomasson 1951, Wilson 1959, URS 1987). These changes in groundwater have had no known impacts on riparian or marsh vegetation in the drainage.

Nixon et al. (1972) found that in this region direct recharge of groundwater by on-site precipitation did not occur every year. Rather, recharge occurred irregularly and was influenced by precipitation, soil, and local climatic conditions. On a typical site, they estimated that recharge from precipitation would occur on average every 7 years with a range of between 3 and 20 years.

The Lompoc Terrace contains a groundwater aquifer in the Careaga sand (Evenson and Miller 1963). Two wells currently withdraw water from this aquifer for Vandenberg use at a rate of about 350 ac-ft/yr; this exceeds the natural recharge by about 100 ac-ft/yr but is small compared to the total storage of about 30,000 ac-ft (URS 1987). It is unlikely that this removal of groundwater has any current impact on wetlands vegetation.

Canada Honda Creek, the largest stream on South Vandenberg, is about 9 mi (14.5 km) long with a drainage basin of 12 mi^2 (31 km^2) (Mahrdt et al. 1976). About one-half of its length has a perennial flow. Riparian woodland occurs along parts of the creek (Mahrdt et al. 1976). Minor amounts of groundwater occur in alluvium along this creek (Evenson and Miller 1963). Bear Creek, Spring Canyon Creek, and Lompoc Canyon Creek also occur in the Lompoc Terrace area; these streams generally have intermittent flow (Evenson and Miller 1963).

Several intermittent and perennial streams draining slopes of the Santa Ynez Mountains occur in the Sudden Ranch area. These include Oil Well Canyon, Canada Agua Viva, Water Canyon, Canada del Morida, Canada del Jolloru, and others. Past grazing practices have impacted riparian vegetation along these creeks (Coulombe and Cooper 1976).

Jalama Creek occurs along the southern boundary of Vandenberg. The stream is about 8 mi (12.8 km) long and drains an area of 24 mi^2 (62 km^2) (Mahrdt et al. 1976). The creek is open to the ocean most of the year, but only the lower 50 m are subject to tidal surges. Riparian woodland occurs along much of the creek (Mahrdt et al. 1976).

The Base Bioenvironmental Engineer monitors water quality in surface streams including Shuman Creek, San Antonio Creek, Santa Ynez River, Canada Honda Creek, Jalama Creek, and several other smaller streams on a periodic basis (AFR 19-7). Groundwater quality data are collected from monitoring wells around launch facilities, hypergolic fuel facilities, and landfills (AFR 19-7). Drinking water quality is also monitored (URS 1987). Other data on groundwater quality are also presented in USGS reports (Upson and Thomasson 1951, Evenson and Miller 1963, Muir 1964, Wilson 1959, Hutchinson 1980).

PREVIOUS STUDIES OF VEGETATION AND FLORA

The need for comprehensive ecological information on Vandenberg was identified by Wooten et al. (1974). Information was needed for planning and analysis for planned Space Shuttle development at Vandenberg. They recommended: 1) preparation of a vegetation map from aerial photography with ground truthing; 2) vegetation sampling to identify major species and species diversity; 3) identification of rare and endangered species and significant or unique biological conditions; 4) descriptions of vegetation succession; 5) recommendations for land management and conservation of natural resources. They also recommended that comprehensive studies of terrestrial animal communities, avifauna, and aquatic systems be conducted.

Vegetation types identified included chaparral, Bishop pine forest, tanbark oak forest, grassland, live oak woodland, and sand dunes.

Ecological Surveys

The first comprehensive ecological study of Vandenberg was conducted by SDSU in 1975-76 (Coulombe and Cooper 1976, Coulombe and Mahrdt 1976, Reilly et al. 1976). A vegetation map was prepared at the scale of the Base Master Planning maps (nominally 1:9600) from aerial photography; types mapped at this level of resolution are listed in Table 9. Ground truthing was conducted by comparing vegetation at 130 points to the original map; classification success was about 94% (Coulombe and Mahrdt 1976). These maps were digitized using the GRID system, an early geographic information system (GIS). Due to limitations of this system, the digitized maps were less detailed than the base map. Resolution was reduced first using a 2.55 ac (1.03 ha) grid and then further reduced using a 22.3 ac (9.02 ha) grid. Summary maps in the SDSU reports are at the 22.3 ac level of resolution.

Two sets of vegetation data were collected in the SDSU project. Thirty-four permanent quadrats were established in major vegetation types as follows: Bishop pine forest-4, tanbark oak forest-2, oak (foothill) woodland-4, riparian woodland-4, chaparral-4, coastal sage scrub-3, purple sage scrub-3, coastal dune scrub-4, coastal salt marsh-2, and annual grassland-4. Two 20 m transects were sampled for percent cover in each quadrat. In addition, nine pairs of concentric plots were sampled in each quadrat for species presence and estimated cover. Each pair consisted of a 3.99 m radius plot for shrubs and trees and a 1.26 m radius plot for herbs. Species presence and a visual estimate of cover were obtained in each plot (Coulombe and Mahrdt 1976).

Table 9. Vegetation types mapped on Vandenberg Air Force Base by San Diego State University on Base Master Planning maps (1:9600) (Reilly et al. 1976).

Code Number	Category
1	Bishop pine forest
72	Bishop pine forest-sparse phase
2	Tanbark oak forest
3	Foothill woodland
31	Foothill woodland-dense phase
4	Riparian woodland
42	Riparian woodland-sparse phase
5	Chaparral
52	Chaparral-sparse phase
6	Coastal sage scrub-normal phase
62	Coastal sage scrub-sparse phase
7	Coastal sage scrub-*Salvia leucophylla* phase
8	Coastal sage scrub-stabilized dune phase
9	Wet soil scrub
10	Huckleberry scrub
11	Coastal bluff
12	Coastal strand
13	Coastal salt marsh
14	Freshwater marsh
16	Grassland-annual
17	Miscellaneous native herb communities
18	Ruderal vegetation
19	Planted trees
20	Agricultural plantings
21	Non-agricultural plantings
22	Freshwater
23	Man-made facilities and cantonment
24	Disked areas
25	Naturally bare soil
26	*Acer nequndo* stands
99	Land not within the base boundary
00	Ocean

A second set of 103 presence and estimated cover plots were sampled to determine the accuracy of the vegetation map. In addition to the vegetation types sampled by the permanent quadrats, wet soil scrub, coastal bluff, coastal strand, and freshwater marsh were sampled by these plots (Coulombe and Mahrdt 1976).

Summary data by vegetation type for both the presence-estimated cover plots and the permanent quadrats are given in Coulombe and Mahrdt (1976), as are maps locating the permanent quadrats. Original data for each permanent quadrat cannot be located in Air Force files (Michael McElligott, pers. comm.) or at San Diego State University (Paul H. Zedler, pers. comm.).

Twenty-six rare or endangered plants were listed as observed or expected on Vandenberg (Coulombe and Cooper 1976). Plant collections were made, but no comprehensive floristic list was produced (Coulombe and Mahrdt 1976). Soil maps were digitized using a 22.3 ac (9.02 ha) grid cell as was exposure (aspect); elevation was coded in 200 ft (61 m) classes and digitized using the same grid system (Reilly et al. 1976).

In an extension of the SDSU project, Mahrdt et al. (1976) provided data on coastal wetlands in northern Santa Barbara County. They gave descriptions, vegetation maps, and plant species lists for the coastal sections of Shuman Creek, San Antonio Creek, Santa Ynez River, Canada Honda Creek, and Jalama Creek; information on drainage size and hydrology was also included.

Sensitive Plant Communities

Zedler (1977b) examined the status of Bishop pine forest on Vandenberg. Eight stands of differing ages and densities were sampled using belt transects; data recorded included tree diameter at 10 cm and 1.5 m (dbh) above ground, tree height, tree condition, and number of cones. Shrubs were sampled in 1 m^2 plots; stem diameter at 10 cm above ground was measured. Cones were collected and analyzed for seed number and soundness. Stands sampled ranged from 15 to >60 years in age. Stands were mainly even-aged since most regeneration occurred after fire; however, some non-fire recruitment had occurred. Seed predation by squirrels was high, but only the two oldest stands sampled had few sound seeds and could therefore be reduced in density by fire. One stand, burned in 1974, had a satisfactory number of seedlings by 1977. Zedler (1977b) concluded that Bishop pine stands on Vandenberg were in generally good condition but should be considered a unique resource because they are distinct and genetically isolated from other populations, representing a rare ecosystem type.

The Fish and Wildlife Service (Dial 1980) conducted a study of Barka Slough. Quantitative vegetation data were collected at five sites. Plant collections were made; a total of 171 species were identified. A vegetation map of the slough was prepared from aerial photography; willow woodland, box elder woodland, marshland and meadow, remnant salt marsh, coyote bush, old snag stands, and old fields were the major types. Examination of aerial photography from 1943, 1956, 1967, and 1979 indicated vegetation changes had occurred, particularly the invasion of willow into what were marshes on the northern side of the slough. These changes were thought to be caused by decline of water levels caused by overdraft of groundwater within the San Antonio Creek basin. Unless overdraft ceased, the Fish and Wildlife Service predicted the deterioration of Barka Slough as a viable wetland.

In 1980, the Fish and Wildlife Service also prepared maps of wetlands on Vandenberg (Fish and Wildlife Service 1980). Maps were prepared from 1:80000 and 1:24000 black and white aerial imagery. Draft maps were made at

1:24000 and then enlarged to the final maps at the Base Master Planning map format (66 sheets, 1:4800). Vegetation classification was that of the National Wetlands Inventory (Cowardin et al. 1979).

Special Interest Plants

Wooten et al. (1977) examined the impact of Space Shuttle support construction on special interest plant species on Vandenberg. Five species, *Castilleja mollis, Monardella crispa, Scrophularia atrata, Cirsium rhothophilum,* and *Erigeron foliosus* var. *blochmaniae,* then candidates for listing as threatened or endangered, occurred in areas expected to be impacted by Shuttle-related construction. In an appendix to that report, Beauchamp and Oberbauer (1977) provided additional data including vegetation maps of the construction localities, species composition (percent cover) of major vegetation types at these sites, and maps of the populations of special interest plants at these sites.

Zedler (1979) examined the abundance, distribution, and population biology of *Cirsium rhothophilum* on Vandenberg. Active dunes were systematically sampled with transects extending from the beach to the stabilized dunes; species presence was recorded in 1 m^2 plots located along these transects. Belt transects were also sampled for the presence of *C. rhothophilum.* This species is restricted to active dunes; total size of the population was estimated as 72000 to 75000 plants. The population biology of the species was also examined; that study was later published (Zedler et al. 1983b). *C. rhothophilum* is adapted to the active dune habitat, and the population appeared to be stable.

Smith (1983) examined the status of eight candidate threatened or endangered plants on Vandenberg. These were: *Castilleja mollis, Chorizanthe* *breweri*, *Cirsium loncholepis*, *Cirsium rhothophilum*, *Eriodictyon capitatum*, *Monardella crispa*, *Monardella undulata* var. *frutescens*, and *Scrophularia atrata*. He discussed taxonomic or nomenclatural problems with the species of *Monardella* and with *Scrophularia atrata*. Other plant species of interest observed during the study were also noted.

Jacks et al. (1984) examined the response of one population of *Eriodictyon capitatum* on 35th Street to prescribed fire. Four 3 x 3 m plots were established pre-fire (June 1982); shrubs in these plots were mapped for cover, measured for height, and stems measured for diameter at 10 cm above the ground. Shrub cover was determined on a 60 m transect. Thirty-five clumps of *Eriodictyon capitatum* were located, stakes positioned near them, 2 x 2 m plots established, and positions of *E. capitatum* stems recorded relative to the stake; condition (live or dead) and basal diameter of stems were also recorded. In June 1983, field measurements were repeated on the four vegetation plots and 22 of the *Eriodictyon* plots (the remainder did not burn). *Eriodictyon* responded to fire by sprouting but established no new seedlings. Of the other chaparral species, *Arctostaphylos rudis* and *Adenostoma fasciculatum* sprouted, while *Arctostaphylos purissima*, *Ceanothus ramulosus*, *C. impressus*, *Lotus scoparius*, *Salvia mellifera*, and *Baccharis pilularis* established from seed. However, *Carpobrotus edulis* also established in considerable density post-fire; many of these seedlings were still living three years later (Zedler and Scheid 1987).

Environmental Impact Statements/Environmental Assessments

A series of Environmental Impact Statements (EISs) and Environmental Assessments (EAs) have provided some information on vegetation and flora of

Vandenberg. Many of these were prepared for oil development projects; others were for Air Force projects.

The EIS for the MX project examined the four candidate sites, Shuman Canyon, San Antonio Terrace, Burton Mesa, and Lompoc Terrace, proposed for these facilities and provided vegetation maps and descriptions for these areas (USAF 1978). Much more detailed biological data were provided for the San Antonio Terrace site selected for the MX facilities (HDR 1979). Vegetation was mapped at a scale of 1:4800. Major vegetation types in the project area were dune scrub and dune swale vegetation; the latter consisted of mesic scrub, willow thicket, and dune marsh. Distribution of rare plants (*Scrophularia atrata, Castilleja mollis, Monardella undulata* var. *frutescens, Erigeron foliosus* var. *blochmaniae*, and *Senecio blochmaniae*) were mapped. *Cirsium loncholepis* was also originally identified but this identification was in error (Smith 1983, Howald et al. 1985).

Population characteristics of these species were estimated in 100 m^2 plots placed along three long transects (1070 to 1340 m). Dune swales were also examined. Plant species occurring in the study area were listed. Quantitative vegetation data (percent cover) were collected on 11 sets of three, 30 m transects.

Grace Petroleum Corporation proposed drilling one exploratory well on an area of the Lompoc Terrace they termed the Surf Prospect. ERCO (1981) provided preliminary information including a brief plant species list for one site. Later the proposed site was changed and TRACER (1984) prepared a second EA. Vegetation at this site was mapped as coastal dune scrub dominated by *Artemisia californica* and *Ericameria ericoides* and ruderal, dominated by *Carpobrotus edulis* and other weedy species. Plant species on the site were listed; *Scrophularia atrata* was the only special interest plant found.

Dames and Moore (1984c) prepared an EA for the rehabilitation of the Southern Pacific Railroad Bridge at the mouth of the Santa Ynez River. They prepared a vegetation map of the area; types were coastal strand, coastal dune scrub, coastal salt marsh, and annual grassland. A list of vascular plants was compiled from a floristic survey. No special interest plants occurred in areas to be impacted by the construction, but *Monardella crispa* was scattered in adjacent dune scrub.

Northern Michigan Exploration Company proposed developing an oil and gas development project on its lease area of 1828 ac (740 ha) in the northeast corner of Vandenberg, an area termed the Graciosa Prospect. The project called for establishing up to 16 well pads and drilling up to 175 wells over 20 to 25 years. Dames and Moore (1984a, b) prepared the EA for this project. They mapped vegetation of the site. Oak woodland and savanna, grassland, and dune scrub were major types. Minor areas of agricultural fields, chaparral, black sage scrub, riparian woodland, and planted *Eucalyptus* also occurred. A floristic list was prepared. No plants that are candidates for federal listing were observed, but three species of interest in the state were: *Arctostaphylos pechoensis* (probably *A. purissima*), *Erysimum suffrutescens* var. *lompocense*, and *Prunus fasciculata* var. *punctata*.

Conoco, Inc. holds mineral leases on a part of northeastern Vandenberg known as the Todos Santos area. In 1983, they proposed drilling four exploratory wells on the tract. WESTEC (1983) prepared the EA for this project. Sizes of the four separate areas were: Area 1-395 ac (160 ha), Area 2-490 ac (198 ha), Area 3-915 ac (370 ha), and Area 4-175 ac (71 ha). Vegetation maps were prepared for each area. Area 1 was primarily coastal sage scrub and grassland with some oak woodland, chaparral, and *Eucalyptus* groves. Area 2 was dominated by oak woodland and coastal sage scrub on the uplands with grassland, agricultural fields, and riparian woodland along San Antonio Creek. Area 3 was mainly oak woodland and grassland with riparian woodland along drainages. *Arctostophylos rudis*, *A. purissima*, and *Erysimum suffrutescens* var. *lompocense* occurred within this site. Area 4 was primarily grassland with some coastal sage scrub. A plant species list was prepared from a field survey conducted in December 1982.

In 1985, Conoco, Inc. proposed a more extensive oil exploration and development project on the Todos Santos tract. Dames and Moore (1985b, c) prepared the EA for this project. They mapped the vegetation for the whole tract. Major types were oak woodland, dune scrub, coastal sage scrub, grassland, and riparian woodland with associated wetlands. Lesser amounts of chaparral and agricultural areas occurred. Common and characteristic plant species of the major types were listed. Special interest plants occurring in the area included *Arctostaphylos purissima*, *A. rudis*, and *Ceanothus impressus* var. *impressus*. *Nasturtium gambelii* was previously reported from Barka Slough (Dial 1980).

Union Oil Company proposed oil development on part of their lease holdings known as the Northwest Lompoc/Jesus Maria tract on northern Vandenberg in 1985. Dames and Moore (1985a) prepared the EA. Vegetation was mapped; major types were coastal sage scrub, chaparral, dune scrub, grassland, riparian woodland, oak woodland, and agricultural areas. Dune swale wetlands also occurred in the San Antonio Terrace area. A list of common and characteristic plant species was prepared. Special interest plants occurring in the area included *Arctostaphylos purissima*, *A. rudis*, *Cordylanthus rigidus* ssp. *littoralis*, *Ceanothus impressus* var. *impressus*, *Erysimum suffrutescens* var. *grandifolium*, *Erysimum suffrutescens* var. *lompocense*, and *Monardella crispa*.

Hrubetz Oil Company proposed to drill four exploratory wells in the Lompoc Canyon area of South Vandenberg in 1985. Dames and Moore (1985d) prepared the EA. Major vegetation types were mapped as chaparral, coastal scrub-including both coastal sage scrub and coastal dune scrub, floodplain scrub (a variant of coastal sage scrub dominated by *Baccharis pilularis* ssp. *consanguinea* on the floodplain of Lompoc Canyon), and annual grassland. Plant species on the site were listed. Special interest plant species observed were *Arctostophylos purissima*, *A. rudis*, *Ceanothus impressus* var. *impressus*, *Monardella crispa*, and *Quercus parvula*.

Howald et al. (1985) prepared the technical appendix on terrestrial and freshwater biology for the Union Oil Project/Exxon Project Shamrock and Central Santa Maria Basin Study. This project was an offshore oil development that involved building a pipeline from landfall near Surf across Vandenberg to Lompoc as well as other facilities and pipelines outside of Vandenberg's boundaries (A.D. Little, Inc. 1985). Howald et al. (1985) provided regional overviews on vegetation, rare or declining plants and plant communities; specific information was also provided on the pipeline corridor. Vegetation near the mouth of the Santa Ynez River was mapped; salt marsh, freshwater marsh, riparian scrub, and riparian woodland were the major wetland types.

Space Launch Complex 4 (SLC-4), the Titan launch complex on south Vandenberg, required rehabilitation after the Titan explosion of April 1986. The EA for this project was prepared by Versar, Inc. (1987). Vegetation around the SLC-4 facility and around the proposed X-ray facility was mapped. Dune scrub, coastal sage scrub, coastal sage-chaparral scrub, *Eucalyptus* groves, and wetlands associated with Spring Canyon were mapped. Plant species lists for the two sites were prepared. Special interest plants observed were: *Castilleja mollis*, *Erigeron foliosus* var. *blochmaniae*, *Erysimum suffrutescens* var.

grandifolium, Monardella undulata var. *frutescens, Quercus parvula*, and *Scrophularia atrata*.

Other Studies

Human (1987) compiled a floristic list for an area along San Antonio Creek between Highway S-20 and the Lompoc-Casmalia Road.

URS (1987) compiled existing information in relation to the Mineral Resources Management Plan. Constraints to mineral (particularly oil) development were considered including biological resources. Wetlands, sensitive or unusual plant communities (coastal dune scrub, foredunes, Burton Mesa chaparral, tanbark oak forest, Bishop pine forest), and certain special interest plants were mapped. Digitized data bases were compiled using the GEOGRAPHICS system (Brad Stewart, URS Corporation, pers. comm.).

Schmalzer and Hinkle (1987a) established baseline conditions for monitoring Space Shuttle launches from Space Launch Complex 6. Fifty permanent vegetation transects were established and vegetation sampled in March 1986 (wet season); these were resampled in October 1986 (dry season). Soil samples were taken from all transects at the wet season sampling and from a subsample during the dry season. Vegetation types sampled were annual grassland, coastal sage scrub, purple sage scrub, and chaparral.

Zammit and Zedler (1988) examined the effects of simulated acid deposition of the type produced by a Shuttle launch on seedling survival and yield and seed germination. No seedlings of the test species (*Mimulus aurantiacus, Artemisia californica, Baccharis pilularis*) survived treatments with pH 0.5 and 1.0 solutions, but some survived at pH 2.5. Germination was reduced in most species with a pH 1.0 treatment, but the magnitude of the response varied between species and with seed moisture condition.

Hickson (1987a) and Davis et al. (1987) examined Burton Mesa chaparral in relation to time since fire and physical site characteristics, particularly depth to a subsoil pan and distance from the coast. Oak understory plots (those with *Quercus agrifolia*) differed from shrub chaparral plots (those lacking oaks). For oak plots, herb species were associated with stand age and distance from the coast. For plots with only a shrub canopy, shrub species composition was related to stand age and depth to a subsoil pan. Herb composition was related to stand age, cover of sclerophyllous shrubs, depth to a subsoil pan, and distance from the coast.

Ongoing Studies

Studies currently underway on Vandenberg include that of *Carpobrotus edulis* being conducted by Carla D'Antonio (University of California, Santa Barbara) and a continuation of the acid deposition work by Paul H. Zedler (San Diego State University). A study is being conducted relating to the region around the Casmalia Toxic Waste Facility which includes part of Vandenberg[1]. As part of this project a vegetation map has been prepared and Wayne Ferren (University of California, Santa Barbara, Department of Biological Sciences) is examining certain wetlands on the base (pers. comm.). Data were not available in time to incorporate into this report.

Important Regional Studies

Several significant studies have been completed in areas near Vandenberg. Smith et al. (1976) studied the Nipomo dunes and wetlands to the

[1] Actual and potential effects of the Casmalia Toxic Waste Disposal Facility, Phase 1: Planning Environmental Research. Progress Report to Santa Barbara County Health Care Services. Sept. 1987. Daniel Botkin, Principal Investigator and Tad Reynales, Co-Principal Investigator.

north of Vandenberg. A brief description of this area is given by Jones (1984). Ferren et al. (1984) examined the vegetation and flora of La Purisima Mission State Historic Park. Howald et al. (1986) prepared the technical appendix on terrestrial and freshwater biology for the Exxon Lompoc Pipeline Project; this report provided vegetation and floristics data for the pipeline route as well as a regional overview. Davis (1987) analyzed the use of Thematic Mapper Simulator and Thematic Mapper data to map coast live oak woodlands and forest in the Burton Mesa and Purisima Hills near Vandenberg.

Comments

Although numerous studies have contributed some information on the vegetation and flora of Vandenberg, there are limitations to many of these studies and many gaps exist in the available data.

1) Only the SDSU study was comprehensive in its geographic coverage; all other studies have been of localized areas or specific topics.

2) Few copies were made of the original base vegetation maps (1:9600) from the SDSU study, and they were little used in subsequent work. The utility of the digitized SDSU maps was limited somewhat by the loss of resolution required by the early GIS system used. Even so, little use was made of these data; only the MX EIS (USAF 1978) and the region of influence study conducted by Oak Ridge National Laboratory (Krummel et al. 1986) appeared to make much use of these data. Since the maps were not used, neither were they updated as conditions changed. Most of the subsequent projects that required vegetation maps created their own maps and made no comparisons to the SDSU maps.

3) Many EAs and EISs are limited in the time available, and field surveys for plants are made only for a short period in one season. Ephemerals and

plants only identifiable at certain times of the year will often be missed in such studies.

4) No single organization has maintained a consistent and continuous data base of biological information about Vandenberg. Studies have been conducted by universities, other federal agencies, and numerous consulting companies. Similarly, different Air Force groups (Strategic Air Command, Space Division, Office of Scientific Research) have funded and directed studies, as have oil companies. Given these divisions, each study, EA, or EIS has been viewed as a separate entity and contributed little to a cumulative understanding of the biology of the base.

5) With a few exceptions (e.g., Zedler's studies on Bishop pine [1977b] and *Cirsium rhothophilum* [1979]), Air Force projects have been focused on requirements for EAs, EISs, or other immediate management needs. Therefore, there are few data available on more general questions of fire ecology, vegetation dynamics, population biology of endemic taxa, etc. As important as fire is to vegetation of Vandenberg, only the recent studies by Hickson (1987a) and Davis et al. (1987) provide comprehensive information.

6) Several studies have pointed out the need for monitoring on a continuing or periodic basis of certain areas or conditions. For example, Dial (1980) found that vegetation of Barka Slough had changed, probably as a result of groundwater overdraft. Recommendations for monitoring of vegetation in Barka Slough in that report and by Hutchinson (1980) and Mallory (1980) were never implemented.

METHODS

Bibliography of Vegetation and Related Topics Relevant to Vandenberg

A bibliography of references on vegetation and related topics relevant to Vandenberg was prepared. Included are references on vegetation, floristics, and exotic plants; also included are geology, soils, and hydrology, where appropriate.

References were determined by: 1) examining reports held by the Environmental Task Force at Vandenberg; 2) examining other past studies completed on the base; 3) computer literature searches for references on exotic plants of concern using the DIALOG system (Lockheed Dialog Information Retrieval Service 1979); 4) computer literature searches for references on major plant communities occurring on the base; and 5) review of literature citations in the references previously found.

A preliminary bibliography was submitted to the Environmental Task Force in March 1987 for review.

The composite bibliography was compiled into a database using the REF-11 software (DG Systems 1984) on an IBM PC-compatible system.

Preliminary Floristic List

Previous studies of the flora and vegetation of Vandenberg were reviewed and species lists were taken from the individual reports. Only species lists that were from areas within Vandenberg's boundaries were used; eighteen reports (including the present) met this criterion. Some taxa, particularly special interest plants, from Smith (1976) and Howald et al. (1985) were added if the sites reported were on Vandenberg. Lists were compiled into a data base using dBaseIII Plus software (Ashton-Tate 1985) on an IBM PC-compatible system.

Species nomenclature in the draft list was compared to Smith (1976) or to Munz (1974) or Munz and Keck (1973) for species not in Smith.

Nomenclature follows Smith (1976) except where current usage by area botanists (e.g., Ferren et al. 1984) differs.

Taxonomic determinations are those of the original authors. Herbaria collections were not examined for Vandenberg specimens in preparing this list; only specimens collected in the current study were examined.

Special Interest Plants

Previous studies reviewed for the floristic list were also reviewed for special interest plants. Status of plants was determined from Smith and York (1984). A preliminary list was submitted to the Environmental Task Force in December 1986 for review; comments were also received from Chuck Pergler, Martin Marietta Corporation, Vandenberg and from Wayne R. Ferren, Jr., University of California, Santa Barbara. Recent data on special interest plants available from the California Natural Diversity Data Base (CNDDB 1987) were obtained through the Environmental Task Force. All special interest plants encountered during field work were noted.

Serpentine Flora

Flora of serpentine outcrop areas on Vandenberg is not well known; several special interest plant species (*Calochortus clavatus* var. *clavatus*, *Chorizanthe breweri*, *Chorizanthe rectispina*) have been suggested to occur in these areas (Coulombe and Cooper 1976), but these have not been confirmed. Areas of serpentine on base were identified from geologic maps (Dibblee 1950, Woodring and Bramlette 1950) and several of these areas were examined on June 1, 2, and 3, 1987. Areas examined on South Vandenberg were along the north slope of Honda Canyon and at the end of Arguello Boulevard. On North Vandenberg, areas along Globe Road, along Soldado Road, in Dairy Canyon, and in the Lions Head area were examined. At these sites, the dominant species were noted and unknown plants of interest were collected, particularly *Chorizanthe* and *Calochortus*.

Current Vegetation Study

Stand Selection for Vegetation Sampling

Types and numbers of stands to be sampled were determined in consultation with staff of the Vandenberg Environmental Task Force (Michael McElligott, Richard Nichols). Objectives were to: 1) resample some of the SDSU study sites to determine if vegetation changes had occurred, and 2) sample new sites of high priority to the base. Priorities for new sites were: dune systems on North Vandenberg, grasslands in or associated with critical grazing areas, wetlands in Barka Slough, wetlands near SLC-3, and vernal wetlands. Stands were selected after field reconnaissance. Before sampling vernal wetlands, a number of possible sites were examined with Wayne R. Ferren, Jr., University of California, Santa Barbara. Sites were located on Base Master Planning maps.

Field Sampling

The methods used in field sampling depended upon the community type (Table 10). Line intercept transects 15 m in length were used to determine percent cover in two height classes, 0 to 0.5 m and >0.5 m, in shrub communities (chaparral, coastal sage scrub, coastal dune scrub), grassland, and marshes. Transects were also used to sample the understory of forest and woodland communities (Bishop pine forest, tanbark oak forest, riparian woodland, oak woodland). Dunes were sampled with 15 m transects at one site and with 30 m transects at two other sites, since vegetation on the active dunes is sparse. The ends of each transect were marked with metal fence posts;

Table 10. Vegetation sampling conducted for Basewide Monitoring Program.

Stand Number This Study	SDSU Stand Number (if any)	Plot Numbers	Vegetation Type	Sampling	Location
1	SDSU #5	51,52,53	Chaparral	15m transects-cover 150m2 plots-presence	North side of Washington Street, MP #28*
2	SDSU #12	54,55,56	Chaparral	15m transects-cover 150m2 plots-presence	Arguello Road at Lompoc Valley Road, MP #48
3	–	58,59,60	Chaparral	15m transects-cover 150m2 plots-presence	Oak Mountain-Cherry Ridge area, MP #65
4	SDSU #18	61,62,63	Chaparral	15m transects-cover 150m2 plots-presence	Santa Ynez Ridge Road, MP #51
5	SDSU #23	64,65,66	Chaparral	15m transects-cover 150m2 plots-presence	Spring Canyon Road near Arguello Road, MP #54
6	SDSU #24	67,68,69	Bishop pine forest	0.1 ac plots-canopy 15m transects-cover 150m2 plots-presence	Lucio Blvd. off Arguello Road, MP #55
7	SDSU #17	70,71	Bishop pine forest (1974 burn)	0.016 ac plots-canopy 15m transects-cover 150m2 plots-presence	Santa Ynez Ridge Road, MP #51
8	–	72,73,74	Grassland	15m transects-cover	Point Sal area, MP #8
9	–	75,76,77	Grassland	15m transects-cover	Point Sal area, MP #5
10	–	78,79,80	Grassland	15m transects-cover	Point Sal area, MP #8
11	–	81,82,83	Coastal dune scrub	15m transects-cover 150m2 plots-presence	Perigee Road area, MP #18
12	SDSU #27	84,85	Tanbark oak forest	0.1 ac plots-canopy 15m transects-cover	Tranquillon Mountain, MP #59
13	SDSU #26	86,87,88	Coastal sage scrub	15m transects-cover 150m2 plots-presence	Honda Ridge Road, MP #53
14	SDSU #1	89,90,91	Oak woodland	0.2 ac plots-canopy 15m transects-cover 150m2 plots-presence	East side of SR 20 north of San Antonio Creek, MP #21
15	SDSU #10	92,93,94	Coastal dune scrub	15m transects-cover 150m2 plots-presence	Old Surf Road at Bear Creek Road near SLC-4, MP #47
16	–	95,96,97	Riparian willow	0.1 ac plots-canopy 15m transects-cover 150m2 plots-presence	Bear Creek near SLC-3, MP #47, #50

Table 10. (continued).

Stand Number This Study	SDSU Stand Number (if any)	Plot Numbers	Vegetation Type	Sampling	Location
17	SDSU #30	98,99, 100	Grassland	15m transects-cover	Miguelito Road-Sudden Ranch area, MP #64
18	SDSU #31	101,102, 103	Grassland	15m transects-cover	Miguelito Road-Sudden Ranch area, MP #62
19	SDSU #29	104,105, 106	Purple sage scrub	15m transects-cover 150m2 plots-presence	Coast Road east of boathouse MP #61
20	SDSU #7	107,108, 109	Salt marsh	15m transects-cover 150m2 plots-presence	South side of Santa Ynez estuary, MP #41
21	SDSU #15	110,111, 112	Oak woodland	0.2 ac plots-canopy 15m transects-cover 150m2 plots-presence	LaSalle Canyon Road area, MP #51
22	–	113,114, 115	Freshwater marsh	15m transects-cover 150m2 plots-presence	Barka Slough-north side, MP #25
23	–	116,117, 118	Dune	15m transects-cover	Purisima Point area, MP #22
24	–	119,120, 121	Dune	30m transects-cover	San Antonio Terrace dunes area, MP #22
25	–	122,123, 124	Dune	30m transects-cover	South of mouth of San Antonio Creek, MP #17
26	–	125,126, 127	Box elder woodland	0.1 ac plots-canopy 15m transects-cover 150m2 plots-presence	Barka Slough-south side, MP #25
27	–	128	Vernal pool	15 1m2 transects (cover classes) along 150 m transect	35th Street, MP #37
28	–	129	Seasonal wetland	14 1 m2 plots (cover classes) along 24m transect	35th Street, MP #37
29	–	130	Seasonal wetland	10 1m2 plots (cover classes) along 10m transect	Tangair area, MP #27

*Base Master Planning map number

numbered aluminum tags were attached to one of the posts. In grasslands that are grazed, the transect on which vegetation was determined was offset 3 m from each post, since cattle often rub against posts creating a bare zone around them.

The SDSU study used transects for vegetation sampling (Coulombe and Mahrdt 1976). Two 20 m transects were located in each permanent quadrat. The transects were not permanently marked although markers were placed at or near each plot. The same stands sampled by SDSU were relocated but the identical transects were not sampled.

The canopy of forest and woodland types was sampled with circular plots. Plots 0.1 ac (0.04 ha) in size were used in forests of moderate density (e.g., tanbark oak forest, mature Bishop pine forest); smaller plots, 0.016 ac (0.0065 ha) were used in a dense stand of young Bishop pine that burned in 1974. Oak woodland was sampled using larger plots, 0.2 ac (0.08 ha), since it typically is less dense with a more open canopy. Plots were centered on the numbered post marking one end of the 15 m transect.

The diameter breast height (dbh 1.5 m) of all stems of living and dead woody plants >2.5 cm dbh was recorded within the circular plots. Stems 2.5 to 12.5 cm dbh are considered the sapling layer, while stems >12.5 cm dbh are considered the canopy. Stems were counted separately if they were distinct at 1.5 m. In riparian woodland (willow, box elder), sprouting is very common. Sprouts were recorded as individual stems. An effort was made to identify how many individual trees occurred.

In shrub communities such as chaparral, 15 m transects were considered to be inadequate to represent the complete floristic composition of the stand, since many of the herbs in these communities are small and occur in low density. Therefore, 150 m^2 rectangular plots were established centered on the

15 m transects extending 5 m on each side of the transect for the 15 m length in these communities. The presence of herbs and shrubs in these plots was recorded. When it was logistically possible and likely to yield additional information, plots were revisited more than once and additional species, primarily herbs were recorded. Vegetation sampling was conducted in January, March, and May 1987 (Table 11).

Species were identified using standard references (Hoover 1970, Munz and Keck 1973, Munz 1974, Smith 1976). With certain difficult specimens, assistance was obtained from botanists at the University of California, Santa Barbara (Wayne Ferren) or the Santa Barbara Botanical Garden (Clifton Smith, Steve Junak, Holly Forbes, and Dennis Odion).

All sample transects were photographed to document current conditions.

Certain environmental parameters were recorded at each plot including aspect, slope angle upslope and downslope, slope angle to the right and to the left facing downslope, plot shape, and type of litter layer. Grazing by cattle or other herbivores (deer, rabbits) was noted, as was evidence of past fires.

Vernal wetlands on Vandenberg differ in the scale of the vegetation pattern and had to be sampled using different methods. The basic method used was to establish a permanent transect and sample 1 m^2 plots at appropriate intervals along it. Species were recorded by cover classes in these plots; classes used were 1-5%, 5-10%, 10-25%, 25-50%, 50-75%, and 75-100%. In the large vernal pool (Stand 27), plots were placed every 10 m along a transect of 150 m. The other two sites were mound and trough topography in chaparral (Stand 28) and coastal dune scrub (Stand 29). Shorter transects were used and plots were placed more closely together to sample the significant features of the vegetation. In Stand 28, plots were placed every second meter or every

Table 11. Dates of vegetation sampling (1987).

Plot Number	Date Canopy Plot or Transect Sampled	Date $150m^2$ Plot Sampled
51	1-15	3-31
52	1-15	3-31
53	1-15	3-31
54	1-15	3-30
55	1-15	3-30
56	1-15	3-30
57	1-15	N/A
58	1-16	5-19
59	1-16	5-19
60	1-16	5-19
61	1-19	3-31
62	1-19	3-31
63	1-19	3-31
64	1-19	3-31
65	1-19	3-31
66	1-19	3-31
67	1-19,1-20	5-18
68	1-20	5-18
69	1-20	5-18
70	1-20	5-18
71	1-20	5-18
72	3-23	N/A
73	3-23	N/A
74	3-25	N/A
75	3-25	N/A
76	3-25	N/A
77	3-25	N/A
78	3-23	N/A
79	3-23	N/A
80	3-23	N/A
81	1-21	3-26
82	1-21	3-26
83	1-21	3-26
84	1-22	N/A
85	1-22	N/A
86	1-22	3-30
87	1-22	3-30
88	1-22	3-30
89	1-23,3-24	3-24,5-18
90	1-23,3-24	3-24,5-18
91	1-23,3-24	3-24,5-18

Table 11. (continued).

Plot Number	Date Canopy Plot or Transect Sampled	Date 150m^2 Plot Sampled
92	1-23	3-26
93	1-23	3-26
94	1-23	3-26
95	5-21	5-21
96	5-21	5-21
97	5-26	5-26
98	3-19	N/A
99	3-19	N/A
100	3-19	N/A
101	3-19	N/A
102	3-19	N/A
103	3-19	N/A
104	1-26	3-30
105	1-26	3-30
106	1-26	3-30
107	5-18	5-21
108	5-18	5-21
109	5-18	5-21
110	1-27,3-20	5-19
111	1-27,3-20	3-20,5-19
112	1-27,3-20	5-19
113	5-20	5-20
114	5-20	5-20
115	5-20	5-20
116	3-26	N/A
117	3-26	N/A
118	3-26	N/A
119	3-27	N/A
120	3-27	N/A
121	3-27	N/A
122	3-27	N/A
123	3-27	N/A
124	3-27	N/A
125	1-29,5-20	5-20
126	1-29,5-20	5-20
127	1-29,5-20	5-20
128	5-28	N/A
129	5-28	N/A
130	5-29	N/A

meter along a 24 m transect. In Stand 29, every meter along a 10 m transect was sampled.

Data Analysis

For each line-intercept transect, percent cover was calculated for each height class, 0 to 0.5 m and >0.5 m. These data were entered into ASCII data files on an IBM PC-compatible computer. Summary statistics (means and standard deviations) were calculated using SPSS (Norusis 1986).

Lists of additional species occurring in the 150 m^2 plots were compiled and entered into data files.

Stem diameter measurements for forest and woodland plots were grouped into 5 cm dbh classes. From these data, stem density per plot, stem density per hectare, relative density (RD), basal area per plot, basal area per hectare, relative basal area (RBA), and importance value (IV=RD + RBA) were calculated. Calculations were made by plot for each species and for the total understory and canopy. Densities of individual trees (represented by multiple stems) were also tabulated. For each stand, summary statistics were calculated for density per hectare, relative density, basal area per hectare, relative basal area, and importance value for the canopy and understory. Diameter distribution curves ($\log_{10}$ stems/ha vs. diameter) were plotted as a way of examining stand dynamics.

For the samples from vernal pools, plots were grouped into zones and mean percent cover was calculated from mid-points of the cover classes. In the vernal pool (Stand 27, Transect 128), three zones were recognized: main pool, pool edge, and upland transition. At the other two sites (Stand 28, Transect 129; Stand 29, Transect 130), the three zones were: mound, transitional, and trough.

RESULTS

Bibliography of Vegetation and Related Topics Relevant to Vandenberg

The bibliography is given in Appendix I. A total of 621 references are listed. The bibliography is not exhaustive but does contain many appropriate references.

Preliminary Floristic List

The floristic list for Vandenberg compiled from past studies and current work consists of 624 taxa representing 311 genera and 80 families. The list presented in Appendix II is arranged alphabetically by genera and that in Appendix III is arranged alphabetically by family.

Special Interest Plants

Fifty-two taxa of special interest plants that occur or have been suggested to occur on Vandenberg are listed (Table12). The only federally listed species included is *Cordylanthus maritimus* ssp. *maritimus*; this species was suggested to occur in the Santa Ynez salt marsh (Coulombe and Cooper 1976), but it has not been found in later studies (Dames and Moore 1984c, Howald et al. 1985). Two Category 1 species occur: *Cordylanthus rigidus* ssp. *littoralis* and *Eriodictyon capitatum.* Seventeen Category 2 species are listed; four of these (*Ceanothus impressus* var. *nipomensis*, *Chorizanthe breweri*, *C. rectispina*, *Thermopsis macrophylla* var. *agnina*) have not been confirmed as occurring on Vandenberg. Taxonomic or nomenclatural problems exist for several taxa including *Erysimum suffrutescens* var. *grandifolium* and *Erysimum suffrutescens* var. *lompocense*, *Monardella crispa* and *Monardella undulata* var. *frutescens*, and *Scrophularia atrata.*

Table 12. Special Interest Vascular Plants on Vandenberg Air Force Base.

Taxa	Common Name	Federal[1] Status	State[2] Status	CNPS[3] Status	RED[4] Code	Locations, Comments, and References
Agrostis hooverii (Poaceae)	Hoover's bent grass	–	–	L4	1-2-3	A few scattered localities (D. Smith 1983).
Amsinckia spectabilis var. microcarpa (Boraginaceae)	Fiddleneck	–	–	Ap.1	–	Coastal habitats-moderately common (C. Smith 1976, D. Smith 1983, Howald et al. 1985).
Aphanisma blitoides (Chenopodiaceae)	Aphanisma	C2	–	L3	1-2-2	Pt. Sal (C. Smith 1976); Lions Head (D. Smith 1983).
Arctostaphylos purissima (Ericaceae)	Purissima manzanita	–	–	Ap.1	–	Chaparral-Burton Mesa and adjacent areas (Smith 1976, Westec 1983, Dames & Moore 1985a,b,c, Hickson 1987, this study). (C. Smith [1976] includes with A. pechoensis var. viridissima).
Arctostaphylos rudis (Ericaceae)	Shagbark manzanita	C2	–	L4	1-1-3	Chaparral-Burton Mesa, Lompoc Terrace and adjacent areas (Coulombe and Cooper 1976, C. Smith 1976, Wooten et al. 1977, Beauchamp and Oberbauer 1977, USAF 1978, Westec 1983, Dames & Moore 1985a,b,c, Howald et al. 1985, Hickson 1987, CNDDB 1987 4 localities, this study).
Arctostaphylos viridissima (Ericaceae) (A. pechoensis var. viridissima)	White-haired manzanita	–	–	L4	1-1-3	Chaparral-Burton Mesa and adjacent areas (Coulombe and Cooper 1976, Beauchamp and Oberbauer 1977, Wooten et al. 1977, USAF 1978, Dames & Moore 1984a). Probably Arctostaphylos purissima (see text).
Baccharis plummerae (Asteraceae)	Plummer's baccharis	–	–	L4	1-1-3	Pt. Sal (C. Pergler pers. comm.).
Calochortus clavatus var. clavatus (Liliaceae)	Club-haired mariposa-lily	–	–	L4	1-1-3	Coulombe and Cooper (1976) expected (not observed) from exposed grassy slopes on serpentine, not found in this study.
Castilleja mollis (Scrophulariaceae)	Soft-leaved paintbrush	C2	–	1B	1-2-3	Stabilized dunes and San Antonio Terrace (Coulombe and Cooper 1976, C. Smith 1976, Beauchamp and Oberbauer 1977, Wooten et al. 1977, HRD 1979, D. Smith 1983, Versar 1987, CNDDB 1987 6 localities), Under revision, may be reduced to subspecies rank under C. affinis (Wayne Ferren pers. comm.).

Table 12. (Continued)

Taxa	Common Name	Federal[1] Status	State[2] Status	CNPS[3] Status	RED[4] Code	Locations, Comments, and References
Ceanothus impressus var. impressus (Rhamnaceae)	Santa Barbara ceanothus	–	–	Ap.1	–	Chaparral-Burton Mesa and adjacent areas (C. Smith 1976, Beauchamp and Oberbauer 1977, Wooten et al. 1977, USAF 1978, Dames & Moore 1985a,b,c, Hickson 1987, this study).
Ceanothus impressus var. nipomensis (Rhamnaceae)	Nipomo ceanothus	C2	–	Ap.1	–	Coulombe and Cooper (1976)-to be expected on northern part of base. Hoover (1970) and C. Smith (1976) question whether it is a distinct taxon.
Ceanothus papillosus ssp. roweanus (Rhamnaceae)	Tranquillon ceanothus	–	–	Ap.1	–	C. Smith (1976) Tranquillon Mt. and head of Lompoc Canyon; Beauchamp and Oberbauer 1977, Wooten et al. 1977, Burton Mesa-Shuttle Tow Road, this study.
Chorizanthe angustifolia (Polygonaceae)	Spine flower	–	–	Ap.1	–	Coulombe and Cooper (1976) Lompoc Terrace, disked field along Bear Creek Road.
Chorizanthe breweri (Polygonaceae)	Brewer's spine flower	C2	–	L1B	2-1-3	Coulombe and Cooper (1976) expected (not observed) from serpentine soils and outcrops. C. Smith (1976) does not report from Santa Barbara County. D. Smith (1983) did not locate and believes it is not on base. Not located in this study.
Chorizanthe pungens var. pungens (Polygonaceae)	Monterey spine flower	C2	–	L1B	2-2-3	C. Smith (1976) Burton Mesa.
Chorizanthe rectispina (Polygonaceae)	One-awned chorizanthe	C2	–	L1B	2-1-3	Coulombe and Cooper (1976) expected (not observed) in serpentine and granitic areas. C. Smith (1976) does not list for Santa Barbara County. Not found in this study.
Cicuta maculata var. bolanderi (Apiaceae)	Water-hemlock	–	–	Ap.1	–	C. Smith (1976) expected (not observed) in Barka Slough. Occurs at mouth of Santa Maria River (W. Ferren, pers. comm.).
Cirsium loncholepis (Asteraceae)	La Graciosa thistle	C2	–	L1B	2-2-3	D. Smith (1983) one population along Santa Ynez River. Reports from San Antonio Terrace (HDR 1979) were in error (D. Smith 1983, Howald et al. 1985).

Table 12. (Continued)

Taxa	Common Name	Federal[1] Status	State[2] Status	CNPS[3] Status	RED[4] Code	Locations, Comments, and References
Cirsium rhothophilum (Asteraceae)	Surf thistle	C2	–	L1B	2-2-3	Active dunes systems, Pt. Arguello, and Rocky Pt. (C. Smith 1976, Zedler 1979, Beauchamp and Oberbauer 1977, Wooten et al. 1977, D. Smith 1983, Zedler et al. 1983, Howald et al. 1985, C. Pergler pers. comm., CNDDB 1987 9 loc., this study).
Cordylanthus maritimus ssp. maritimus (Scrophulariaceae)	Salt marsh bird's beak	FE	CE	L1B	2-2-2	Coulombe and Cooper (1976) expected (not observed) at Santa Ynez estuary. Not located by Dames & Moore (1984b) or Howald et al. (1985). Probably not on base.
Cordylanthus rigidus ssp. littoralis (Scrophulariaceae)	Seaside bird's beak	C1	CE	L1B	3-3-3	Burton Mesa (Dames & Moore 1985a, Howald et al. 1985), CNDDB 1987 1 locality.
Corethrogyne leucophylla (Asteraceae)	Branching beach aster	–	–	L4	1-1-3	Coulombe and Cooper (1976) plants attributed to this taxa reported from Bishop pine forest. C. Smith (1976) collections from Pt. Sal attributed to this but probably part of C. filaginifolia var. latifolia complex.
Dicentra ochroleuca (Fumariaceae)	Cream-flowered eardrops	–	–	Ap.1	–	Coulombe and Cooper (1976) - disturbed cut slope of Tranquillon Mt.
Dichondra donnelliana (Convolvulaceae)	Dichondra	–	–	Ap.1	–	C. Smith (1976) - Pt. Sal area; D. Smith (1983) several localities, this study. May be D. occidentalis Wayne Ferren, pers. comm.).
Dithyrea maritima (Brassicaceae)	Beach spectacle pod	C2	–	L1B	2-3-2	Coastal dunes (C. Smith 1976, D. Smith 1983, CNDDB 3 localities, this study).
Dudleya blochmaniae ssp. blochmaniae (Crassulaceae)	Blochman's dudleya	–	–	L4	1-1-2	C. Smith (1976) Pasture at Pt. Sal; D. Smith (1983) 4 localities, this study.
Erigeron foliosus var. blochmaniae (Asteraceae)	Blochman's leafy daisy	C3c	–	L4	1-2-3	Coastal dunes (Coulombe and Cooper 1976, C. Smith 1976, Beauchamp and Oberbauer 1977, Wooten et al. 1977, D. Smith 1983, Versar 1987, this study).

Table 12. (Continued)

Taxa	Common Name	Federal[1] Status	State[2] Status	CNPS[3] Status	RED[4] Code	Locations, Comments, and References
Erigeron sanctarum (Asteraceae)	Saint's daisy	–	–	L4	1-1-3	C. Smith (1976) Pt. Sal; D. Smith (1983) 35th St. Yerba Santa site, Hickson 1987, this study.
Eriodictyon capitatum (Hydrophyllaceae)	Lompoc yerba santa	C1	CR	L1B	3-2-3	3 populations - 2 in Pine Canyon and 1 on 35th St. (Coulombe and Cooper 1976, D. Smith 1983, Jacks et al. 1984, CNDDB 1987).
Eriogonum gracile var. cithariforme (Polygonaceae)	Wild buckwheat	–	–	Ap.1	–	Coulombe and Cooper (1976) expected (not observed) in foothills region.
Erysimum insulare (Brassicaceae)	Island wallflower	C2	–	L1B	2-1-3	C. Smith (1976) Surf; Beauchamp and Oberbauer (1977) location not specified.
Erysimum suffrutescens var. grandifolium (Brassicaceae)	Large-leaved wallflower	–	–	L4	1-2-3	Stabilized dunes (Coulombe and Cooper 1976, Wooten et al. 1977, Beauchamp and Oberbauer 1977, C. Smith 1976, D. Smith 1983, Dames & Moore 1985a, Versar 1987, this study).
Erysimum suffrutescens var. lompocense (Brassicaceae)	San Luis Obispo wallflower	–	–	L4	1-2-3	Chaparral, coastal scrub, and other sites (Coulombe and Cooper 1976, C. Smith 1976, Beauchamp and Oberbauer 1977, Wooten et al. 1977, Westec 1983, Dames & Moore 1984a, 1985a. Relationship between varities may need clarification (D. Smith 1983). Recent taxonomic revision (Price 1987) changes the nomenclature (see text).
Fritillaria biflora (Liliaceae)	Chocolate lily	–	–	Ap.1	–	C. Smith (1976) Pt. Sal; Beauchamp and Oberbauer (1977) location not specified.
Galium cliftonsmithii (Rubiaceae)	Santa Barbara bedstraw	–	–	L4	1-1-3	Howald et al. (1985) Canada Honda Creek; C. Smith (1976) reports a questionable record from Canada Honda Creek.
Grindelia latifolia ssp. latifolia (Asteraceae)	Coastal gumplant	–	–	L4	1-1-3	C. Smith (1976) Pt. Sal; Howald et al. (1985) Pt. Conception to Pt. Sal.

Table 12. (Continued)

Taxa	Common Name	Federal[1] Status	State[2] Status	CNPS[3] Status	RED[4] Code	Locations, Comments, and References
Juncus falcatus (Juncaceae)	Rush	--	--	Ap.1	--	Beauchamp and Oberbauer (1977)-location not specified, W. Ferren (pers. comm.), this study.
Layia carnosa (Asteraceae)	Layia	–	–	–	–	Of interest to CNDDB though not listed in Smith and York (1984). Old record from Surf. Not relocated in 1987 (D. Hickson pers. comm.).
Malacothamnus sp. (Malvaceae)	Mallow	–	–	–	–	(C. Smith 1976) Possibly an undescribed species. Relocated 1987 (R. Nichols pers. comm.).
Malacothrix incana (Asteraceae)	Dune malacothrix	–	–	L4	1-1-3	Relatively common in dune systems (Coulombe and Cooper 1976, C. Smith 1976, Beauchamp and Oberbauer 1977, Wooten et al. 1977, D. Smith 1983, Howald et al. 1985, this study).
Mondardella crispa (Lamiaceae)	Crisp monardella	C2	–	L1B	2-2-3	Taxonomic and nomenclatural confusion between this and the next taxa, at least in past studies (see text). Considered together, they occur in active and stabilized dunes in coastal areas and the San Antonio Terrace. CNDDB 1987 6 localities.
Monardella undulata var. frutescens (Lamiaceae)	San Luis Obispo monardella	C2	–	L1B	2-2-3	(Coulombe and Cooper 1976, Beauchamp and Oberbauer 1977, Wooten et al. 1977, HDR 1979, D. Smith 1983, Westec 1983, Dames & Moore 1984b, 1985a, Howald et al. 1985, Versar 1987, CNDDB 1987 7 localities).
Monardella undulata var. undulata (Lamiaceae)	Curly-leaved monardella	–	–	L4	1-1-3	Howald et al. (1985) Oak Canyon.
Nasturtium (=Cardamine) gambelii (Brassicaceae)	Gambels' water cress	C2	–	L3	1-2-2	One population - Barka Slough (Dial 1980).
Pholisma arenarium (Lennoaceae)	Pholisma	–	–	Ap.1	–	HDR (1980) expected (not observed) on San Antonio Terrace.
Pinus remorata (Pinaceae)	Santa Cruz Island pine	–	–	L4	1-1-3	Zedler (1977) May not be distinct from P. muricata on mainland.
Polygala cornuta ssp. pollardii (Polygalaceae)	Pollard's milkwort	–	–	L4	1-1-3	Possibly occurring (not confirmed) on South VAFB (C. Pergler, pers. comm.).

Table 12. (Continued)

Taxa	Common Name	Federal[1] Status	State[2] Status	CNPS[3] Status	RED[4] Code	Locations, Comments, and References
Prunus fasciculata var. punctata (Rosaceae)	Desert almond	--	--	L4	1-1-3	Dames & Moore (1984a) Graciosa project area.
Quercus parvula (Fagaceae)	Santa Cruz Island oak	C3c	–	L4	1-1-3	Burton Mesa chaparral and Bishop pine (Dames & Moore 1985c, Howald et al. 1985, Versar 1987).
Sanicula hoffmanii (Apiaceae)	Hoffman's sanicle	C2	–	L4	1-1-3	C. Smith (1976) Pt. Sal, W. Ferren (pers. comm.).
Scrophularia atrata (Scrophulariaceae)	Black-flowered figwort	C2	–	L3	2-2-3	Widely reported but hybridizes with S. californica and many populations may not be distinct (Coulombe and Cooper 1976, Beauchamp and Oberbauer 1977, Wooten et al. 1977, HDR 1979, D. Smith 1983, Dames & Moore 1985a,c, Howald et al. 1985, C. Pergler, pers. comm., Versar 1987).
Senecio blochmaniae (Asteraceae)	Blochman's butterweed	–	–	Ap.1	–	Stabilized dunes (Coulombe and Cooper 1976, C. Smith 1976, Beauchamp and Oberbauer 1977, Wooten et al. 1977, HDR 1979, D. Smith 1983, this study).
Solanum xantii ssp. hoffmannii (Solanaceae)	Hoffman's nightshade	–	–	L4	1-1-3	C. Smith (1976) possible record from Miguelito Canyon, Beauchamp and Oberbauer (1977) location not specified, this study.
Thermopsis macrophylla var. agnina (Fabaceae)	Santa Barbara false lupine	C2	CR	L1B	3-1-3	Coulombe and Cooper (1976) expected (not observed) at high elevations.

Table 12. (Continued)

Special Interest Vascular Plants on Vandenberg Air Force Base
Category Explanations

1 The categories for Federal Status are:

FE: Federally listed, endangered.
FT: Federally listed, threatened.
C1: Candidate for Federal listing, sufficient data exists to support listing.
C2: Candidate for Federal listing, data is not sufficient to support listing.
C3a: Extinct.
C3b: Taxonomically invalid.
C3c: Formerly candidate species now considered too widespread or not sufficiently threatened to justify listing.

2 The categories for State Status are:

CE: State listed, endangered.
CR: State listed, rare.

3 The California Native Plant Society listing (Smith and York 1984) categories are:

L1B (List 1B): Plants rare and endangered in California and elsewhere.
L2 (List 2): Plants rare and endangered in California but more common elsewhere.
L3 (List 3): Plants about which more information is needed.
L4 (List 4): Plants of limited distribution (a watch list).
Ap.I (Appendix I): Plants considered, but not included (those here were considered too common to be listed).

4 The categories for RED Code (California Native Plant Society) are:

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

E **(Endangered)**
1: Not endangered.
2: Endangered in a portion of its range.
3: Endangered throughout its range.

D **(Distribution)**
1: More or less widespread outside California.
2: Rare outside California.
3: Endemic to California.

Table12. (Continued)

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Serpentine Flora

Both serpentine sites examined on South Vandenberg were annual grassland vegetation with scattered rock outcrops. The site on the north slope of Honda Canyon was relatively small. Introduced annual grasses (*Avena* spp., *Bromus* spp.) dominated the site, but some native perennial grasses (*Stipa* spp., *Elymus condensatus*) occurred (Table 13). Steep north-facing slopes were more mesic, supporting species such as *Adiantum jordanii.* Except for inaccessible areas, this site was grazed regularly. No special interest plants were located there.

The Arguello Road serpentine site was much larger. Most of it was regularly grazed annual grassland with scattered rock outcrops. Some areas around facilities are no longer grazed. Introduced grasses (*Avena* spp., *Lolium perenne*) dominated. *Chorizanthe palmeri* occurred rather than one of the listed species of *Chorizanthe* (Table 14). Collections of *Chorizanthe palmeri* and *C. obovata* were identified by Dr. James L. Reveal, Botany Department, University of Maryland. A seep in this area supported other species (Table 14).

The serpentine area examined on North Vandenberg along Globe Road was occupied by annual grassland; no special interest or unusual plants were found at this site (Table 15). The serpentine area along Soldado Road was also dominated by annual grasses, but extensive populations of *Chorizanthe obovata* occurred (Table 16).

Serpentine areas in the Dairy Canyon area were primarily coastal sage scrub rather than grassland. They had a more xeric appearance than adjacent vegetation on other substrates, but no special interest plants were found (Table 17).

Table 13. Plants Noted in the North Slope Honda Canyon Serpentine Area.

Ridge Crest: Annual Grassland Type

Dominants	Also Occurring
Avena spp.	*Chlorogalum pomeridianum*
Bromus diandrus	*Corethrogyne filaginifolia*
Bromus mollis	*Cryptantha clevelandii*
Calystegia macrostegia	*Dudleya* sp.
Eschscholzia californica	*Eriogonum elongatum*
Lolium perenne	*Eriogonum parvifolium*
	Erodium cicutarium
	Hemizonia fasciculata
	Hordeum leporinum
	Hypochoeris glabra
	Linanthus androsaces
	Lotus junceus
	Melica imperfecta
	Orthocarpus purpurascens
	Silene gallica
	Sisyrinchium bellum
	Stipa lepida
	Stipa pulchra
	Lomatium utriculatum

Slopes (with scattered outcrops):

Additional Species

Elymus condensatus
Lupinus succulentus
Platystemon californicus
Salvia columbariae

Steep North-facing Slopes:

Additional species

Adiantum jordanii
Collinsia sp.
Elymus glaucus
Gilia capitata
Hordeum californicum
Koeleria macrantha
Senecio californica
Sonchus sp.

Table 14. Plants Noted in the Arguello Road Serpentine Area.

Slopes (with scattered outcrops): Annual Grassland Type

Dominants	Also Occurring
Avena spp.	*Corethrogyne filaginifolia*
Lolium perenne	*Eschscholzia californica*
Lomatium utriculatum	*Hemizonia* sp.
	Mirabilis californica ssp. *californica*

Seasonal Seep:*

Bloomeria crocea
Chlorogalum pomeridianum
Cirsium brevistylum
Corethrogyne filaginifolia
Cryptantha sp.
Elymus (triticoides ?)
Erechtites glomerata
Eriophyllum confertiflorum
Lolium perenne ssp.*multiflorum*
Lupinus (latifolius ?)
Pogogyne (douglasii ?)
Sisyrinchium bellum
Stipa lepida
Stipa pulchra

Perennial Springhead (Wet):*

Juncus mexicanus
Juncus (phaeocephalus ?)
Mimulus guttatus
Polypogon interruptus
Polypogon monspeliensis
Rumex conglomeratus

? Indicates uncertainty in taxonomic determination.

* From list compiled by Wayne R. Ferren, Jr. (University of California, Santa Barbara), May 22 1987.

Table 15. Plants Noted in the Globe Road Serpentine Area.

Along Drainage: Annual Grassland Type

Dominants	Also Occurring
Avena spp.	*Brassica nigra*
Bromus mollis	*Bromus diandrus*
Calystegia macrostegia	*Bromus mollis*
Centaurea melitensis	*Lolium perenne*
Scattered native bunch grasses	*Koeleria phleoides*
	Picris echioides
	Salvia columbariae
	Sonchus sp.
	Vulpia sp.

Table 16. Plants Noted in the Soldado Road Serpentine Area.

Flat to Sloping Areas Along Fault Line: Annual Grassland Type

Dominants	Also Occurring
Bromus mollis	*Bromus rubens*
Chorizanthe obovata	*Calystegia macrostegia*
	Eschscholzia californica
	Mirabilis californica ssp. *californica*
	Marrubium vulgare
	Stipa pulchra
	Zauschneria californica ssp. *californica*

Table 17. Plants Noted in the Dairy Canyon Serpentine Area.

South-facing Slopes: Purple Sage Scrub Type

Dominants

Salvia leucophylla

North-facing Slopes: Coastal Sage Scrub Type

Dominants

Artemisia californica
Coreopsis gigantea

Canyon Bottom Wetlands (Grazed):

Dominants

Distichlis spicata
Scirpus sp.

Table 18. Plants Noted in the Lions Head Serpentine Area.

Outcrop North of Lions Head:

Significant Plants

Chorizanthe obovata
Dudleya blochmaniae ssp. *blochmaniae*

Lions Head:

Significant Plants

Chorizanthe obovata
Dudleya blochmaniae ssp. *blochmaniae*
Mariposa argillosa

The northernmost serpentine areas on Vandenberg are in the Lions Head area. On an outcrop north of Lions Head, *Chorizanthe obovata* and *Dudleya blochmaniae* ssp. *blochmaniae* were found; these occurred with annual grasses (Table 18). Part of the Lions Head outcrop had been quarried; *Chorizanthe obovata, Dudleya blochmaniae* ssp. *blochmaniae*, and a large population of *Mariposa argillosa* occurred there in undisturbed locations.

Current Vegetation Study

Vegetation Sampling

Twenty-nine separate stands were sampled representing 15 vegetation types (Table 10). Location of stands is given in Appendix IV. Fifteen of these stands had been sampled previously by SDSU. The total number of permanent quadrats sampled by SDSU was 34 (Coulombe and Mahrdt 1976); thus, 44% of the SDSU stands were resampled in this study.

All original vegetation data collected in this project are included as appendicies to this report. These are arranged as follows: Appendix V- percent cover data from all 15 m transects and species presence in associated 150 m^2 plots, where used; Appendix VI- canopy vegetation data including diameter distributions, density, basal area, and importance values; Appendix VII- cover class data from 1m^2 plots along transects in seasonal wetlands; Appendix VIII- environmental parameters associated with vegetation transects. Data are archived in computer data bases (IBM PC-compatible) as well as in hard copy. Vegetation data bases are described in Appendix IX, Table IX-1. Geographic information system files produced in this project including those for the vegetation and land use types map (Provancha 1988) are described in Appendix IX, Table IX-2 .

Vegetation Types

Chaparral. There was conspicuous stand-to-stand variability in the chaparral sampled. Stand 1 was a mature stand on the Burton Mesa. Dominants were *Arctostaphylos purissima* and *A. rudis*; open space in the stand was common (Table 19; Appendix V, Tables V-1 through V-6). Stand 2, located on the Lompoc Terrace, was dominated by *Quercus wislizenii.* This was a dense stand with little open space but with many dead shrubs (Table 20; Appendix V, Tables V-7 through V-12). *Lotus scoparius, Heteromeles arbutifolia*, and *Prunus ilicifolia* dominated Stand 3 located in the Oak Mountain-Cherry Ridge area of the Santa Ynez Mountains (Table 21; Appendix V, Tables V-14 through V-19). This variant of chaparral was not sampled on Vandenberg by SDSU. This stand burned in 1981. Stand 4 was in an area of mixed chaparral and Bishop pine forest. *Arctostaphylos purissima/refugioensis* and *Quercus wislizenii* were the dominant shrubs and there were few openings (Table 22; Appendix V, Tables V-20 through V-25). Stand 5 was very dense chaparral located on slopes above Spring Canyon. *Arctostaphylos purissima/ refugioensis* was dominant; *Adenostoma fasciculatum* and *Arctostaphylos tomentosa* were also abundant, and *Vaccinium ovatum* occurred (Table 23; Appendix V, Tables V-26 through V-31).

Bishop Pine Forest. The two stands of Bishop pine forest sampled differed structurally; one was a mature stand and one originated after a 1974 fire. Stand 6, the mature stand, had a canopy of Bishop pine (*Pinus muricata*) (Table 24) and an understory of Bishop pine and chaparral shrubs (*Arctostaphylos* spp., *Quercus wislizenii*) (Table 25); the transects were also dominated by chaparral shrubs (Table 26; Appendix V, Tables V-32 through V-37). The diameter distribution of Bishop pine (Figure 1) had fewer stems in the

Table 19. Summary of vegetation transect data from Stand 1 - Chaparral.[1]

Taxa	Percent Cover > 0.5 m		< 0.5 m	
	$\bar{X}$	SD	$\bar{X}$	SD
Arctostaphylos purissima	53.8	2.2	0.3	0.6
Arctostaphylos rudis	12.4	15.1		
Dead - *Arctostaphylos purissima*	3.8	4.0		
Mimulus aurantiacus	2.9	5.0	2.6	1.0
Dead - *Ceanothus* sp.	2.0	1.8	0.4	0.8
Ceanothus ramulosus	1.8	3.1		
Ericameria ericoides	1.7	2.6	0.7	1.2
Salvia mellifera	1.6	2.7	0.4	0.8
Adenostoma fasciculatum	1.1	1.9		
Dead - *Ceanothus ramulosus*	1.1	1.9		
Cortaderia jubata	0.7	1.2		
Dead - *Arctostaphylos rudis*	0.7	1.2	4.9	8.5
Dead - *Ericameria ericoides*	0.7	1.2		
Baccharis pilularis ssp. *consanguinea*	0.3	0.6		
Dead - *Mimulus aurantiacus*	0.2	0.4	0.4	0.8
Bare ground			16.3	18.0
Lotus scoparius			0.6	1.0
Croton californicus			0.3	0.6
Horkelia cuneata			0.2	0.4
Galium nuttallii			0.1	0.2
Total - Live (%)	76.2	17.8	5.2	1.9
Total - Dead (%)	8.4	3.1	5.8	8.9

1 Summarizes three 15 m transects, 51, 52, and 53. Same location as SDSU #5.

Table 20. Summary of vegetation transect data from Stand 2 - Chaparral.[1]

Taxa	Percent Cover > 0.5 m		Percent Cover < 0.5 m	
	$\bar{X}$	SD	$\bar{X}$	SD
Quercus wislizenii	40.8	14.6	9.1	6.0
Dead - *Quercus wislizenii*	13.3	13.4	0.1	0.2
Dead - *Ceanothus* sp.	6.4	11.1	0.9	1.6
Dead - *Salvia mellifera*	6.0	10.4		
Dead - *Ceanothus impressus*	4.9	8.5		
Dead - *Pteridium aquilinum*	3.8	4.0	2.6	1.6
Ceanothus impressus	2.9	5.0		
Toxicodendron diversilobum	2.2	3.9	0.2	0.4
Dead - *Baccharis pilularis* ssp. *consanguinea*	2.0	3.5		
Ericameria ericoides	1.3	2.3	1.8	1.4
Baccharis pilularis ssp. *consanguinea*	1.1	1.9		
Adenostoma fasciculatum	0.7	1.2	1.7	2.9
Artemisia californica	0.4	0.8	0.6	0.5
Salvia mellifera	0.4	0.8	0.1	0.2
Agrostis sp.			11.2	2.1
Carex cf. *globosa*			10.8	9.3
Unknown herbs			3.2	2.9
Bare ground			2.0	2.0
Gnaphalium sp.			1.9	2.7
Galium nuttallii			0.4	0.8
Lotus scoparius			0.3	0.6
Poaceae - unknown			0.2	0.2
Total - Live (%)	49.9	8.7	41.5	11.2
Total - Dead (%)	36.4	12.1	3.6	0.2

1 Summarizes three 15 m transects, 54, 55, and 56. Same location as SDSU #12.

Table 21. Summary of vegetation transect data from Stand 3 - Chaparral.[1]

Taxa	Percent Cover > 0.5 m		< 0.5 m	
	$\bar{X}$	SD	$\bar{X}$	SD
Lotus scoparius	41.1	9.2		
Heteromeles arbutifolia	31.1	24.8		
Prunus ilicifolia	28.7	9.2	0.4	0.8
Dead - *Lotus scoparius*	7.6	8.5	3.3	2.9
Encelia californica	3.1	4.3		
Dead - *Heteromeles arbutifolia*	2.7	0.7		
Solanum xantii var. *hoffmannii*	1.3	2.3	0.4	0.8
Bare ground			2.4	2.8
Total - Live (%)	101.8	7.0	0.9	1.5
Total - Dead (%)	10.2	7.8	3.3	2.9

1 Summarizes three 15 m transects, 58, 59, and 60.

Table 22. Summary of vegetation transect data from Stand 4 - Chaparral.[1]

Taxa	Percent Cover > 0.5 m $\bar{X}$	> 0.5 m SD	< 0.5 m $\bar{X}$	< 0.5 m SD
Arctostaphylos purissima / refugioensis	46.7	20.3	0.3	0.6
Quercus wislizenii	23.8	12.6	5.3	7.0
Ceanothus impressus	7.8	13.5		
Dead - *Ceanothus impressus*	6.9	12.0		
Adenostoma fasciculatum	4.3	5.3	6.9	12.0
Dead - *Ceanothus* sp.	4.2	3.7		
Dead - *Quercus wislizenii*	1.8	3.1		
Dead - *Arctostaphylos purissima / refugioensis*	2.0	3.5		
Standing dead	1.3	1.7		
Dead - *Adenostoma fasciculatum*	1.6	2.7		
Baccharis pilularis ssp. *consanguinea*	0.4	0.8		
Bare ground			2.4	4.2
Total - Live (%)	86.3	11.5	12.8	9.4
Total - Dead (%)	17.8	16.6	3.3	2.9

1 Summarizes three 15 m transects, 61, 62, and 63. Same location as SDSU #18.

Table 23. Summary of vegetation transect data from Stand 5 - Chaparral.[1]

Taxa	Percent Cover > 0.5 m $\bar{X}$	> 0.5 m SD	< 0.5 m $\bar{X}$	< 0.5 m SD
Arctostaphylos purissima / refugioensis	49.8	28.0	13.1	22.7
Adenostoma fasciculatum	16.5	11.7	1.3	2.3
Arctostaphylos tomentosa	14.1	17.7		
Quercus wislizenii	7.3	6.4		
Vaccinium ovatum	4.9	8.5		
Ceanothus ramulosus	1.3	2.3		
Dead - *Arctostaphylos purissima/ refugioensis*	1.3	1.3		
Dead - *Vaccinium ovatum*	0.9	1.6		
Dead - *Quercus wislizenii*	0.7	1.2		
Dead - *Arctostaphylos tomentosa*	0.3	0.6		
Dead - *Arctostaphylos* sp.			1.1	1.9
Total - Live (%)	94.0	33.0	14.4	25.0
Total - Dead (%)	3.2	0.7	1.1	1.9

1 Summarizes three 15 m transects, 64, 65, and 66. Same location as SDSU #23.

Table 24. Canopy composition of Stand 6 - Bishop pine forest.[1]

Taxa	Density Per Hectare $\bar{X}$ (SD)	Relative Density $\bar{X}$ (SD)	Basal Area (m^2/ha) $\bar{X}$ (SD)	Relative Basal Area $\bar{X}$ (SD)	Importance Value $\bar{X}$ (SD)
Pinus muricata	502.43 (213.05)	81.07 (13.45)	14.02 (4.60)	82.0 (11.4)	163.1 (24.9)
Dead - *Pinus muricata*	107.07 (86.80)	18.93 (13.45)	3.20 (2.67)	18.0 (11.4)	36.9 (24.9)
Total Canopy	609.50 (207.26)		17.22 (6.20)		

Table 25. Understory composition of Stand 6 - Bishop pine forest.[2]

Taxa	Density Per Hectare $\bar{X}$ (SD)	Relative Density $\bar{X}$ (SD)	Basal Area (m^2/ha) $\bar{X}$ (SD)	Relative Basal Area $\bar{X}$ (SD)	Importance Value $\bar{X}$ (SD)
Pinus muricata	189.43 (121.90)	51.47 (31.38)	1.05 (0.83)	55.3 (35.2)	106.8 (24.9)
Dead - *Pinus muricata*	107.10 (51.47)	33.20 (20.49)	0.60 (0.43)	37.9 (30.1)	71.1 (49.4)
Arctostaphylos purissima/refugioensis	16.47 (28.52)	7.40 (12.82)	0.03 (0.06)	2.5 (4.3)	9.9 (17.1)
Quercus wislizenii	32.93 (57.04)	6.33 (10.97)	0.06 (0.11)	3.4 (5.9)	9.7 (16.9)
Arctostaphylos tomentosa	8.23 (14.26)	1.60 (2.77)	0.02 (0.03)	0.9 (1.5)	2.5 (4.3)
Total Understory	354.17 (150.97)		1.76 (0.41)		

[1]Summarizes three 0.1 ac plots, 67, 68, and 69.

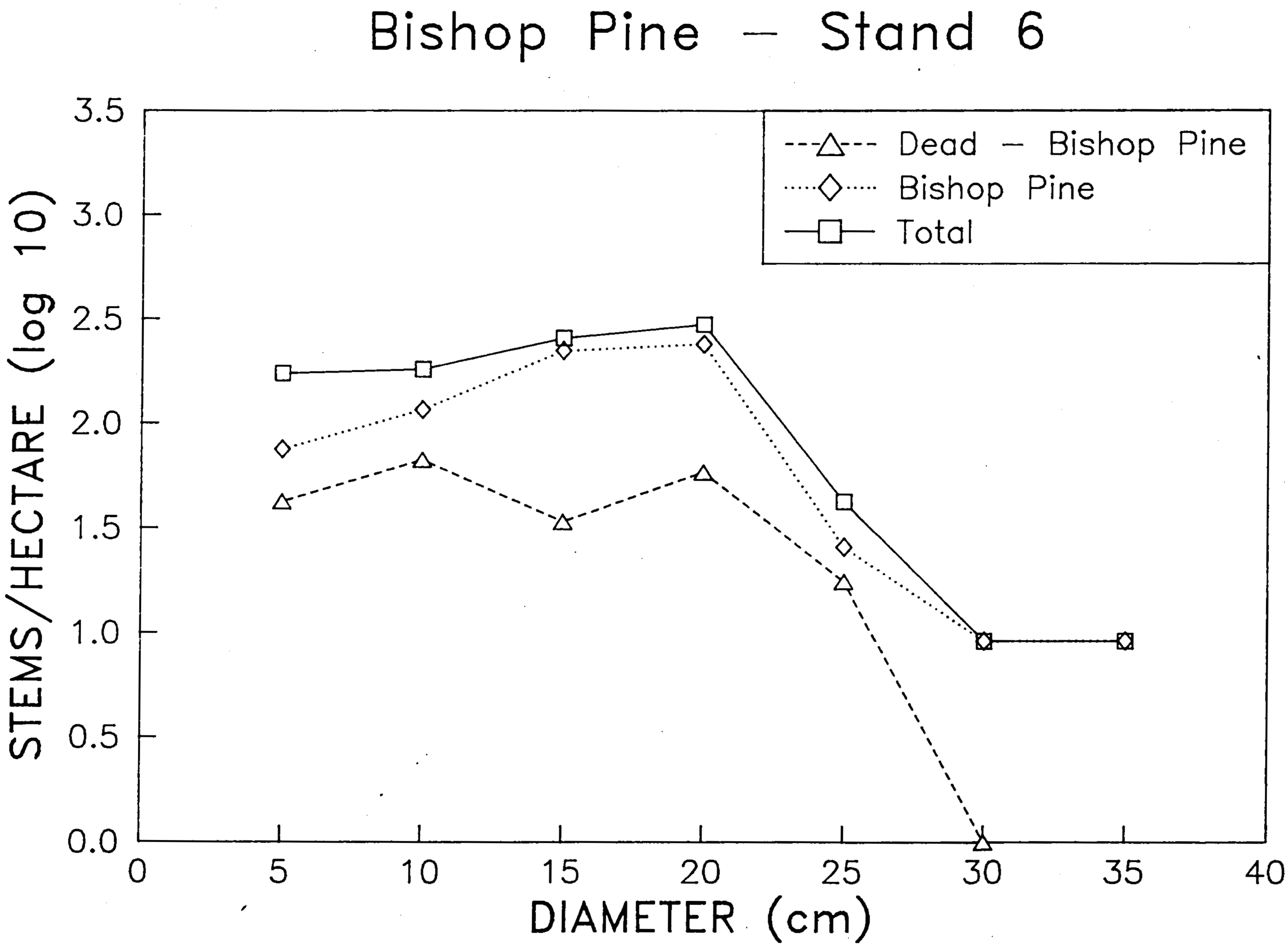
[2]Summarizes three 0.1 ac plots, 67, 68, and 69.

Table 26. Summary of vegetation transect data from Stand 6 - Bishop pine forest.[1]

Taxa	Percent Cover > 0.5 m		< 0.5 m	
	$\bar{X}$	SD	$\bar{X}$	SD
Quercus wislizenii	17.6	23.1	5.0	8.7
Arctostaphylos tomentosa	14.3	18.9	0.3	0.6
Dead - *Pinus muricata*	10.8	8.6	3.7	3.2
Adenostoma fasciculatum	9.1	15.2	0.7	1.2
Quercus agrifolia	9.1	15.8	7.0	12.1
Dead - *Quercus* sp.	6.4	7.1		
Standing dead	3.8	6.5		
Arctostaphylos purissima / refugioensis	3.2	5.6	2.9	5.0
Dead - *Arctostaphylos tomentosa*	2.1	2.0		
Dead - *Quercus wislizenii*	0.7	1.2		
Dead - *Arctostaphylos purissima / refugioensis*	0.6	1.0		
Heteromeles arbutifolia	0.4	0.8		
Galium nuttallii			0.1	0.2
Bare ground			19.0	9.8
Total - Live (%)	53.8	23.9	16.0	4.7
Total - Dead (%)	24.3	9.5	3.7	3.2

1 Summarizes three 15 m transects, 67, 68, and 69. Same location as SDSU #24.

Figure 1. Diameter distributions for Stand 6 - Bishop pine forest.



smaller size classes than in the larger, a characteristic that generally indicates relative lack of reproduction. Stand 7, in contrast, was a dense, young stand with no canopy size (dbh > 12.5 cm) individuals (Table 27). Shrub species were similar to the adjacent chaparral (Table 28; Appendix V, Tables V-38 through V-41). Stems were clustered in the small size classes, declining sharply (Figure 2); apparently no large trees survived the fire in this stand.

Tanbark Oak Forest. Tanbark oak (*Lithocarpus densiflora*) was the only canopy species occurring in this type (Table 29). However, huckleberry (*Vaccinium ovatum*) was important in the understory (Table 30), and it was the dominant shrub on the vegetation transects (Table 31; Appendix V, Tables V-57 through V-58). The diameter distribution (Figure 3) also indicated the high density of small-diameter huckleberry stems; however, tanbark oak reproduction was occurring as indicated by the number of sapling layer stems.

Annual Grassland. Five stands of annual grassland were sampled, three in the northern part of the base and two in the Sudden Ranch area; all were dominated by introduced annual grasses with various introduced and native herbs. Stand 8 was dominated by *Hordeum leporinum* with *Bromus mollis* and *Brassica nigra* common (Table 32, Appendix V, Tables V-42 through V-44); the native grass, *Stipa pulchra*, was present. This site was on moderate slopes. Stand 9 was on steep slopes and was grazed at the time of sampling. It was also dominated by *Hordeum leporinum*, but there was more bare ground and thistles were more abundant than in the previous stand (Table 33; Appendix V, Tables V-45 through V-47). *Bromus diandrus* and *Avena barbata* dominated Stand 10 (Table 34; Appendix V, Tables V-48 through V-50) which was located on a bench with gentle slopes. Stand 17 and Stand 18 were both in the

Table 27. Understory composition of Stand 7 - Bishop pine forest.[1]

Taxa	Density Per Hectare $\bar{X}$ (SD)	Relative Density $\bar{X}$ (SD)	Basal Area (m^2/ha) $\bar{X}$ (SD)	Relative Basal Area $\bar{X}$ (SD)	Importance Value $\bar{X}$ (SD)
Pinus muricata	8531.60 (4573.88)	100.00	16.58 (11.19)	100.00	200.00
Total Understory	8531.60 (4573.88)		16.58 (11.19)		

1 Summarizes two 0.016 ac plots, 70 and 71. Stand burned in 1974.

Table 28. Summary of vegetation transect data from Stand 7 - Bishop pine forest.[1]

Taxa	Percent Cover > 0.5 m		< 0.5 m	
	$\bar{X}$	SD	$\bar{X}$	SD
Pinus muricata	71.2	8.3		
Quercus wislizenii	12.4	17.5	5.9	4.5
Dead - *Pinus muricata*	6.8	0.7	13.2	4.9
Dead - *Ceanothus impressus*	6.4	9.0		
Adenostoma fasciculatum	5.0	7.1		
Arctostaphylos purissima/refugioensis	3.7	5.2	9.9	13.9
Ceanothus impressus	3.7	5.2	1.4	0.9
Arctostaphylos tomentosa	2.5	3.5	0.4	0.5
Bare ground			32.4	3.7
Lotus scoparius			3.4	4.7
Galium nuttallii			0.5	0.3
Dead - *Lotus scoparius*			0.4	0.5
Baccharis pilularis ssp. *consanguinea*			0.2	0.2
Unknown herb			0.2	0.2
Total - Live (%)	98.3	1.4	21.6	6.0
Total - Dead (%)	13.2	9.7	13.6	5.4

1 Summarizes two 15 m transects, 70 and 71. Same location as SDSU #17.

Figure 2. Diameter distributions for Stand 7 - Bishop pine forest.

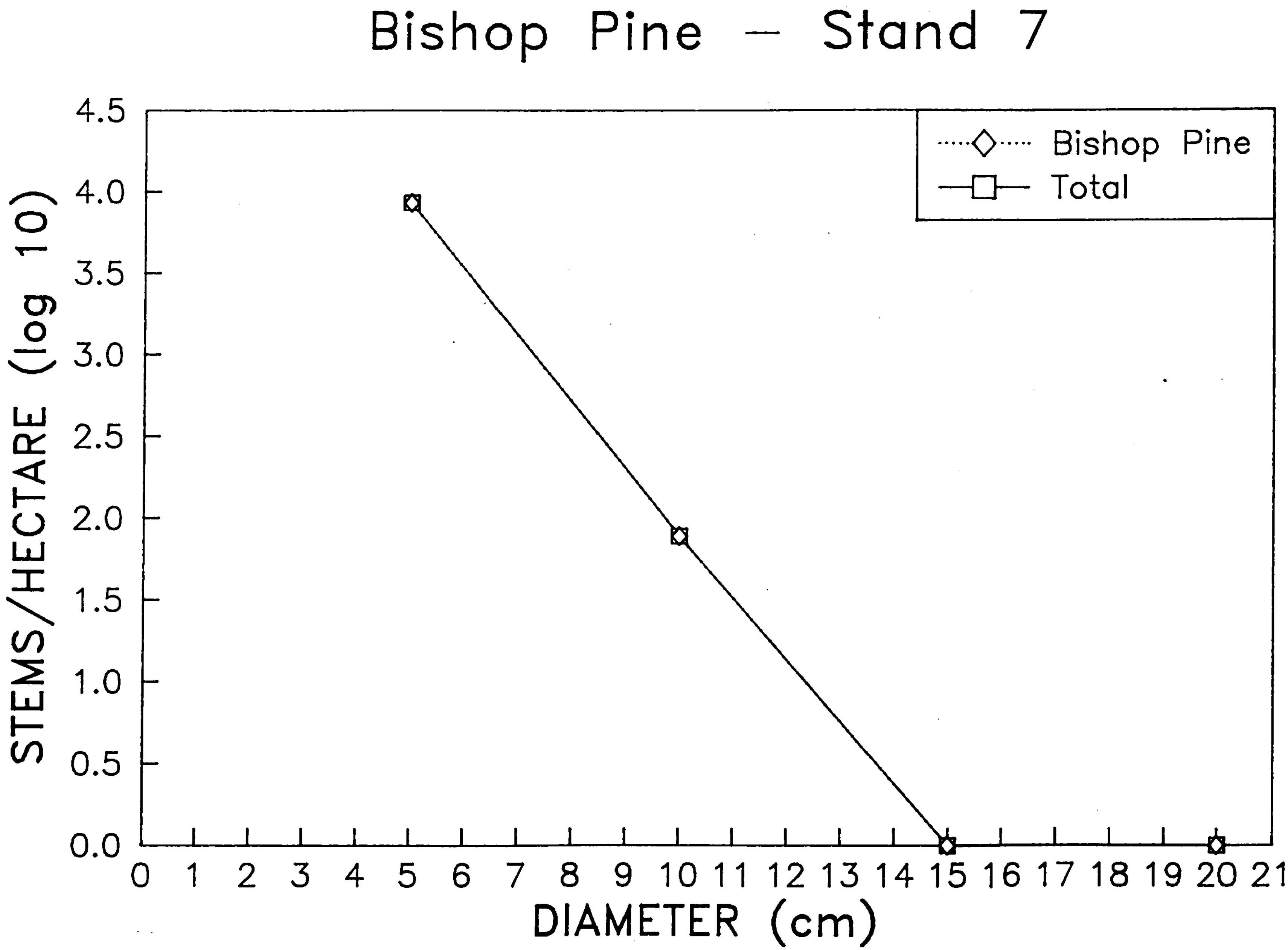


Table 29. Canopy composition of Stand 12 - Tanbark oak forest.[1]

Taxa	Density Per Hectare $\bar{X}$ (SD)	Relative Density $\bar{X}$ (SD)	Basal Area (m^2/ha) $\bar{X}$ (SD)	Relative Basal Area $\bar{X}$ (SD)	Importance Value $\bar{X}$ (SD)
Lithocarpus densiflora	481.85 (87.33)	90.50 (13.44)	55.28 (4.56)	88.35 (16.48)	178.85 (29.91)
Dead - *Lithocarpus densiflora*	49.40 (69.86)	9.50 (13.44)	8.88 (12.55)	11.65 (16.48)	21.15 (29.91)
Total Canopy	531.25 (17.47)		64.15 (17.11)		

Table 30. Understory composition of Stand 12 - Tanbark oak forest.[2]

Taxa	Density Per Hectare $\bar{X}$ (SD)	Relative Density $\bar{X}$ (SD)	Basal Area (m^2/ha) $\bar{X}$ (SD)	Relative Basal Area $\bar{X}$ (SD)	Importance Value $\bar{X}$ (SD)
Lithocarpus densiflora	284.15 (52.40)	10.20 (0.57)	1.14 (0.31)	18.75 (6.58)	28.95 (6.01)
Dead - *Lithocarpus densiflora*	24.70 (34.93)	0.80 (1.13)	0.20 (0.28)	2.95 (4.17)	21.15 (29.91)
Vaccinium ovatum	2471.00 (279.59)	89.00 (1.70)	4.84 (0.55)	78.30 (2.40)	167.30 (0.70)
Total Understory	2779.85 (366.92)		6.18 (0.52)		

[1]Summarizes two 0.1 ac plots, 84 and 85.

[2]Summarizes two 0.1 ac plots, 84 and 85.

Table 31. Summary of vegetation transect data from Stand 12 - Tanbark oak forest.[1]

Taxa	Percent Cover > 0.5 m		< 0.5 m	
	$\bar{X}$	SD	$\bar{X}$	SD
Vaccinium ovatum	93.3	8.5		
Dead - *Lithocarpus densiflora*	2.4	3.3		
Dead - *Vaccinium ovatum*	0.7	0.9		
Bare ground			5.4	7.6
Polystichum munitum			1.0	1.4
Total - Live (%)	93.3	8.5	1.0	1.4
Total - Dead (%)	3.0	2.4	0.0	0.0

1 Summarizes two 15 m transects, 84 and 85. Same location as SDSU #27.

Figure 3. Diameter distributions for Stand 12 - Tanbark oak forest.

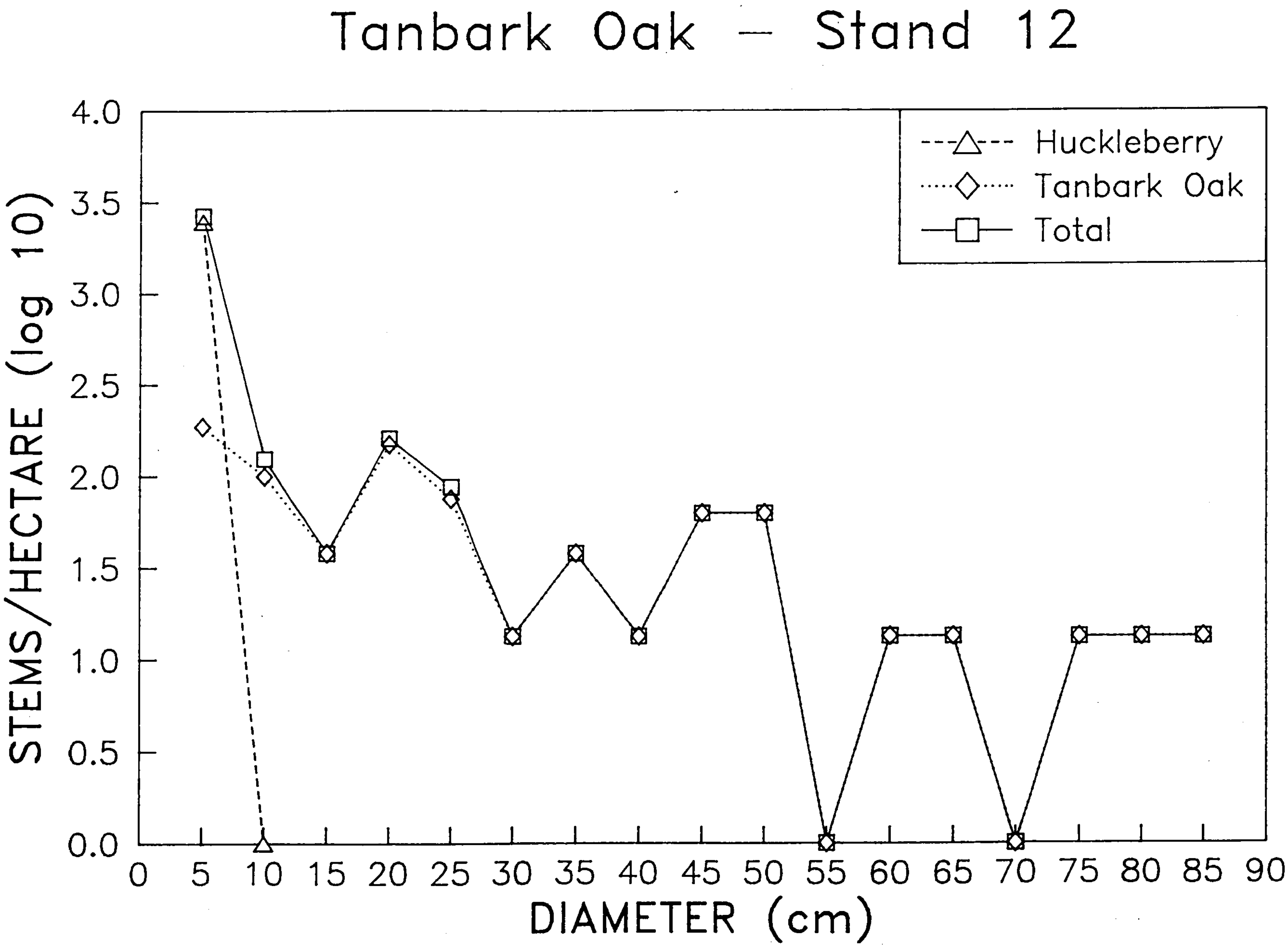


Table 32. Summary of vegetation transect data from Stand 8 - Annual grassland.[1]

Taxa	Percent Cover > 0.5 m X̄	Percent Cover > 0.5 m SD	Percent Cover < 0.5 m X̄	Percent Cover < 0.5 m SD
Hordeum leporinum			49.8	22.1
Bromus mollis			28.0	19.6
Brassica nigra	0.2	0.4	18.0	15.1
Medicago polymorpha			13.6	9.7
Erodium botrys			11.2	4.7
Bromus diandrus			5.8	9.4
Stipa pulchra			5.3	9.2
Avena barbata			3.8	3.4
Hypochoeris glabra			1.4	2.2
Bare ground			1.3	1.2
Atriplex sp.			1.0	1.7
Unknown thistle			0.7	0.7
Erodium cicutarium			0.5	0.7
Silybum marianum			0.4	0.8
Malva parviflora			0.3	0.6
Vulpia bromoides			0.3	0.6
Unknown herbs			0.1	0.2
Total - Live (%)	0.2	0.4	140.3	1.8
Total - Dead (%)	0.0	0.0	0.0	0.0

1 Summarizes three 15 m transects, 72, 73, and 74.

Table 33. Summary of vegetation transect data from Stand 9 - Annual grassland.[1]

Taxa	Percent Cover > 0.5 m $\bar{X}$	> 0.5 m SD	< 0.5 m $\bar{X}$	< 0.5 m SD
Hordeum leporinum			65.1	12.6
Bare ground			10.2	8.0
Unknown thistle			9.2	11.9
Silybum marianum			8.3	8.5
Brassica nigra			7.3	6.3
Bromus diandrus			1.9	1.7
Rock			1.7	1.7
Malva parviflora			1.2	1.6
Apiaceae - unknown			0.3	0.6
Medicago polymorpha			0.3	0.4
Calystegia macrostegia ssp. *cyclostegia*			0.2	0.4
Erodium botrys			0.1	0.2
Lupinus sp.			0.1	0.2
Sonchus sp.			0.1	0.2
Total - Live (%)			94.6	11.7
Total - Dead (%)			0.0	0.0

1 Summarizes three 15 m transects, 75, 76, and 77.

Table 34. Summary of vegetation transect data from Stand 10 - Annual grassland.[1]

Taxa	Percent Cover > 0.5 m		< 0.5 m	
	$\bar{X}$	SD	$\bar{X}$	SD
Brassica nigra	6.0	5.0	4.1	2.6
Avena barbata	2.1	1.6	17.9	8.3
Bromus diandrus	0.3	0.6	62.1	16.9
Medicago polymorpha			19.4	5.7
Amsinckia intermedia			6.8	11.7
Erodium botrys			4.4	4.6
Bromus mollis			4.1	2.1
Bromus sp.			2.3	4.0
Bare ground			1.3	0.9
Hordeum leporinum			0.9	0.8
Silene gallica			0.1	0.2
Sonchus asper			0.1	0.2
Total - Live (%)			122.2	4.5
Total - Dead (%)			0.0	0.0

1 Summarizes three 15 m transects, 78, 79, and 80.

Miguelito Road area on Sudden Ranch. Stand 17 was dominated by *Hordeum leporinum*, *Bromus diandrus*, and *Erodium botrys* (Table 35; Appendix V, Tables V-83 through V-85), while *Bromus diandrus* and *Hordeum leporinum* dominated Stand 18 (Table 36; Appendix V, Tables V-86 through V-88).

Oak Woodland. Coast live oak (*Quercus agrifolia*) was the only canopy tree in Stand 14 (Table 37) and made up most of the sapling layer (Table 38). The shrub and herb vegetation sampled by the vegetation transect was quite diverse (Table 39; Appendix V, Tables V-65 through V-70). Diameter distributions (Figure 4) indicated that some oak regeneration was occurring. Coast live oak was also the sole canopy tree in Stand 21 (Table 40); canopy density was similar to that of Stand 14, but basal area was greater. Live oak was less abundant in the sapling layer, however (Table 41). The diameter distribution (Figure 5) indicated a lack of oak reproduction. Vegetation sampled by the transects was also less diverse (Table 42; Appendix V, Tables V-101 through V-106). One of the plots in this stand (Plot 110) was on a very steep slope with an unstable soil surface, and another one (Plot 112) appeared heavily grazed; these factors may have contributed to the sparsity of herbs in this stand.

Coastal Sage Scrub. The one stand of coastal sage scrub sampled (Stand 13) was dominated by *Baccharis pilularis* ssp. *consanguinea* and *Artemisia californica*; a variety of other shrubs and herbs occurred (Table 43; Appendix V, Tables V-59 through V-64).

Purple Sage Scrub. Purple sage scrub is considered a variant of coastal sage scrub and is common on South Vandenberg. *Salvia leucophylla*

Table 35. Summary of vegetation transect data from Stand 17 - Annual grassland.[1]

Taxa	Percent Cover > 0.5 m $\bar{X}$	> 0.5 m SD	< 0.5 m $\bar{X}$	< 0.5 m SD
Hordeum leporinum			45.1	8.2
Bromus diandrus			32.1	7.8
Erodium botrys			22.8	11.2
Avena barbata			3.9	2.1
Medicago polymorpha			3.9	2.9
Rock			3.3	5.8
Amsinckia intermedia			1.7	2.9
Stipa pulchra			1.4	2.2
Brassica nigra			1.2	1.2
Unknown herb #1			0.9	1.6
Chenopodium californicum			0.8	0.7
Calystegia macrostegia ssp. *cyclostegia*			0.6	1.0
Unknown herb #2			0.4	0.8
Unknown herb #3			0.4	0.8
Erodium cicutarium			0.3	0.4
Bromus sp.			0.2	0.4
Lupinus succulentus			0.2	0.4
Malva parviflora			0.1	0.2
Bare ground			0.1	0.2
Total - Live (%)			116.1	11.6
Total - Dead (%)			0.0	0.0

1 Summarizes three 15 m transects, 98, 99, and 100. Same location as SDSU #30.

Table 36. Summary of vegetation transect data from Stand 18 - Annual grassland.[1]

Taxa	Percent Cover > 0.5 m $\bar{X}$	> 0.5 m SD	< 0.5 m $\bar{X}$	< 0.5 m SD
Bromus diandrus			60.1	25.4
Hordeum leporinum			27.1	9.6
Rock			4.9	8.5
Avena barbata			3.5	3.7
Medicago polymorpha			2.8	3.6
Bare ground			1.5	1.4
Silybum marianum			1.2	1.0
Sonchus oleraceus			0.4	0.8
Bromus mollis			0.3	0.6
Brassica nigra			0.3	0.6
Malva parviflora			0.3	0.6
Unknown herb #1			0.2	0.4
Unknown herb #2			0.1	0.2
Total - Live (%)			96.5	9.8
Total - Dead (%)			0.0	0.0

[1] Summarizes three 15 m transects, 101, 102, and 103. Same location as SDSU #31.

Table 37. Canopy composition of Stand 14 - Oak woodland.[1]

Taxa	Density Per Hectare $\bar{X}$ (SD)	Relative Density $\bar{X}$ (SD)	Basal Area (m^2/ha) $\bar{X}$ (SD)	Relative Basal Area $\bar{X}$ (SD)	Importance Value $\bar{X}$ (SD)
Quercus agrifolia	469.50 (75.16)	99.27 (1.27)	24.15 (5.02)	99.67 (0.58)	198.93 (1.85)
Dead - *Quercus agrifolia*	4.13 (7.16)	0.73 (1.27)	0.07 (0.13)	0.33 (0.58)	1.07 (1.85)
Total Canopy	473.60 (82.24)		24.23 (4.95)		

Table 38. Understory composition of Stand 14 - Oak woodland.[2]

Taxa	Density Per Hectare $\bar{X}$ (SD)	Relative Density $\bar{X}$ (SD)	Basal Area (m^2/ha) $\bar{X}$ (SD)	Relative Basal Area $\bar{X}$ (SD)	Importance Value $\bar{X}$ (SD)
Quercus agrifolia	300.63 (259.84)	97.20 (2.42)	1.27 (1.17)	97.76 (2.30)	194.96 (4.53)
Dead - *Quercus agrifolia*	8.27 (7.16)	2.10 (2.10)	0.04 (0.05)	1.93 (1.86)	4.03 (3.50)
Baccharis pilularis ssp. *consanguinea*	4.13 (7.16)	0.70 (1.21)	0.01 (0.01)	0.30 (0.52)	1.00 (1.73)
Total Understory	312.97 (272.17)		1.32 (1.23)		

[1]Summarizes three 0.2 ac plots, 89, 90, and 91.

[2]Summarizes three 0.2 ac plots, 89, 90, and 91.

Table 39. Summary of vegetation transect data from Stand 14 - Oak woodland.[1]

Taxa	Percent Cover > 0.5 m X̄	> 0.5 m SD	< 0.5 m X̄	< 0.5 m SD
Toxicodendron diversilobum	10.3	10.5	7.2	6.7
Quercus agrifolia	4.2	4.7		
Elymus condensatus	4.0	6.9		
Baccharis pilularis ssp. *consanguinea*	1.3	2.3		
Bromus carinatus	0.4	0.8	4.2	3.7
Fabaceae - unknown	0.4	0.8	1.4	2.4
Bromus diandrus			24.8	36.5
Salvia spathacea			10.8	9.3
Melica imperfecta			10.0	9.7
Bare ground			6.4	7.7
Bromus sp.			6.2	5.9
Stellaria media			5.0	5.6
Stachys bullata			4.9	4.6
Claytonia perfoliata			3.2	4.1
Pityrogramma triangularis			2.5	2.3
Galium nuttallii			1.7	2.1
Pteridium aquilinum			1.4	2.5
Cardamine oligosperma			1.2	1.1
Galium aparine			0.9	0.9
Avena barbata			0.8	0.7
Silybum marianum			0.7	1.2
Viola pedunculata			0.7	1.2
Pterostegia drymarioides			0.5	0.7
Cirsium vulgare			0.4	0.6
Chenopodium californicum			0.3	0.6
Gnaphalium sp.			0.3	0.6
Unknown herb			0.3	0.6
Pholistoma auritum			0.2	0.4
Sonchus sp.			0.2	0.4
Carex cf. *globosa*			0.1	0.2
Medicago polymorpha			0.1	0.2
Total - Live (%)	20.7	19.6	90.8	14.3
Total - Dead (%)	0.0	0.0	0.0	0.0

[1] Summarizes three 15 m transects, 89, 90, and 91. Same location as SDSU #1.

Figure 4. Diameter distributions for Stand 14 - Oak woodland.

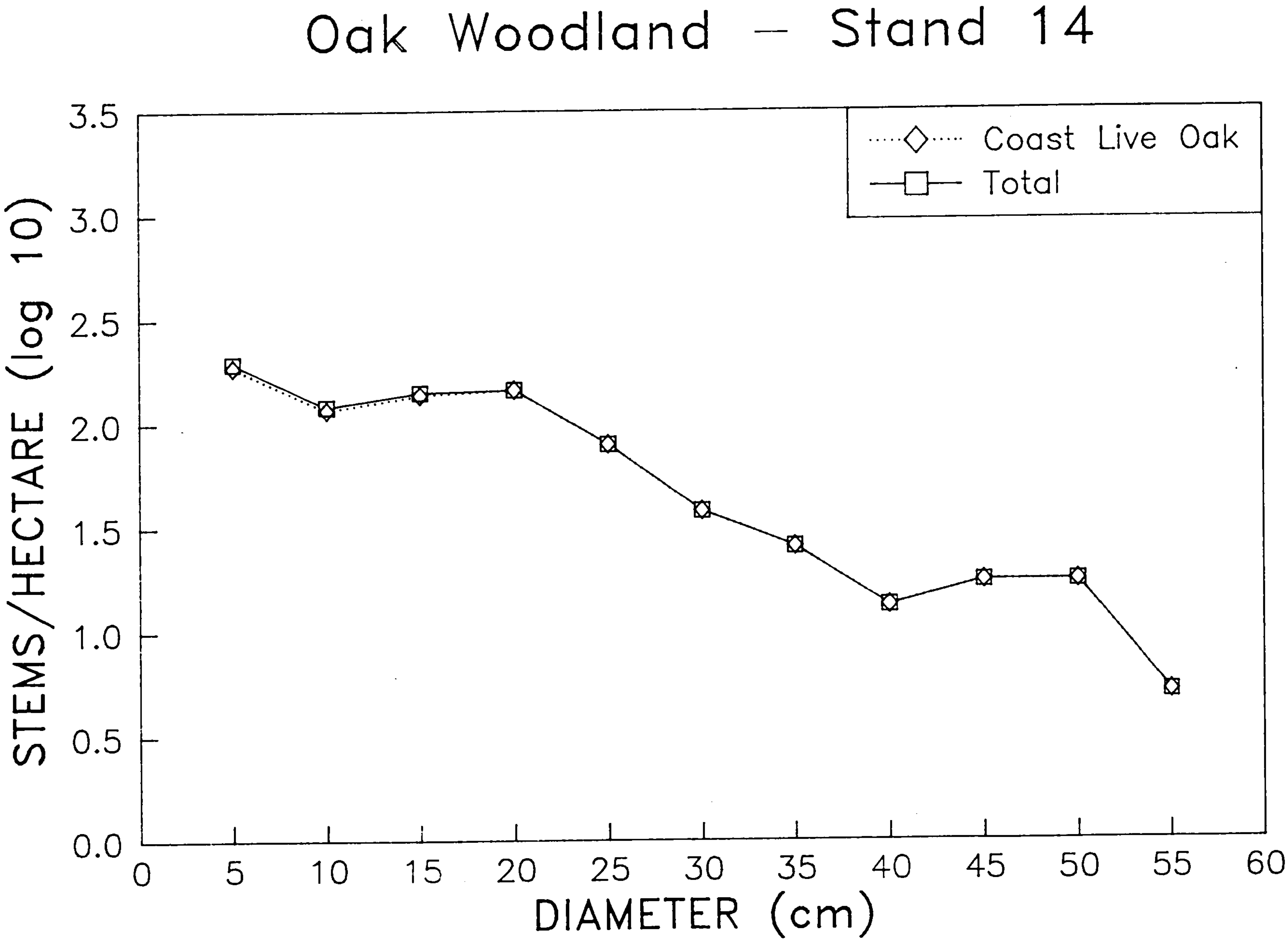


Table 40. Canopy composition of Stand 21 - Oak woodland.[1]

Taxa	Density Per Hectare X̄ (SD)	Relative Density X̄ (SD)	Basal Area (m^2/ha) X̄ (SD)	Relative Basal Area X̄ (SD)	Importance Value X̄ (SD)
Quercus agrifolia	411.83 (105.06)	89.73 (3.07)	48.36 (11.90)	96.23 (0.95)	185.97 (3.93)
Dead - *Quercus agrifolia*	45.30 (7.10)	10.27 (3.07)	1.84 (0.25)	3.77 (0.95)	6.47 (11.20)
Total Canopy	457.13 (105.06)		50.20 (11.90)		

Table 41. Understory composition of Stand 21 - Oak woodland.[2]

Taxa	Density Per Hectare X̄ (SD)	Relative Density X̄ (SD)	Basal Area (m^2/ha) X̄ (SD)	Relative Basal Area X̄ (SD)	Importance Value X̄ (SD)
Quercus agrifolia	28.83 (39.69)	25.00 (36.35)	0.11 (0.11)	31.37 (38.98)	56.37 (75.16)
Dead - *Quercus agrifolia*	4.13 (7.16)	3.70 (6.41)	0.01 (0.01)	2.77 (4.79)	6.47 (11.20)
Sambucus mexicana	45.30 (78.46)	30.57 (52.94)	0.14 (0.24)	26.97 (46.71)	57.53 (99.65)
Toxicodendron diversilobum	8.23 (14.26)	7.40 (12.82)	0.02 (0.03)	5.57 (9.64)	12.97 (22.46)
Total Understory	86.50 (77.17)		0.27 (0.26)		

[1]Summarizes three 0.2 ac plots, 110, 111, 112.

[2]Summarizes three 0.2 ac plots, 110, 111, 112.

Figure 5. Diameter distributions for Stand 21 - Oak woodland.

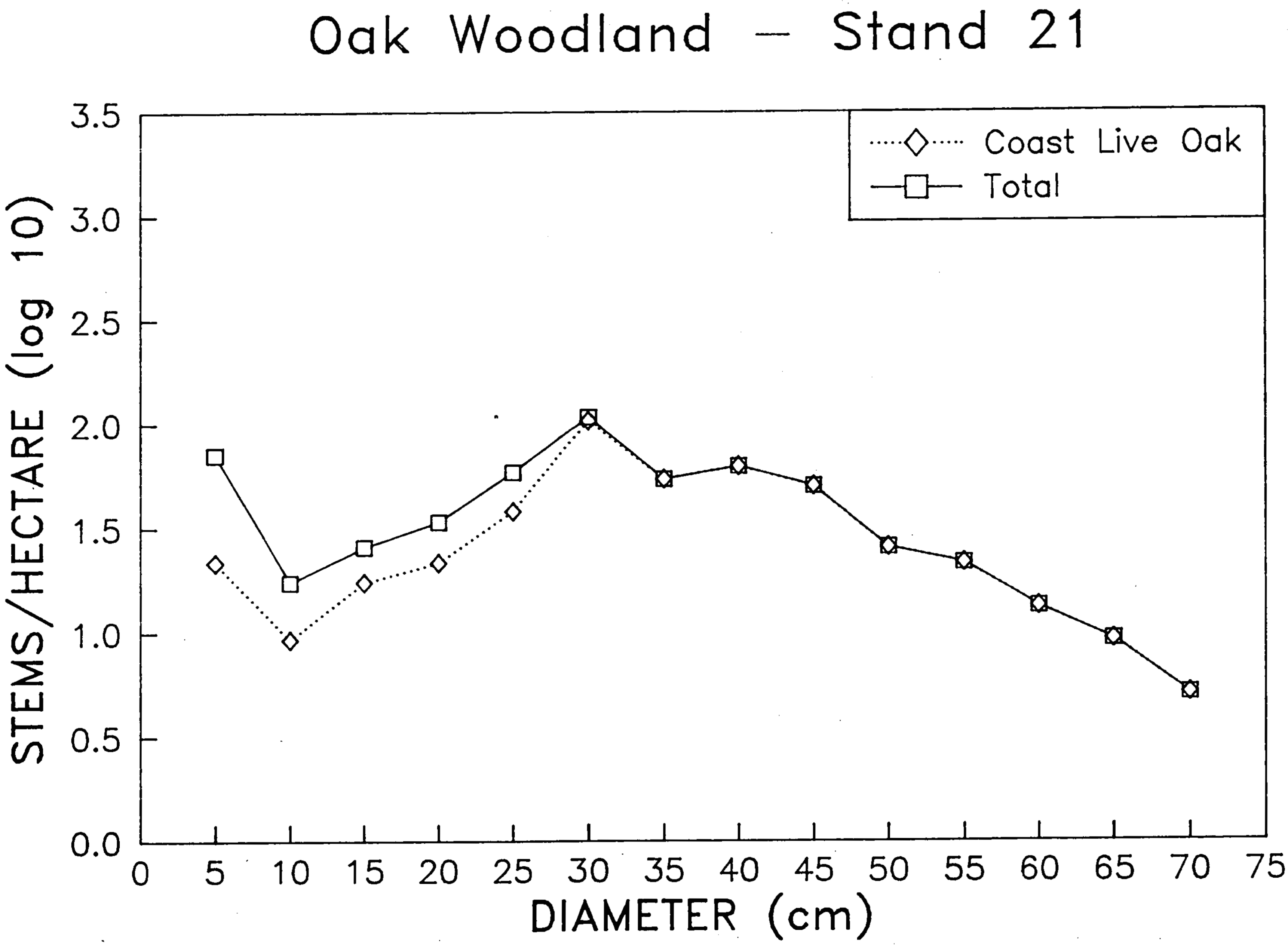


Table 42. Summary of vegetation transect data from Stand 21 - Oak woodland.[1]

Taxa	Percent Cover > 0.5 m		Percent Cover < 0.5 m	
	$\bar{X}$	SD	$\bar{X}$	SD
Osmaronia cerasiformis	8.4	14.6	0.3	0.6
Quercus agrifolia	5.6	9.6	0.2	0.4
Dryopteris arguta	3.2	4.5	6.6	9.1
Bare ground			42.1	28.4
Galium aparine			9.0	11.6
Bromus diandrus			8.3	12.5
Toxicodendron diversilobum			4.9	6.3
Stachys bullata			4.6	2.2
Marah fabaceus			1.8	2.3
Symphoricarpos mollis			1.7	2.9
Claytonia perfoliata			1.2	2.1
Rubus ursinus			1.1	1.9
Silybum marianum			0.8	1.3
Unknown thistle			0.6	1.0
Conium maculatum			0.2	0.4
Total - Live (%)	17.2	28.7	41.3	14.0
Total - Dead (%)	0.0	0.0	0.0	0.0

1 Summarizes three 15 m transects, 110, 111, and 112. Same location as SDSU #15.

Table 43. Summary of vegetation transect data from Stand 13 - Coastal sage scrub.[1]

Taxa	Percent Cover > 0.5 m		Percent Cover < 0.5 m	
	$\bar{X}$	SD	$\bar{X}$	SD
Baccharis pilularis ssp. *consanguinea*	30.0	26.5	5.3	4.7
Artemisia californica	26.2	30.3	3.9	5.1
Dead - *Baccharis pilularis* ssp. consanguinea	6.9	7.1	0.6	0.5
Dead - *Artemisia californica*	2.0	2.4	1.2	1.8
Ribes speciosum	1.6	2.7		
Mimulus aurantiacus	1.2	1.6	2.8	4.3
Solanum sp.	0.4	0.8	1.1	0.5
Elymus condensatus	0.2	0.4	0.1	0.2
Eriogonum parvifolium	0.2	0.4	0.2	0.4
Bare ground			7.6	3.4
Unknown herbs			5.0	8.7
Galium nuttallii			2.4	3.4
Unknown herb			1.2	1.2
Poaceae - unknown #1			1.1	1.9
Poaceae - unknown #2			1.0	1.7
Standing dead			0.8	1.1
Gnaphalium sp.			0.7	0.6
Dead - *Elymus condensatus*			0.7	1.2
Achillea millefolium			0.3	0.6
Corethrogyne filaginifolia			0.2	0.4
Rubus sp.			0.2	0.4
Dead - *Mimulus aurantiacus*			0.2	0.4
Anagallis arvensis			0.1	0.2
Lotus scoparius			0.1	0.2
Oxalis sp.			0.1	0.2
Salvia mellifera			0.1	0.2
Total - Live (%)	59.9	8.9	26.1	14.9
Total - Dead (%)	8.9	6.1	3.4	2.2

[1] Summarizes three 15 m transects, 86, 87, and 88. Same location as SDSU #26.

dominated the stand sampled (Stand 19). *Artemisia californica*, *Encelia californica*, and *Elymus condensatus* also occurred, but there was less diversity than in the coastal sage scrub (Table 44; Appendix V, Tables V-89 through V-94).

Coastal Dune Scrub. Two stands of coastal dune scrub were sampled, one on North Vandenberg (Stand 11, San Antonio Terrace) and one on South Vandenberg (Stand 15, Lompoc Terrace). Stand 11 was dominated by *Ericameria ericoides* and *Artemisia californica* with various other shrubs and herbs occurring (including *Erysimum suffrutescens* var. *grandifolium*) (Table 45; Appendix V, Tables V-51 through V-56). Standing dead shrubs and open spaces were common in the community. Stand 15 had the same dominant species but some different associates including *Senecio blochmaniae* (Table 46; Appendix V, Tables V-71 through V-76). However, *Carpobrotus edulis* and *Conicosia pugioniformis*, invasive exotic species, were present at this site; their presence may be associated with disturbance from communication cables and other operations in the area.

Coastal Dunes. Three stands of vegetation on active dunes were sampled between Purisima Point and the mouth of San Antonio Creek. The first stand was north of Purisima Point. Two transects in this stand were in primarily native dune vegetation, while one was in European beach grass (*Ammophila arenaria*). Since these types are quite different they are summarized separately. Stand 23a was open dune vegetation with bare ground accounting for more than half of the cover (Table 47; Appendix V, Tables V-113, V-115). Low shrubs (e.g., *Haplopappus venetus* var. *sedoides*) and perennial, often succulent, herbs (e.g., *Carpobrotus aequilaterus, Abronia* spp.) were common.

Table 44. Summary of vegetation transect data from Stand 19 - Purple sage scrub.[1]

Taxa	Percent Cover > 0.5 m $\bar{X}$	> 0.5 m SD	< 0.5 m $\bar{X}$	< 0.5 m SD
Salvia leucophylla	42.7	25.8	1.9	3.3
Artemisia californica	9.8	10.2	4.5	7.6
Encelia californica	8.2	8.4	3.7	2.9
Elymus condensatus	5.9	10.2		
Dead - *Artemisia californica*	4.8	8.3	0.6	1.0
Dead - *Salvia leucophylla*	3.3	2.4	0.3	0.6
Dead - *Encelia californica*	0.2	0.4		
Galium nuttallii	0.1	0.2	0.1	0.2
Poaceae - unknown			20.8	21.3
Bare ground			7.2	4.5
Unknown herb			*[2]	
Total - Live (%)	66.7	33.1	31.0	27.5
Total - Dead (%)	8.3	6.6	0.9	0.9

1 Summarizes three 15 m transects, 81, 82, and 83.

2 Present.

Table 45. Summary of vegetation transect data from Stand 11 - Coastal dune scrub. [1]

Taxa	Percent Cover > 0.5 m $\bar{X}$	Percent Cover > 0.5 m SD	Percent Cover < 0.5 m $\bar{X}$	Percent Cover < 0.5 m SD
Ericameria ericoides	17.7	15.4		
Artemisia californica	13.6	7.7	4.6	1.2
Lupinus chamissonis	7.8	13.5	2.3	4.0
Dead - *Artemisia californica*	7.0	2.0	5.8	2.5
Phacelia ramosissima	4.0	6.9	1.6	2.7
Toxicodendron diversilobum	2.9	5.0		
Standing dead	2.9	3.9	2.3	2.2
Dead - *Ericameria ericoides*	0.7	1.2	3.6	5.3
Dead - *Phacelia ramosissima*	0.7	1.2		
Erysimum suffrutescens var. *grandifolium*	0.4	0.8	1.2	2.1
Bare ground			17.8	4.5
Eriogonum parvifolium			1.9	1.9
Corethrogyne filaginifolia			2.9	3.0
Dead - *Eriogonum parvifolium*			0.9	1.6
Dudleya sp.			0.4	0.8
Moss			0.4	0.8
Lotus scoparius			0.1	0.2
Poaceae - unknown			0.1	0.2
Crassula erecta			*[2]	
Total - Live (%)	46.3	19.4	15.6	3.9
Total - Dead (%)	10.6	5.6	15.8	11.1

1 Summarizes three 15 m transects, 81, 82, and 83.
2 Present.

Table 46. Summary of vegetation transect data from Stand 15 - Coastal dune scrub.[1]

Taxa	Percent Cover > 0.5 m $\bar{X}$	> 0.5 m SD	< 0.5 m $\bar{X}$	< 0.5 m SD
Artemisia californica	15.3	14.5	4.6	3.9
Ericameria ericoides	8.9	7.8	4.7	6.1
Dead - *Artemisia californica*	3.1	3.4	2.1	2.8
Senecio blochmaniae	2.2	3.9		
Standing dead	2.0	3.5	5.2	3.7
Dead - *Ericameria ericoides*	1.8	1.7	0.2	0.4
Dead - *Eriophyllum confertiflorum*	0.2	0.4	1.8	1.6
Bare ground			23.7	11.6
Carpobrotus edulis			4.8	8.3
Conicosia pugioniformis			4.6	3.9
Croton californicus			3.2	2.9
Dead - *Phacelia ramosissima*			2.2	3.9
Dead - *Conicosia pugioniformis*			1.5	2.0
Eriophyllum confertiflorum			1.0	1.5
Fabaceae - unknown			0.4	0.5
Calystegia sp.			0.2	0.4
Gnaphalium sp.			0.2	0.4
Phacelia ramosissima			0.2	0.4
Moss			0.2	0.2
Lotus scoparius			0.1	0.2
Total - Live (%)	26.6	14.6	24.3	8.9
Total - Dead (%)	7.1	4.1	13.0	7.5

1 Summarizes three 15 m transects, 92, 93, and 94. Same location as SDSU #10.

Table 47. Summary of vegetation transect data from Stand 23a - Coastal dune.[1]

Taxa	Percent Cover > 0.5 m		Percent Cover < 0.5 m	
	X̄	SD	X̄	SD
Bare ground			52.7	6.2
Haplopappus venetus var. *sedoides*			12.4	6.2
Dead - *Haplopappus venetus* var. *sedoides*			10.7	9.0
Carpobrotus aequilaterus			9.7	1.9
Dead - *Carpobrotus aequilaterus*			5.0	5.2
Ambrosia chamissonis			2.2	2.6
Abronia latifolia			1.4	1.9
Atriplex sp.			1.4	1.9
Standing dead			1.2	0.2
Abronia maritima			0.9	1.2
Abronia sp.			0.4	0.5
Camissonia sp.			0.2	0.2
Cryptantha sp.			0.2	0.2
Dead - *Ambrosia chamissonis*			0.2	0.2
Total - Live (%)			28.4	5.7
Total - Dead (%)			17.0	14.2

1 Summarizes two 15 m transects, 116 and 118.

In contrast, *Ammophila arenaria* dominated Stand 23, Plot 117; there was much less bare ground and few other species (Table 48). Stand 24 was located farther north and was open dune vegetation with bare ground common; various low shrubs and herbs occurred including *Cirsium rhothophilum* (Category 2), *Malacothrix incana* var. *succulenta*, and *Senecio blochmaniae* (special interest plants) (Table 49; Appendix V,Tables V-116 through V-118). Stand 25 was just south of San Antonio Creek and was similar in composition to Stand 24 except that one transect (#124) was farther inland and had taller shrubs and greater cover. The Category 2 plant, *Dithyrea maritima*, and the special interest plants, *Erigeron foliosus* var. *blochmaniae*, *Malacothrix incana* var. *succulenta*, and *Senecio blochmaniae*, occurred (Table 50; Appendix V, Tables V-119 through V-121).

Box Elder Riparian Woodland. One stand of box elder riparian woodland was sampled on the south side of Barka Slough. *Acer negundo* ssp. *californica* dominated the canopy (Table 51) and the understory (Table 52); it was well represented in the small size classes as indicated by the diameter distribution (Figure 6). *Acer* and *Rubus ursinus* were most abundant on the transects (Table 53; Appendix V, Tables V-122 through V-127).

Willow Riparian Woodland. One stand of willow was sampled along Bear Creek near SLC-3. Part of this riparian wetland, sampled by two plots, had apparently burned in 1977, but the third plot had not burned. *Salix* sp. was the dominant canopy and understory species. Canopy density and basal area are greater when summarized for all three plots (Table 54) than for just the two burned in 1977 (Table 56); understory density and basal area show the opposite pattern (Table 55, Table 57). Diameter distributions reflect this pattern; the one for the whole stand (Figure 7) had more stems in larger size classes

Table 48. Summary of vegetation transect data from Stand 23, plot 117 - *Ammophila* - dominated coastal dune.[1]

Taxa	Percent Cover > 0.5 m		< 0.5 m	
	$\bar{X}$	SD	$\bar{X}$	SD
Ammophila arenaria			81.0	
Bare ground			10.0	
Dead - *Ammophila arenaria*			8.7	
Cryptantha sp.			1.0	
Total - Live (%)			82.0	
Total - Dead (%)			8.7	

1 A single 15m transect, considered separately since much different from other dune transects.

Table 49. Summary of vegetation transect data from Stand 24 - Coastal dune.[1]

Taxa	Percent Cover > 0.5 m X̄	> 0.5 m SD	< 0.5 m X̄	< 0.5 m SD
Bare ground			58.3	26.6
Carpobrotus aequilaterus			10.8	8.2
Ambrosia chamissonis			5.0	3.2
Haplopappus venetus var. *sedoides*			4.3	2.7
Eriogonum parvifolium			3.1	4.7
Senecio blochmaniae			2.3	2.1
Cirsium rhothophilum			2.1	2.8
Dead - *Ericameria ericoides*			1.4	2.4
Cakile maritima			1.9	0.6
Ericameria ericoides			1.8	2.0
Dead - *Carpobrotus aequilaterus*			1.5	2.6
Dead - *Ambrosia chamissonis*			1.2	0.5
Lupinus chamissonis			0.9	1.6
Camissonia sp.			0.8	0.8
Abronia sp.			0.7	0.6
Malacothrix incana var. *succulenta*			0.7	0.7
Dead - *Haplopappus venetus* var. *sedoides*			0.4	0.3
Dead - *Camissonia* sp.			0.3	0.4
Standing dead			0.3	0.4
Dead - *Cirsium rhothophilum*			0.2	0.3
Eschscholzia californica var. *maritima*			0.1	0.2
Dead - *Abronia* sp.			0.1	0.1
Total - Live (%)			34.4	23.5
Total - Dead (%)			5.4	2.8

1 Summarizes three 30m transects, 119, 120, and 121.

Table 50. Summary of vegetation transect data from Stand 25 - Coastal dune.[1]

Taxa	Percent Cover > 0.5 m $\bar{X}$	> 0.5 m SD	< 0.5 m $\bar{X}$	< 0.5 m SD
Lupinus chamissonis	4.9	8.5	8.6	14.7
Eriophyllum staechadifolium	2.9	5.0	1.1	1.3
Standing dead	0.8	1.3	5.1	3.8
Erigeron foliosus var. *blochmaniae*	0.4	0.8	1.8	3.1
Senecio blochmaniae	0.4	0.7	1.6	2.7
Bare ground			41.8	30.4
Carpobrotus aequilaterus			11.5	8.1
Ambrosia chamissonis			6.4	6.0
Dead - *Ambrosia chamissonis*			2.9	4.0
Dead - *Lupinus chamissonis*			2.4	4.2
Dead - *Carpobrotus aequilaterus*			2.4	2.1
Camissonia cheiranthifolia			0.9	1.6
Phacelia ramosissima			0.9	1.6
Corethrogyne filaginifolia			0.8	1.1
Cakile maritima			0.7	1.2
Haplopappus venetus var. *sedoides*			0.6	1.0
Abronia sp.			0.5	0.5
Eriastrum densifolium var. *densifolium*			0.3	0.6
Abronia latifolia			0.2	0.4
Dithyrea maritima			0.2	0.3
Dead - *Cakile maritima*			0.2	0.3
Malacothrix incana var. *succulenta*			0.2	0.3
Sonchus oleraceus			0.1	0.1
Total - Live (%)	8.7	15.0	36.3	15.7
Total - Dead (%)	0.8	1.3	13.0	1.7

1 Summarizes three 30m transects, 122, 123, and 124.

Table 51. Canopy composition of Stand 26 - Box elder riparian woodland.[1]

Taxa	Density Per Hectare X̄ (SD)	Relative Density X̄ (SD)	Basal Area (m^2/ha) X̄ (SD)	Relative Basal Area X̄ (SD)	Importance Value X̄ (SD)
Acer negundo ssp. *californica*	370.67 (107.72)	96.97 (5.25)	21.90 (1.96)	94.10 (10.22)	191.07 (15.47)
Dead - *Acer negundo* ssp.*californica*	8.23 (14.26)	3.03 (5.25)	1.62 (2.80)	5.90 (10.22)	8.93 (15.47)
Total Canopy	378.90 (93.57)		23.51 (3.83)		

Table 52. Understory composition of Stand 26 - Box elder riparian woodland.[2]

Taxa	Density Per Hectare X̄ (SD)	Relative Density X̄ (SD)	Basal Area (m^2/ha) X̄ (SD)	Relative Basal Area X̄ (SD)	Importance Value X̄ (SD)
Acer negundo ssp. *californica*	1103.73 (396.38)	94.50 (2.99)	3.57 (1.51)	92.13 (5.64)	186.63 (8.63)
Dead - *Acer negundo* ssp.*californica*	57.63 (37.73)	5.00 (2.52)	0.26 (0.22)	6.73 (4.73)	11.73 (7.24)
Salix sp.	8.23 (14.26)	0.50 (0.87)	0.06 (0.11)	1.13 (1.96)	1.63 (2.83)
Total Understory	1169.60 (432.46)		3.90 (1.74)		

[1]Summarizes three 0.1 ac plots, 125, 126, and 127.

[2]Summarizes three 0.1 ac plots, 125, 126, and 127.

Figure 6. Diameter distributions for Stand 26 - Box elder riparian woodland.

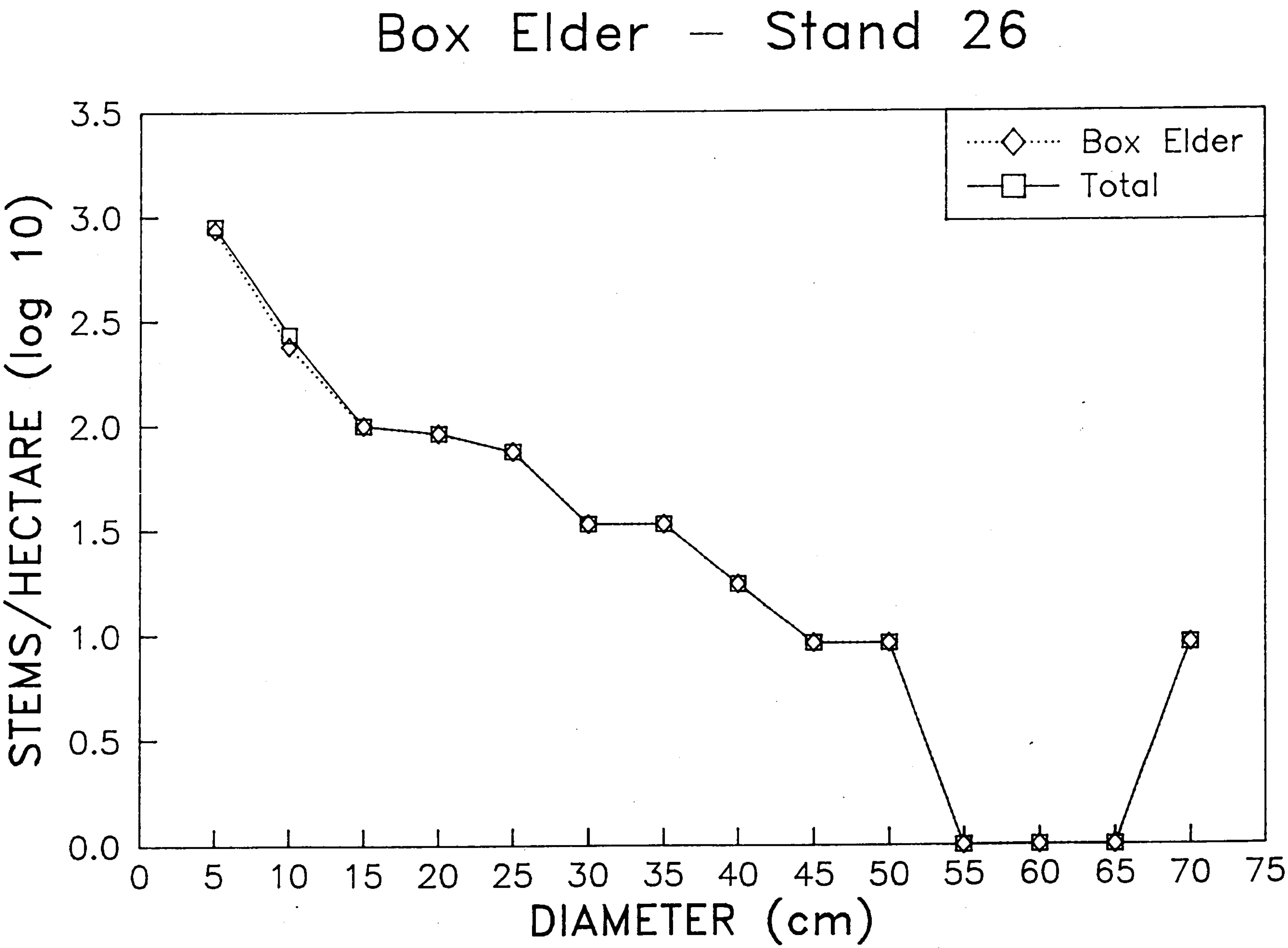


Table 53. Summary of vegetation transect data from Stand 26 - Box elder riparian woodland.[1]

Taxa	Percent Cover > 0.5 m $\bar{X}$	> 0.5 m SD	< 0.5 m $\bar{X}$	< 0.5 m SD
Acer negundo ssp. *californica*	92.0	12.7	0.4	0.8
Rubus ursinus	28.7	20.5	16.2	12.9
Urtica holosericea	7.3	5.5	0.7	1.2
Ribes divaricatum	1.1	1.9	0.6	1.0
Salix sp.	0.2	0.4		
Bare ground			1.3	2.3
Dead - *Acer negundo*			0.4	0.8
Dead - *Rubus ursinus*			0.1	0.2
Total - Live (%)	129.3	16.0	17.9	13.2
Total - Dead (%)	0.0	0.0	0.5	0.9

1 Summarizes three 15m transects, 125, 126, and 127.

Table 54. Canopy composition of Stand 16 - Willow riparian woodland.[1]

Taxa	Density Per Hectare $\bar{X}$ (SD)	Relative Density $\bar{X}$ (SD)	Basal Area (m^2/ha) $\bar{X}$ (SD)	Relative Basal Area $\bar{X}$ (SD)	Importance Value $\bar{X}$ (SD)
Salix sp.	247.10 (196.14)	86.77 (11.70)	8.46 (10.23)	83.80 (26.35)	167.27 (34.52)
Dead - *Salix* sp.	49.40 (49.40)	13.20 (11.68)	1.91 (1.66)	19.53 (24.20)	32.73 (34.52)
Total Canopy	296.50 (243.36)		10.37 (11.18)		

Table 55. Understory composition of Stand 16 - Willow riparian woodland.[2]

Taxa	Density Per Hectare $\bar{X}$ (SD)	Relative Density $\bar{X}$ (SD)	Basal Area (m^2/ha) $\bar{X}$ (SD)	Relative Basal Area $\bar{X}$ (SD)	Importance Value $\bar{X}$ (SD)
Salix sp.	1993.27 (1176.07)	92.60 (6.89)	7.49 (3.72)	95.47 (2.89)	188.07 (9.46)
Dead - *Salix* sp.	131.77 (164.52)	6.43 (7.70)	0.36 (0.29)	3.97 (2.89)	10.40 (10.40)
Baccharis pilularis ssp. *consanguinea*	32.93 (57.04)	0.97 (1.67)	0.06 (0.11)	0.57 (0.98)	1.53 (2.66)
Total Understory	2158.03 (1224.17)		7.92 (4.02)		

[1]Summarizes three 0.1 ac plots, 95, 96, and 97.

[2]Summarizes three 0.1 ac plots, 95, 96, and 97.

Table 56. Canopy composition of Stand 16a - Willow riparian woodland.[1]

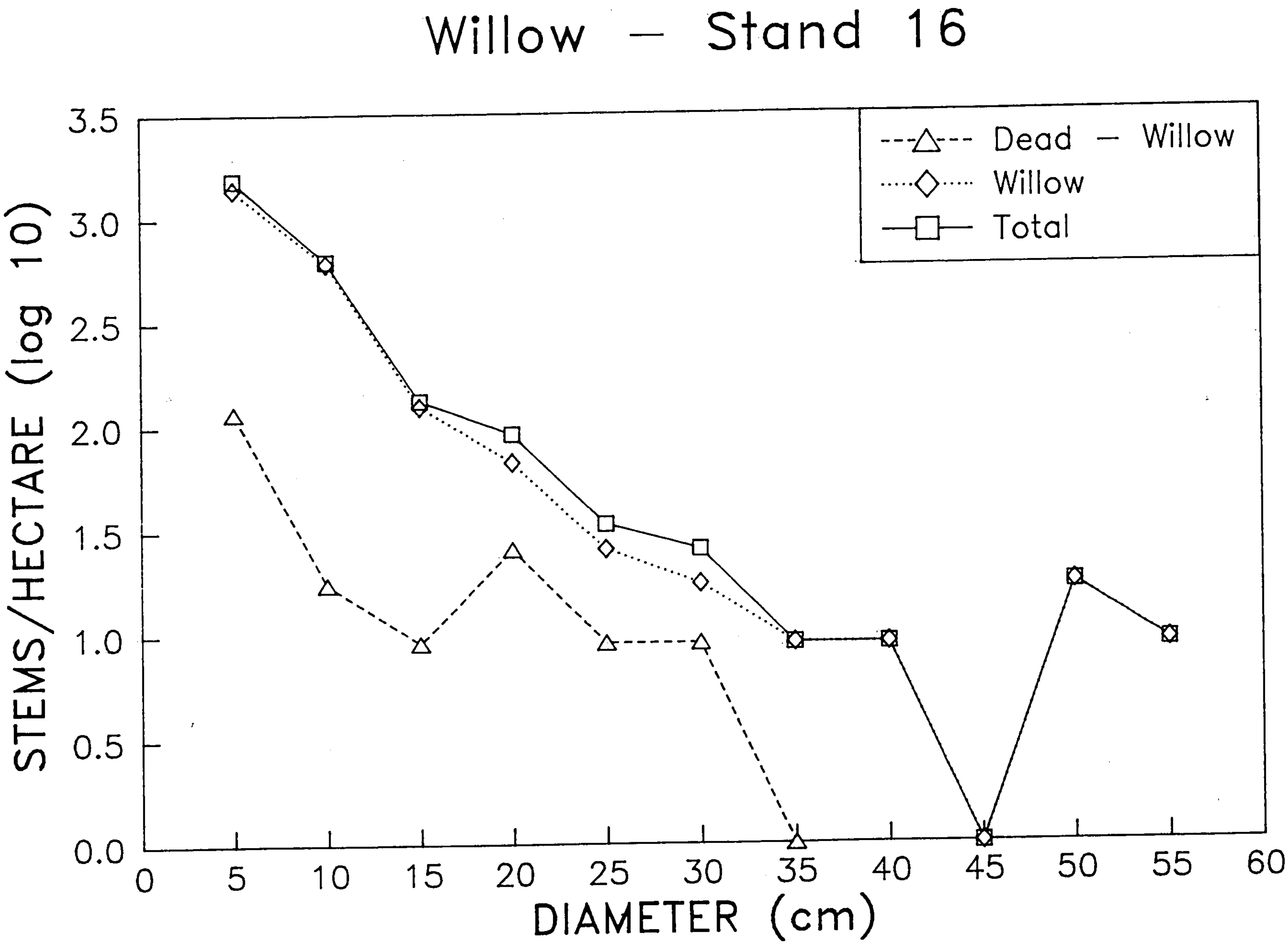
Taxa	Density Per Hectare $\bar{X}$ (SD)	Relative Density $\bar{X}$ (SD)	Basal Area (m^2/ha) $\bar{X}$ (SD)	Relative Basal Area $\bar{X}$ (SD)	Importance Value $\bar{X}$ (SD)
Salix sp.	135.90 (52.47)	88.90 (15.70)	2.58 (1.17)	76.70 (32.95)	165.60 (48.65)
Dead - *Salix* sp.	24.70 (34.93)	11.10 (15.70)	1.48 (2.09)	23.30 (32.95)	34.40 (48.65)
Total Canopy	160.60 (87.40)		4.06 (3.26)		

Table 57. Understory composition of Stand 16a - Willow riparian woodland.[2]

Taxa	Density Per Hectare $\bar{X}$ (SD)	Relative Density $\bar{X}$ (SD)	Basal Area (m^2/ha) $\bar{X}$ (SD)	Relative Basal Area $\bar{X}$ (SD)	Importance Value $\bar{X}$ (SD)
Salix sp.	2520.40 (1048.36)	90.20 (7.78)	9.52 (1.74)	93.90 (1.41)	184.10 (9.19)
Dead - *Salix* sp.	185.30 (192.19)	8.35 (9.83)	0.51 (0.17)	5.25 (2.62)	13.60 (12.45)
Baccharis pilularis ssp. *consanguinea*	49.40 (69.86)	1.45 (2.05)	0.10 (0.13)	0.85 (1.20)	2.30 (3.26)
Total Understory	2755.20 (926.03)		10.13 (1.71)		

[1]Summarizes two 0.1 ac plots, 95 and 97.
2Summarizes two 0.1 ac plots, 95 and 97.

Figure 7. Diameter distributions for Stand 16 - Willow riparian woodland.



than the distribution for the burned plots (Figure 8). Other shrubs and herbs such as *Toxicodendron diversilobum, Ribes divaricatum, Carex schottii,* and *Rubus ursinus* were common (Table 58; Appendix V, Tables V-77 through V-82).

Freshwater Marsh. One freshwater marsh on the north side of Barka Slough was sampled. Although some live *Typha latifolia* and *Cladium californicum* occurred, *Urtica holosericea* and dead *Typha* dominated the transects (Table 59; Appendix V, Tables V-107 through V-112). Cracks, some 1.5 m or more deep and 1.0 m wide, had formed in the organic soil there. It appeared that *Urtica* was replacing *Typha* in a substantial area and not just where the transects were located.

Salt Marsh. One stand of salt marsh on the south side of the Santa Ynez River was sampled. *Frankenia grandifolia* and *Salicornia virginica* dominated the area (Table 60; Appendix V, Tables V-95 through V-100).

Vernal Pools and Seasonal Wetlands. Outside of riparian areas on Vandenberg, seasonal wetlands of several types occur where soil or site characteristics create wet conditions for part of the year. The first site sampled can be characterized as a vernal pool; it was a grassy opening about 150 m across in a matrix of Burton Mesa chaparral vegetation. Three zones were distinguished there. The edge of the pool was dominated by *Elymus triticoides* ssp. *triticoides*; the main area of the pool was dominated by *Phalaris lemmonii* and *Juncus phaeocephalus* with *Distichlis spicata* and *Hordeum californicum* locally abundant and other wetland species occurring; *Avena barbata* dominated the upland transition area (Table 61; Appendix VII, Table VII-1).

Figure 8. Diameter distributions for Stand 16a - Willow riparian woodland.

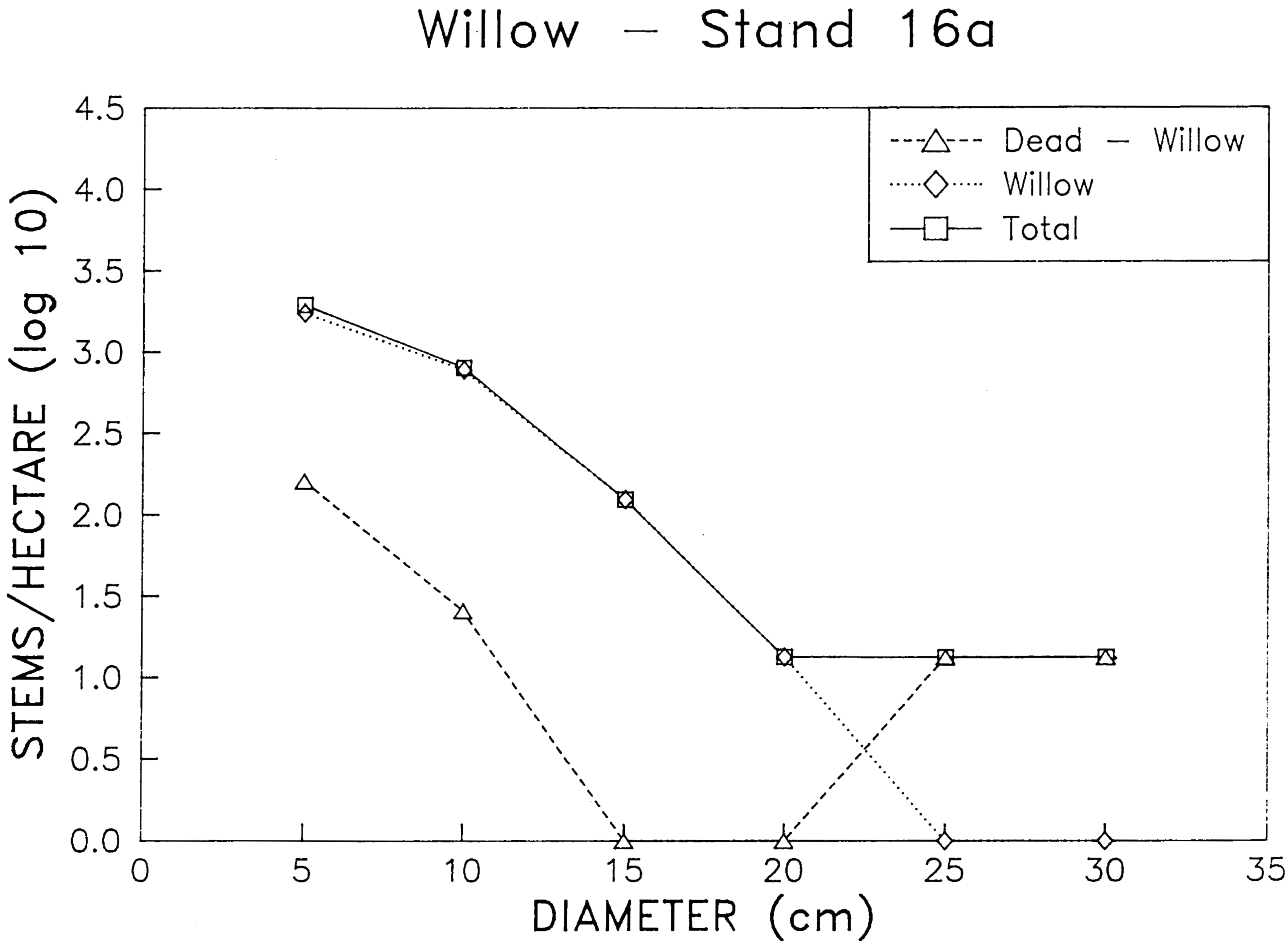


Table 58. Summary of vegetation transect data from Stand 16 - Willow riparian woodland.[1]

Taxa	Percent Cover > 0.5 m $\bar{X}$	> 0.5 m SD	< 0.5 m $\bar{X}$	< 0.5 m SD
Salix sp.	94.9	8.8		
Toxicodendron diversilobum	17.0	29.4	7.4	12.9
Ribes divaricatum	13.0	11.5	4.5	5.3
Carex schottii	12.7	21.9	1.2	2.1
Rubus ursinus	12.7	11.4	5.4	4.2
Senecio mikanioides	8.7	15.0	4.0	6.9
Urtica holosericea	4.1	5.8	0.9	1.6
Elymus condensatus	2.6	4.4		
Scrophularia californica	2.6	2.4	2.3	2.1
Stachys bullata	2.5	2.3	0.1	0.2
Artemisia douglasiana	2.2	3.9	5.8	10.0
Dead - *Salix* sp.	0.8	1.1	0.9	0.9
Zantedeschia aethiopica	0.1	0.2		
Bare ground			9.9	14.3
Sambucus mexicana			1.0	1.7
Lonicera involucrata var. *ledebourii*			0.1	0.2
Total - Live (%)	173.0	41.5	31.8	12.5
Total - Dead (%)	0.8	1.1	0.9	0.9

1 Summarizes three 15 m transects, 95, 96, and 97.

Table 59. Summary of vegetation transect data from Stand 22 - Freshwater marsh.[1]

Taxa	Percent Cover > 0.5 m $\bar{X}$	Percent Cover > 0.5 m SD	Percent Cover < 0.5 m $\bar{X}$	Percent Cover < 0.5 m SD
Urtica holosericea	46.6	16.5	26.2	18.2
Dead - *Typha latifolia*	13.2	13.7	14.6	0.8
Cladium californicum	5.1	8.8		
Typha latifolia	1.6	1.4	0.9	0.5
Dead - *Cladium californicum*	0.9	1.6		
Eleocharis sp.	0.1	0.2		
Dead - *Urtica holosericea*			1.7	2.1
Rubus ursinus			0.2	0.4
Total - Live (%)	53.3	20.6	27.3	17.5
Total - Dead (%)	14.1	15.1	16.2	1.3

1 Summarizes three 15 m transects, 113, 114, and 115.

Table 60. Summary of vegetation transect data from Stand 20 - Salt marsh.[1]

Taxa	Percent Cover > 0.5 m $\bar{X}$	> 0.5 m SD	< 0.5 m $\bar{X}$	< 0.5 m SD
Salicornia virginica	6.0	5.8	20.1	8.9
Brassica nigra	0.1	0.2	0.1	0.2
Frankenia grandifolia			75.8	5.9
Atriplex semibaccata			5.1	8.8
Polypogon monospeliensis			3.7	6.4
Dead - *Salicornia virginica*			1.3	1.5
Melilotus indicus			0.9	1.6
Apiastrum angustifolium			0.6	1.0
Sonchus asper			0.3	0.6
Bare ground			0.3	0.4
Galium aparine			0.2	0.4
Rumex sp.			0.1	0.2
Total - Live (%)	6.1	5.7	106.9	9.3
Total - Dead (%)	0.1	0.2	1.4	1.4

1 Summarizes three 15 m transects, 107, 108, and 109 Same location as SDSU #7.

The second site was an area of mound and trough topography in Burton Mesa chaparral. The mounds supported small shrubs, introduced and native grasses, and various herbs. *Dichondra donnelliana*, a special interest plant, was present. Plants characteristic of wetlands such as *Eryngium armatum* and *Juncus* spp. were important in the transitional areas, but *Carpobrotus edulis* was also well established there. *Eryngium* increased in abundance in the trough areas; other herbs occurred including *Dudleya blochmaniae* ssp. *blochmaniae*, a special interest plant (Table 62; Appendix VII, Table VII-3).

The third site was also mound and trough topography but in a matrix of coastal dune scrub. On the mounds, several shrubs (*Baccharis pilularis* ssp. *consanguinea, Artemisia californica, Eriogonum parvifolium*) were important, and a variety of herbs occurred. In the transitional areas, characteristic wetland plants such as *Eryngium armatum* and *Juncus* spp. were present along with other forbs and graminoids. *Eryngium* increased in abundance in the trough areas, but upland species also occurred (Table 63; Appendix VII, Table VII-4).

DISCUSSION

Preliminary Floristic List

The floristic list compiled from past studies should be regarded as preliminary and incomplete since there have been no comprehensive studies of the flora of Vandenberg. Although 624 taxa would appear a substantial number, Ferren et al. (1984) reported approximately 400 taxa from La Purisima Mission State Historic Park, which has an area of 966 ac (39.1 ha), less than 1% the size of Vandenberg. Other taxa from Vandenberg may be represented in herbaria collections at institutions such as the University of California, Santa Barbara, the Santa Barbara Botanical Garden, San Diego State University, and

Table 61. Composition of three vegetation zones in 35th street vernal pool-transect #128.[1]

Zone 1 - Edge of pool area, plots #1 and #14.

Taxa	Percent Cover $\bar{X}$	SD
Elymus triticoides ssp. *triticoides*	87.5	0.0
Frankenia grandifolia	1.5	2.1
Eleocharis cf. *palustris*	1.5	2.1
Rumex crispus	0.3	0.4
Sonchus sp.	0.3	0.4

Zone 2 - Main area of pool, plots #2 through #13.

Taxa	Percent Cover $\bar{X}$	SD
Phalaris lemmonii	36.8	27.5
Juncus phaeocephalus	28.3	29.5
Distichlis spicata	8.3	11.0
Hordeum californicum	5.2	18.0
Sida leprosa var. *hederacea*	4.8	5.1
Eleocharis cf. *palustris*	4.5	10.6
Avena barbata	2.3	5.3
Koeleria macrantha	2.2	5.3
Bromus diandrus	1.7	5.0
Bromus mollis	1.0	2.2
Eryngium armatum	0.3	0.9
Atriplex semibaccata	0.3	0.9
Sonchus sp.	0.1	0.2
Conyza canadensis	0.1	0.1

[1] Cover classes determined in 1 m^2 plots along transect; mean calculated from midpoints of classes.

Table 61. (continued).

Zone 3 - Upland transition area, plot #15.

Taxa	Percent Cover $\bar{X}$	SD
Avena barbata	17.5	0.0
Hypochoeris glabra	3.0	0.0
Vulpia octoflora	3.0	0.0
Anagallis arvensis	0.5	0.0
Bromus diandrus	0.5	0.0
Bromus mollis	0.5	0.0
Carpobrotus edulis	0.5	0.0
Conyza canadensis	0.5	0.0
Elymus triticoides ssp. *triticoides*	0.5	0.0
Gnaphalium luteo-album	0.5	0.0
Juncus falcatus	0.5	0.0
Sonchus sp.	0.5	0.0
Unknown herb	0.5	0.0

Table 62. Composition of three vegetation zones in 35th street seasonal wetland-transect #129.[1]

Zone 1 - Mound areas, plots #1, #2, #3, and #14.

Taxa	Percent Cover $\bar{X}$	SD
Lotus junceus	7.8	6.8
Carpobrotus edulis	6.3	8.3
Baccharis pilularis ssp. *consanguinea*	4.5	3.7
Avena barbata	3.4	3.1
Stipa pulchra	3.4	3.1
Elymus sp.	1.9	3.8
Anagallis arvensis	1.0	1.4
Dudleya lanceolata	1.0	1.4
Dichondra donnelliana	0.9	1.4
Eryngium armatum	0.8	1.5
Hypochoeris glabra	0.4	0.3
Sonchus sp.	0.4	0.3
Bromus diandrus	0.1	0.3
Bromus mollis	0.1	0.3
Filago gallica	0.1	0.3
Gnaphalium luteo-album	0.1	0.3
Gnaphalium purpureum	0.1	0.3
Spergularia macrotheca	0.1	0.3
Vulpia sp.	0.1	0.3

Zone 2 - Transitional, plots #4, #9, #10, and #13.

Taxa	Percent Cover $\bar{X}$	SD
Carpobrotus edulis	25.1	30.5
Sisyrinchium bellum	8.9	10.0
Stipa pulchra	3.4	3.1
Filago gallica	2.4	1.3
Elymus sp.	1.6	1.6
Hypochoeris glabra	1.5	1.7
Anagallis arvensis	1.1	1.3
Eryngium armatum	1.8	1.4
Sonchus sp.	1.0	1.4
Lotus junceus	0.9	1.4
Plantago coronopus	0.9	1.4
Baccharis pilularis ssp. *consanguinea*	0.8	1.5

[1] Cover classes determined in 1 m^2 plots along transect; means calculated from midpoints of classes.

Table 62. (continued).

Zone 2 (continued)

Taxa	Percent Cover $\bar{X}$	SD
Hemizonia sp.	0.8	1.5
Centaurium davyi	0.3	0.3
Juncus falcatus	0.3	0.3
Bromus mollis	0.1	0.3
Centauria melitensis	0.1	0.3
Conyza sp.	0.1	0.3
Erodium cicutarium	0.1	0.3
Gnaphalium sp.	0.1	0.3
Juncus phaeocephalus	0.1	0.3
Parapholis incurva	0.1	0.3
Sonchus asper	0.1	0.3
Sonchus oleraceus	0.1	0.3

Zone 3 - Trough, plots #5, #6, #7, #8, #11, and #12.

Taxa	Percent Cover $\bar{X}$	SD
Sisyrinchium bellum	11.8	6.5
Eryngium armatum	9.3	6.6
Stipa pulchra	4.8	3.2
Filago gallica	2.1	2.8
Elymus sp.	1.5	1.6
Sonchus sp.	0.9	1.0
Koeleria macrantha	0.7	1.2
Spergularia macrotheca	0.7	1.2
Juncus phaeocephalus	0.6	1.2
Plantago coronopus	0.6	1.2
Avena barbata	0.5	1.2
Centaurium davyi	0.5	0.0
Anagallis arvensis	0.4	0.2
Hypochoeris glabra	0.4	0.2
Dudleya blochmaniae ssp. *blochmaniae*	0.3	0.3
Cotula coronopifolia	0.2	0.3
Dudleya lanceolata	0.2	0.3
Juncus falcatus	0.2	0.3
Navarretia sp.	0.2	0.3
Gnaphalium purpureum	0.1	0.2
Hemizonia sp.	0.1	0.2
Parapholis incurva	0.1	0.2

Table 63. Composition of three vegetation zones in the Tangair area seasonal wetland-transect #130.[1]

Zone 1 - Mound areas, plots #1, #2, #9, and #10.

Taxa	Percent Cover $\bar{X}$	SD
Baccharis pilularis ssp. *consanguinea*	30.0	15.0
Artemisia californica	10.3	18.2
Eriogonum parvifolium	10.3	18.2
Stipa pulchra	3.4	3.1
Koeleria macrantha	2.3	1.5
Galium nuttallii	1.8	1.4
Hypochoeris glabra	1.1	1.3
Horkelia cuneata	1.0	1.4
Daucus pusillus	0.9	1.4
Sisyrinchium bellum	0.9	1.4
Solidago sp.	0.9	1.4
Calystegia sp.	0.8	1.5
Gnaphalium ramosissimum	0.8	1.5
Rhamnus californica	0.8	1.5
Stipa cf. *pulchra*	0.8	1.5
Toxicodendron diversilobum	0.8	1.5
Anagallis arvensis	0.4	0.3
Agrostis diegoensis	0.4	0.3
Erodium botrys	0.3	0.3
Erodium cicutarium	0.3	0.3
Gnaphalium purpureum	0.3	0.3
Stylocline gnaphalioides	0.3	0.3
Achillea millefolium	0.1	0.3
Cardionema ramosissimum	0.1	0.3
Clarkia pupurea	0.1	0.3
Corethrogyne filaginifolia	0.1	0.3
Gastridium ventricosum	0.1	0.3
Gnaphalium luteo-album	0.1	0.3
Juncus falcatus	0.1	0.3
Juncus phaeocephalus	0.1	0.3
Silene gallica		

[1] Cover classes determined in 1m^2 plots along transect; means calculated from midpoints of classes.

Table 63. (continued).

Zone 2 - Transitional, plots #3, #4, #5, and #8.

Taxa	Percent Cover $\bar{X}$	SD
Baccharis pilularis ssp. *consanguinea*	15.6	16.3
Sisyrinchium bellum	8.3	7.0
Stipa pulchra	8.1	7.2
Koeleria macrantha	5.8	3.5
Horkelia cuneata	3.4	3.1
Solidago sp.	3.4	3.1
Eryngium armatum	1.5	1.7
Erodium cicutarium	1.0	1.4
Agrostis diegoensis	0.9	1.4
Gnaphalium purpureum	0.9	1.4
Juncus falcatus	0.9	1.4
Juncus phaeocephalus	0.9	1.4
Achillea millefolium	0.8	1.5
Hypochoeris glabra	0.4	0.3
Rumex angiocarpus	0.4	0.3
Orthocarpus sp.	0.3	0.3
Gnaphalium luteo-album	0.3	0.3
Anagallis arvensis	0.1	0.3
Artemisia californica (seedling)	0.1	0.3
Clarkia purpurea	0.1	0.3
Dichelostemma pulchellum	0.1	0.3
Erodium cicutarium	0.1	0.3
Erodium sp.	0.1	0.3
Gnaphalium sp.	0.1	0.3
Spergularia macrantha	0.1	0.3

Zone 3 - Trough, plots #5, #6, #7, #8, #11, and #12.

Taxa	Percent Cover $\bar{X}$	SD
Eryngium armatum	12.5	7.1
Sisyrinchium bellum	12.5	7.1
Baccharis pilularis ssp. *consanguinea*	10.3	10.3
Rumex angiocarpus	3.0	0.0
Gnaphalium purpureum	1.8	1.8
Erodium botrys	1.5	2.1
Gnaphalium luteo-album	0.5	0.0
Hypochoeris glabra	0.5	0.0
Juncus falcatus	0.5	0.0
Juncus phaeocephalus	0.5	0.0
Artemisia californica (seedling)	0.3	0.4
Achillea millefolium	0.3	0.4
Erodium cicutarium	0.3	0.4
Solidago sp.	0.3	0.4
Stipa pulchra	0.3	0.4

others, but examination of these collections was beyond the scope of this project.

Special Interest Plants

Special interest plants have received more attention than the general flora of Vandenberg; however, the information available varies greatly between taxa. Of the 52 special interest taxa, one is listed as federally endangered and 19 are being considered for federal listing. However, the federally listed species, *Cordylanthus maritimus* ssp. *maritimus*, and four of the Category 1 or 2 plants, *Ceanothus impressus* var. *nipomensis*, *Chorizanthe breweri*, *Chorizanthe rectispina*, and *Thermopsis macrophylla* var. *agnina*, have no confirmed occurrence on Vandenberg. Similarly, of the 32 other taxa considered, six are not confirmed for the base (*Calochortus clavatus* var. *clavatus*, *Cicuta maculata* var. *bolanderi*, *Corethrogyne leucophylla*, *Eriogonum gracile* var. *cithariforme*, *Pholisma arenarium*, *Polygala cornuta* ssp. *pollardii*). Only two taxa have been the subject of specific studies; Jacks et al. (1984) examined the response of the 35th Street population of *Eriodictyon capitatum* to fire and Zedler (1979, see also Zedler et al. [1983b]) examined the distribution and species biology of *Cirsium rhothophilum*.

Taxonomic or nomenclatural problems exist for several of the special interest plants on Vandenberg. *Arctostaphylos purissima* was recognized as a distinct taxon by Wells (1968) with a distribution centered on the Burton Mesa extending north to Point Sal. Two other auriculate-leaved species of *Arctostaphylos* are listed on Vandenberg in some reports: *Arctostaphylos viridissima* and *A. pechoensis*. Wells (1968) considered *A. viridissima* endemic to Santa Cruz Island and *A. pechoensis* restricted to the Pecho Hills area in San Luis Obispo County. Therefore, these taxa are unlikely to occur on

Vandenberg. The taxonomic treatments in commonly used manuals (Munz and Keck 1973, Munz 1974, Smith 1976) do not clearly distinguish *A. purissima* from the other taxa, and this has probably led to the reports of *A. viridissima* and *A. pechoensis* on Vandenberg. *Arctostaphylos refugioensis* is known from the Refugio Pass area in Santa Barbara County (Wells 1968); it could occur on Vandenberg and may intergrade with *A. purissima*.

Three special interest plants in the genus *Erysimum* have been reported from Vandenberg: *Erysimum insulare, E. suffrutescens* var. *grandifolium*, and *E. suffrutescens* var. *lompocense.* A recent taxonomic revision by Price (1987) changes the nomenclature of these taxa but has yet to be formally adopted. He treats *Erysimum insulare* as composed of three subspecies: *E. insulare* ssp. *insulare*, distributed on the northern Channel Islands, *E. insulare* ssp. *suffrutescens*, in stabilized dunes from Los Angeles County to San Luis Obispo County, and *E. insulare* ssp. *grandifolium*, in stabilized dunes between Point Arguello and Point Sal, Santa Barbara County, and at Morro Rock, San Luis Obispo County. However, he suggests that *E. insulare* ssp. *suffrutescens* and *E. insulare* ssp. *grandifolium* may not be distinct. He renames *E. suffrutescens* var. *lompocense* as *E. capitatum* ssp. *lompocense*. Since these changes are very recent and may be further modified, the older nomenclature is used in this report; effects of the taxonomic changes on classification of these taxa as special interest plants are yet undetermined.

The *Monardella* complex on Vandenberg appears to be composed of three taxa, although the proper nomenclature is uncertain. Standard manuals (Hoover 1970, Munz and Keck 1973, Smith 1976) treat these as *Monardella undulata* var. *undulata*, an annual of sandy places, *Monardella undulata* var. *frutescens*, a perennial of stabilized dunes, and *Monardella crispa*, a perennial of mainly active dunes. The two perennial taxa pose nomenclatural problems.

D. Smith (1983) examined the type collection of *M. crispa* and believes that the plants usually called *M.undulata* var. *frutescens* correspond to this type and should be called *M. crispa.* The perennial *Monardella* previously known as *M. crispa* (Hoover 1970) should be considered an unnamed subspecies of *M. crispa.* The taxa generally known as *M. undulata* var. *frutescens* is scattered in stabilized dunes on Vandenberg (HDR 1979, D. Smith 1983, Howald et al. 1985); the other perennial *Monardella* is also reported (Richard Nichols, pers. comm.). Both are listed in the California Natural Diversity Data Base for Vandenberg (CNDDB 1987) with the nomenclatural usage apparently varying with the study. However, both taxa are Category 2 plants and should be similarly regarded in terms of conservation.

Scrophularia atrata hybridizes extensively with *S. californica* (Coulombe and Cooper 1976, D. Smith 1983). Considering this, D. Smith (1983) suggested that *S. atrata* should be classified as a variety of *S. californica*; he also showed that the only valid characteristics separating the two taxa were flower characteristics. Therefore, many of the populations reported as *Scrophularia atrata* on Vandenberg may be *S. californica* or hybrids (Chuck Pergler, pers. comm.).

Category 1 and 2 plants occurring on Vandenberg are discussed briefly below.

Aphanisma blitoides is known to occur at only one location on Vandenberg. It is uncommon on the mainland in Santa Barbara County (Smith 1976) but occurs on the Channel Islands as well as in coastal areas in southern California (Munz 1974).

Arctostaphylos rudis occurs with some frequency in chaparral on the Burton Mesa and adjacent areas on Vandenberg; however, the species is a regional endemic ranging only from Oceano, San Luis Obispo County, to near

Lompoc, Santa Barbara County (Munz and Keck 1973). Furthermore, the extent of Burton Mesa chaparral has declined markedly in the last 40 years and Burton Mesa chaparral outside of Vandenberg is being developed rapidly, making that on the base increasingly important (Davis et al. 1987, Hickson 1987a, 1988).

Castilleja mollis is endemic to stabilized and partially stabilized dunes from Point Conception to Pismo Beach (Smith 1976). It occurs in these habitats on Vandenberg and is probably most abundant in the San Antonio Terrace (HDR 1979). Outside of the base, oil development and off-road vehicle use have resulted in the plant's habitat being lost and degraded (Howald et al. 1985). On base, the MX program development removed some of the plant's habitat (HDR 1979).

Chorizanthe pungens var. *pungens* ranges from Santa Barbara County to Monterey County (Smith 1976). It is reported from sandy places on the Burton Mesa (Smith 1976), indicating that it probably is on Vandenberg; however, no specific locations have been mapped. The plant is an annual and is similar to and readily confused with the *Chorizanthe angustifolia-diffusa* complex (Smith 1976, Howald et al. 1985).

Cirsium loncholepis is endemic to freshwater and brackish marshes in northwestern Santa Barbara County and southwestern San Luis Obispo County, ranging from the Dune Lakes area near Oceano, San Luis Obispo County, to Canada de las Flores, northwest of Los Alamos, Santa Barbara County (Smith 1976, Howald et al. 1985). On Vandenberg, it is known only from several sites in an area along the Santa Ynez River (D. Smith 1983); previous reports from the San Antonio Terrace (HDR 1979) were in error (D. Smith 1983, Howald et al. 1985). The populations on Vandenberg are the only ones in public ownership (Howald et al. 1985). The current status of these populations is unknown since a survey in spring 1987 was unsuccessful in relocating them (Richard Nichols, pers. comm.).

Cirsium rhothophilum is endemic to coastal dunes and associated habitats from Point Conception in Santa Barbara County to Pismo Beach in San Luis Obispo County (Smith 1976, Howald et al. 1985). The major extant populations of the species are on Vandenberg. Loss and degradation of dune habitat outside the protected areas on the base have occurred from recreational and off-road vehicle use and the spread of introduced plants, particularly *Ammophila arenaria* and *Carpobrotus edulis* (Howald et al. 1985). Zedler (1979, Zedler et al. 1983b) studied the distribution and population biology of the plant and found that it had a vegetative stage lasting five or more years before flowering, in most cases died after flowering, and could tolerate limited sand burial. The total population size appeared relatively stable with sufficient seed production to compensate for mortality.

Cordylanthus rigidus ssp. *littoralis* was originally known from the Monterey Peninsula (Munz and Keck 1973) and was first reported from Santa Barbara County in studies related to the Union Oil Project (Howald et al. 1985) and the Northwest Lompoc/Jesus Maria Project (Dames and Moore 1985a). These sites were on the Burton Mesa. The current range and abundance of the plant on Vandenberg are uncertain. It is an annual and only identifiable in flowering condition; therefore, surveys must be conducted at the proper time of year to locate it.

Dithyrea maritima occurs in coastal dunes from Los Angeles County to Morro Bay in San Luis Obispo County (Smith 1976, Howald et al. 1985). On Vandenberg, it is reported from several areas of undisturbed dune vegetation (D. Smith 1983, this study). As for other dune plants, recreational use, off-road vehicles, and spread of introduced plants are the major threats.

Eriodictyon capitatum is endemic to northwestern Santa Barbara County, occurring in a few scattered localities (Smith 1976, Howald et al. 1985). Three populations occur on Vandenberg, two in Pine Canyon in Bishop pine forest and one along 35th Street in chaparral (D. Smith 1983). The 35th Street stand was subjected to a controlled burn in 1982; *Eriodictyon* resprouted after fire but no seedlings established (Jacks et al. 1984). *Eriodictyon capitatum* generally appears not to form viable seed (D. Smith 1983, Jacks et al. 1984). D. Smith (1983) suggested that each population is a clone arising from the branching of underground stems and may require cross-pollination with another colony to produce viable seed. Although the controlled burn stimulated *Eriodictyon* sprouting, it also lead to a great increase in *Carpobrotus edulis* in the stand (Jacks et al. 1984, Zedler and Scheid 1987).

Erysimum insulare has been reported from Surf (Munz 1974, Smith 1976). The status of this population has apparently not been recently determined, and there are taxonomic uncertainties in the genus (Price 1987).

Nomenclatural problems with the perennial species of *Monardella* were previously discussed. Using the traditional terminology, *Monardella undulata* var. *frutescens* ranges from Point Arguello in Santa Barbara County to the vicinity of Oceano in San Luis Obispo County, primarily in stabilized and partially stabilized dunes (Howald et al. 1985). Major populations occur on Vandenberg, particlarly on the San Antonio Terrace (HDR 1979, Howald et al. 1985). *Monardella crispa* is apparently more common on open dunes and blowouts rather than stabilized dunes but does not occur on foredunes (Howald et al. 1985). Since it is now reported for Vandenberg (Richard Nichols, pers. comm.), the range of *Monardella crispa* would appear to be from Vandenberg in Santa Barbara County to Oceano in San Luis Obispo County (Howald et al.

1985). Development, recreational use, and off-road vehicles are the major threats to these plants.

Nasturtium (=*Cardamine*) *gambelii* ranges from San Luis Obispo County to San Diego County, but is only occasionally found in swampy places (Munz and Keck 1973, Smith 1976). Dial (1980) reported a single population of two plants in Barka Slough. The recent status of the population has not been determined.

Sanicula hoffmanii occurs in areas near the coast of Santa Barbara and San Luis Obispo Counties and on Santa Rosa, Santa Cruz, and San Nicolas Islands (Munz 1974). It has been known from Point Sal (Smith 1976) and does occur on Vandenberg (Wayne Ferren, pers. comm.), but little is known of its distribution or population size on the base.

Scrophularia atrata is considered endemic to coastal northern Santa Barbara and San Luis Obispo Counties (Smith 1976, Howald et al. 1985). Hybridization with *S. californica* makes it difficult to determine its exact distribution on Vandenberg, although it has been reported from a variety of habitats. Examination of flowering material from these populations is needed for an exact determination of their status.

Serpentine Flora

The examination of the flora of serpentine areas was limited by the time available. It is evident that serpentine areas on Vandenberg differ floristically from surrounding vegetation on other substrates and contain plants not common elsewhere. However, no serpentine endemics nor the three species of special interest plants (*Chorizanthe breweri*, *Chorizanthe rectispina*, *Calochortus clavatus* var. *clavatus*) that Coulombe and Cooper (1976) suggested might occur on serpentine on Vandenberg were found. Two species of *Chorizanthe* (*C. obovata, C. palmeri*) and *Mariposa argillosa* which is included in the genus *Calochortus* by many authorities did occur.

It is still possible that the special interest serpentine plants occur on Vandenberg, since this study was not exhaustive; however, there are reasons that this may not be likely. The serpentine areas on Vandenberg are relatively small in size and are disjunct from large serpentine areas by considerable distances. Those on Vandenberg are the southernmost significant outcrops (Kruckeberg 1984 a, c). The largest serpentine area in Santa Barbara County is the Figueroa Mountain area of the San Rafael Mountains; there are also serpentine outcrops in central and northern San Luis Obispo County (Kruckeberg 1984 a, c). The two main areas of serpentine on Vandenberg are separated from each other, one on South Base and one on North Base. It is quite possible, given the small size and disjunct distribution of these areas, that serpentine endemics that evolved elsewhere never reached Vandenberg. It is also possible that some species may have been lost from the long history of grazing, since most serpentine areas are grasslands. Serpentine areas on Vandenberg should be considered significant, since they do contribute to the overall floristic diversity on the base and contain species not common on other substrates. Serpentine populations of widespread species may represent local racial or ecotypic variants adapted to the unique soil conditions of this substrate even though they may not be distinguishable as varieties or subspecies (Kruckeberg 1984 a, b, c).

Comparison to SDSU Study and Other Past Work

Original plot data from the SDSU vegetation study no longer exist; therefore, only general comparisons between the current study and the summary data published by Coulombe and Mahrdt (1976) are possible.

Chaparral. Four stands originally sampled by SDSU and one additional stand were sampled. Dominants are similar between the two samples (Table 64), but other minor shrubs and herbs not recorded by SDSU were recorded in this study. This may be due to the differences in sampling methodology, or for herbs, it may be due to different time of sampling, since the presence of many herbs is seasonal. *Arctostaphylos viridissima* in the SDSU study is probably *A. purissima*. The composite data from the SDSU study do not reveal the degree of site-to-site variability in chaparral as do the data from individual stands. Dominants varied among the stands sampled (Tables 19 to 23).

Bishop pine forest. Two of the four stands of Bishop pine forest originally sampled by SDSU were sampled. Dominants on the vegetation transects are similar (Table 65). SDSU did not record canopy density or basal area; thus, no comparisons with those data are possible.

Tanbark oak forest. One of two stands of tanbark oak forest sampled by SDSU was sampled. Dominants on the vegetation transects are similar (Table 66), but SDSU recorded several shrubs and herbs that were not encountered in this study. No data are available for comparison to the canopy density and basal area.

Annual grassland. Two of the four stands of annual grassland sampled by SDSU were sampled. Three new stands on North Vandenberg were also sampled. Both samples are dominated by introduced grasses with a mix of introduced and native herbs (Table 67). *Bromus rigidus* is now termed *Bromus*

Table 64. Chaparral vegetation data from the SDSU study.[1]

Species	Percent Occurrence	Percent Cover $\bar{X}$	Percent Cover SD
Trees and Shrubs			
Quercus wislizenii	75.0	28.5	26.5
Adenostoma fasciculatum	64.0	9.3	15.9
Arctostaphylos viridissima	58.0	19.5	23.7
Arctostaphylos rudis	53.0	15.8	31.5
Ceanothus ramulosus	36.0	3.0	3.5
Haplopappus ericoides	33.0	0.8	1.5
Baccharis pilularis	33.0	0.3	0.5
Ceanothus impressus	30.0	2.8	5.5
Diplacus lompocensis	29.0	1.0	2.0
Ceanothus papillosus var. *roweanus*	22.0	0.8	1.5
Herbs			
Pteridium aquilinum	22.0	2.5	5.0
Galium nutallii	14.0	0.3	0.5
Horkelia cuneata	11.0	*[2]	*
Total Bare Ground (%)		12.5	8.7
Total Plant Cover (100% - % bare ground)		87.5	

[1]Modified from Coulombe and Mahrdt (1976) Table 3.2.19. Summarizes four permanent quadrats, SDSU # 5, 12, 18, and 23. Cover is based on eight transects totaling 160 m. Percent occurrence is based on 36 circular plots.

[2]Species marked with an asterisk (*) appeared in the presence plots but not in the transects.

Table 65. Bishop pine forest vegetation data from the SDSU study.[1]

Species	Percent Occurrence	Percent Cover $\bar{X}$	Percent Cover SD
Trees and Shrubs			
Pinus muricata	86.0	40.0	17.1
Quercus wislizenii	69.0	12.5	10.2
Adenostoma fasciculatum	61.0	23.0	23.3
Arctostaphylos viridissima	53.0	7.5	10.7
Arctostaphylos viridissima x *rudis*	33.0	15.3	16.6
Vaccinium ovatum	28.0	3.3	6.5
Ceanothus ramulosus	19.0	2.5	5.0
Arctostaphylos rudis	19.0	0.8	1.5
Baccharis pilularis	14.0	0.3	0.5
Haplopappus ericoides	11.0	0.3	0.5
Diplacus lompocensis	8.0	0.3	0.5
Lotus scoparius	8.0	*[2]	*
Salvia mellifera	8.0	*	*
Herbs			
Pteridium aquilinum	19.0	2.3	5.5
Miscellaneous herbs	17.0	*	*
Total Bare Ground (%)		18.5	12.9
Total Plant Cover (100% - % bare ground)		81.5	

[1]Modified from Coulombe and Mahrdt (1976) Table 3.2.15. Summarizes four permanent quadrats, SDSU # 17, 19, 24, and 25. Cover is based on eight transects totaling 160 m. Percent occurrence is based on 36 circular plots.

[2]Species marked with an asterisk (*) appeared in the presence plots but not in the transects.

Table 66. Tanbark oak forest vegetation data from the SDSU study.[1]

Species	Percent Occurrence	Percent Cover $\bar{X}$	Percent Cover Range
Trees and Shrubs			
Lithocarpus densiflora	100.0	84.0	45-100
Vaccinium ovatum	94.0	75.5	27-100
Adenostoma fasciculatum	22.0	9.0	<1-14
Arctostaphylos viridissima	17.0	8.0	<1-12
Diplacus lompocensis	17.0	0.8	<1- 1
Baccharis pilularis	6.0	0.5	<1- 1
Ceanothus ramulosus	6.0	*[2]	*
Ceanothus papillosus var. *roweanus*	6.0	*	*
Arctostaphylos rudis	6.0	*	*
Lotus scoparius	6.0	*	*
Herbs			
Pteridium aquilinum	28.0	*	*
Stellaria media	6.0	*	*
Heuchera micrantha	6.0	*	*
Symphoricarpus mollis	6.0	*	*
Galium andrewsii	6.0	*	*
Total Bare Ground (%)		1.5	0-3.0
Total Plant Cover (100% - % bare ground)		98.5	

[1]Modified from Coulombe and Mahrdt (1976) Table 3.2.15. Summarizes two permanent quadrats, SDSU # 27 and 28. Cover is based on four transects totaling 70 m. Percent occurrence is based on 18 circular plots.

[2]Species marked with an asterisk (*) appeared in the presence plots but not in the transects.

Table 67. Annual grassland vegetation data from the SDSU study.[1]

Species	Percent Occurrence	Percent Cover $\bar{X}$	Percent Cover SD
Trees and Shrubs			
Artemisia californica	28.0	1.0	1.4
Eucalyptus spp.	22.0	*[2]	*
Herbs			
Mixed grasses and forbs	**[3]	86.5	11.0
Bromus rigidus	75.0	*	*
Erodium cicutarium	55.0	*	*
Cryptantha clevelandii	28.0	*	*
Hypochoeris glabra	25.0	*	*
Medicago hispida	25.0	*	*
Amsinckia intermedia	25.0	*	*
Lupinus nanus	22.0	*	*
Orthocarpus purpurascens	22.0	*	*
Eschscholzia californica	22.0	*	*
Brassica rapa	22.0	*	*
Silybum marianum	20.0	*	*
Rumex acetosella	17.0	*	*
Hordeum depressum	17.0	*	*
Total Bare Ground (%)		11.5	11.2
Total Plant Cover (100% - % bare ground)		88.5	

[1]Modified from Coulombe and Mahrdt (1976) Table 3.2.24. Summarizes four permanent quadrats, SDSU # 3, 11, 30, and 31. Cover is based on eight transects totaling 160 m. Percent occurrence is based on 36 circular plots.

[2]Cover for these species (marked by *) lumped together under mixed grasses and forbes.

[3]Because this category (marked by **) represents a combination of species, it has no percent occurrence.

diandrus and *Brassica rapa* is *Brassica nigra*. Other differences between the two samples relate to the different areas sampled and also to the time of sampling; there are marked seasonal changes in composition in annual grassland.

Oak woodland. SDSU sampled four stands of oak woodland, two of which were resampled in this study. Dominants are similar between the two samples (Table 68), but a greater diversity of shrubs and herbs were recorded in this study. Different sampling methods and time of sampling may account for some of this variation. No previous data exist with which to compare the canopy basal area and density.

Coastal sage scrub. One of the three stands of coastal sage scrub sampled by SDSU was sampled in this study. Composition of these stands is generally similar (Table 69).

Purple sage scrub. SDSU sampled three stands of purple sage scrub; one was resampled in this study. Dominants and associated species in these two samples are similar (Table 70).

Coastal dune scrub. SDSU sampled four stands of coastal dune scrub. One of these stands was resampled and an additional stand on the San Antonio Terrace was sampled. Dominants between the two samples of coastal dune scrub are similar except that *Artemisia californica* was not recorded in the SDSU sample (Table 71). The reasons for this are not known. It is not likely that *Artemisia* established recently. *Carpobrotus edulis* and *Conicosia pugioniformis* are now present in Stand 15 (SDSU Stand 10); these may be recent invaders, since they were not recorded in the SDSU study. HDR (1979) sampled coastal dune scrub on the San Antonio Terrace. Composition of their

Table 68. Oak woodland vegetation data from the SDSU study.[1]

Species	Percent Occurrence	Percent Cover $\bar{X}$	Percent Cover SD
Trees and Shrubs			
Quercus agrifolia	100.0	52.3	2.9
Toxicodendron diversilobum	44.0	8.9	13.2
Artemisia californica	39.0	3.3	4.3
Rubus ursinus	22.0	6.8	7.8
Baccharis pilularis	22.0	1.0	2.0
Herbs			
Mixed grasses and forbs	**[2]	25.0	30.8
Galium aparine	69.0	6.5	8.2
Pholistoma auritum	33.0	1.3	1.3
Montia perfoliata	33.0	*[3]	*
Pteridium aquilinum	22.0	*	*
Horkelia cuneata	19.0	*	*
Stachys rigida	19.0	0.8	1.0
Conium maculatum	19.0	0.8	1.5
Viola quercetorum	16.5	*	*
Pterostegia drymarioides	16.5	*	*
Total Bare Ground (%)		33.3	21.5
Total Plant Cover (100% - % bare ground)		66.6	

[1] Modified from Coulombe and Mahrdt (1976) Table 3.2.17. Summarizes four permanent quadrats, SDSU # 1, 2, 15, and 16. Cover is based on eight transects totaling 160 m. Percent occurrence is based on 36 circular plots.

[2] Because this category (marked by **) represents a combination of species, it has no percent occurrence.

[3] Cover for these species (marked by *) lumped together under mixed grasses and forbes.

Table 69. Coastal sage scrub vegetation data from the SDSU study.[1]

Species	Percent Occurrence	Percent Cover	
		$\bar{X}$	SD
Trees and Shrubs			
Artemisia californica	96.0	26.0	20.5
Lotus scoparius	52.0	6.0	7.9
Baccharis pilularis	41.0	16.7	17.6
Haplopappus ericoides	33.0	11.7	20.2
Salvia mellifera	33.0	4.7	8.1
Rhamnus californica	33.0	3.3	5.8
Herbs			
Pterostegia drymariodes	55.0	*[2]	*
Anagallis arvensis	52.0	*	*
Gnaphalium ramosissimum	44.0	*	*
Erodium cicutarium	30.0	*	*
Solanum xantii	26.0	*	*
Achillea millefolium	22.0	*	*
Pteridium aquilinum	18.0	*	*
Camissonia micrantha	15.0	*	*
Bromus rubens	15.0	*	*
Total Bare Ground (%)		15.7	19.7
Total Plant Cover (100% - % bare ground)		84.3	

[1]Modified from Coulombe and Mahrdt (1976) Table 3.2.20. Summarizes three permanent quadrats, SDSU # 20, 26, and 34. Cover is based on six transects totaling 120 m. Percent occurrence is based on 27 circular plots.

[2]Species marked with an asterisk (*) appeared in the presence plots but not in the transects.

Table 70. Purple sage scrub vegetation data from the SDSU study.[1]

Species	Percent Occurrence	Percent Cover $\bar{X}$	Percent Cover SD
Trees and Shrubs			
Salvia leucophylla	100.0	68.0	13.2
Artemisia californica	100.0	12.0	5.6
Encelia californica	48.0	10.0	15.6
Baccharis pilularis	22.0	1.7	2.9
Lotus scoparius	22.0	*[2]	*
Salvia mellifera x *leucophylla*	11.0	*	*
Herbs			
Miscellaneous herbs	37.0	*	*
Galium nutallii	14.0	0.7	1.2
Elymus condensatus	14.0	0.3	0.6
Anagallis arvensis	11.0	*	*
Marah fabaceus	7.0	*	*
Bromus rubens	7.0	*	*
Erodium cicutarium	7.0	*	*
Chenopodium californicum	7.0	*	*
Sanicula crassicaulis	4.0	*	*
Total Bare Ground (%)		19.7	9.1
Total Plant Cover (100% - % bare ground)		80.3	

[1]Modified from Coulombe and Mahrdt (1976) Table 3.2.21. Summarizes three permanent quadrats, SDSU # 29, 32, and 33. Cover is based on six transects totaling 120 m. Percent occurrence is based on 27 circular plots.

[2]Species marked with an asterisk (*) appeared in the presence plots but not in the transects.

Table 71. Coastal dune scrub vegetation data from the SDSU study.[1]

Species	Percent Occurrence	Percent Cover $\bar{X}$	Percent Cover SD
Trees and Shrubs			
Haplopappus ericoides	94.0	42.0	29.0
Senecio blochmaniae	36.0	2.8	3.6
Lupinus chamissonis	30.0	10.3	15.1
Lotus scoparius	19.0	2.0	2.3
Herbs			
Corethrogyne filaginifolia	25.0	3.8	7.5
Carpobrotus aequilaterus	22.0	0.3	7.5
Descurainia pinnata	22.0	*[2]	*
Camissonia micrantha	19.0	*	*
Gnaphalium ramosissimum	16.0	*	*
Pterostegia drymarioides	14.0	0.5	1.0
Festuca octoflora	14.0	0.3	0.5
Cryptantha clevelandii	11.0	0.3	0.5
Erysimum suffrutescens	8.0	0.3	0.5
Chenopodium californicum	8.0	0.5	1.0
Phacelia ramosissima	8.0	0.3	0.5
Total Bare Ground (%)		36.5	21.2
Total Plant Cover (100% - % bare ground)		63.5	

[1] Modified from Coulombe and Mahrdt (1976) Table 3.2.22. Summarizes four permanent quadrats, SDSU # 9, 10, 13, and 21. Cover is based on eight transects totaling 160 m. Percent occurrence is based on 36 circular plots.

[2] Species marked with an asterisk (*) appeared in the presence plots but not in the transects.

samples and ones from this study are similar, but since they sampled more transects over a larger area, they encountered more species.

Willow riparian woodland. SDSU sampled four stands of willow riparian woodland. One stand, not one of those previously sampled, was sampled here. However, the general composition of these samples is similar (Table 72).

Salt marsh. One of the two SDSU salt marsh stands was resampled. The stand sampled in this study was dominated by *Frankenia grandifolia* and *Salicornia virginica*, while in the composite SDSU data *Salicornia virginica* and *Jaumea carnosa* were dominant (Table 73). Whether this difference resulted from differences in transect placement or reflects vegetation changes in the salt marsh is not known.

Box elder riparian woodland. SDSU did not sample box elder riparian woodland, but the Fish and Wildlife Service did in its study of Barka Slough (Dial 1980). Their study site was near the stand sampled in this study and had similar species composition. Canopy density was somewhat higher in their stand (588.2/ha compared to 378.9/ha), but this probably varies from site to site.

Freshwater marsh. The Fish and Wildlife Service in the Barka Slough study (Dial 1980) sampled in the vicinity of the freshwater marsh site sampled in this study. At that time, they mapped the area as marshland dominated by *Typha* and *Scirpus*. Their transect in the area was dominated by *Scirpus olneyi* (40.8%) and *Typha latifolia* (9.5%) with only a minor amount of *Urtica holosericea* (1.8%). Now, *Urtica* dominates the stand sampled in this study, and there are only minor amounts of live *Typha*, although the cover of dead *Typha* indicates its past importance. No *Scirpus* occurred in transects from this study. The earlier sampling was conducted May 7, 1980, and this sampling was on May 15, 1987; so the difference in season of sampling is not a factor. Precipitation in 1979 was 16.43 in (41.73 cm) in Lompoc and 13.28 in (33.73

Table 72. Riparian woodland vegetation data from the SDSU study.[1]

Species	Percent Occurrence	Percent Cover $\bar{X}$	SD
Trees and Shrubs			
Salix spp.	78.0	67.8	45.7
Baccharis pilularis	45.0	4.3	5.1
Toxicodendron diversilobum	42.0	21.9	33.0
Ribes speciosum	22.0	1.2	0.9
Artemisia californica	19.0	0.5	1.0
Sambucus caerulea	19.0	*[2]	*
Symphoricarpus mollis	14.0	2.6	5.3
Rubus ursinus	11.0	1.8	2.0
Herbs			
Conium maculatum	27.0	8.3	13.2
Elymus condensatus	25.0	5.0	8.1
Urtica holosericea	25.0	1.0	2.1
Galium aparine	16.0	*	*
Artemisia douglasiana	14.0	7.1	9.0
Scrophularia atrata	8.0	0.3	0.5
Montia perfoliata	8.0	*	*
Total Bare Ground (%)		0	0
Total Plant Cover (100% - % bare ground)		100	

[1] Modified from Coulombe and Mahrdt (1976) Table 3.2.18. Summarizes four permanent quadrats, SDSU # 4, 8, 14, and 22. Cover is based on eight transects totaling 132 m. Percent occurrence is based on 36 circular plots.

[2] Species marked with an asterisk (*) appeared in the presence plots but not in the transects.

Table 73. Salt marsh vegetation data from the SDSU study.[1]

Species	Percent Occurrence	Percent Cover $\bar{X}$	Percent Cover Range
Herbs			
Salicornia virginica	100	92.5	85-100
Jaumea carnosa	50	15.5	1-30
Chenopodium californicum	8	*2	*
Total Bare Ground (%)		0	0
Total Plant Cover (100% - % bare ground)		100	

[1]Modified from Coulombe and Mahrdt (1976) Table 3.2.23. Summarizes two permanent quadrats, SDSU # 6 and 7. Cover is based on four transects totaling 80 m. Percent occurrence is based on 18 circular plots.

[2]Species marked with an asterisk (*) appeared in the presence plots but not in the transects.

cm) in Santa Maria while the 1986 values were 15.80 in (40.13 cm) and 13.94 in (35.41 cm), respectively, indicating no drastic differences in precipitation the year before each of these studies. The area adjacent to the marsh was mapped as *Carex* meadow in 1980 (Dial 1980). It was not sampled, but observations indicate that it too is now dominated by *Urtica*. Dial (1980) made no mention of the cracking of the soil on the north side of Barka Slough; this is a feature so obvious and unusual, with cracks 1.5 m deep and up to 1.0 m wide, that had it been present in 1980 he would have commented on it. All of these observations indicate that the wetland vegetation on the northern side of Barka Slough is deteriorating, probably as a result of a declining water table from groundwater withdrawal. In 1980, Dial found, using historic and recent aerial photography, that the marshland on the north of Barka Slough had declined in area due to willow invasion, which he attributed to declining water levels. Hutchinson (1980) and Mallory (1980) predicted that the water table in Barka Slough would decline due to groundwater withdrawal and that this decline would first be evident on the north side. Current observations of vegetation change are consistent with those predictions.

Comparison to Regional Vegetation Patterns

In this section the vegetation of Vandenberg is discussed in relation to regional vegetation patterns. The objectives are to provide a perspective on the importance of the vegetation preserved on the base, indicate relationships of the vegetation types used here to statewide classification systems, and point out significant management issues where they occur. Important aspects of the ecology of the major vegetation types on base are reviewed, but the literature review is selective rather than exhaustive; further references are provided in Appendix I.

The most detailed classification system currently in use for all of California is that of Holland (1986). Comparisons of Vandenberg vegetation are made to those types; for some communities comparisons are made to other literature (e.g., Barbour and Major 1977, Paysen et al. 1980). In general, nomenclature used here for community types is similar to that of Holland (1986), but it is not identical given the differences in scale of the areas involved.

Chaparral. Chaparral is one of the major vegetation types in California. Hanes (1977) states that it occupies 3.5 million ha (8.6 million ac) in the state. Chaparral ranges from southwest Oregon (Detling 1961) into Baja California (Hanes 1977) with extensions into Arizona and central Mexico (Mooney and Miller 1985). Studies of chaparral date from the pioneering work of Cooper (1922), Sampson (1944b), and Sweeney (1956), to recent symposia (Mooney and Conrad 1977, Conrad and Oechel 1982), and ongoing research programs (Conrad et al. 1986); yet many unresolved questions exist.

Chaparral is a shrub community dominated by evergreen, sclerophyllous shrubs; typically these shrubs have small, thick, heavily cutinized leaves, dense, rigid branching, and extensive root systems (Cooper 1922). Although the floristic diversity of chaparral communities was noted by early workers (e.g., Cooper 1922), a detailed classification of chaparral types has been slow to emerge. Hanes (1977) lists the main chaparral types as Chamise, Ceanothus, Scrub Oak, Manzanita, Montane, Red Shanks, Serpentine, Desert, and Woodland Chaparrals. Paysen et al. (1980), at the series level in their classification in which chaparral is considered a subformation, list Chamise, Bush Chinquapin, Mountain Mahogany, Manzanita, Scrub Oak, Prunus, Redshank, Sumac, and Toyon series. Holland (1986) includes 28 chaparral types that are distinguished on the basis of a combination of dominant species, geographical location, and site type. It is important to classify chaparral at a detailed level for management concerns as well as scientific reasons. Different chaparral types contain dominant species with varying life histories and responses to fire and may differ in ecosystems properties such as rates of biomass production and mineral cycling; assuming that all chaparral types should be managed the same way is unreasonable.

Fire is central to the ecology of chaparral, but these fire relationships are complex. Old stands of chaparral accumulate large amounts of biomass, including considerable standing dead material; when dry, these stands will burn in intense fires (Tyrrel 1982). Natural fires originate primarily from lightning ignition. Lightning strike frequency is not uniform throughout California. Keeley (1977b) showed that lightning frequency decreased from north to south, from medium and high to low elevations, and from interior regions to the coast; lightning-caused fires follow this same pattern (Keeley 1982). However, man-caused fires follow the opposite pattern, more frequent at lower elevations, coastal areas, and towards the south. Lightning and fire frequencies are very low on the Channel Islands (Bjorndalen 1978). Presently, man-caused fires dominate the fire pattern throughout California; Keeley (1982) found that only 16.2% of the wildfires burning 13.1% of the area recorded in the 1970's were lightning-caused.

The role of aboriginal man in burning chaparral vegetation in California is unclear. Sampson (1944b) reviewed historical records and concluded that while Indian burning to facilitate hunting, to secure native plant foods, and to clear small areas for tobacco cultivation occurred, these fires were seldom extensive and probably had little impact on brushlands. Lewis (1973) and Aschmann (1977) considered the impact of Indian use of fire to be more important. Timbrook et al. (1980) suggested that the Chumash Indians burned grasslands in the Vandenberg area, and these fires may have spread inland to the chaparral.

Vegetation impacts changed with European settlement. Initial Spanish settlement was concentrated around the missions, but included the introduction of substantial herds of cattle (Tyrrel 1982, Dunn 1986). Impacts greatly accelerated in the Gold Rush era; human populations increased rapidly, herds of cattle and sheep were greatly increased to supply food, burning was common to improve pasturage, marginal lands were farmed, and destructive lumbering practices were common (Sampson 1944b, Dunn 1986). In the late 1800's, recognition of the importance of chaparral for watershed protection to insure a continued water supply in southern California grew, and the first forest reserves were established (Tyrrel 1982). Ability to suppress fires increased in the following decades, but this was counterbalanced to some extent by increasing human population and increasing access to wildlands which increased wildfires (Tyrrel 1982). In northern California, burning chaparral for grazing remained common in the 1930's (Sampson 1944b). In the 1950's, programs to convert chaparral to grassland were instituted (Tyrrel 1982). None of these programs have eliminated the occurrence of large, sometimes devastating, wildfires (Tyrrel 1982); this has increased interest in prescribed burning to reduce fuel loads and wildfire hazards.

In only a few areas has a determination of fire frequency in chaparral before European settlement been possible. Byrne et al. (1977) found charcoal layers in varved sediments in the Santa Barbara Channel dating from the sixteenth to seventeenth century that indicated major fire-flood events every 20 to 40 years. This record appears to track events in the first coastal range in Los Padres National Forest less than 50 km away. While this indicates a recurring cycle of large fires, it is not clear that this means that a given area burned every

20 to 40 years. Sauer (1977) suggested a pattern of infrequent, intense, large fires in the Santa Monica Mountains. Keeley and Keeley (1986) cite work indicating a natural fire cycle of up to 100 years for inland areas of Santa Cruz County and longer at the coast and at low elevations.

Some chaparral types become senescent with age. Chamise (*Adenostoma fasciculatum*) chaparral stands on south-facing slopes in the San Gabriel and San Bernadino Mountains of southern California greater than 60 years since fire are decadent, with a high proportion of dead wood, little annual growth, no seedling development (Hanes 1971), and no indication of further successional change (Patric and Hanes 1964). Chamise growth is more rapid in the southern Sierra Nevada Mountains and senescence sets in at less than 40 years (Rundel and Parsons 1979). This is not a universal pattern of chaparral development. On north-facing slopes in the San Gabriel and San Bernadino Mountains, scrub oak chaparral develops post-fire and does not become senescent; mature stands develop a closed canopy and some short-lived species are lost, but growth of the dominant shrubs continues (Hanes 1971). Keeley and Keeley (1977) noted a vigorous, 90-year-old chaparral stand dominated by *Arctostaphylos glauca* and *A. glandulosa*.

Life history traits of chaparral plants do not indicate that all are adapted to uniform, frequent fire cycles. Some obligate seeding shrub species are short-lived, but others are long-lived (Keeley 1975). *Arctostaphylos glauca* (obligate seeder) has greater reproductive output at 90 years old than at 23 years (Keeley and Keeley 1977). There is a range of reproductive patterns between only seedling production and predominately sprouting (Keeley 1977a). Keeley (1977b) and Keeley and Zedler (1978) suggested that evolution of the non-sprouting life history in chaparral shrubs of *Arctostaphylos* and *Ceanothus* depended on the occurrence of at least some long, fire-free periods. Zedler

(1977a) showed that chaparral dominated by *Cupressus forbesii* requires long fire cycles (>50 years) for successful reproduction and declines at shorter intervals.

Site degradation can be caused by increased or decreased fire frequencies (Vogl 1977). Unusually short intervals between fires can have profound effects, eliminating non-sprouting shrubs and reducing density of sprouting shrubs (P. Zedler 1982, Zedler et al. 1983a). Frequent burning has been used to convert chaparral to grassland (Sampson 1944b, Keeley and Keeley 1986). Fire suppression can lead to fuel accumulations that are prone to large, intense fires (Parsons 1976, Tyrrel 1982).

Fire produces profound environmental and biological changes in chaparral (Hanes 1977). Vegetation cover and most litter are removed. Non-sprouting shrubs are killed. Mortality of sprouting shrubs varies with fire intensity and seasonality; more intense fires produce greater mortality among sprouting shrubs as do fires when starch reserves in the roots are low (Rundel 1982). Much of the nitrogen present in biomass is lost from the system by volatilization (DeBano et al. 1977, 1979, DeBano and Conrad 1978), but available forms of nitrogen (ammonia, nitrate) may be increased (Christensen 1973, Christensen and Muller 1975). Some potassium may also be volatilized (DeBano et al. 1977). Other nutrients are deposited in ash, often in soluble form; these are available for plant growth but may be lost by erosion and leaching. Christensen and Muller (1975) reported increases in total phosphorus, potassium, and sulfur but decreases in organic matter, cation exchange capacity, and calcium plus magnesium in the surface soil. Schlesinger and Gray (1982) found that atmospheric nutrient inputs equal or exceed normal losses in runoff, but long periods may be required to replace losses by volatilization and erosion from fire. On steep slopes, loss of vegetation cover can greatly accelerate erosion (Sampson 1944a, Mooney and Parsons 1973). Insolation reaching the soil surface is much greater post-fire and soil temperature regimes are changed (Sweeney 1956). Soil heating from fire alters soil microbial populations (Dunn and DeBano 1977, Dunn et al. 1979), and the changed conditions post-fire affect decomposition and mineralization (Christensen 1973). Water repellent layers may be formed by fire in some soils, or if present at the surface pre-fire, they may be moved deeper in the soil (DeBano 1981). Allelopathic substances may be destroyed by fire and soil heating (McPherson and Muller 1969), or the microbial populations responsible for generating them may be altered (Kaminsky 1981). Fire reduces populations of small mammals in the short-term; herbivory, especially by small mammals, affects herb and shrub seedling survival (Christensen and Muller 1975, Mills 1983, 1986).

There are common features to post-fire succession in many chaparral types. Regrowth the first year post-fire is usually dominated by herbaceous species (Sampson 1944b, Sweeney 1956, Keeley and Keeley 1981); these may include annual "fire" species (pyrophyte endemics) that seldom occur except after fire as well as more widespread annuals (Hanes 1977). Herb growth may be important in limiting nutrient losses from the system (Rundel 1982, Rundel and Parsons 1984). Seedlings of shrubs and subshrubs, sprouts of perennial herbs, and shrub sprouts also typically occur (Hanes 1977, Keeley et al. 1981). Germination of seeds of herbs, subshrubs, and shrubs stored in the soil is stimulated by fire; diverse life histories and germination behaviors are represented (Keeley et al. 1985, Keeley 1987). Germination of some species is stimulated by soil heating, some by charate from burned stems, and some by varying temperature regimes (Keeley 1986, 1987). However, seed mortality from fire is greater when soils are moist than when they are dry; since prescribed fires are often conducted in the cool season when soils are moist, these may result in abnormal seed mortality (Parker 1987). Generally, species of the mature chaparral are present from the beginning post-fire but do not assume dominance until later years, a difference from classical successional patterns (Hanes 1971, Vogl 1982). Subshrubs such as *Lotus scoparius* may be important in the second and subsequent years post-fire (Nilsen and Schlesinger 1981); these may also have a role in reducing nutrient losses (Nilsen and Schlesinger 1981, Nilsen 1982). Gradually shrub sprouts and/or seedlings occupy more space in the community, the abundance of herbs and subshrubs declines, and eventually short-lived shrubs are eliminated (Hanes 1971, Rundel 1982). At least some shrub species in some chaparral types are capable of establishing in gaps in mature chaparral without fire (P. Zedler 1982).

Successional patterns are not uniform throughout the range of chaparral or at all site conditions within a region. Sprouting shrubs are more important on north-facing slopes and at higher elevations in the Santa Monica Mountains (Hanes and Jones 1967, Hanes 1971, Keeley and Sonderstrom 1986), while coastal sage scrub species occur with chaparral species on south-facing slopes. Annual grasses are more important in post-fire succession in chamise chaparral in northern California than in southern California (Horton and Kraebel 1955).

Chaparral plants display numerous adaptations to the sites on which they grow. Hellmers et al. (1955) found that root systems of chaparral shrubs could be very deep, extending into the fractured bedrock; there was also a pattern of different shrub types partitioning the soil. However, chaparral survives on sites with shallow soil; on a site with only 60 cm of soil above impenetrable bedrock, Kummerow et al. (1977) found roots concentrated in the upper soil layer, but some depth partitioning occurred even under those conditions. Phenology of chaparral shrubs is closely tied to environmental conditions; growth occurs primarily when moisture is available and temperatures moderate, but there are also species specific patterns (Nilsen and Muller 1981, Baker et al. 1982, Gill and Mahal 1986). Some photosynthesis occurs year-round in the evergreen shrubs but is reduced during the drought season (Mooney and Miller 1985).

Productivity of chaparral is generally considered low, ca 400 $g/m^2/yr$ (Mooney 1977b). This is not universally true; *Ceanothus megacarpus* chaparral maintains much higher production rates, ca 1050 $g/m^2/yr$ (Gray 1982). Soils on which chaparral occurs are generally considered nutrient deficient, particularly in nitrogen and phosphorus (Mooney and Miller 1985). Nutrient cycling is therefore important to continued production. Marion (1982) found that decomposition was the process most important in releasing nitrogen; decomposition and fire were both important in releasing potassium, calcium, and magnesium in a variety of Mediterranean systems. In *Ceanothus megacarpus* chaparral, mean residence time for litter on the soil surface is 4.6 years (Schlesinger and Hasey 1981); this is much shorter than the fire cycle, indicating the importance of decomposition to the nutrient supply (Schlesinger 1985). No foliar nutrient deficiencies occur in this type by 20 years post-fire (Schlesinger and Gill 1980), and a high proportion of the nutrients required for annual growth (46% N, 56% P) are reabsorbed from senescent foliage (Schlesinger et al. 1982). In contrast, Rundel and Parsons (1980) found a decline in foliage concentrations of nitrogen and phosphorus in chamise chaparral post-fire; they suggested that nutrients tied up in the biomass limited production by 16 years post-fire when net increases in live biomass cease.

These cases indicate the risks of generalizing from one type of chaparral to another without data.

Chaparral is a major vegetation type on Vandenberg and a variable one; chaparral occurs on parts of the Burton Mesa, San Antonio Terrace, Lompoc Terrace, canyon slopes on South Base, and some of the slopes of the lower Santa Ynez Mountains. Chaparral species also occur in association with the Bishop pine forest as discussed later. Special interest plants occurring in chaparral on Vandenberg include *Arctostaphylos purissima, A. rudis, Ceanothus impressus* var. *impressus*, *C. papillosus* ssp. *roweanus*, *Chorizanthe pungens* var. *pungens*, *Cordylanthus rigidus* ssp. *littoralis*, *Dichondra donnelliana*, *Dudleya blochmaniae* ssp. *blochmaniae*, *Erigeron sanctarum*, *Eriodictyon capitatum*, *Erysimum suffrutescens* var. *lompocense*, *Juncus falcatus*, *Prunus fasciculata* var. *punctata*, *Quercus parvula*, and *Solanum xantii* ssp. *hoffmannii* (see Table 12). Other plants of special interest known from Burton Mesa chaparral include *Agrostis hooveri*, *Amsinckia spectabilis* var. *microcarpa*, *Chorizanthe angustifolia* var. *angustifolia*, *Erysimum suffrutescens* var. *grandifolium*, and *Monardella undulata* var. *undulata* (Hickson 1987a).

Burton Mesa chaparral is better known than the other types on Vandenberg. It is a variety of maritime chaparral and is included in the Central Maritime Chaparral type by Holland (1986); this type includes stands near Monterey and Fort Ord (Griffin 1978), on the Nipomo Mesa in southern San Luis Obispo County, and in northern Santa Barbara County, primarily on the Burton Mesa. Central Maritime Chaparral occurs on sandy substrates within the zone of summer coastal fog incursion (Holland 1986). It is distinguished by a group of endemic species of *Arctostaphylos* and *Ceanothus* that occur together with more widespread taxa. Burton Mesa chaparral contains the endemic shrubs

Arctostaphylos purissima, A. rudis, Ceanothus impressus var. *impressus,* and *C. ramulosus* var. *fascicularis,* as well as other endemic and narrowly distributed species including many of the special interest plants listed above (Howald et al. 1985). Some of the characteristic species of Burton Mesa chaparral occur on the San Antonio Terrace and the Lompoc Terrace on Vandenberg (Diana Hickson, pers. obs.), and some extend into the Nipomo Mesa (Wells 1962). Burton Mesa chaparral is considered a regionally rare and declining plant community, since it is localized in its occurrence, and much of its original extent has been lost to development (Howald et al. 1985). Less than half the original area of Burton Mesa chaparral is still extant (Hickson 1987a), and some of that is degraded by the invasion of exotic plants (*Carpobrotus edulis, Cortaderia jubata*) (Zedler and Scheid 1987, Hickson 1988). Other types of maritime chaparral have also been greatly reduced (Griffin 1978, Holland 1986).

Only recently have aspects of the ecology of Burton Mesa chaparral been examined. Davis et al. (1987) and Hickson (1987a) sampled Burton Mesa chaparral stands ranging from 1 to 50 years after fire. They found that plots containing coast live oak (*Quercus agrifolia*) (oak plots) differed in understory composition from plots lacking oaks (shrub plots). Herb species in oak plots are associated with stand age and distance from the coast. In shrub plots, woody perennial species composition is associated with stand age and depth to a subsoil pan, while herb composition is related to stand age, percent cover of sclerophyllous shrubs, depth to a subsoil pan, and distance from the coast. Post-fire recovery is broadly similar to that of other chaparral types. Herbs are most important in the first year post-fire and decline in abundance as shrub cover increases; however, the herbaceous flora lacks many of the pyrophyte endemics that occur only the first year after fire in some chaparral types. Subshrubs such as *Lotus scoparius* and *Helianthemum scoparium* are important three to five years post-fire and then decline. Among the major shrub species, *Ceanothus impressus* var. *impressus*, *C. ramulosus* var. *fascicularis* and *Arctostaphylos purissima* are obligate seeders but with different life histories. *Ceanothus impressus* var. *impressus* occurs in plots less than 12 years post-fire, *C. ramulosus* var. *fascicularis* obtains greatest cover in plots ca 25 years post-fire and then declines, while *Arctostaphylos purissima* is most abundant on plots at least 50 years old. *Quercus agrifolia* and *Arctostaphylos rudis* (both sprouters) also increase in importance with age.

There have been no studies of biomass levels and production rates (which relate to fuel loads and accumulation), nutrient cycling or possible limitations imposed by nutrient deficiencies, the presence and dynamics of seed banks in the soil, or the effects of season of burn on regeneration in Burton Mesa chaparral. Recent work has shown that Burton Mesa chaparral is prone to invasion by exotic plants, particularly *Carpobrotus edulis*, after fire (Jacks et al. 1984, Zedler and Scheid 1987, Hickson 1988).

No comprehensive data exist for other chaparral types on Vandenberg. Types dominated by *Quercus wislizenii*, *Arctostaphylos* spp., and *Heteromeles arbutifolia* with *Prunus ilicifolia* and *Lotus scoparius* were sampled in this project. In addition, types dominated by *Adenostoma fasciculatum* and *Ceanothus impressus* var. *impressus* have been mapped (Provancha 1988, see also Appendix IX, Table IX-2).

The current fire regime on the Burton Mesa (Hickson 1987a) and on all of Vandenberg (Hickson 1988) is entirely anthropogenic. Natural fire intervals are unknown, but given the coastal location and the low incidence of lightning, fire-free intervals were probably long. Wildfire hazards exist on Vandenberg and to reduce these a fuel management program using controlled burning has been instituted (Wakimoto et al. 1980a, b).

There is a need for more comprehensive information on the fire ecology of Burton Mesa chaparral as well as other plant communities on Vandenberg. Burton Mesa chaparral is a regionally declining plant community and contains many special interest plants. Much of the remaining acreage of this type occurs on Vandenberg. Fire naturally occurred in chaparral, but not all chaparral is adapted to the same fire frequency. In order to preserve and manage the remaining areas of this vegetation, practices are needed that reduce fuel hazards but minimize invasion of exotic plants (see Hickson 1988 for detailed recommendations). Future construction should also avoid intact stands of Burton Mesa chaparral as much as possible.

Bishop pine forest. Bishop pine (*Pinus muricata*) is one of several closed cone (serotinous) conifers (cypress and pine) in California whose life cycles are related to fire (Vogl et al. 1977, Zedler 1986). In Southern California, these conifers generally occur in close association with chaparral (Zedler 1986). Bishop pine is discontinuously distributed along the coast of California from Humboldt County south to Santa Barbara County and on the Channel Islands; a disjunct population occurs in Baja California (Griffin and Critchfield 1972). This maritime distribution may be related to frequent fog which reduces moisture stress and supplies water through fog drip. The current distribution is generally considered a relict of a forest once more widespread when precipitation was greater (Axelrod 1978). There is a high degree of genetic variability in the species (Vogl et al. 1977, Millar 1983). Geographic races have been distinguished on both morphological and chemical basis. *Pinus remorata* has been described as a separate species, but is considered by others (e.g., Vogl et al. 1977) as a variant of *P. muricata*.

Bishop pine occurs primarily in even-age stands that originate after fire; fire causes the cones to open and seed to be dispersed, exposes mineral soil favoring pine seedling establishment, and reduces shading from the pine canopy and other vegetation (Vogl et al. 1977, Zedler 1977b). Some cones may open without fire or be opened by squirrels and the seed dispersed, so that some establishment may occur without fire (Zedler 1977b). Bishop pine is a short-lived species; 80 to 100 years in the absence of fire is probably the maximum life span (Vogl et al. 1977, Zedler 1986). However, it does bear cones at an early age. Bishop pine has definite substrate preferences, generally occurring on shallow, acid soils. In the Purisima Hills, Cole (1980) found Bishop pine primarily on diatomaceous shale. The populations on Vandenberg are primarily on poorly consolidated sandstones (Zedler 1977b).

The Bishop pine forest on Vandenberg corresponds to the Southern Bishop Pine Forest type of Holland (1986). Forests of these and related closed-cone pines are termed Closed-cone Pine Forest (Griffin and Critchfield 1972, Smith 1976).

Zedler (1977b) examined the Bishop pine stands on Vandenberg in some detail. He found that most of the stands were relatively young (15-35 years) and in good condition. Cone crops were sufficient that fire intervals as short as 25 years would allow regeneration. There was no direct evidence that Bishop pine was declining on the base, although some areas that appeared suitable were not occupied by the pine; neither was the pine spreading.

Special interest plants associated with Bishop pine forest on Vandenberg include *Arctostaphylos purissima, Ceanothus papillosus* ssp. *roweanus*, one of the three populations of *Eriodictyon capitatum*, and *Quercus parvula* (see Table 12). *Pinus remorata* or *P. muricata* of the *remorata* type, depending on the uncertain taxonomic status of this entity, also occurs (Zedler 1977b).

Bishop pine forest on Vandenberg is, as Zedler (1977b) stated, a rare ecosystem type and should receive special management consideration. Reasons for the special status of Bishop pine forest include: 1) the total extent of Bishop pine on Vandenberg is limited; 2) these populations are distinct genetically; 3) these stands are the only ones in public ownership containing the southern race of Bishop pine; and 4) dense Bishop pine forest is the most important habitat for the grey squirrel (*Sciurus griesus*) on Vandenberg (Zedler 1977b). The regional importance of this forest is widely recognized (Coulombe and Cooper 1976, Smith 1976, Howald et al. 1985, URS 1987).

The two stands of Bishop pine examined in this study also appear to be in good condition. The stand burned in 1974 regenerated and appears to be growing normally. The mature stand shows no evidence of decline at present. Zedler (1977b) pointed out that periodic monitoring of Bishop pine forest should be conducted. Since ten years have past from the original survey, it would be appropriate to reexamine more stands of Bishop pine in the near future. The implementation of a Fuel Management Plan for Vandenberg increases the importance of understanding the fire ecology of these stands (Hickson 1988). Future development and construction including excavation of borrow pits should avoid Bishop pine forest as much as possible.

Tanbark oak forest. Tanbark oak *(Lithocarpus densiflora)* is a common understory taxa in redwood forests (Zinke 1977) and a canopy dominant in the mixed evergreen forest (Sawyer et al. 1977, Holland 1986). Forests in which tanbark oak is the sole or major canopy dominant have been reported, but little is known of their ecology (Sawyer et al. 1977).

The populations of tanbark oak on Vandenberg are near the southern limits of their range (Griffin and Critchfield 1972). Tanbark oak and its associated species are considered relict associations of forests that were once more widespread when precipitation was greater (Smith 1976, Howald et al. 1985); it is thought that they are maintained on high ridges such as Tranquillon Mountain by the frequent fog that reduces evapotranspiration stress and may increase soil moisture by fog drip. The regional significance of this tanbark oak forest is widely recognized (Coulombe and Cooper 1976, Smith 1976, Howald et al. 1985, URS 1987).

The tanbark oak forest on Vandenberg appears to be stable under current conditions. Any future construction on Tranquillon Mountain should avoid disturbing intact stands of the forest, since its total extent is quite limited. Fire is not required for the maintenance of tanbark oak forest and should be avoided in these stands. Although young tanbark oak trees may recover from fire, older trees may be killed or damaged so that they are lost by subsequent attack from insects and fungi (Fowells 1967). Basal sprouting usually occurs after fire or other damage (Fowells 1967). For a population at the extreme of its range, however, it would be prudent to avoid additional stress. Wells (1962) suggested that repeated fires could transform live oak forest into shrubland or grassland; a similar transformation is probably possible with tanbark oak forest. There is also a risk of erosion on these steep slopes if the vegetation cover was removed.

Annual grassland. Annual grassland in California is a vegetation type dominated by introduced annual grasses (e.g., *Avena* spp., *Bromus* spp., *Vulpia* spp.), introduced forbs (e.g., *Erodium* spp., *Medicago* spp.), and native forbs (e.g., *Eschscholzia californica, Hemizonia* spp.) (Heady 1977). Known by several names, including California annual type (Talbot et al. 1939, Bentley and Talbot 1948), valley grassland (Heady 1977), and non-native grassland

(Holland 1986), this community has developed in the last two hundred years (Heady 1977). Annual grassland now occupies about 10 million ac (4 million ha) in California (Biswell 1956). It is distributed primarily in a ring around the Central Valley and in the Coast Ranges (Heady 1977).

The origin of this grassland is only partially understood, since it arose before any systematic observations were made on the natural vegetation of California. It is often stated that annual grassland replaced perennial bunchgrass grassland dominated by *Stipa pulchra* (Heady 1977). Clements (1934) first concluded this based on relict *Stipa pulchra* stands along railroad tracks, but Biswell (1956) suggested that native annual grasses may have dominated some areas and that native forbs may have also been important. The only direct evidence on the composition of the original grassland is the recent finding that opal phytoliths in the soil under annual grassland are characteristic of *Stipa* (panicoid-type) perennial grasses rather than the introduced festucoid grasses (Bartolome et al. 1986).

The destruction of the native grassland apparently occurred under the combined impact of the introduction of cattle to grasslands not adapted to continuous heavy grazing, overgrazing and drought (particularly during the 1850's and 1860's), cultivation of marginal lands, and the introduction of annual grasses and forbs from the Mediterranean region (Heady 1977). Jackson (1985) found that the annual grasses that now dominate the California grassland do not form stable annual grasslands in their homeland, but rather are mainly ruderal species in early successional grassland or degraded shrubland; they were, however, preadapted to the climatic and environmental conditions found in California. Similar annual grasslands have formed in the Mediterranean-climate region of Chile (Gulmon 1977).

Not all of the area now in grassland may have been grassland before European settlement. Some areas of other vegetation types, particularly chaparral and coastal sage scrub, have been deliberately converted to grassland by controlled burning and grazing together with other shrub control measures (Sampson 1944b, Heady 1972, Tyrrel 1982, Keeley and Keeley 1986). Fire and grazing may also have opened areas of oak forest and woodland (Wells 1962). Burning by aboriginal people may have been important in maintaining grasslands, particularly in some coastal areas (Timbrook et al. 1982).

The conversion from the original grassland to the present annual grassland is essentially a permanent transition (Heady 1977). The removal of grazing does not usually result in the reestablishment of perennial grassland (Bartolome and Gemmill 1981). Even remnant perennial grasslands have a substantial proportion of annual grasses (White 1967, Robinson 1971).

Several studies have examined the ecology of *Stipa pulchra* in relation to its status and failure to reestablish dominance. White (1967) found *Stipa pulchra* on a variety of sites on the Hastings Reservation, with no simple relation to soil moisture. McNaughton (1968) found *Stipa* to be more important on serpentine than on sandstone at the Jasper Ridge site; on serpentine it was found on the wetter sites but on sandstone on the drier sites. Robinson (1971) found remnant *Stipa* associations near Monterey usually on clayey soils; germination tests showed that *Stipa* germinated but seedlings were not successful when grown with *Avena fatua*. Bartolome and Gemmill (1981) found that *Stipa* seedlings died during the period of rapid growth of seedlings of *Bromus mollis* and *Festuca megalura*; they suggested that disturbances that reduce the density of annual grasses including fire, grazing, and soil disturbance are now required for *Stipa* establishment. Adult plants of *Stipa*, once established and in the absence of grazing, are often competitive with annual grasses; Hull and Muller (1977) suggested that an allelopathic interaction might be involved. Bartolome (1981) noted that adult plants of *Stipa* were severely affected if defoliated (grazed or burned) in the spring. Biswell (1956) stated that annual burning favored *Stipa* but did not give the season of burning. He also suggested that perennial grasses could be favored or maintained by a grazing system where the annuals were grazed up to the time of their maturity followed by protection from grazing while the perennial grasses flowered and set seed.

As a vegetation type dominated by annual plants, the species composition, density, biomass (yield), and other properties of annual grassland are sensitive to weather (Talbot et al. 1939, Heady 1958, Ewing and Menke 1983a, b), amount of mulch (Heady 1956), rodents (Fitch 1948, Fitch and Bentley 1949, Borchert and Jain 1978), and fertilization or soil nutrient levels (Gulmon 1979, Center et al. 1984, Caldwell et al. 1985). McNaughton (1968) observed differences with aspect and with substrate (sandstone vs. serpentine). Fire effects are generally considered minor (Heady 1972), but Larson and Duncan (1982) found increased yield the second year after fire. Heady (1958) pointed out that three types of changes, site-to-site, seasonal, and year-to-year, are superimposed in annual grassland.

In a general sense, annual grasslands on Vandenberg are typical of those in the region, but it is also clear that they occur on varying slopes, aspects, and substrates, and their composition also varies. This variability needs to be considered in monitoring of grassland conditions. Most areas are dominated by annual grasses, but perennial grasses still occur. Grassland together with oak woodland form the resource base for grazing leases on the base. Range management issues are beyond the scope of this report and have been addressed elsewhere (Soil Conservation Service 1978 [revised 1987]), but proper range management is important to maintaining this resource.

Coast live oak woodland. Coast live oak (*Quercus agrifolia*) is widely distributed along the coastal region of California from Mendocino County south into Baja California and occurs in the general community types termed Mixed Evergreen Forest and Foothills Woodland (Griffin and Critchfield 1972). Coast Live Oak Woodland is recognized as a distinct community type within the general Foothills Woodland classification (Griffin 1977, Holland 1986); Coast Live Oak Forest also occurs (Holland 1986), most often in mesic sites. Some areas have only scattered coast live oaks in a grassland matrix and can be considered savanna. Wells (1962) suggested that the more open woodlands and savannas may have been derived from closed forests by repeated fires and grazing. Although coast live oak is relatively fire-resistant (Plumb and Gomez 1983), stems less than 6 in (15.2 cm) can be girdled and hence killed by intense fires.

There are few detailed studies of coast live oak woodland (Griffin 1977). Parker and Muller (1982) found that the annual vegetation beneath isolated live oak trees differed considerably from the surrounding annual grassland; environmental differences under the oak trees included reduced light intensity, increased soil moisture and nutrients, and moderation of temperature extremes compared to the grassland. Griffin (1973) found that pre-dawn xylem sap tensions in coast live oaks were low even in the dry season; he suggested that this may indicate that the trees are deep rooted, reaching the water table. Davis (1986) examined the use of Thematic Mapper data to distinguish oak forest, oak woodland, and associated communities.

Lack of oak regeneration has been noted in many oak woodlands (Griffin 1977); damage to acorns and seedlings by cattle, deer, rodents, and insects is thought to account for much of the failure of deciduous oaks to establish. Live oaks are somewhat more resistant to grazing. Griffin (1971) found that, in the absence of cattle grazing, coast live oak acorns required burial by birds or rodents for germination, seedlings did not survive in competition with grasses in savanna sites, pocket gophers killed seedlings, and browsing by deer limited the growth of seedlings and saplings that did survive.

The reproductive status of oak woodlands on Vandenberg is not clear. One of the two stands sampled here appeared to have little regeneration, but a wider sampling would be required to determine this for oak woodlands in general on Vandenberg. No special interest plants were encountered in the oak woodlands sampled on base, but they do support (at least where there is little grazing) a mesic flora not commonly found in annual grasslands or other communities. Oak woodlands are considered sensitive plant communities by the County of Santa Barbara (Howald et al. 1985, URS 1987). Since oak trees are sensitive to disturbance, and regeneration is often limited, future development and construction should avoid oak woodlands as much as possible.

Coastal sage scrub and purple sage scrub. These were considered as two separate types in sampling and analysis, but they are related; purple sage scrub is a variant of coastal sage scrub, and the available literature on them overlaps.

Coastal sage scrub (also known as southern coastal sage or soft chaparral) is a shrub vegetation type dominated by drought-deciduous, mesophyllous, shallow-rooted shrubs (Kirkpatrick and Hutchinson 1977); typical species include *Artemisia californica, Salvia mellifera, Salvia leucophylla*, and *Encelia californica* (Mooney 1977a). It contrasts with chaparral which is dominated by evergreen, sclerophyllous, typically deep-rooted shrubs. Although long recognized as a distinct community (Epling and Lewis 1942), few detailed studies existed before the last decade (Mooney 1977a), and many unresolved questions still exist regarding this vegetation type. The related northern coastal scrub (Heady et al. 1977) is also poorly understood; within that type, scrub communities dominated by *Baccharis pilularis* ssp. *consanguinea* and by *Lupinus varicolor* or *L. arboreus* are known.

Coastal sage scrub species can invade other sites including grassland (Westman 1976, Axelrod 1978, Hobbs 1986, Hobbs and Mooney 1986), chaparral after fire (Gray 1983a), and sites denuded by landslides, mudflows, or other soil loss (Axelrod 1978). However, coastal sage scrub appears to be a permanent feature of xeric sites in the region (Westman 1981a, b).

Coastal sage scrub ranges along the California coast to the Mexican border and south into Baja California (Axelrod 1978, Westman 1983). The northern boundary is variously placed; Axelrod (1978) extended it into Oregon, while Westman (1983) placed it at San Francisco, considering the northern communities better grouped with northern coastal scrub or chaparral. Coastal sage scrub is not uniform along this latitudinal gradient. Axelrod (1978) distinguished types based on geographical regions: Franciscan (north coast), Lucian (central coast), Diablan (central interior), Venturan (south coast), Riversidian (south interior), and Diegan (southernmost coast and Baja California); he noted that these types intergraded. The classification adopted by Holland (1986) is similar. Westman (1983) recognized four regional types of coastal sage scrub (Diablan, Venturan, Riversidian, and Diegan), but noted that the Venturan type was segregated at the local scale into two dominance types, *Salvia mellifera* and *Salvia leucophylla*; two additional types of coastal succulent scrub occurred in Baja California. In the region between Santa Barbara and Banning, Kirkpatrick and Hutchinson (1977) recognized divisions based on coastal versus interior location and described 11 types based on physiognomy, structure, and species composition.

Westman (1981a, b, 1983) identified major gradients influencing composition of coastal sage scrub through its geographic range as evapotranspirative stress, soil fertility and parent material, and regional air pollution levels. Kirkpatrick and Hutchinson (1980) also found relationships with continentality, aspect, slope, and substrate. In addition to gradients in composition, Westman (1981a) found gradients in species richness, particularly that of herbs; herb richness was related to precipitation, favorable temperature during the growing season, shading by shrubs, and soil nitrogen. Coastal sage scrub in the region near Point Conception was particularly rich in herbs; this appears related to the mix of northern and southern species occurring due to the frequent fog lowering moisture stress (Westman 1981a).

Coastal sage scrub often occurs associated with annual grassland; the contact between these two types is frequently marked by a bare zone. Early work attributed this to allelopathy (Muller et al. 1964, C. Muller 1965, W. Muller 1965, Muller and Muller 1964, Muller and del Moral 1966). Later, Halligan (1973, 1974, 1976) showed that grazing by small mammals was primarily responsible for this zone and allelopathic effects were secondary.

Coastal sage scrub is also often associated with chaparral. In general, coastal sage scrub dominates at lower elevations or on south-facing slopes, while chaparral is at higher elevations. Coastal sage scrub species are capable of surviving on more xeric sites by being drought-deciduous; growth is concentrated in winter and spring when soil moisture is available (Gray 1982), and leaves are shed or replaced by small leaves (Westman 1981c) when soil moisture levels decline. In a series of studies comparing adjacent stands of coastal sage scrub *(Salvia leucophylla-Artemisia californica)* and chaparral *(Ceanothus megacarpus)* in the Santa Monica Mountains, it was found that the chaparral had greater live biomass, annual production, litter biomass, and height than the coastal sage scrub; leaves of coastal sage scrub species were higher in nutrient concentrations, but nutrient-use efficiency was higher in chaparral (Gray and Schlesinger 1981, 1983, Gray 1982, 1983b). Gray (1983a) suggested that the boundary between these types was dynamic; coastal sage scrub species had invaded chaparral after fire but were shaded out later, and a progressive invasion of chaparral into coastal sage scrub had occurred over several fire cycles. McPherson and Muller (1967) reported *Ceanothus cuneatus* to be shading out *Salvia leucophylla* in a mixed stand 26 years post-fire. Elsewhere boundaries between coastal sage scrub and chaparral have been stable for long periods (Westman 1982).

The fire ecology of coastal sage scrub is complex. Herbs dominate the first post-fire season, and many are the same as occur in chaparral post-fire (Keeley and Keeley 1984). Herb abundance declines in subsequent years but remains higher than in chaparral (Westman 1982). In coastal areas, resprouting of shrub species is important after fire; shrub seedlings may establish the second year from seeds shed by the first-year sprouts (Malanson and O'Leary 1982, Keeley and Keeley 1984). Species are not uniform in their sprouting ability, and intense fires can kill root crowns so that sprouting does not occur (Westman et al. 1981, Westman and O'Leary 1986). Sprouting is also less common in interior regions than near the coast (Westman et al. 1981, Keeley 1986).

Natural fire frequencies in coastal sage scrub are poorly known. Westman (1982) found a mean return interval of 20 years in the western Santa Monica Mountains between 1930 and 1978, but this is probably more frequent than the presettlement fire frequency (Malanson 1985a). Coastal sage scrub does not become senescent in the absence of fire; healthy stands 60 years old are reported (Westman 1982). Coastal shrub species are capable of seedling establishment in intact stands (Westman 1982) and of basal sprouting without fire or other defoliation (Malanson and Westman 1985). Frequent fires could shift the species composition of coastal sage scrub (Malanson 1985b). In the past, fire management of coastal sage scrub has been the same as for chaparral; however, it may be that the two types have different optimum fire frequencies and that for coastal sage scrub may be longer than previously assumed (Malanson and Westman 1985).

The extent of coastal sage scrub has been greatly reduced. Westman (1981a) estimated that only 10 to 15% of the original area of coastal sage scrub remained; he also noted that many of the species in this type are localized, increasing the potential for species loss with habitat loss. Much less coastal sage scrub is in preserves than chaparral, and those preserved are of the Venturan type (Westman 1982). Areas of coastal sage scrub adjacent to chaparral may provide seed sources for herbs important in post-fire recovery; thus, it may be important to include these areas when preserving chaparral (Westman 1979a). Coastal sage scrub is sensitive to air pollution, and damage has been observed in the Los Angeles area (Westman 1979b, 1985).

Coastal sage scrub on Vandenberg is variable, occurring on different sites with different histories. Some stands are in areas once grazed or farmed; the nature of the presettlement vegetation on such sites is unknown. Other stands on steep slopes and in canyons have probably been coastal sage scrub for long periods. The importance of *Baccharis pilularis* ssp. *consanguinea* in some stands shows a relationship to northern coastal scrub (Heady et al. 1977, Grams et al. 1977) or the Franciscan association of Axelrod (1978). However, the large areas of purple sage scrub on South Base are clearly related to the Venturan coastal sage scrub subtype dominated by *Salvia leucophylla* documented to the south (Kirkpatrick and Hutchinson 1977, Westman 1983). The overlap of these different assemblages contributes to the species richness noted by Westman (1981a). Coastal sage scrub is not a rare community on Vandenberg, but proper management, particularly in relation to fire and grazing, is required to maintain the resource.

Coastal dune scrub. Coastal dune scrub is the shrub vegetation occupying more or less stabilized dunes inland from the active coastal dunes. This vegetation on Vandenberg corresponds to the Central Dune Scrub of Holland (1986) and is generally similar to vegetation of the Nipomo dunes (Smith et al. 1976, Jones 1984). The SDSU study used the term coastal sage scrub-stabilized dune phase for this type (Coulombe and Cooper 1976). Howald et al. (1985) consider coastal dune scrub a regionally rare and declining plant community due to development, off-road vehicle use, cattle grazing, and invasion of exotic plants. Holton and Johnson (1979) note that large areas of the stabilized dunes described by Cooper (1967) have been lost to development and that only two areas with substantial acreage remain: the Dillon Beach-Point Reyes area north of San Francisco and the Morro Bay-Purisima Point area in central California. The ecological importance of coastal dune scrub on Vandenberg was previously noted by Coulombe and Cooper (1976), HDR (1979), and URS (1987). Special interest plants with their primary distribution in this community type include *Castilleja mollis*, *Erigeron foliosus* var. *blochmaniae*, *Erysimum suffrutescens* var. *grandifolium*, *Monardella undulata* var. *frutescens*, and *Senecio blochmaniae* (see Table 12.)

Coastal dune scrub is not uniform across its range in California. Barbour and Johnson (1977) note that the dominant shrubs *Ericameria (Haplopappus) ericoides* and *Lupinus chamissonis* are present at both Point Reyes and Vandenberg, but that there are few other species in common. Neither is coastal dune scrub a homogeneous vegetation type on a local basis. Holton and Johnson (1979) recognized four types within the coastal dune scrub at Point Reyes. Similar variability, although with different species groups, can be observed in the coastal dune scrub on Vandenberg. Henningston, Durham & Richardson (HDR) (1979) present data indicating variability with topographic position in coastal dune scrub on the San Antonio Terrace. In addition, swales within the dune topography support distinct vegetation types including mesic scrub dominated by *Baccharis pilularis* ssp. *consanguinea*, willow (*Salix lasiolepis*) thicket, California wax myrtle *(Myrica californica)* thicket, and small marshes *(Juncus* spp., *Scirpus* spp., *Typha* spp.), some with open water and various aquatic and semiaquatic herbs (HDR 1979). Vegetation sampling in the current project does not represent the full range of variation in coastal dune scrub vegetation, but does provide data from permanent transects for future comparisons.

It should be noted that the dunes occupied by coastal dune scrub are stable only in a relative sense. Disturbance or removal of the vegetation cover can lead to wind erosion and renewed sand movement.

Coastal dunes. Sandy beaches and dunes once occupied about 23% of the coast of California (Cooper 1967), but many areas have been greatly modified by development (Barbour and Johnson 1977). Three related habitats and vegetation types occur in these areas: beaches, active dunes, and stabilized dunes.

Beach is used for the expanse of sandy substrate between mean tide and the foredune (Barbour and Johnson 1977). Vegetation cover on beaches is sparse (Barbour and Robichaux 1976, Barbour et al. 1976) and consists of species tolerant of or adapted to salt spray, sand movement, and occasional inundation (Barbour and DeJong 1977, Barbour 1978). Regional trends in beach vegetation have been examined by Breckon and Barbour (1974), Macdonald and Barbour (1974), Barbour et al. (1975, 1976), and Barbour and Johnson (1977). In California, a major division is between beaches dominated by grasses *(Ammophila arenaria, Elymus mollis)* north of Point Reyes and beaches dominated by forbs to the south. Few data are available on the beach vegetation on Vandenberg; Barbour et al. (1976) and Barbour and Johnson (1977) found *Abronia maritima*, *Cakile maritima*, and *Ambrosia chamissonis* to be the major beach taxa on Vandenberg. Beaches were not sampled in the present study, but these three taxa were found in the active dunes there.

Active dunes are dynamic habitats subject to continual sand erosion and deposition. Vegetation is important to the eventual stabilization of dune sands as they move inland. In California, a major division in active dune vegetation is between dunes dominated by grasses *(Ammophila arenaria, Elymus mollis)* and those dominated by forbs (Barbour and Johnson 1977). The introduced grass, *Ammophila arenaria*, has had a profound impact on dune morphology, flora, and fauna as reviewed elsewhere (Schmalzer and Hinkle 1987b). The natural dune vegetation on Vandenberg was forb-dominated and persists in areas that have not been extensively disturbed or planted in *Ammophila arenaria* as was done in the Purisima Point area (Peters and Sciandrone 1964). Although Holland (1986) appears to include Vandenberg within the area classified as Northern Foredunes, the lack of native dune grasses and the importance of suffrutescent herbs *(Abronia* spp., *Ambrosia chamissonis)* indicates that they should be considered with the type he terms Southern Foredunes. Some authors (e.g., Smith [1976], Howald et al. [1985]) classify beach and active dune vegetation together as coastal strand.

On a regional basis, Howald et al. (1985) consider active dunes to be a rare and declining plant community because of the loss and degradation of this habitat due to off-road vehicle use, oil production, military construction, and other development. Invasion of exotic plants has also replaced the native flora in many dune systems. Therefore, the coastal dunes on Vandenberg are important as remaining areas of this vegetation with its associated flora. The coastal dune complex between Point Sal north to Pismo Beach, known collectively as the Nipomo Dunes, a designated National Natural Landmark, is similar in vegetation and flora to dunes on Vandenberg, but this area is only partially protected (Smith et al. 1976, Jones 1984). Special interest plants occurring primarily in active dunes on Vandenberg include *Cirsium rhothophilum*, *Dithyrea maritima*, and *Malacothrix incana* (see Table 12).

The vegetation sampling in this project was not sufficient to characterize completely active dune systems on Vandenberg, nor was it intended to do so. Rather, it provides representative data and establishes some permanent transects for future comparison. Vegetation of dune systems varies with topographic position and exposure to the wind as shown for relatively undisturbed dunes at Morro Bay (Williams and Potter 1972, Williams 1974) and at Monterey Bay (Bluestone 1981). Dune vegetation also changes with time (McBride and Stone 1976, Williams and Williams 1984); some of these changes may be successional, resulting in greater dune stability and increased vegetation cover, while other changes, such as blowouts, reverse that process.

Box elder riparian woodland. California box elder *(Acer negundo* ssp. *californica)* is a subspecies endemic to California where it is generally restricted to riparian situations (Griffin and Critchfield 1972). Holstein (1984) states that it is locally common in riparian communities in the drier parts of the Coast Ranges and the lower parts of the Sacramento and San Joaquin Valleys, but it is seldom a canopy dominant, usually occurring as a shade-tolerant subordinant tree in riparian forests dominated by *Populus* spp. and *Salix* spp. In a survey of coastal wetlands in northern Santa Barbara County, Mahrdt et al. (1976) reported box elder only from San Antonio Creek. Howald et al. (1985) listed box elder as one of the riparian trees of the region, but the only site dominated by box elder they noted was part of Barka Slough as first reported by Dial (1980). Holland (1986) does not list a box elder riparian forest or woodland in his classification.

In the Fish and Wildlife Service survey of Barka Slough, 70 ac (28.3 ha) were mapped as box elder woodland, and it was noted that the great blue heron rookery was located almost exclusively in this type (Dial 1980). Reasons for the local dominance of box elder are not known; however, it appears to be an unusual and perhaps unique plant community. The significance of the Barka Slough system has been noted in the past (Smith 1976, Dial 1980, Capelli and Stanley 1984). The box elder woodland does not currently show indications of decline, but its condition should be monitored periodically. If the historic changes in Barka Slough vegetation (Dial 1980) and those occurring since 1980 seen in this study are due to overdraft of ground water, then the forested wetlands in the center of the Slough, including the box elder woodland, will be affected in the future.

Willow riparian woodland. Most of the riparian woodlands on Vandenberg are dominated by willows *(Salix* spp.*)* (Coulombe and Mahrdt 1976), including most of the forested portion of Barka Slough (Dial 1980). In the region, *Salix lasiolepis* (arroyo willow) is often dominant, but *Salix laevigata* (red willow) and *Salix lasiandra* (yellow willow) also occur (Howald et al. 1985). Holland (1986) recognizes a Central Coast Arroyo Willow Riparian Forest in his classification. Several species of willows are major riparian trees throughout California (Holstein 1984).

The importance of riparian systems nationwide (e.g., Johnson and McCormick 1979, Johnson et al. 1985) and in California (Warner and Hendrix 1984) is recognized. Throughout California, riparian vegetation has been greatly reduced since European settlement, with up to 90% losses in some regions due to agricultural and urban development (see Warner and Hendrix 1984). Much of the remaining riparian wetlands in the coastal region of Santa Barbara County is in the northern part of the county (Capelli and Stanley 1984), and most of this occurs on Vandenberg (Mahrdt et al. 1976). Therefore, careful management of these remaining riparian areas is required. Past grazing has impacted some riparian wetlands (Coulombe and Cooper 1976, Dial 1980). The current policy of excluding cattle from wetlands (Richard Nichols, pers. comm.) should be implemented wherever feasible, since grazing has serious negative impacts on riparian areas unless very carefully managed, particularly in arid and semiarid regions (Behnke and Raleigh 1979). The need to monitor the status of Barka Slough was previously discussed. Barka Slough is the only wetlands system on Vandenberg studied in any detail. There is a need for more comprehensive information on wetlands systems on the base so that management decisions can be made on an informed basis.

Freshwater marsh. Freshwater marsh vegetation is of minor extent on Vandenberg. Mahrdt et al. (1976) note that small areas of marsh occur at the mouth of San Antonio Creek, in swales in the coastal dunes, and upstream from the salt marsh on the Santa Ynez River. Coulombe and Cooper (1976) note small areas of marsh vegetation around man-made and natural lakes on base. Some swales and depressions in the San Antonio Terrace also support marsh vegetation (HDR 1979). Composition of these marshes is variable; *Scirpus* spp., *Typha* spp., *Carex* spp., and *Juncus* spp. may be locally important. Howald et al. (1985) indicate some of the complexity of this vegetation in the region. Holland (1986) includes a Coastal and Valley Freshwater Marsh community but notes that types dominated by *Scirpus* and *Typha* require clarification.

The largest and most diverse freshwater marshes were those occurring in Barka Slough (Mahrdt et al. 1976). Dial (1980) mapped 140 ac (56 ha) as marsh dominated by *Scirpus olneyi* and *Typha latifolia* and meadow dominated by *Carex* spp. He noted that the historical extent of these marshes had been much greater, but willows had invaded many areas formerly marsh. Remnants of these marshes still exist, but these appear in transition to uplands vegetation. Areas on the north side of the Slough, mapped as marsh dominated by *Scirpus* and *Typha* in 1980, now are dominated by *Urtica*. Without a reversal of the overdraft of the San Antonio aquifer (see Hydrology section), the continued existence of these marshlands and eventually of the entire Barka Slough system is unlikely. The regional importance of these wetlands, particularly as wildlife habitat, has been recognized (Dial 1980, URS 1987).

Coastal salt marsh. Only one coastal salt marsh occurs on Vandenberg, that associated with the Santa Ynez River and Lagoon (Coulombe and Cooper

1976). This is also the only large coastal salt marsh in northern Santa Barbara County (Mahrdt et al. 1976). With the exception of the San Francisco Bay complex, salt marshes along the California coast were relatively small and distributed discontinuously at river mouths and bays that provided suitable conditions for their formation (Macdonald 1977). Salt marshes and other coastal wetlands in California have been drastically reduced by development. J. Zedler (1982) estimates that only 25% of the salt marshes existing in southern California (Point Conception to the Mexican border) before European settlement remain. Macdonald (1977) documents salt marsh decline for the whole state and Nichols et al. (1986) that for San Francisco Bay.

Salt marsh vegetation differs from northern to southern California. Holland (1986) recognizes two types, northern and southern salt marsh. The Santa Ynez salt marsh is of the northern salt marsh type, since it lacks characteristic southern species (J. Zedler 1982). Macdonald (1977) indicates that another major division of salt marsh vegetation is between marshes with regular tidal fluctuation and those without tides or with only restricted fluctuation. The Santa Ynez lagoon is closed to the ocean much of the year, preventing tidal fluxes, and this salt marsh lacks the zone of *Spartina foliosa* characteristic of tidal marshes. The dominant species of the Santa Ynez salt marsh, *Salicornia virginica* and *Frankenia grandifolia*, are characteristic of these non-tidal marshes (Macdonald 1977). The Carpinteria salt marsh (Ferren 1985) also has a large area dominated by *Salicornia virginica*, although it has some tidal exchange.

Vegetation of the Santa Ynez lagoon is not uniform. Howald et al. (1985) describe and map several types there including salt marsh, transitional marsh, freshwater marsh, riparian scrubland, and riparian woodland. These types appear generally related to the gradient in salinity but have also been influenced by diking and impounding in parts of the wetland system (Howald et al. 1985).

No special interest plants are known to occur in this marsh system. However, it should be considered a rare ecosystem type and has importance as wildlife habitat as recognized in previous studies (Mahrdt et al. 1976, Dames and Moore 1984c, Howald et al. 1985). Future development should avoid impacting this system as much as possible.

Dial (1980) described a remnant inland salt marsh of about 55 ac (22 ha) in Barka Slough but noted that the salt marsh species were being replaced by uplands vegetation. This site was not examined in the present study.

Vernal pools and seasonal wetlands. Vernal pools are small topographic depressions where drainage is restricted by a hardpan or similar soil feature that fill with water during the winter wet season and slowly dry out in spring and summer (Holland and Jain 1977). Vegetation of these pools is usually markedly different from the surrounding vegetation type and typically occurs in concentric rings related to the topographic gradient from mound to pool bottom, the depth and duration of standing water, and associated soil properties (Holland and Jain 1977, Schlising and Sanders 1982). Vernal pools are best developed in the Great Valley in California and are known for their floristic diversity (Holland and Jain 1977). Much of the area once in vernal pools has been lost to development and intensive agriculture.

Vernal pools and associated seasonal wetlands are uncommon in the coastal regions of Santa Barbara County, and those in the northern part of the county are little studied (Howald et al. 1985). On Vandenberg, vernal wetlands were previously reported by Howald et al. (1985), and the composition of some had been examined by Wayne Ferren (pers. comm.). The three sites examined in the present study all differed, indicating some of the diversity of these sites on base. None of these fit the vernal pool community types listed by Holland (1986). Special interest plants encountered in the limited sampling of these wetlands in this study included *Dichondra donnelliana*, *Dudleya blochmaniae* ssp. *blochmaniae*, and *Juncus falcatus* (see Table 12). Other species such as *Eryngium armatum* and *Phalaris lemmonii*, although without any formal protected status, were observed only in these sites. A more complete understanding of the flora and vegetation on these sites would require a more detailed and longer term study. These sites contribute to the floristic and ecological diversity of the base and should be considered when planning future development and construction.

Other vegetation features. There are other features of the vegetation pattern on Vandenberg that were not sampled in this project and will be mentioned only briefly.

Coastal bluff vegetation is a minor type on Vandenberg (Coulombe and Cooper 1976). Steep coastal bluffs have low-growing mats of *Dudleya* spp., *Eriogonum parvifolium*, *Eriophyllum staechadifolium*, *Castilleja* spp., and *Carpobrotus* spp.; on more gradual slopes shrubby vegetation of *Coreopsis gigantea*, *Encelia californica*, *Lupinus* spp., *Artemisia californica*, and *Baccharis pilularis* spp. *consanguinea* occurs (Howald et al. 1985).

Planted stands of trees of blue gum (*Eucalyptus globulus*), Monterey pine (*Pinus radiata*), Monterey cypress (*Cupressus macrocarpa*), and golden wattle (*Acacia longifolia*) occur on the base. Some are in the cantonment area and some in undeveloped areas. Monterey pine and cypress show a limited tendency to spread from plantings. Monterey pine has established seedlings in some areas near the cantonment, and Monterey cypress established after fire in a site on South Base (Diana Hickson, pers. obs.). *Eucalyptus* can have negative impacts on native flora; its spreading appears limited on the base, but has occurred in a few areas such as the area near the north end of the runway and in LaSalle Canyon (Diana Hickson, pers. obs.). Monterey pine and cypress and *Eucalyptus* provide roost and nest sites for birds, and some are used as roost trees for Monarch butterflies. Monarch butterfly roosts are designated an environmentally sensitive habitat by Santa Barbara County and their known locations on base were mapped by URS (1987). *Acacia* species are weed problems in some parts of California, but it is not clear whether the populations on Vandenberg are spreading (Schmalzer and Hinkle 1987b). These types are mapped where possible (Provancha 1988, see also Appendix IX, Table IX-2).

Some areas are dominated by exotic plants such as *Ammophila arenaria* on certain dunes, *Carpobrotus edulis*, and *Cortaderia jubata*. *Carpobrotus* invades burned as well as disturbed areas, while disturbance favors the spread of *Cortaderia*. The potential for controlling these species is reviewed elsewhere (Schmalzer and Hinkle 1987b).

Various disturbed, ruderal, or successional vegetation types occur as a result of past land use practices, old clearings or fields, past grazing, or previous construction. *Baccharis pilularis* ssp. *consanguinea* commonly invades moist sites as on the south side of Barka Slough (Dial 1980) and along the Santa Ynez River (Howald et al. 1985); old fields dominated by *Conium maculatum* also occur (Dial 1980, Paul Schmalzer, pers. obs.). In annual grasslands or formerly grazed areas, areas dominated by *Silybum marianum* (Schmalzer and Hinkle 1987a) or *Brassica nigra* (Paul Schmalzer, pers. obs.) occur. The likely successional changes on these sites are unknown.

RECOMMENDATIONS FOR MANAGEMENT AND FURTHER STUDY

There are several general recommendations and a list of specific ones that are considered important to improving the understanding of ecological conditions on Vandenberg and providing a better basis for management decisions.

There is a need for a continuing program to maintain and update data bases of environmental information. The data bases created by this project, maps, GIS files, lists of special interest plants, species lists, and quantitative vegetation data, will not remain current. New construction, controlled burning, and other management programs will change conditions. New information will accumulate from EIS/EA studies and other projects. Vegetation changes can be expected in response to fire, changing hydrologic conditions, changing grazing regimes, and other factors. Just as the utility of the data supplied by the SDSU study declined over time without being updated, so will the data generated by this project.

There is a need for a monitoring program to follow up on the effects of management actions. While considerable effort has gone into analyzing and predicting environmental effects, little has been done to determine what the effects were afterwards. This monitoring needs to be conducted using valid scientific methods. Several examples can be cited. Deterioration of wetlands vegetation in Barka Slough was shown to have occurred by the Fish and Wildlife Service (Dial 1980), and further declines were predicted by the U.S. Geological Survey (Hutchinson 1980, Mallory 1980); both agencies indicated the importance of monitoring these declines. However, no monitoring was conducted, and data from this study indicate continuing changes in the wetland vegetation on the north side of Barka Slough. The invasion of exotic plants into burned chaparral was not predicted by the environmental assessment for that program (Wakimoto et al. 1980a); neither was it noted by the informal post-fire surveys conducted by base fire personnel. That it was observed by Jacks et al. (1984), Zedler and Scheid (1987), and Hickson (1988) was a fortuitous result of studies with other main objectives; yet this may be a serious problem for the long-term viability of Burton Mesa chaparral. Responses of plant and animal populations, community composition and dynamics, and ecosystem properties are not so readily predicted that environmental impacts can be reliably assessed without monitoring to complement the process.

There are many plant communities on Vandenberg about which relatively little is known, many special interest plants for which there is little information on distribution or species ecology, and many other pertinent ecological questions. Vandenberg has preserved from extensive development examples of plant communities, populations of special interest plants, and other features such as active and stabilized dunes that are of significant scientific interest. In the past, there have been relatively few studies on Vandenberg by university scientists and few studies of general ecological questions not directly related to Air Force mission requirements. Exceptions to this include studies of Bishop pine forests (Zedler 1977b), populations of *Cirsium rhothophilum* (Zedler 1979, Zedler et al. 1983b), and responses to fire of *Eriodictyon capitatum* (Jacks et al. 1984). It would be of benefit to the base to maintain contacts with university scientists and to facilitate base access for studies of mutual interest, where possible. The Burton Mesa fire ecology study (Davis et al. 1987, Hickson 1987a) and the ongoing study of *Carpobrotus* by Carla D'Antonio are recent examples of university studies yielding important information.

In specific, there are a number of areas where additional information is needed.

Vegetation conditions in Barka Slough need to be monitored in relation to changes in groundwater hydrology. The decline of wetland vegetation on the north side of Barka Slough appears to confirm past predictions. Sampling there in this study was necessarily limited by the basewide scope of the project and the time available. A larger network of permanent transects and plots should be established and resampled periodically. Groundwater levels and the flow rate of San Antonio Creek should also be monitored. Barka Slough is considered one of the most important wetlands in the region; its loss from groundwater withdrawal would be ecologically significant. Since the base currently depends on the San Antonio aquifer for its primary water supply, the situation needs careful monitoring.

There is a need for much more comprehensive information on fire ecology, particularly in relation to the controlled burning program, the endemic Burton Mesa chaparral, and the spread of exotic plants. Hickson (1988) has presented detailed recommendations in this regard. Two separate studies, one of the 35th Street *Eriodictyon* site (Jacks et al. 1984, Zedler and Scheid 1987) and a survey of recent burns (Hickson 1988), indicate that fire encourages the spread of *Carpobrotus edulis*. Modifications to the controlled burning program need to be considered including longer fire cycles, limiting soil disturbance from firebreaks, and control or removal of exotic plants (Hickson 1988, Schmalzer and Hinkle 1987b). Monitoring of botanical composition of burn areas has been identified by base personnel as an information requirement but has not been funded (Richard Nichols, pers. comm.).

Category 1 and 2 plants have been considered in most EIS and EA studies, and available information was compiled in this study. However, distribution of some of the species is poorly understood, and there are taxonomic uncertainties with several taxa. A specific study of these special interest plants to examine populations in the field, determine if previously identified populations are extant, determine ranges of poorly known species, examine herbarium specimens, and enter the new information into a GIS data base would be valuable. Inventories of endangered species for each base are required by AFR 126-1 and have been identified as requirements by base personnel, but additional work has not been funded (Richard Nichols, pers. comm.).

Establishment of permanent vegetation samples (plots, transects) in other sites sampled by SDSU or in new sites of priority to the base would create a larger and more reliable data base to compare to historical information and to monitor future changes.

Areas of serpentine bedrock on Vandenberg support a flora distinct from adjacent substrates. The survey of these areas in this study was limited to one time period. To prepare a complete floristic inventory of serpentine areas and determine for certain if serpentine endemics or other special interest plants are present, representative serpentine areas on both the northern and southern parts of the base should be visited periodically throughout the growing season and plant specimens collected and identified.

Many of the wetlands vegetation types on Vandenberg and their associated flora are poorly understood. This makes the ecological assessment of projects that impact wetlands difficult (e.g., Versar 1987). Vernal pools and seasonal wetlands present in some areas of chaparral and coastal sage scrub received limited sampling in this study; some were previously examined by Wayne Ferren (University of California, Santa Barbara). Some wetlands in stabilized dunes on the San Antonio Terrace were examined by HDR (1979). Riparian areas outside of Barka Slough have also received only minor attention (Coulombe and Mahrdt 1976, this study). A comprehensive survey of wetlands vegetation and flora is required to understand these vegetation types, to provide a basis for impact assessment, and to determine responses to mitigation strategies such as fencing cattle out of riparian zones. Wetlands inventories are required by AFR 126-1 but have not been funded for Vandenberg (Richard Nichols, pers. comm.).

The preparation of a complete floristic list for the base should be a long-term goal. Accurate records of floristic inventories completed for various projects should be kept and added to the preliminary data base established in this study. In addition, field surveys in various plant communities at different times of the year, examination of herbarium records and specimens at important regional herbaria, and resolution of taxonomic questions will be necessary to produce a reliable list. The need for a complete floristic list is recognized by base personnel but has not been funded (Richard Nichols, pers. comm.).

Photographic coverage of the base of similar quality and resolution to that obtained for this study and/or LANDSAT imagery (depending on the utility of each to the base) should be obtained at intervals of every five years to maintain a data base for determining changes in land use and vegetation, fire history, and soil erosion conditions.

CONCLUSIONS

1) Vandenberg contains a large, diverse vascular flora due to the diversity of plant communities and environmental conditions, ranging from tanbark oak forest to coastal dunes, and its position in a transitional region between northern and southern California. A complete floristic list is not available and will require further work.

2) Many special interest plants occur on Vandenberg. For some of these taxa, the populations on base represent a significant part of those remaining

anywhere. Coastal dunes, stabilized dunes (coastal dune scrub), and Burton Mesa chaparral are particularly rich in special interest plants and require special management consideration.

3) Serpentine areas on Vandenberg are floristically distinct from adjacent substrates, although serpentine endemic plants have not been found. Additional work is required for a complete inventory of the serpentine flora on base.

4) Seasonal wetlands and vernal pools are distinct ecological communities with a unique flora that have not been studied in detail on Vandenberg.

5) No major changes in the plant communities originally sampled by SDSU and resampled in this study could be determined. There are limits to this conclusion, since only the composite data and not the original stand data from the SDSU study are extant, not all of the SDSU stands were resampled, and the chaparral stands sampled by SDSU had not burned in wild or controlled fires since they were established, making no assessment of fire effects and responses possible from these data.

6) Wetlands on the north side of Barka Slough have deteriorated and are being replaced by ruderal communities as compared to conditions documented by the Fish and Wildlife Service in 1980. These changes are probably related to groundwater withdrawal from the San Antonio aquifer and need to be studied and monitored in greater detail to predict the future of the Barka Slough system and guide management actions.

7) Vandenberg contains remaining areas of several plant communities that are rare or declining on a regional basis. Tanbark oak forest and Bishop pine forest are relict communities south of their main present range. Burton Mesa chaparral is a regionally endemic community much reduced from its

former extent. Coastal dunes and coastal dune scrub have declined from development, recreational use, and the spread of exotic plants. Wetlands (riparian, coastal, and other types) are also significant regional features for their vegetation and as wildlife habitat. These communities need to be considered when planning future development, evaluating management actions (e.g., controlled burning), and determining priorities for further work.

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APPENDIX I

BIBLIOGRAPHY OF VEGETATION AND RELATED TOPICS RELEVANT TO VANDENBERG

Bibliography of Vegetation and Associated
Topics Relevant to Vandenberg AFB

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APPENDIX II

PRELIMINARY PLANT SPECIES LIST FOR VANDENBERG, ARRANGED BY GENERA

PRELIMINARY SPECIES LIST
Vandenberg Air Force Base

Family Name	Genus Name	Species Name	Variety	Subspecies	References
Nyctaginaceae	Abronia	latifolia			1,9,12,15
Nyctaginaceae	Abronia	latifolia	Xmaritima		16
Nyctaginaceae	Abronia	maritima			1,7,9,12,15
Nyctaginaceae	Abronia	umbellata			1,2,9,10,20
Fabaceae	Acacia	longifolia			10,20
Fabaceae	Acacia	melanoxylon			20
Aceraceae	Acer	negundo		californicum	2,3,6,7,9,11,15
Asteraceae	Achillea	millefolium			2,3,7,8,10,15,20
Asteraceae	Achillea	millefolium	californica		6
Rosaceae	Adenostoma	fasciculatum			1,2,3,4,7,8,9,12,14,15,17
Polypodiaceae	Adiantum	jordanii			2,8,15,20
Poaceae	Agrostis	diegoensis			2,3,15,20
Poaceae	Agrostis	exarata			8
Poaceae	Agrostis	hooveri			2,16
Poaceae	Agrostis	semiverticillata			6
Poaceae	Agrostis	stolonifera	major		11
Rosaceae	Alchemilla	occidentalis			5
Amaranthaceae	Amaranthus	albus			6
Amaranthaceae	Amaranthus	hybridus			6
Amaranthaceae	Amaranthus	powellii			6
Asteraceae	Amblyopappus	pusillus			16
Asteraceae	Ambrosia	acanthicarpa			11
Asteraceae	Ambrosia	chamissonis		bipinnatisecta	1,7,9,12,15
Asteraceae	Ambrosia	psilostachya	californica		1,2,3,4,5,6
Poaceae	Ammophila	arenaria			1,2,10,15
Boraginaceae	Amsinckia	intermedia			2,3,6,7,11,13,15,20
Boraginaceae	Amsinckia	menziesii			6
Boraginaceae	Amsinckia	spectabilis	microcarpa		2,6,10,16
Boraginaceae	Amsinckia	spectabilis	spectabilis		1,5,14,15,20
Primulaceae	Anagallis	arvensis			1,2,3,5,6,7,10,11,12,14,15,20
Primulaceae	Anagallis	arvensis	caerulea		11
Asteraceae	Anthemis	cotula			6,11,20
Chenopodiaceae	Aphanisma	blitoides			16
Apiaceae	Apiastrum	angustifolium			2,6,7,9,14,15
Apiaceae	Apium	graveolens			2,3,6,11,20
Ericaceae	Arctostaphylos	glandulosa			7
Ericaceae	Arctostaphylos	purissima			2,3,4,14,8,15,20
Ericaceae	Arctostaphylos	rudis			2,3,4,7,8,9,12,14,15
Ericaceae	Arctostaphylos	tomentosa			2,15
Ericaceae	Arctostaphylos	viridissima			7,9,12
Caryophyllaceae	Arenaria	douglasii			14,16
Asteraceae	Artemisia	biennis			6
Asteraceae	Artemisia	californica			1-15,17,20
Asteraceae	Artemisia	douglasiana			2,3,4,6,7,11,15,20
Asteraceae	Artemisia	dracunculus			7,10,20
Asteraceae	Aster	chilensis			6
Asteraceae	Aster	radulinus			15
Fabaceae	Astragalus	curtipes			11
Fabaceae	Astragalus	nuttallii			2,7,9,10,12,20
Fabaceae	Astragalus	pomonensis			1,5,6
Chenopodiaceae	Atriplex	patula	hastata		1,2,3,6,11
Chenopodiaceae	Atriplex	semibaccata			1,2,3,5,6,12,15,20

PRELIMINARY SPECIES LIST
Vandenberg Air Force Base

Family Name	Genus Name	Species Name	Variety	Subspecies	References
Chenopodiaceae	Atriplex	serenana			6
Poaceae	Avena	barbata			2,3,5,6,11,14,15,20
Poaceae	Avena	fatua			2,3,4,7,9,11,13,20
Poaceae	Avena	sativa			6
Polypodiaceae	Azolla	filiculoides			6,7,10,11
Asteraceae	Baccharis	douglasii			2,3,6,7,9,10,11,15,20
Asteraceae	Baccharis	glutinosa			2,3,6,11,17,20
Asteraceae	Baccharis	pilularis		consanguinea	all except 16,18,19
Apiaceae	Berula	erecta			2,6
Amaryllidaceae	Bloomeria	crocea			2,14,15
Apiaceae	Bowlesia	incana			6,11
Brassicaceae	Brassica	campestris			5,6,7,8,9,11,20
Brassicaceae	Brassica	geniculata			5,6,12
Brassicaceae	Brassica	kaber			6
Brassicaceae	Brassica	nigra			1,2,3,4,6,8,10,11,15,17, 20
Brassicaceae	Brassica	oleracea			6
Amaryllidaceae	Brodiaea	jolonensis			16
Poaceae	Bromus	arizonicus			6,15
Poaceae	Bromus	carinatus	carinatus		6,15,20
Poaceae	Bromus	commutatus			11
Poaceae	Bromus	diandrus			all except 1,8,16,18,19
Poaceae	Bromus	mollis			2-7,10-15,17,20
Poaceae	Bromus	rubens			2,3,5-10,12-15,17,20
Poaceae	Bromus	tectorum			8
Poaceae	Bromus	willdenovii			6
Brassicaceae	Cakile	maritima			1,7,9,12,15
Portulacaceae	Calandrinia	breweri			14,20
Portulacaceae	Calandrinia	ciliata	menziesii		2,6,15,20
Callitrichaceae	Callitriche	marginata			16
Liliaceae	Calochortus	albus			14
Liliaceae	Calochortus	venustus			16
Portulacaceae	Calyptridium	monandrum			14,15
Convolvulaceae	Calystegia	macrostegia		cyclostegia	2,3,5,6,11,12,14,15,20
Convolvulaceae	Calystegia	soldanella			7,9,12,13
Convolvulaceae	Calystegia	subacaulis			3
Onagraceae	Camissonia	cheiranthifolia		cheiranthifolia	1,5,6,12,15,20
Onagraceae	Camissonia	micrantha			2,3,5,6,7,10,11,14,15,17, 20
Onagraceae	Camissonia	strigulosa			6,14,20
Brassicaceae	Capsella	bursa-pastoris			2,6,11,12,15
Brassicaceae	Cardamine	gambelii			11
Brassicaceae	Cardamine	oligosperma			15
Brassicaceae	Cardaria	draba			2,6
Caryophyllaceae	Cardionema	ramosissimum			2,3,4,5,10,12,15,20
Asteraceae	Carduus	pyncnocephalus			2,4,5,6,17,20
Asteraceae	Carduus	tenuiflorus			11
Cyperaceae	Carex	barbarae			2,3,11
Cyperaceae	Carex	globosa			2,3,14,15
Cyperaceae	Carex	lanuginosa			11
Cyperaceae	Carex	pansa			10
Cyperaceae	Carex	praegracilis			1,2,3,4,11,15
Cyperaceae	Carex	schottii			15

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Family Name	Genus Name	Species Name	Variety	Subspecies	References
Cyperaceae	Carex	subbracteata			6
Cyperaceae	Carex	triquetra			15
Aizoaceae	Carpobrotus	aequilateris			1,5,7,9,10,15
Aizoaceae	Carpobrotus	aequilateris	Xedulis		10
Aizoaceae	Carpobrotus	edulis			1,2,4,5,6,7,10,12,14,15,20
Scrophulariaceae	Castilleja	affinis			13,20
Scrophulariaceae	Castilleja	mollis			9,10,20
Apiaceae	Caucalis	microcarpa			6
Rhamnaceae	Ceanothus	cuneatus			8,20
Rhamnaceae	Ceanothus	impressus	impressus		2,3,4,7,9,12,13,14,15,20
Rhamnaceae	Ceanothus	oliganthus			15
Rhamnaceae	Ceanothus	papillosus	roweanus		7,9,15
Rhamnaceae	Ceanothus	ramulosus	fascicularis		2,3,4,7,9,12,14,15,17,20
Rhamnaceae	Ceanothus	thyrsiflorus			9,20
Asteraceae	Centaurea	melitensis			2,3,6,11,12,15
Asteraceae	Centaurea	solstitialis			5,8
Gentianaceae	Centaurium	davyi			15
Caryophyllaceae	Cerastium	glomeratum			11
Ceratophyllaceae	Ceratophyllum	demersum			11
Rosaceae	Cercocarpus	betuloides	betuloides		2,6,7,9,17
Asteraceae	Chaenactis	glabriuscula			11
Asteraceae	Chaetopappa	alsinoides			16
Chenopodiaceae	Chenopodium	album			6
Chenopodiaceae	Chenopodium	ambrosioides	ambrosioides		6
Chenopodiaceae	Chenopodium	ambrosioides	anthelminticum		6
Chenopodiaceae	Chenopodium	berlandieri			6
Chenopodiaceae	Chenopodium	californicum			1,2,5,6,7,10,11,14,15,17, 20
Chenopodiaceae	Chenopodium	macrospermum	farinosum		11
Chenopodiaceae	Chenopodium	murale			2,11,12,20
Liliaceae	Chlorogalum	pomeridianum			2,6,14,15
Polygonaceae	Chorizanthe	angustifolia			1,5
Polygonaceae	Chorizanthe	californica	californica		1,2,6,11,14,15,20
Polygonaceae	Chorizanthe	californica	suksdorfii		10,12,18
Polygonaceae	Chorizanthe	coriacea			12,14
Polygonaceae	Chorizanthe	diffusa	nivea		14,15
Polygonaceae	Chorizanthe	obovata			15
Polygonaceae	Chorizanthe	palmeri			15
Polygonaceae	Chorizanthe	pungens			5,18
Asteraceae	Chrysopsis	villosa	echioides		2,3
Apiaceae	Cicuta	douglasii			2,3,6,11,15
Asteraceae	Cirsium	arvense			15
Asteraceae	Cirsium	brevistylum			2,3,6,11,15,20
Asteraceae	Cirsium	californicum			12,14,15
Asteraceae	Cirsium	loncholepis			16
Asteraceae	Cirsium	occidentale			1,2,4,5,6,10,14,15,17,20
Asteraceae	Cirsium	rhothophilum			7,9,12,15
Asteraceae	Cirsium	vulgare			2,3,6,8
Cyperaceae	Cladium	californicum			11,15
Onagraceae	Clarkia	purpurea			14,15
Portulacaceae	Claytonia	perfoliata	parviflora		6
Portulacaceae	Claytonia	perfoliata	perfoliata		2,5,6,7,11,14,15,17,20
Ranunculaceae	Clematis	lasiantha			10

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Family Name	Genus Name	Species Name	Variety	Subspecies	References
Ranunculaceae	Clematis	ligusticifolia			6,7,20
Asteraceae	Cnicus	benedictus			2
Scrophulariaceae	Collinsia	heterophylla			2
Aizoaceae	Conicosia	pugioniformis			2,4,5,6,9,10,12,14,15,20
Apiaceae	Conium	maculatum			1,2,3,5,6,7,8,9,10,11,14, 15,20
Convolvulaceae	Convolvulus	arvensis			2,6,20
Asteraceae	Conyza	bonariensis			2,6,20
Asteraceae	Conyza	canadensis			2,3,4,5,6,8,10,15,20
Asteraceae	Conyza	coulteri			1,15
Scrophulariaceae	Cordylanthus	rigidus		littoralis	2
Scrophulariaceae	Cordylanthus	rigidus		rigidus	2,14
Asteraceae	Coreopsis	gigantea			1,7,9,10,12,13,15,20
Asteraceae	Corethrogyne	filaginafolia			1-10,12,14,15,17,20
Cornaceae	Cornus	glabrata			6
Cornaceae	Cornus	occidentalis			11
Cornaceae	Cornus	stolonifera	californica		2,3,6,15
Poaceae	Cortaderia	jubata			2,6,15
Asteraceae	Cotula	australis			2,3,11,15
Asteraceae	Cotula	coronopifolia			1,2,3,6,7,9,11,15
Crassulaceae	Crassula	aquatica			16
Crassulaceae	Crassula	erecta			2,6,14,15,20
Euphorbiaceae	Croton	californicus	californicus		1-12,14,15,17,20
Boraginaceae	Cryptantha	clevelandii			7,9,14,15
Boraginaceae	Cryptantha	intermedia			6,11,12
Boraginaceae	Cryptantha	leiocarpa			2,9,10,15
Cucurbitaceae	Cucurbita	foetidissima			6
Cupressaceae	Cupressus	macrocarpa			4,6,10
Convolvulaceae	Cuscuta	californica			6
Convolvulaceae	Cuscuta	salina			1
Poaceae	Cynodon	dactylon			2,3,6
Cyperaceae	Cyperus	alternifolius			2,10
Cyperaceae	Cyperus	eragrostis			6,7,9,11
Cyperaceae	Cyperus	esculentus			9
Solanaceae	Datura	meteloides			6,9
Apiaceae	Daucus	pusillus			5,14,15
Ranunculaceae	Delphinium	parryi			14
Papaveraceae	Dendromecon	rigida			2,7,14
Brassicaceae	Dentaria	integrifolia	californica		2,3,8
Brassicaceae	Descurainia	pinnata		menziesii	1,7,10,14,15
Caryophyllaceae	Dianthus	barbatus			6
Fumariaceae	Dicentra	ochroleuca			7
Amaryllidaceae	Dichelostemma	pulchellum			2,3,6,8,14,15
Convolvulaceae	Dichondra	donnelliana			13,15,16
Dipsacaceae	Dipsacus	sativus			6
Poaceae	Distichlis	spicata			1,2,3,6,9,11,15,20
Brassicaceae	Dithyrea	maritima			9,15,16
Aspidiaceae	Dryopteris	arguta			2,6,7,15,20
Crassulaceae	Dudleya	blochmaniae		blochmaniae	15,16
Crassulaceae	Dudleya	caespitosa			10,12,15,20
Crassulaceae	Dudleya	farinosa			7,9
Crassulaceae	Dudleya	lanceolata			1,2,3,6,14,15,20

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Family Name	Genus Name	Species Name	Variety	Subspecies	References
Poaceae	Echinochloa	crusgalli			6
Poaceae	Ehrharta	calycina			2,3,4,5,6,10,15,20
Cyperaceae	Eleocharis	macrostachya			11
Cyperaceae	Eleocharis	parishii			11
Cyperaceae	Eleocharis	sp.			6,15
Poaceae	Elymus	condensatus			2,3,6,7,8,9,10,13,15,17,20
Poaceae	Elymus	glaucus		glaucus	6,15
Poaceae	Elymus	triticoides		triticoides	2,3,4,6,11,15
Hydrophyllaceae	Emmenanthe	penduliflora			20
Asteraceae	Encelia	californica			2,7,9,15,17,20
Onagraceae	Epilobium	adenocaulon			2,3,6,9,11,20
Onagraceae	Epilobium	paniculatum			6
Orchidaceae	Epipactis	gigantea			11
Equisetaceae	Equisetum	arvense			11
Equisetaceae	Equisetum	laevigatum			6,11
Equisetaceae	Equisetum	telmateia	braunii		7,9,20
Asteraceae	Erechtites	arguta			2,3,6,15
Euphorbiaceae	Eremocarpus	setigerus			2,3,6,7,8,9,17
Polemoniaceae	Eriastrum	densifolium		densifolium	9,10,15
Polemoniaceae	Eriastrum	densifolium		elongatum	2,9,14,15
Asteraceae	Ericamaria	ericoides		ericoides	1-10,12-15,17,20
Asteraceae	Erigeron	foliosus	blochmaniae		7,9,10,12,15,16,20
Asteraceae	Erigeron	foliosus	foliosus		6
Asteraceae	Erigeron	philadelphicus			11
Asteraceae	Erigeron	sanctarum			14,16
Hydrophyllaceae	Eriodictyon	capitatum			16
Polygonaceae	Eriogonum	elongatum			2,6,15
Polygonaceae	Eriogonum	fasiculatum			6,13,20
Polygonaceae	Eriogonum	gracile			2,3,6
Polygonaceae	Eriogonum	parvifolium	parvifolium		2,3,4,5,7,8,9,10,12,14,15, 17,20
Asteraceae	Eriophyllum	confertiflorum			2,3,8,9,12,14,15,20
Asteraceae	Eriophyllum	multicaule			6,8,12,14
Asteraceae	Eriophyllum	staechadifolium		artemisiaefolium	1,5,7,9,12,14,15,20
Geraniaceae	Erodium	botrys			2,3,5,6,12,13,14,15,20
Geraniaceae	Erodium	cicutarium			2-9,11-15,17,20
Geraniaceae	Erodium	moschatum			2,6,17
Apiaceae	Eryngium	armatum			15
Brassicaceae	Erysimum	suffrutescens	grandifolium		2,5,7,9,10,13,15,20
Brassicaceae	Erysimum	suffrutescens	lompocense		2,8,9,20
Papaveraceae	Eschscholzia	californica	californica		1,2,3,4,5,6,10,13,15,20
Papaveraceae	Eschscholzia	californica	maritima		12,15,20
Myrtaceae	Eucalyptus	globulus			2,4,6,8,10,17,20
Hydrophyllaceae	Eucrypta	chrysanthemifolia			2,15
Euphorbiaceae	Euphorbia	crenulata			5
Euphorbiaceae	Euphorbia	lathyris			10
Euphorbiaceae	Euphorbia	maculata			6
Euphorbiaceae	Euphorbia	peplus			20
Euphorbiaceae	Euphorbia	prostrata			6
Asteraceae	Evax	sparsiflora			16
Asteraceae	Filago	arizonica			11
Asteraceae	Filago	californica			2,14,15
Asteraceae	Filago	gallica			2,14,15

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Family Name	Genus Name	Species Name	Variety	Subspecies	References
Apiaceae	Foeniculum	vulgare			2,3,6,7,9,11
Frankeniaceae	Frankenia	grandifolia			1,2,3,6,7,9,11,15
Liliaceae	Fritillaria	biflora			18
Rubiaceae	Galium	andrewsii			7,14
Rubiaceae	Galium	aparine			6,7,11,15,20
Rubiaceae	Galium	californicum			5
Rubiaceae	Galium	nuttallii			2,3,6,7,14,15,17
Rubiaceae	Galium	spurium	echinospermum		20
Rubiaceae	Galium	trifidum	subbiflorum		11
Aizoaceae	Gasoul	crystallinum			1,7,9,11,20
Aizoaceae	Gasoul	nodiflorum			1
Poaceae	Gastridium	ventricosum			2,6,14,15
Asteraceae	Gazania	longiscapa			6
Geraniaceae	Geranium	carolinianum			6,11
Polemoniaceae	Gilia	archilleafolia			15
Polemoniaceae	Gilia	austrooccidental			14
Polemoniaceae	Gilia	capitata		abrotanifolia	11,15
Polemoniaceae	Gilia	clivorum			6,14
Asteraceae	Gnaphalium	beneolens			4,6,14,15
Asteraceae	Gnaphalium	bicolor			2,5,10,15,20
Asteraceae	Gnaphalium	californicum			1,2,3,6,7,10,14,15,20
Asteraceae	Gnaphalium	chilense			1,2,6,15,20
Asteraceae	Gnaphalium	luteo-album			2,5,6,7,14,15,20
Asteraceae	Gnaphalium	microcephalum			2,3,10,15,20
Asteraceae	Gnaphalium	palustre			11
Asteraceae	Gnaphalium	purpureum			8,11,14,15,20
Asteraceae	Gnaphalium	ramosissimum			1,2,6,7,9,10,11,12,14,15, 20
Asteraceae	Grindelia	latifolia			2,18
Orchidaceae	Habenaria	elegans			15
Asteraceae	Haplopappus	squarrosus			2,3,9,13,15
Asteraceae	Haplopappus	venetus		vernonioides	1,6,7,8,9,12,13,15,20
Asteraceae	Haplopappus	venetus	sedoides		12,15
Asteraceae	Helenium	bolanderi			7
Asteraceae	Helenium	puberulum			2,3,6,7,9,10,11,15,20
Cistaceae	Helianthemum	scoparium			2,3,4,14,15,20
Boraginaceae	Heliotropium	curassavicum	oculatum		1,2,3,6,7,9,10,11,15
Asteraceae	Hemizonia	fasciculata			15
Asteraceae	Hemizonia	paniculata		increscens	2,4,9,11,15,20
Asteraceae	Hemizonia	ramosissima			2,3
Urticaceae	Hesperocnide	tenella			5,6,11,14,15
Rosaceae	Heteromeles	arbutifolia			2,3,4,8,15,17,20
Asteraceae	Heterotheca	grandiflora			2,3,4,6,14,17,20
Saxifragaceae	Heuchera	pilosissima	hemisphaerica		7
Poaceae	Hordeum	depressum			11
Poaceae	Hordeum	geniculatum			2,3,6
Poaceae	Hordeum	glaucum			6,11
Poaceae	Hordeum	leporinum			5,6,12,13,15,20
Poaceae	Hordeum	vulgare	vulgare		2,6
Rosaceae	Horkelia	cuneata			2,3,4,5,6,7,14,10,15,20
Apiaceae	Hydrocotyle	ranunculoides			6
Apiaceae	Hydrocotyle	verticillata			10,11
Asteraceae	Hypochoeris	glabra			2,3,5,6,9,11,12,14,15,20

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Family Name	Genus Name	Species Name	Variety	Subspecies	References
Asteraceae	Hypochoeris	radicata			6
Asteraceae	Jaumea	carnosa			1,6,7,9
Juglandaceae	Juglans	californica			9
Juncaceae	Juncus	balticus			2
Juncaceae	Juncus	bufonius	bufonius		6,17,20
Juncaceae	Juncus	effusus	brunneus		2,3,6,10,11,17,20
Juncaceae	Juncus	falcatus			15
Juncaceae	Juncus	leseurii			1,7,9,10
Juncaceae	Juncus	mexicanus			6,15
Juncaceae	Juncus	oxymeris			7,9,11
Juncaceae	Juncus	patens			2,3,4,11,12,15
Juncaceae	Juncus	phaeocephalus	paniculatus		11
Juncaceae	Juncus	phaeocephalus	phaeocephalus		2,3,6,10,15
Juncaceae	Juncus	sphaerocarpus			11
Juncaceae	Juncus	tenuis			8
Juncaceae	Juncus	textilis			1,2,6,10,15
Juncaceae	Juncus	xiphioides			2,6,8,9,20
Scrophulariaceae	Kickxia	elatine			6
Poaceae	Koeleria	macrantha			2,3,15
Poaceae	Koeleria	phleoides			6,11,14
Asteraceae	Lactuca	serriola			2,3,6,11
Poaceae	Lamarckia	aurea			2,6,11,12,15,20
Asteraceae	Lasthenia	chrysostoma			2,3
Asteraceae	Layia	glandulosa			2,3,14,20
Asteraceae	Layia	hieracioides			5
Asteraceae	Layia	paniculata			10,14
Asteraceae	Layia	platyglossa			15
Lemnaceae	Lemna	minima			2,3,6,7,11
Brassicaceae	Lepidium	campestre			7
Brassicaceae	Lepidium	nitidum	nitidum		20
Brassicaceae	Lepidium	virginicum	pubescens		6
Polemoniaceae	Leptodactylon	californicum		californicum	2,14
Asteraceae	Lessingia	germanorum	pectinata		2,3,6
Polemoniaceae	Linanthus	androsaces			15
Polemoniaceae	Linanthus	dichotomus			14
Scrophulariaceae	Linaria	canadensis	texana		5,11,14,15,20
Fagaceae	Lithocarpus	densiflora			7,9,15
Brassicaceae	Lobularia	maritima			6,20
Caryophyllaceae	Loeflingia	squarrosa			14
Poaceae	Lolium	perenne		multiflorum	1,2,3,6,11,13,15,20
Poaceae	Lolium	perenne		perenne	6
Poaceae	Lolium	temulentum	temulentum		3,6,9,10
Apiaceae	Lomatium	utriculatum			15
Caprifoliaceae	Lonicera	hispidula	vacillans		2,3,7,17
Caprifoliaceae	Lonicera	involucrata	ledebourii		2,3,6,7,9,10,11,15,20
Fabaceae	Lotus	corniculatus			2,3
Fabaceae	Lotus	hamatus			14
Fabaceae	Lotus	heermannii	eriophorus		16
Fabaceae	Lotus	humistratus			6
Fabaceae	Lotus	junceus			5,15,20
Fabaceae	Lotus	oblongifolius			11
Fabaceae	Lotus	purshianus			6
Fabaceae	Lotus	salsuginosus			6

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Family Name	Genus Name	Species Name	Variety	Subspecies	References
Fabaceae	Lotus	scoparius		scoparius	2-10,12,14,15,17,20
Fabaceae	Lotus	strigosus	hirtellus		6,15
Fabaceae	Lotus	strigosus	strigosus		6,14
Fabaceae	Lotus	subpinnatus			5
Fabaceae	Lupinus	albifrons			4,6,20
Fabaceae	Lupinus	arboreus			2,3,4,5,6,10,13,17,20
Fabaceae	Lupinus	bicolor		umbellatus	6,14,15
Fabaceae	Lupinus	chamissonis			1,2,3,5,7,8,9,10,11,14,15, 17,20
Fabaceae	Lupinus	longifolius			11
Fabaceae	Lupinus	nanus	nanus		5,6,20
Fabaceae	Lupinus	succulentus			6,15
Fabaceae	Lupinus	truncatus			6,14
Lythraceae	Lythrum	hyssopifolia			2,3
Asteraceae	Madia	exigua			2,3,14
Asteraceae	Madia	sativa			2,4,5,6,8,11,20
Malvaceae	Malacothamnus	fasciculatus			2,3
Asteraceae	Malacothrix	incana	succulenta		9,12,15
Asteraceae	Malacothrix	saxatilis	saxatilis		15
Malvaceae	Malva	nicaeensis			6,20
Malvaceae	Malva	parviflora			2,3,6,11,15,17,20
Cucurbitaceae	Marah	fabaceus			2,3,5,6,7,8,9,14,15
Cucurbitaceae	Marah	macrocarpus			20
Liliaceae	Mariposa	agrillosa			15
Lamiaceae	Marrubium	vulgare			1,2,3,5,6,8,11,15,20
Fabaceae	Medicago	polymorpha			2,6,7,11,12,15,20
Poaceae	Melica	imperfecta	imperfecta		2,14,15,20
Poaceae	Melica	imperfecta	refracta		15
Fabaceae	Melilotus	albus			2,6,7,9,14
Fabaceae	Melilotus	indicus			1,5,6,7,9,10,11,14,15,20
Asteraceae	Microseris	linearifolia			14
Scrophulariaceae	Mimulus	aurantiacus		aurantiacus	4,5,6,8,10,13,14,15
Scrophulariaceae	Mimulus	aurantiacus		lompocensis	2,3,7,9,12,20
Scrophulariaceae	Mimulus	cardinalis			2
Scrophulariaceae	Mimulus	floribundus			10
Scrophulariaceae	Mimulus	guttatus			2,3,6,10,11,15
Scrophulariaceae	Mimulus	subsecundus			14
Nyctaginaceae	Mirabilis	californica			15,20
Lamiaceae	Monardella	crispa			1,2,4,9,12,15,16
Lamiaceae	Monardella	undulata	frutescens		10,16,19,20
Lamiaceae	Monardella	undulata	undulata		19
Lamiaceae	Monardella	villosa	obispoensis		15
Myricaceae	Myrica	californica			2,3,6,9,10,11,15
Polemoniaceae	Navarretia	atractyloides			2,4,6,14,15
Campanulaceae	Nemacladus	sp.			14
Solanaceae	Nicotiana	glauca			2,6,8,11
Apiaceae	Oenanthe	sarmentosa			2,3,6,10,11,20
Onagraceae	Oenothera	californica			1
Cactaceae	Opuntia	ficus-indica			6
Cactaceae	Opuntia	littoralis			6
Cactaceae	Opuntia	phaeacantha	major		2,3
Scrophulariaceae	Orthocarpus	densiflorus			17
Scrophulariaceae	Orthocarpus	purpurascens			5,14,20

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Family Name	Genus Name	Species Name	Variety	Subspecies	References
Poaceae	Oryzopsis	miliacea			6
Rosaceae	Osmaronia	cerasiformis			15
Oxalidaceae	Oxalis	albicans		pilosa	6,8,15
Oxalidaceae	Oxalis	corniculata			6,8
Oxalidaceae	Oxalis	pes-caprae			15,20
Paeoniaceae	Paeonia	californica			2,6,8,14,15,20
Poaceae	Parapholis	incurva			15
Moraceae	Parietaria	hespera	californica		15
Poaceae	Paspalum	dilatatum			6
Scrophulariaceae	Pedicularis	densiflora			14
Polypodiaceae	Pellaea	andromedaefolia			8
Poaceae	Pennisetum	clandestinum			6
Scrophulariaceae	Penstemon	centranthifolius			2,6
Scrophulariaceae	Penstemon	cordifolius			9
Asteraceae	Perezia	microcephala			2,6,7,15,17
Apiaceae	Petroselinum	crispum			6
Hydrophyllaceae	Phacelia	distans			10,20
Hydrophyllaceae	Phacelia	douglasii			14
Hydrophyllaceae	Phacelia	ramosissimum			1,2,3,4,5,6,7,9,10,15,17, 20
Hydrophyllaceae	Phacelia	tanacetifolia			10
Hydrophyllaceae	Phacelia	viscida			11
Poaceae	Phalaris	californica			20
Poaceae	Phalaris	canariensis			6,11
Poaceae	Phalaris	lemmonii			15
Poaceae	Phalaris	minor			6
Hydrophyllaceae	Pholistoma	auritum			2,6,7,15,17
Asteraceae	Picris	echioides			1,2,3,4,5,6,11,15,20
Pinaceae	Pinus	muricata			2,4,7,9,15,20
Pinaceae	Pinus	radiata			6,8,10
Polypodiaceae	Pityrogramma	triangularis			2,3,6,8,15,17
Plantaginaceae	Plantago	coronopus			2,3,5,6,8,11,15,20
Plantaginaceae	Plantago	erecta			2,5,6,14,15,20
Plantaginaceae	Plantago	hirtella	galeottiana		11
Plantaginaceae	Plantago	lanceolata			6
Plantaginaceae	Plantago	major			8,10
Plantaginaceae	Plantago	maritima		californica	17
Papaveraceae	Platystemon	californicus			14,15,20
Poaceae	Poa	annua			6
Poaceae	Poa	scabrella			2,6,14
Caryophyllaceae	Polycarpon	depressum			5,14
Polygonaceae	Polygonum	aviculare			6
Polygonaceae	Polygonum	coccineum			9
Polygonaceae	Polygonum	lapathifolium			6
Polygonaceae	Polygonum	punctatum	leptostachyum		6,11
Polypodiaceae	Polypodium	californicum			8
Poaceae	Polypogon	interruptus			2,3,11,15
Poaceae	Polypogon	monspeliensis			1,2,3,6,7,9,10,11,14,15,20
Poaceae	Polypogon	semiverticillatus			2,3,20
Aspidiaceae	Polystichum	munitum			7,15,20
Salicaceae	Populus	trichocarpa			2,3,6,9
Potamogetonaceae	Potamogeton	pectinatus			6,9
Rosaceae	Potentilla	egedii	grandis		2,3,8,9,11

PRELIMINARY SPECIES LIST
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Family Name	Genus Name	Species Name	Variety	Subspecies	References
Rosaceae	Potentilla	glandulosa	glandulosa		6,8
Rosaceae	Prunus	fasciculata	punctata		2,17
Rosaceae	Prunus	ilicifolia			15
Fabaceae	Psoralea	orbicularis			11,16
Pteridaceae	Pteridium	aquilinum	pubescens		2,3,4,6,7,8,9,10,11,14,15, 17,20
Polygonaceae	Pterostegia	drymariodies			2,3,5,6,7,10,11,14,15,20
Fagaceae	Quercus	agrifolia	Xparvula		16
Fagaceae	Quercus	agrifolia	agrifolia		2,3,4,6,7,8,9,10,11,14,15, 17,20
Fagaceae	Quercus	parvula			2,4,20
Fagaceae	Quercus	wislizenii			7,9,15
Asteraceae	Rafinesquia	californica			6,14
Ranunculaceae	Ranunculus	californicus	californicus		6,11,15
Ranunculaceae	Ranunculus	hebecarpus			6
Brassicaceae	Raphanus	sativus			2,3,5,6,11,20
Rhamnaceae	Rhamnus	californica			2,3,4,6,7,8,9,10,12,14,15, 17,20
Rhamnaceae	Rhamnus	crocea			2,3,6,7,9,15,17
Anacardiaceae	Rhus	integrifolia			15,20
Saxifragaceae	Ribes	divaricatum	divaricatum		2,3,4,6,9,10,11,15,20
Saxifragaceae	Ribes	malvaceum			2
Saxifragaceae	Ribes	sanguineum	glutinosum		7,9
Saxifragaceae	Ribes	speciosum			6,7,8,9,15,17
Brassicaceae	Rorippa	nasturtium-aquaticum			2,3,6,7,9,10,11,17
Rosaceae	Rosa	californica			2,3,6,8,10,11,20
Rosaceae	Rubus	leucodermis	bernardinus		8
Rosaceae	Rubus	ursinus			2,3,4,6,7,8,9,10,11,14,15, 17,20
Polygonaceae	Rumex	acetosella			7,9
Polygonaceae	Rumex	angiocarpus			5,6,11,14,15,20
Polygonaceae	Rumex	onglomeratus			2,5,6,15
Polygonaceae	Rumex	crispus			1,2,3,5,6,8,9,11,15
Polygonaceae	Rumex	feuginus			6,7,11,14
Polygonaceae	Rumex	hymenosepalus			11
Polygonaceae	Rumex	salicifolius			2,6,9,10,15,20
Caryophyllaceae	Sagina	occidentalis			15
Chenopodiaceae	Salicornia	virginica			1,2,3,6,7,9,11,15
Salicaceae	Salix	laevigata			2,3,6,11,20
Salicaceae	Salix	lasiandra			9,17,20
Salicaceae	Salix	lasiolepis			2,3,4,5,6,8,10,11,17,20
Chenopodiaceae	Salsola	iberica			1,6,20
Lamiaceae	Salvia	carduacea			2,3,6,13,17
Lamiaceae	Salvia	columbariae			2,6,15,17,20
Lamiaceae	Salvia	greggi			20
Lamiaceae	Salvia	leucophylla			7,9,13,15
Lamiaceae	Salvia	mellifera			1-15,17,20
Lamiaceae	Salvia	spathacea			2,3,4,6,7,9,12,15,17,20
Caprifoliaceae	Sambucus	mexicana			2,3,4,6,7,8,9,11,15,17,20
Primulaceae	Samolus	parviflorus			11
Apiaceae	Sanicula	bipinnatifida			14
Apiaceae	Sanicula	crassicaulis			2,6,7,8,11,12,15,20
Apiaceae	Sanicula	hoffmannii			18

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Family Name	Genus Name	Species Name	Variety	Subspecies	References
Apiaceae	Sanicula	laciniata			6
Lamiaceae	Satureja	douglasii			2,6,7,10,20
Anacardiaceae	Schinus	molle			6
Poaceae	Schismus	barbatus			6
Cyperaceae	Scirpus	acutus			2,3,6,7
Cyperaceae	Scirpus	americanus	monophyllus		6,7,9,11
Cyperaceae	Scirpus	californicus			6,7,9,10,11,20
Cyperaceae	Scirpus	cernuus		californicus	2,3,6,11,20
Cyperaceae	Scirpus	microcarpus			2,3,6,7,11,15,20
Cyperaceae	Scirpus	olneyi			6,7,11
Cyperaceae	Scirpus	robustus			1,2,3,6,7,9,11
Scrophulariaceae	Scrophularia	atrata			2,3,5,6,7,8,9,10,12,20
Scrophulariaceae	Scrophularia	californica			2,3,6,8,11,13,15,20
Selaginellaceae	Selaginella	bigelovii			2
Asteraceae	Senecio	blochmaniae			1,2,7,9,10,15,16,20
Asteraceae	Senecio	californicus			10,14,15
Asteraceae	Senecio	mikanioides			15
Asteraceae	Senecio	vulgaris			6,11,14
Malvaceae	Sida	leprosa	hederacea		11,15
Malvaceae	Sidalcea	malvaeflora			7
Caryophyllaceae	Silene	gallica			2,3,6,11,14,15,20
Caryophyllaceae	Silene	laciniata			14,20
Asteraceae	Silybum	marianum			2,3,5,6,7,9,11,13,15,17,20
Brassicaceae	Sisymbrium	irio			6,11
Brassicaceae	Sisymbrium	officinale			15
Iridaceae	Sisyrinchium	bellum			2,3,15
Solanaceae	Solanum	douglasii			1,2,3,5,6,8,10,15,17,20
Solanaceae	Solanum	nodiflorum			6,8,11
Solanaceae	Solanum	sarrachoides			6,8
Solanaceae	Solanum	umbelliferum	umbelliferum		1,2,6,14,15
Solanaceae	Solanum	xanti	hoffmannii		15
Solanaceae	Solanum	xanti	intermedium		10
Solanaceae	Solanum	xanti	xanti		5,7,14,15,20
Asteraceae	Solidago	californica			7,15,20
Asteraceae	Solidago	confinis			20
Asteraceae	Solidago	occidentalis			6
Asteraceae	Sonchus	asper			1,5,6,11,12,14,15,20
Asteraceae	Sonchus	oleraceus			2,3,5,6,10,14,15,17,20
Poaceae	Sorghum	bicolor			6
Sparganiaceae	Sparganium	eurycarpum			6,7,9,11
Caryophyllaceae	Spergula	arvensis			2,6,15,20
Caryophyllaceae	Spergularia	bocconii			1,2,6,11,17
Caryophyllaceae	Spergularia	macrotheca			15
Caryophyllaceae	Spergularia	marina			6,11
Lamiaceae	Stachys	albens			8
Lamiaceae	Stachys	bullata			2,3,6,7,8,9,11,15,20
Lamiaceae	Stachys	chamissonis			10
Lamiaceae	Stachys	rigida			7
Caryophyllaceae	Stellaria	media			2,3,4,6,7,15,17
Asteraceae	Stephanomeria	exigua		carotifera	12
Asteraceae	Stephanomeria	virgata			2,3,4,6,10,17,20
Poaceae	Stipa	cernua			6,14
Poaceae	Stipa	lepida			2,3,15

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Family Name	Genus Name	Species Name	Variety	Subspecies	References
Poaceae	Stipa	pulchra			2,3,12,15
Brassicaceae	Streptanthus	californicus			7
Asteraceae	Stylocline	gnaphalioides			14,15
Chenopodiaceae	Suaeda	californica			7
Caprifoliaceae	Symphoricarpos	mollis			2,3,7,9,15,20
Asteraceae	Tagetes	patula			6
Tamaricaceae	Tamarix	parviflora			11
Asteraceae	Taraxacum	officinale			15
Aizoaceae	Tetragonia	tetragonioides			1,20
Ranunculaceae	Thalictrum	polycarpum			15,20
Brassicaceae	Thelypodium	lasiophyllum			2
Brassicaceae	Thysanocarpus	curvipes			15
Crassulaceae	Tillaea	erecta			5
Apiaceae	Torilis	nodosa			11
Anacardiaceae	Toxicodendron	diversilobum			1-15,17,20
Fabaceae	Trifolium	amplectens	amplectens		11
Fabaceae	Trifolium	hirtum			6,15
Fabaceae	Trifolium	tridentatum	tridentatum		20
Juncaginaceae	Triglochin	maritimum			6,11,16
Poaceae	Triticum	aestivum			6
Typhaceae	Typha	augustifolia			9
Typhaceae	Typha	domingensis			2,3,7,11,20
Typhaceae	Typha	latifolia			2,3,6,7,9,11,15,20
Urticaceae	Urtica	holosericea			1,2,3,6,7,8,9,10,11,15,20
Urticaceae	Urtica	urens			2,3,6,9,15
Ericaceae	Vaccinium	ovatum			7,9,15,20
Asteraceae	Venegasia	carpesioides			7
Verbenaceae	Verbena	lasiostachys	lasiostachys		6,10,20
Verbenaceae	Verbena	robusta			2,3
Verbenaceae	Verbena	scabra			11
Verbenaceae	Verbena	tenuisecta			6
Scrophulariaceae	Veronica	americana			7
Scrophulariaceae	Veronica	scabra			2,3
Fabaceae	Vicia	americana			8
Fabaceae	Vicia	angustifolia			11
Fabaceae	Vicia	gigantea			16,20
Apocynaceae	Vinca	major			2,3,11
Violaceae	Viola	pedunculata			6,15
Violaceae	Viola	quercetorum			7
Poaceae	Vulpia	bromoides			11,14,15,20
Poaceae	Vulpia	grayi			14
Poaceae	Vulpia	megalura			6,11,13,14,20
Poaceae	Vulpia	myuros			5,6,11,14,15
Poaceae	Vulpia	octoflora			5,6,7,9,12,14,15
Poaceae	Vulpia	pacifica			14
Poaceae	Vulpia	reflexa			14
Araceae	Wolffiella	lingulata			10
Blechnaceae	Woodwardia	fimbriata			2,3,10
Asteraceae	Xanthium	spinosum			2,4,6,8,11
Asteraceae	Xanthium	strumarium	canadense		6,11,17,20
Zannichelliaceae	Zannichellia	palustris			11
Araceae	Zantedeschia	aethiopica			15
Onagraceae	Zauschneria	californica		californica	15

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Family Name	Genus Name	Species Name	Variety	Subspecies	References
Liliaceae	Zygadenus	fremontii			2,14
Liliaceae	Zygadenus	fremontii	minor		16

REFERENCE LIST

1-Dames & Moore (Santa Ynez river bridge), 1984
2-Dames & Moore (Northwest Lompoc), 1985
3-Dames & Moore (Todos Santos), 1985
4-Dames & Moore (Hrubetz), 1985
5-Tracer, 1984
6-Human, 1987
7-Coulombe & Mahrdt, 1976
8-Westec, 1983
9-Mahrdt, 1976
10-HDR, 1979
11-Dial, 1980
12-Beauchamp & Oberbauer, 1977
13-ERCO, 1981
14-Hickson, 1987
15-Schmalzer and Hinkle, 1987; Schmalzer et al. 1987
16-D. Smith, 1983
17-Dames & Moore (Graciosa), 1984
18-C. Smith, 1976
19-Howald et al., 1985
20-Versar, 1987

	Totals
Families	80
Genera	311
Taxa	624

APPENDIX III

PRELIMINARY PLANT SPECIES LIST FOR VANDENBERG, ARRANGED BY FAMILY

PRELIMINARY PLANT SPECIES LIST
Vandenberg Air Force Base

Family Name	Genus Name	Species Name	Variety	Subspecies	References
Aceraceae	Acer	negundo		californicum	2,3,6,7,9,11,15
Aizoaceae	Carpobrotus	aequilateris			1,5,7,9,10,15
Aizoaceae	Carpobrotus	aequilateris	Xedulis		10
Aizoaceae	Carpobrotus	edulis			1,2,4,5,6,7,10,12,14,15,20
Aizoaceae	Conicosia	pugioniformis			2,4,5,6,9,10,12,14,15,20
Aizoaceae	Gasoul	crystallinum			1,7,9,11,20
Aizoaceae	Gasoul	nodiflorum			1
Aizoaceae	Tetragonia	tetragonioides			1,20
Amaranthaceae	Amaranthus	albus			6
Amaranthaceae	Amaranthus	hybridus			6
Amaranthaceae	Amaranthus	powellii			6
Amaryllidaceae	Bloomeria	crocea			2,14,15
Amaryllidaceae	Brodiaea	jolonensis			16
Amaryllidaceae	Dichelostemma	pulchellum			2,3,6,8,14,15
Anacardiaceae	Rhus	integrifolia			15,20
Anacardiaceae	Schinus	molle			6
Anacardiaceae	Toxicodendron	diversilobum			1-15,17,20
Apiaceae	Apiastrum	angustifolium			2,6,7,9,14,15
Apiaceae	Apium	graveolens			2,3,6,11,20
Apiaceae	Berula	erecta			2,6
Apiaceae	Bowlesia	incana			6,11
Apiaceae	Caucalis	microcarpa			6
Apiaceae	Cicuta	douglasii			2,3,6,11,15
Apiaceae	Conium	maculatum			1,2,3,5,6,7,8,9,10,11,14, 15,20
Apiaceae	Daucus	pusillus			5,14,15
Apiaceae	Eryngium	armatum			15
Apiaceae	Foeniculum	vulgare			2,3,6,7,9,11
Apiaceae	Hydrocotyle	ranunculoides			6
Apiaceae	Hydrocotyle	verticillata			10,11
Apiaceae	Lomatium	utriculatum			15
Apiaceae	Oenanthe	sarmentosa			2,3,6,10,11,20
Apiaceae	Petroselinum	crispum			6
Apiaceae	Sanicula	bipinnatifida			14
Apiaceae	Sanicula	crassicaulis			2,6,7,8,11,12,15,20
Apiaceae	Sanicula	hoffmannii			18
Apiaceae	Sanicula	laciniata			6
Apiaceae	Torilis	nodosa			11
Apocynaceae	Vinca	major			2,3,11
Araceae	Wolffiella	lingulata			10
Araceae	Zantedeschia	aethiopica			15
Aspidiaceae	Dryopteris	arguta			2,6,7,15,20
Aspidiaceae	Polystichum	munitum			7,15,20
Asteraceae	Achillea	millefolium			2,3,7,8,10,15,20
Asteraceae	Achillea	millefolium	californica		6
Asteraceae	Amblyopappus	pusillus			16
Asteraceae	Ambrosia	acanthicarpa			11
Asteraceae	Ambrosia	chamissonis		bipinnatisecta	1,7,9,12,15
Asteraceae	Ambrosia	psilostachya	californica		1,2,3,4,5,6
Asteraceae	Anthemis	cotula			6,11,20
Asteraceae	Artemisia	biennis			6
Asteraceae	Artemisia	californica			1-15,17,20
Asteraceae	Artemisia	douglasiana			2,3,4,6,7,11,15,20

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Family Name	Genus Name	Species Name	Variety	Subspecies	References
Asteraceae	Artemisia	dracunculus			7,10,20
Asteraceae	Aster	chilensis			6
Asteraceae	Aster	radulinus			15
Asteraceae	Baccharis	douglasii			2,3,6,7,9,10,11,15,20
Asteraceae	Baccharis	glutinosa			2,3,6,11,17,20
Asteraceae	Baccharis	pilularis		consanguinea	all except 16,18,19
Asteraceae	Carduus	pyncnocephalus			2,4,5,6,17,20
Asteraceae	Carduus	tenuiflorus			11
Asteraceae	Centaurea	melitensis			2,3,6,11,12,15
Asteraceae	Centaurea	solstitialis			5,8
Asteraceae	Chaenactis	glabriuscula			11
Asteraceae	Chaetopappa	alsinoides			16
Asteraceae	Chrysopsis	villosa	echioides		2,3
Asteraceae	Cirsium	arvense			15
Asteraceae	Cirsium	brevistylum			2,3,6,11,15,20
Asteraceae	Cirsium	californicum			12,14,15
Asteraceae	Cirsium	loncholepis			16
Asteraceae	Cirsium	occidentale			1,2,4,5,6,10,14,15,17,20
Asteraceae	Cirsium	rhothophilum			7,9,12,15
Asteraceae	Cirsium	vulgare			2,3,6,8
Asteraceae	Cnicus	benedictus			2
Asteraceae	Conyza	bonariensis			2,6,20
Asteraceae	Conyza	canadensis			2,3,4,5,6,8,10,15,20
Asteraceae	Conyza	coulteri			1,15
Asteraceae	Coreopsis	gigantea			1,7,9,10,12,13,15,20
Asteraceae	Corethrogyne	filaginafolia			1-10,12,14,15,17,20
Asteraceae	Cotula	australis			2,3,11,15
Asteraceae	Cotula	coronopifolia			1,2,3,6,7,9,11,15
Asteraceae	Encelia	califomica			2,7,9,15,17,20
Asteraceae	Erechtites	arguta			2,3,6,15
Asteraceae	Ericamaria	ericoides		ericoides	1-10,12-15,17,20
Asteraceae	Erigeron	foliosus	blochmaniae		7,9,10,12,15,16,20
Asteraceae	Erigeron	foliosus	foliosus		6
Asteraceae	Erigeron	philadelphicus			11
Asteraceae	Erigeron	sanctarum			14,16
Asteraceae	Eriophyllum	confertiflorum			2,3,8,9,12,14,15,20
Asteraceae	Eriophyllum	multicaule			6,8,12,14
Asteraceae	Eriophyllum	staechadifolium	artemisiaefolium		1,5,7,9,12,14,15,20
Asteraceae	Evax	sparsiflora			16
Asteraceae	Filago	arizonica			11
Asteraceae	Filago	califomica			2,14,15
Asteraceae	Filago	gallica			2,14,15
Asteraceae	Gazania	longiscapa			6
Asteraceae	Gnaphalium	beneolens			4,6,14,15
Asteraceae	Gnaphalium	bicolor			2,5,10,15,20
Asteraceae	Gnaphalium	califomicum			1,2,3,6,7,10,14,15,20
Asteraceae	Gnaphalium	chilense			1,2,6,15,20
Asteraceae	Gnaphalium	luteo-album			2,5,6,7,14,15,20
Asteraceae	Gnaphalium	microcephalum			2,3,10,15,20
Asteraceae	Gnaphalium	palustre			11
Asteraceae	Gnaphalium	purpureum			8,11,14,15,20
Asteraceae	Gnaphalium	ramosissimum			1,2,6,7,9,10,11,12,14,15, 20

PRELIMINARY PLANT SPECIES LIST
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Family Name	Genus Name	Species Name	Variety	Subspecies	References
Asteraceae	Grindelia	latifolia			2,18
Asteraceae	Haplopappus	squarrosus			2,3,9,13,15
Asteraceae	Haplopappus	venetus		vernonioides	1,6,7,8,9,12,13,15,20
Asteraceae	Haplopappus	venetus	sedoides		12,15
Asteraceae	Helenium	bolanderi			7
Asteraceae	Helenium	puberulum			2,3,6,7,9,10,11,15,20
Asteraceae	Hemizonia	fasciculata			15
Asteraceae	Hemizonia	paniculata		increscens	2,4,9,11,15,20
Asteraceae	Hemizonia	ramosissima			2,3
Asteraceae	Heterotheca	grandiflora			2,3,4,6,14,17,20
Asteraceae	Hypochoeris	glabra			2,3,5,6,9,11,12,14,15,20
Asteraceae	Hypochoeris	radicata			6
Asteraceae	Jaumea	carnosa			1,6,7,9
Asteraceae	Lactuca	serriola			2,3,6,11
Asteraceae	Lasthenia	chrysostoma			2,3
Asteraceae	Layia	glandulosa			2,3,14,20
Asteraceae	Layia	hieracioides			5
Asteraceae	Layia	paniculata			10,14
Asteraceae	Layia	platyglossa			15
Asteraceae	Lessingia	germanorum	pectinata		2,3,6
Asteraceae	Madia	exigua			2,3,14
Asteraceae	Madia	sativa			2,4,5,6,8,11,20
Asteraceae	Malacothrix	incana	succulenta		9,12,15
Asteraceae	Malacothrix	saxatilis	saxatilis		15
Asteraceae	Microseris	linearifolia			14
Asteraceae	Perezia	microcephala			2,6,7,15,17
Asteraceae	Picris	echioides			1,2,3,4,5,6,11,15,20
Asteraceae	Rafinesquia	californica			6,14
Asteraceae	Senecio	blochmaniae			1,2,7,9,10,15,16,20
Asteraceae	Senecio	californicus			10,14,15
Asteraceae	Senecio	mikanioides			15
Asteraceae	Senecio	vulgaris			6,11,14
Asteraceae	Silybum	marianum			2,3,5,6,7,9,11,13,15,17,20
Asteraceae	Solidago	californica			7,15,20
Asteraceae	Solidago	confinis			20
Asteraceae	Solidago	occidentalis			6
Asteraceae	Sonchus	asper			1,5,6,11,12,14,15,20
Asteraceae	Sonchus	oleraceus			2,3,5,6,10,14,15,17,20
Asteraceae	Stephanomeria	exigua		carotifera	12
Asteraceae	Stephanomeria	virgata			2,3,4,6,10,17,20
Asteraceae	Stylocline	gnaphalioides			14,15
Asteraceae	Tagetes	patula			6
Asteraceae	Taraxacum	officinale			15
Asteraceae	Venegasia	carpesioides			7
Asteraceae	Xanthium	spinosum			2,4,6,8,11
Asteraceae	Xanthium	strumarium	canadense		6,11,17,20
Blechnaceae	Woodwardia	fimbriata			2,3,10
Boraginaceae	Amsinckia	intermedia			2,3,6,7,11,13,15,20
Boraginaceae	Amsinckia	menziesii			6
Boraginaceae	Amsinckia	spectabilis	microcarpa		2,6,10,16
Boraginaceae	Amsinckia	spectabilis	spectabilis		1,5,14,15,20
Boraginaceae	Cryptantha	clevelandii			7,9,14,15
Boraginaceae	Cryptantha	intermedia			6,11,12

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Family Name	Genus Name	Species Name	Variety	Subspecies	References
Boraginaceae	Cryptantha	leiocarpa			2,9,10,15
Boraginaceae	Heliotropium	curassavicum	oculatum		1,2,3,6,7,9,10,11,15
Brassicaceae	Brassica	campestris			5,6,7,8,9,11,20
Brassicaceae	Brassica	geniculata			5,6,12
Brassicaceae	Brassica	kaber			6
Brassicaceae	Brassica	nigra			1,2,3,4,6,8,10,11,15,17,20
Brassicaceae	Brassica	oleracea			6
Brassicaceae	Cakile	maritima			1,7,9,12,15
Brassicaceae	Capsella	bursa-pastoris			2,6,11,12,15
Brassicaceae	Cardamine	gambelii			11
Brassicaceae	Cardamine	oligosperma			15
Brassicaceae	Cardaria	draba			2,6
Brassicaceae	Dentaria	integrifolia	californica		2,3,8
Brassicaceae	Descurainia	pinnata		menziesii	1,7,10,14,15
Brassicaceae	Dithyrea	maritima			9,15,16
Brassicaceae	Erysimum	suffrutescens	grandifolium		2,5,7,9,10,13,15,20
Brassicaceae	Erysimum	suffrutescens	lompocense		2,8,9,20
Brassicaceae	Lepidium	campestre			7
Brassicaceae	Lepidium	nitidum	nitidum		20
Brassicaceae	Lepidium	virginicum	pubescens		6
Brassicaceae	Lobularia	maritima			6,20
Brassicaceae	Raphanus	sativus			2,3,5,6,11,20
Brassicaceae	Rorippa	nasturtium-aquaticum			2,3,6,7,9,10,11,17
Brassicaceae	Sisymbrium	irio			6,11
Brassicaceae	Sisymbrium	officinale			15
Brassicaceae	Streptanthus	californicus			7
Brassicaceae	Thelypodium	lasiophyllum			2
Brassicaceae	Thysanocarpus	curvipes			15
Cactaceae	Opuntia	ficus-indica			6
Cactaceae	Opuntia	littoralis			6
Cactaceae	Opuntia	phaeacantha	major		2,3
Callitrichaceae	Callitriche	marginata			16
Campanulaceae	Nemacladus sp.				14
Caprifoliaceae	Lonicera	hispidula	vacillans		2,3,7,17
Caprifoliaceae	Lonicera	involucrata	ledebourii		2,3,6,7,9,10,11,15,20
Caprifoliaceae	Sambucus	mexicana			2,3,4,6,7,8,9,11,15,17,20
Caprifoliaceae	Symphoricarpos	mollis			2,3,7,9,15,20
Caryophyllaceae	Arenaria	douglasii			14,16
Caryophyllaceae	Cardionema	ramosissimum			2,3,4,5,10,12,15,20
Caryophyllaceae	Cerastium	glomeratum			11
Caryophyllaceae	Dianthus	barbatus			6
Caryophyllaceae	Loeflingia	squarrosa			14
Caryophyllaceae	Polycarpon	depressum			5,14
Caryophyllaceae	Sagina	occidentalis			15
Caryophyllaceae	Silene	gallica			2,3,6,11,14,15,20
Caryophyllaceae	Silene	laciniata			14,20
Caryophyllaceae	Spergula	arvensis			2,6,15,20
Caryophyllaceae	Spergularia	bocconii			1,2,6,11,17
Caryophyllaceae	Spergularia	macrotheca			15
Caryophyllaceae	Spergularia	marina			6,11
Caryophyllaceae	Stellaria	media			2,3,4,6,7,15,17
Ceratophyllaceae	Ceratophyllum	demersum			11
Chenopodiaceae	Aphanisma	blitoides			16

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Family Name	Genus Name	Species Name	Variety	Subspecies	References
Chenopodiaceae	Atriplex	patula	hastata		1,2,3,6,11
Chenopodiaceae	Atriplex	semibaccata			1,2,3,5,6,12,15,20
Chenopodiaceae	Atriplex	serenana			6
Chenopodiaceae	Chenopodium	album			6
Chenopodiaceae	Chenopodium	ambrosioides	ambrosioides		6
Chenopodiaceae	Chenopodium	ambrosioides	anthelminticum		6
Chenopodiaceae	Chenopodium	berlandieri			6
Chenopodiaceae	Chenopodium	californicum			1,2,5,6,7,10,11,14,15,17, 20
Chenopodiaceae	Chenopodium	macrospermum	farinosum		11
Chenopodiaceae	Chenopodium	murale			2,11,12,20
Chenopodiaceae	Salicornia	virginica			1,2,3,6,7,9,11,15
Chenopodiaceae	Salsola	iberica			1,6,20
Chenopodiaceae	Suaeda	californica			7
Cistaceae	Helianthemum	scoparium			2,3,4,14,15,20
Convolvulaceae	Calystegia	macrostegia		cyclostegia	2,3,5,6,11,12,14,15,20
Convolvulaceae	Calystegia	soldanella			7,9,12,13
Convolvulaceae	Calystegia	subacaulis			3
Convolvulaceae	Convolvulus	arvensis			2,6,20
Convolvulaceae	Cuscuta	californica			6
Convolvulaceae	Cuscuta	salina			1
Convolvulaceae	Dichondra	donnelliana			13,15,16
Cornaceae	Cornus	glabrata			6
Cornaceae	Cornus	occidentalis			11
Cornaceae	Cornus	stolonifera	californica		2,3,6,15
Crassulaceae	Crassula	aquatica			16
Crassulaceae	Crassula	erecta			2,6,14,15,20
Crassulaceae	Dudleya	blochmaniae		blochmaniae	15,16
Crassulaceae	Dudleya	caespitosa			10,12,15,20
Crassulaceae	Dudleya	farinosa			7,9
Crassulaceae	Dudleya	lanceolata			1,2,3,6,14,15,20
Crassulaceae	Tillaea	erecta			5
Cucurbitaceae	Cucurbita	foetidissima			6
Cucurbitaceae	Marah	fabaceus			2,3,5,6,7,8,9,14,15
Cucurbitaceae	Marah	macrocarpus			20
Cupressaceae	Cupressus	macrocarpa			4,6,10
Cyperaceae	Carex	barbarae			2,3,11
Cyperaceae	Carex	globosa			2,3,14,15
Cyperaceae	Carex	lanuginosa			11
Cyperaceae	Carex	pansa			10
Cyperaceae	Carex	praegracilis			1,2,3,4,11,15
Cyperaceae	Carex	schottii			15
Cyperaceae	Carex	subbracteata			6
Cyperaceae	Carex	triquetra			15
Cyperaceae	Cladium	californicum			11,15
Cyperaceae	Cyperus	alternifolius			2,10
Cyperaceae	Cyperus	eragrostis			6,7,9,11
Cyperaceae	Cyperus	esculentus			9
Cyperaceae	Eleocharis	macrostachya			11
Cyperaceae	Eleocharis	parishii			11
Cyperaceae	Eleocharis	sp.			6,15
Cyperaceae	Scirpus	acutus			2,3,6,7
Cyperaceae	Scirpus	americanus	monophyllus		6,7,9,11

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Family Name	Genus Name	Species Name	Variety	Subspecies	References
Cyperaceae	Scirpus	californicus			6,7,9,10,11,20
Cyperaceae	Scirpus	cernuus		californicus	2,3,6,11,20
Cyperaceae	Scirpus	microcarpus			2,3,6,7,11,15,20
Cyperaceae	Scirpus	olneyi			6,7,11
Cyperaceae	Scirpus	robustus			1,2,3,6,7,9,11
Dipsacaceae	Dipsacus	sativus			6
Equisetaceae	Equisetum	arvense			11
Equisetaceae	Equisetum	laevigatum			6,11
Equisetaceae	Equisetum	telmateia	braunii		7,9,20
Ericaceae	Arctostaphylos	glandulosa			7
Ericaceae	Arctostaphylos	purissima			2,3,4,14,8,15,20
Ericaceae	Arctostaphylos	rudis			2,3,4,7,8,9,12,14,15
Ericaceae	Arctostaphylos	tomentosa			2,15
Ericaceae	Arctostaphylos	viridissima			7,9,12
Ericaceae	Vaccinium	ovatum			7,9,15,20
Euphorbiaceae	Croton	californicus	californicus		1-12,14,15,17,20
Euphorbiaceae	Eremocarpus	setigerus			2,3,6,7,8,9,17
Euphorbiaceae	Euphorbia	crenulata			5
Euphorbiaceae	Euphorbia	lathyris			10
Euphorbiaceae	Euphorbia	maculata			6
Euphorbiaceae	Euphorbia	peplus			20
Euphorbiaceae	Euphorbia	prostrata			6
Fabaceae	Acacia	longifolia			10,20
Fabaceae	Acacia	melanoxylon			20
Fabaceae	Astragalus	curtipes			11
Fabaceae	Astragalus	nuttallii			2,7,9,10,12,20
Fabaceae	Astragalus	pomonensis			1,5,6
Fabaceae	Lotus	corniculatus			2,3
Fabaceae	Lotus	hamatus			14
Fabaceae	Lotus	heermannii	eriophorus		16
Fabaceae	Lotus	humistratus			6
Fabaceae	Lotus	junceus			5,15,20
Fabaceae	Lotus	oblongifolius			11
Fabaceae	Lotus	purshianus			6
Fabaceae	Lotus	salsuginosus			6
Fabaceae	Lotus	scoparius		scoparius	2-10,12,14,15,17,20
Fabaceae	Lotus	strigosus	hirtellus		6,15
Fabaceae	Lotus	strigosus	strigosus		6,14
Fabaceae	Lotus	subpinnatus			5
Fabaceae	Lupinus	albifrons			4,6,20
Fabaceae	Lupinus	arboreus			2,3,4,5,6,10,13,17,20
Fabaceae	Lupinus	bicolor		umbellatus	6,14,15
Fabaceae	Lupinus	chamissonis			1,2,3,5,7,8,9,10,11,14,15, 17,20
Fabaceae	Lupinus	longifolius			11
Fabaceae	Lupinus	nanus	nanus		5,6,20
Fabaceae	Lupinus	succulentus			6,15
Fabaceae	Lupinus	truncatus			6,14
Fabaceae	Medicago	polymorpha			2,6,7,11,12,15,20
Fabaceae	Melilotus	albus			2,6,7,9,14
Fabaceae	Melilotus	indicus			1,5,6,7,9,10,11,14,15,20
Fabaceae	Psoralea	orbicularis			11,16
Fabaceae	Trifolium	amplectens	amplectens		11

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Family Name	Genus Name	Species Name	Variety	Subspecies	References
Fabaceae	Trifolium	hirtum			6,15
Fabaceae	Trifolium	tridentatum	tridentatum		20
Fabaceae	Vicia	americana			8
Fabaceae	Vicia	angustifolia			11
Fabaceae	Vicia	gigantea			16,20
Fagaceae	Lithocarpus	densiflora			7,9,15
Fagaceae	Quercus	agrifolia	Xparvula		16
Fagaceae	Quercus	agrifolia	agrifolia		2,3,4,6,7,8,9,10,11,14,15,17,20
Fagaceae	Quercus	parvula			2,4,20
Fagaceae	Quercus	wislizenii			7,9,15
Frankeniaceae	Frankenia	grandifolia			1,2,3,6,7,9,11,15
Fumariaceae	Dicentra	ochroleuca			7
Gentianaceae	Centaurium	davyi			15
Geraniaceae	Erodium	botrys			2,3,5,6,12,13,14,15,20
Geraniaceae	Erodium	cicutarium			2-9,11-15,17,20
Geraniaceae	Erodium	moschatum			2,6,17
Geraniaceae	Geranium	carolinianum			6,11
Hydrophyllaceae	Emmenanthe	penduliflora			20
Hydrophyllaceae	Eriodictyon	capitatum			16
Hydrophyllaceae	Eucrypta	chrysanthemifolia			2,15
Hydrophyllaceae	Phacelia	distans			10,20
Hydrophyllaceae	Phacelia	douglasii			14
Hydrophyllaceae	Phacelia	ramosissimum			1,2,3,4,5,6,7,9,10,15,17,20
Hydrophyllaceae	Phacelia	tanacetifolia			10
Hydrophyllaceae	Phacelia	viscida			11
Hydrophyllaceae	Pholistoma	auritum			2,6,7,15,17
Iridaceae	Sisyrinchium	bellum			2,3,15
Juglandaceae	Juglans	californica			9
Juncaceae	Juncus	balticus			2
Juncaceae	Juncus	bufonius	bufonius		6,17,20
Juncaceae	Juncus	effusus	brunneus		2,3,6,10,11,17,20
Juncaceae	Juncus	falcatus			15
Juncaceae	Juncus	leseurii			1,7,9,10
Juncaceae	Juncus	mexicanus			6,15
Juncaceae	Juncus	oxymeris			7,9,11
Juncaceae	Juncus	patens			2,3,4,11,12,15
Juncaceae	Juncus	phaeocephalus	paniculatus		11
Juncaceae	Juncus	phaeocephalus	phaeocephalus		2,3,6,10,15
Juncaceae	Juncus	sphaerocarpus			11
Juncaceae	Juncus	tenuis			8
Juncaceae	Juncus	textilis			1,2,6,10,15
Juncaceae	Juncus	xiphioides			2,6,8,9,20
Juncaginaceae	Triglochin	maritimum			6,11,16
Lamiaceae	Marrubium	vulgare			1,2,3,5,6,8,11,15,20
Lamiaceae	Monardella	crispa			1,2,4,9,12,15,16
Lamiaceae	Monardella	undulata	frutescens		10,16,19,20
Lamiaceae	Monardella	undulata	undulata		19
Lamiaceae	Monardella	villosa	obispoensis		15
Lamiaceae	Salvia	carduacea			2,3,6,13,17
Lamiaceae	Salvia	columbariae			2,6,15,17,20
Lamiaceae	Salvia	greggi			20

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Family Name	Genus Name	Species Name	Variety	Subspecies	References
Lamiaceae	Salvia	leucophylla			7,9,13,15
Lamiaceae	Salvia	mellifera			1-15,17,20
Lamiaceae	Salvia	spathacea			2,3,4,6,7,9,12,15,17,20
Lamiaceae	Satureja	douglasii			2,6,7,10,20
Lamiaceae	Stachys	albens			8
Lamiaceae	Stachys	bullata			2,3,6,7,8,9,11,15,20
Lamiaceae	Stachys	chamissonis			10
Lamiaceae	Stachys	rigida			7
Lemnaceae	Lemna	minima			2,3,6,7,11
Liliaceae	Calochortus	albus			14
Liliaceae	Calochortus	venustus			16
Liliaceae	Chlorogalum	pomeridianum			2,6,14,15
Liliaceae	Fritillaria	biflora			18
Liliaceae	Mariposa	agrillosa			15
Liliaceae	Zygadenus	fremontii			2,14
Liliaceae	Zygadenus	fremontii	minor		16
Lythraceae	Lythrum	hyssopifolia			2,3
Malvaceae	Malacothamnus	fasciculatus			2,3
Malvaceae	Malva	nicaeensis			6,20
Malvaceae	Malva	parviflora			2,3,6,11,15,17,20
Malvaceae	Sida	leprosa	hederacea		11,15
Malvaceae	Sidalcea	malvaeflora			7
Moraceae	Parietaria	hespera	californica		15
Myricaceae	Myrica	californica			2,3,6,9,10,11,15
Myrtaceae	Eucalyptus	globulus			2,4,6,8,10,17,20
Nyctaginaceae	Abronia	latifolia			1,9,12,15
Nyctaginaceae	Abronia	latifolia	Xmaritima		16
Nyctaginaceae	Abronia	maritima			1,7,9,12,15
Nyctaginaceae	Abronia	umbellata			1,2,9,10,20
Nyctaginaceae	Mirabilis	californica			15,20
Onagraceae	Camissonia	cheiranthifolia		cheiranthifolia	1,5,6,12,15,20
Onagraceae	Camissonia	micrantha			2,3,5,6,7,10,11,14,15,17, 20
Onagraceae	Camissonia	strigulosa			6,14,20
Onagraceae	Clarkia	purpurea			14,15
Onagraceae	Epilobium	adenocaulon			2,3,6,9,11,20
Onagraceae	Epilobium	paniculatum			6
Onagraceae	Oenothera	californica			1
Onagraceae	Zauschneria	californica		californica	15
Orchidaceae	Epipactis	gigantea			11
Orchidaceae	Habenaria	elegans			15
Oxalidaceae	Oxalis	albicans		pilosa	6,8,15
Oxalidaceae	Oxalis	corniculata			6,8
Oxalidaceae	Oxalis	pes-caprae			15,20
Paeoniaceae	Paeonia	californica			2,6,8,14,15,20
Papaveraceae	Dendromecon	rigida			2,7,14
Papaveraceae	Eschscholzia	californica	californica		1,2,3,4,5,6,10,13,15,20
Papaveraceae	Eschscholzia	californica	maritima		12,15,20
Papaveraceae	Platystemon	californicus			14,15,20
Pinaceae	Pinus	muricata			2,4,7,9,15,20
Pinaceae	Pinus	radiata			6,8,10
Plantaginaceae	Plantago	coronopus			2,3,5,6,8,11,15,20
Plantaginaceae	Plantago	erecta			2,5,6,14,15,20

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Family Name	Genus Name	Species Name	Variety	Subspecies	References
Plantaginaceae	Plantago	hirtella	galeottiana		11
Plantaginaceae	Plantago	lanceolata			6
Plantaginaceae	Plantago	major			8,10
Plantaginaceae	Plantago	maritima		californica	17
Poaceae	Agrostis	degoensis			2,3,15,20
Poaceae	Agrostis	exarata			8
Poaceae	Agrostis	hooveri			2,16
Poaceae	Agrostis	semiverticillata			6
Poaceae	Agrostis	stolonifera	major		11
Poaceae	Ammophila	arenaria			1,2,10,15
Poaceae	Avena	barbata			2,3,5,6,11,14,15,20
Poaceae	Avena	fatua			2,3,4,7,9,11,13,20
Poaceae	Avena	sativa			6
Poaceae	Bromus	arizonicus			6,15
Poaceae	Bromus	carinatus	carinatus		6,15,20
Poaceae	Bromus	commutatus			11
Poaceae	Bromus	diandrus			all except 1,8,16,18,19
Poaceae	Bromus	mollis			2-7,10-15,17,20
Poaceae	Bromus	rubens			2,3,5-10,12-15,17,20
Poaceae	Bromus	tectorum			8
Poaceae	Bromus	willdenovii			6
Poaceae	Cortaderia	jubata			2,6,15
Poaceae	Cynodon	dactylon			2,3,6
Poaceae	Distichlis	spicata			1,2,3,6,9,11,15,20
Poaceae	Echinochloa	crusgalli			6
Poaceae	Ehrharta	calycina			2,3,4,5,6,10,15,20
Poaceae	Elymus	condensatus			2,3,6,7,8,9,10,13,15,17,20
Poaceae	Elymus	glaucus		glaucus	6,15
Poaceae	Elymus	triticoides		triticoides	2,3,4,6,11,15
Poaceae	Gastridium	ventricosum			2,6,14,15
Poaceae	Hordeum	depressum			11
Poaceae	Hordeum	geniculatum			2,3,6
Poaceae	Hordeum	glaucum			6,11
Poaceae	Hordeum	leporinum			5,6,12,13,15,20
Poaceae	Hordeum	vulgare	vulgare		2,6
Poaceae	Koeleria	macrantha			2,3,15
Poaceae	Koeleria	phleoides			6,11,14
Poaceae	Lamarckia	aurea			2,6,11,12,15,20
Poaceae	Lolium	perenne		multiflorum	1,2,3,6,11,13,15,20
Poaceae	Lolium	perenne		perenne	6
Poaceae	Lolium	temulentum	temulentum		3,6,9,10
Poaceae	Melica	imperfecta	imperfecta		2,14,15,20
Poaceae	Melica	imperfecta	refracta		15
Poaceae	Oryzopsis	miliacea			6
Poaceae	Parapholis	incurva			15
Poaceae	Paspalum	dilatatum			6
Poaceae	Pennisetum	clandestinum			6
Poaceae	Phalaris	californica			20
Poaceae	Phalaris	canariensis			6,11
Poaceae	Phalaris	lemmonii			15
Poaceae	Phalaris	minor			6
Poaceae	Poa	annua			6
Poaceae	Poa	scabrella			2,6,14

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Family Name	Genus Name	Species Name	Variety	Subspecies	References
Poaceae	Polypogon	interruptus			2,3,11,15
Poaceae	Polypogon	monspeliensis			1,2,3,6,7,9,10,11,14,15,20
Poaceae	Polypogon	semiverticillatus			2,3,20
Poaceae	Schismus	baratus			6
Poaceae	Sorghum	bicolor			6
Poaceae	Stipa	cernua			6,14
Poaceae	Stipa	lepida			2,3,15
Poaceae	Stipa	pulchra			2,3,12,15
Poaceae	Triticum	aestivum			6
Poaceae	Vulpia	bromoides			11,14,15,20
Poaceae	Vulpia	grayi			14
Poaceae	Vulpia	megalura			6,11,13,14,20
Poaceae	Vulpia	myuros			5,6,11,14,15
Poaceae	Vulpia	octoflora			5,6,7,9,12,14,15
Poaceae	Vulpia	pacifica			14
Poaceae	Vulpia	reflexa			14
Polemoniaceae	Eriastrum	densifolium		densifolium	9,10,15
Polemoniaceae	Eriastrum	densifolium		elongatum	2,9,14,15
Polemoniaceae	Gilia	archilleafolia			15
Polemoniaceae	Gilia	austrooccidental			14
Polemoniaceae	Gilia	capitata		abrotanifolia	11,15
Polemoniaceae	Gilia	clivorum			6,14
Polemoniaceae	Leptodactylon	californicum		californicum	2,14
Polemoniaceae	Linanthus	androsaces			15
Polemoniaceae	Linanthus	dichotomus			14
Polemoniaceae	Navarretia	atractyloides			2,4,6,14,15
Polygonaceae	Chorizanthe	angustifolia			1,5
Polygonaceae	Chorizanthe	californica	californica		1,2,6,11,14,15,20
Polygonaceae	Chorizanthe	californica	suksdorfii		10,12,18
Polygonaceae	Chorizanthe	coriacea			12,14
Polygonaceae	Chorizanthe	diffusa	nivea		14,15
Polygonaceae	Chorizanthe	obovata			15
Polygonaceae	Chorizanthe	palmeri			15
Polygonaceae	Chorizanthe	pungens			5,18
Polygonaceae	Eriogonum	elongatum			2,6,15
Polygonaceae	Eriogonum	fasiculatum			6,13,20
Polygonaceae	Eriogonum	gracile			2,3,6
Polygonaceae	Eriogonum	parvifolium	parvifolium		2,3,4,5,7,8,9,10,12,14,15, 17,20
Polygonaceae	Polygonum	aviculare			6
Polygonaceae	Polygonum	coccineum			9
Polygonaceae	Polygonum	lapathifolium			6
Polygonaceae	Polygonum	punctatum	leptostachyum		6,11
Polygonaceae	Pterostegia	drymariodies			2,3,5,6,7,10,11,14,15,20
Polygonaceae	Rumex	acetosella			7,9
Polygonaceae	Rumex	angiocarpus			5,6,11,14,15,20
Polygonaceae	Rumex	conglomeratus			2,5,6,15
Polygonaceae	Rumex	crispus			1,2,3,5,6,8,9,11,15
Polygonaceae	Rumex	feuginus			6,7,11,14
Polygonaceae	Rumex	hymenosepalus			11
Polygonaceae	Rumex	salicifolius			2,6,9,10,15,20
Polypodiaceae	Adiantum	jordanii			2,8,15,20
Polypodiaceae	Azolla	filiculoides			6,7,10,11

PRELIMINARY PLANT SPECIES LIST
Vandenberg Air Force Base

Family Name	Genus Name	Species Name	Variety	Subspecies	References
Polypodiaceae	Pellaea	andromedaefolia			8
Polypodiaceae	Pityrogramma	triangularis			2,3,6,8,15,17
Polypodiaceae	Polypodium	californicum			8
Portulacaceae	Calandrinia	breweri			14,20
Portulacaceae	Calandrinia	ciliata	menziesii		2,6,15,20
Portulacaceae	Calyptridium	monandrum			14,15
Portulacaceae	Claytonia	perfoliata	parviflora		6
Portulacaceae	Claytonia	perfoliata	perfoliata		2,5,6,7,11,14,15,17,20
Potamogetonaceae	Potamogeton	pectinatus			6,9
Primulaceae	Anagallis	arvensis			1,2,3,5,6,7,10,11,12,14, 15,20
Primulaceae	Anagallis	arvensis	caerulea		11
Primulaceae	Samolus	parviflorus			11
Pteridaceae	Pteridium	aquilinum	pubescens		2,3,4,6,7,8,9,10,11,14,15, 17,20
Ranunculaceae	Clematis	lasiantha			10
Ranunculaceae	Clematis	ligusticifolia			6,7,20
Ranunculaceae	Delphinium	parryi			14
Ranunculaceae	Ranunculus	californicus	californicus		6,11,15
Ranunculaceae	Ranunculus	hebecarpus			6
Ranunculaceae	Thalictrum	polycarpum			15,20
Rhamnaceae	Ceanothus	cuneatus			8,20
Rhamnaceae	Ceanothus	impressus	impressus		2,3,4,7,9,12,13,14,15,20
Rhamnaceae	Ceanothus	oliganthus			15
Rhamnaceae	Ceanothus	papillosus	roweanus		7,9,15
Rhamnaceae	Ceanothus	ramulosus	fascicularis		2,3,4,7,9,12,14,15,17,20
Rhamnaceae	Ceanothus	thyrsiflorus			9,20
Rhamnaceae	Rhamnus	californica			2,3,4,6,7,8,9,10,12,14,15, 17,20
Rhamnaceae	Rhamnus	crocea			2,3,6,7,9,15,17
Rosaceae	Adenostoma	fasciculatum			1,2,3,4,7,8,9,12,14,15,17
Rosaceae	Alchemilla	occidentalis			5
Rosaceae	Cercocarpus	betuloides	betuloides		2,6,7,9,17
Rosaceae	Heteromeles	arbutifolia			2,3,4,8,15,17,20
Rosaceae	Horkelia	cuneata			2,3,4,5,6,7,14,10,15,20
Rosaceae	Osmaronia	cerasiformis			15
Rosaceae	Potentilla	egedii	grandis		2,3,8,9,11
Rosaceae	Potentilla	glandulosa	glandulosa		6,8
Rosaceae	Prunus	fasciculata	punctata		2,17
Rosaceae	Prunus	ilicifolia			15
Rosaceae	Rosa	californica			2,3,6,8,10,11,20
Rosaceae	Rubus	leucodermis	bernardinus		8
Rosaceae	Rubus	ursinus			2,3,4,6,7,8,9,10,11,14,15, 17,20
Rubiaceae	Galium	andrewsii			7,14
Rubiaceae	Galium	aparine			6,7,11,15,20
Rubiaceae	Galium	californicum			5
Rubiaceae	Galium	nuttallii			2,3,6,7,14,15,17
Rubiaceae	Galium	spurium	echinospermum		20
Rubiaceae	Galium	trifidum	subbiflorum		11
Salicaceae	Populus	trichocarpa			2,3,6,9
Salicaceae	Salix	laevigata			2,3,6,11,20
Salicaceae	Salix	lasiandra			9,17,20

PRELIMINARY PLANT SPECIES LIST
Vandenberg Air Force Base

Family Name	Genus Name	Species Name	Variety	Subspecies	References
Salicaceae	Salix	lasiolepis			2,3,4,5,6,8,10,11,17,20
Saxifragaceae	Heuchera	pilosissima	hemisphaerica		7
Saxifragaceae	Ribes	divaricatum	divaricatum		2,3,4,6,9,10,11,15,20
Saxifragaceae	Ribes	malvaceum			2
Saxifragaceae	Ribes	sanguineum	glutinosum		7,9
Saxifragaceae	Ribes	speciosum			6,7,8,9,15,17
Scrophulariaceae	Castilleja	affinis			13,20
Scrophulariaceae	Castilleja	mollis			9,10,20
Scrophulariaceae	Collinsia	heterophylla			2
Scrophulariaceae	Cordylanthus	rigidus		littoralis	2
Scrophulariaceae	Cordylanthus	rigidus		rigidus	2,14
Scrophulariaceae	Kickxia	elatine			6
Scrophulariaceae	Linaria	canadensis	texana		5,11,14,15,20
Scrophulariaceae	Mimulus	aurantiacus		aurantiacus	4,5,6,8,10,13,14,15
Scrophulariaceae	Mimulus	aurantiacus		lompocensis	2,3,7,9,12,20
Scrophulariaceae	Mimulus	cardinalis			2
Scrophulariaceae	Mimulus	floribundus			10
Scrophulariaceae	Mimulus	guttatus			2,3,6,10,11,15
Scrophulariaceae	Mimulus	subsecundus			14
Scrophulariaceae	Orthocarpus	densiflorus			17
Scrophulariaceae	Orthocarpus	purpurascens			5,14,20
Scrophulariaceae	Pedicularis	densiflora			14
Scrophulariaceae	Penstemon	centranthifolius			2,6
Scrophulariaceae	Penstemon	cordifolius			9
Scrophulariaceae	Scrophularia	atrata			2,3,5,6,7,8,9,10,12,20
Scrophulariaceae	Scrophularia	californica			2,3,6,8,11,13,15,20
Scrophulariaceae	Veronica	americana			7
Scrophulariaceae	Veronica	scabra			2,3
Selaginellaceae	Selaginella	bigelovii			2
Solanaceae	Datura	meteloides			6,9
Solanaceae	Nicotiana	glauca			2,6,8,11
Solanaceae	Solanum	douglasii			1,2,3,5,6,8,10,15,17,20
Solanaceae	Solanum	nodiflorum			6,8,11
Solanaceae	Solanum	sarrachoides			6,8
Solanaceae	Solanum	umbelliferum	umbelliferum		1,2,6,14,15
Solanaceae	Solanum	xanti	hoffmannii		15
Solanaceae	Solanum	xanti	intermedium		10
Solanaceae	Solanum	xanti	xanti		5,7,14,15,20
Sparganiaceae	Sparganium	eurycarpum			6,7,9,11
Tamaricaceae	Tamarix	parviflora			11
Typhaceae	Typha	augustifolia			9
Typhaceae	Typha	domingensis			2,3,7,11,20
Typhaceae	Typha	latifolia			2,3,6,7,9,11,15,20
Urticaceae	Hesperocnide	tenella			5,6,11,14,15
Urticaceae	Urtica	holosericea			1,2,3,6,7,8,9,10,11,15,20
Urticaceae	Urtica	urens			2,3,6,9,15
Verbenaceae	Verbena	lasiostachys	lasiostachys		6,10,20
Verbenaceae	Verbena	robusta			2,3
Verbenaceae	Verbena	scabra			11
Verbenaceae	Verbena	tenuisecta			6
Violaceae	Viola	pedunculata			6,15
Violaceae	Viola	quercetorum			7
Zannichelliaceae	Zannichellia	palustris			11

REFERENCE LIST

1-Dames & Moore (Santa Ynez river bridge), 1984
2-Dames & Moore (Northwest Lompoc), 1985
3-Dames & Moore (Todos Santos), 1985
4-Dames & Moore (Hrubetz), 1985
5-Tracer, 1984
6-Human, 1987
7-Coulombe & Mahrdt, 1976
8-Westec, 1983
9-Mahrdt, 1976
10-HDR, 1979
11-Dial, 1980
12-Beauchamp & Oberbauer, 1977
13-ERCO, 1981
14-Hickson-1987
15-Schmalzer and Hinkle, 1987; Schmalzer et al. 1987
16-D. Smith, 1983
17-Dames & Moore (Graciosa), 1984
18-C. Smith, 1976
19-Howald et al, 1985
20-Versar, 1987

	Totals
Families	80
Genera	311
Taxa	624

APPENDIX IV

LOCATION OF SAMPLE STANDS

Figure IV-1. Location of Stand 1.

Vegetation type: Chaparral

Master Planning Map No.: 28

Transect Nos.: 51, 52, 53

SDSU Stand No. (if any): 5

Location: Stand on north side of Washington Street about 0.3 mile west of Airfield Road and 0.8 mile east of 13th Street.

Comments: Stand is mature chaparral but with some open areas between shrubs. _Cortaderia jubata_ has established in disturbed area along road and around borrow pit north of this stand.

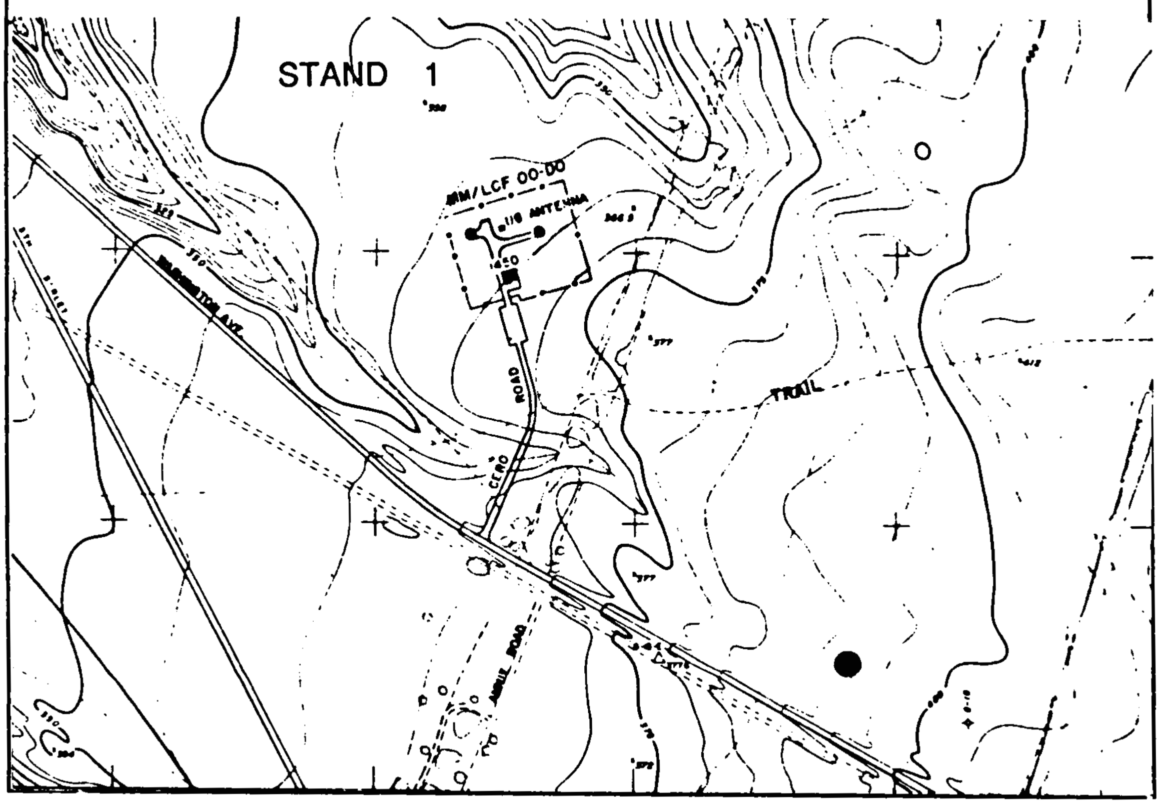


Figure IV-2. Location of Stand 2.

Vegetation type: Chaparral

Master Planning Map No.: 48

Transect Nos.: 54, 55, 56

SDSU Stand No. (if any): 12

Location: Stand is north of Lompoc Valley Road and east of Arguello Boulevard beyond gate on Lompoc Valley Road. Transects are approximately midway between road and power line.

Comments: Stand is dense chaparral with few openings.

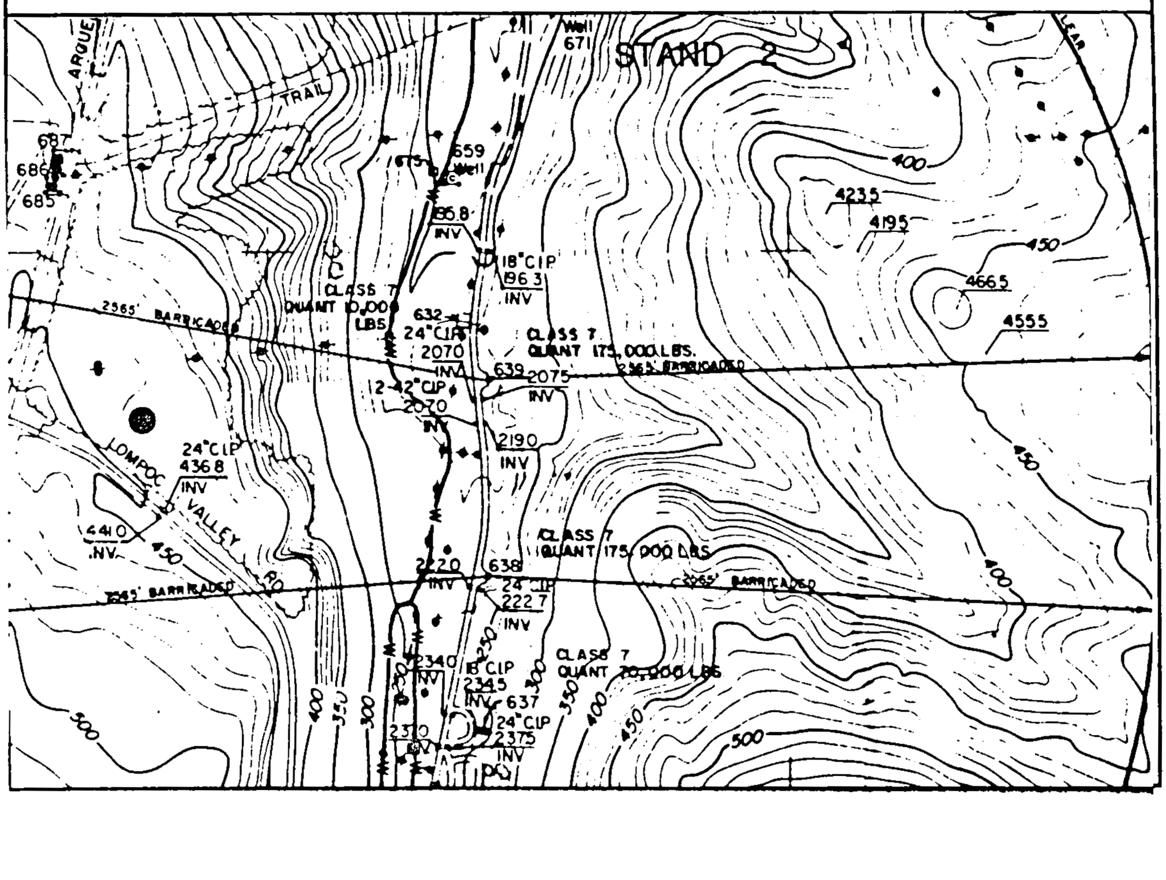


Figure IV-3. Location of Stand 3.

Vegetation type: Chaparral

Master Planning Map No.: 65

Transect Nos.: 58, 59, 60

SDSU Stand No. (if any): N/A

Location: Take jeep trail east of Oak Mountain facility and then south. Stand is on slope west of trail.

Comments: Area burned in 1981.

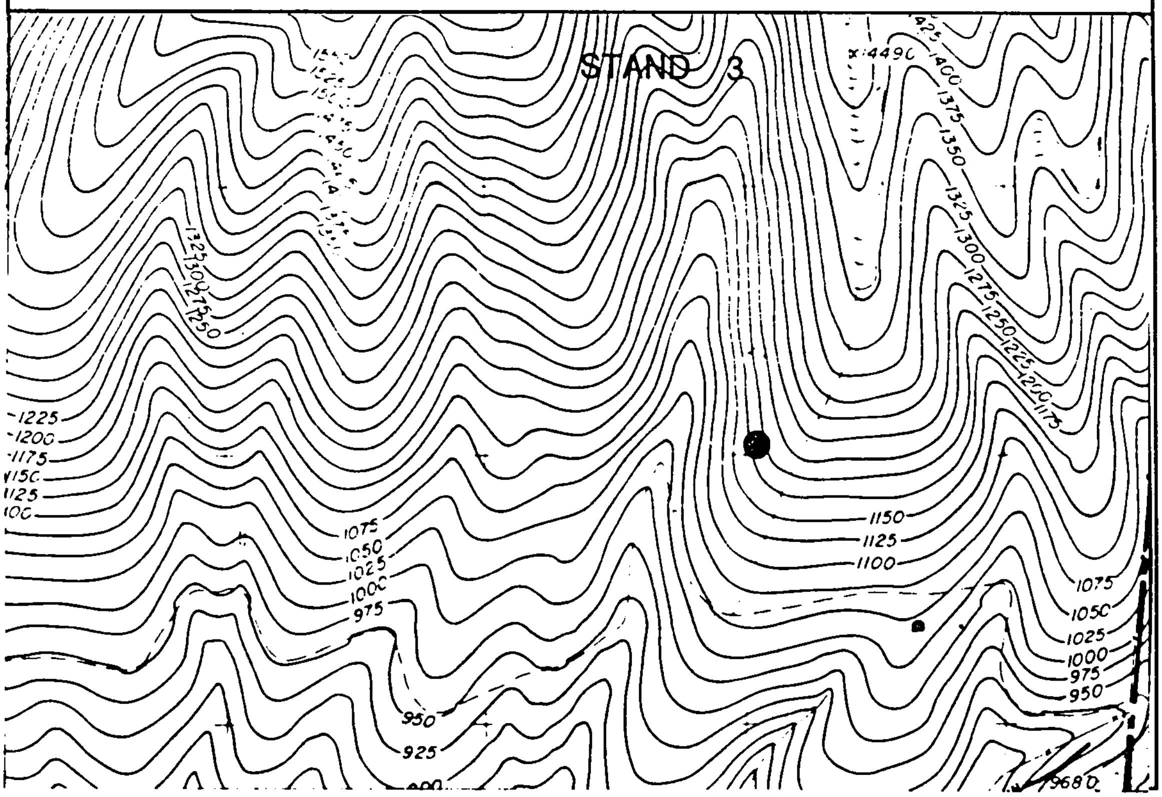


Figure IV-4. Location of Stand 4 and Stand 7.

Vegetation type: 4: Chaparral, 7: Bishop Pine

Master Planning Map No.: 51

Transect Nos.: 4: 61, 62, 63; 7: 70, 71

SDSU Stand No. (if any): 4: 18; 7: 17

Location: Santa Ynez Ridge Road. 4: 3.0 mile south of Arguello Boulevard. 7: 2.9 mile south of Arguello Boulevard and 0.1 mile south of Radio Receiver Road. Both on west side of road.

Comments: Bishop pine (7) is dense stand originating after 1974 fire.

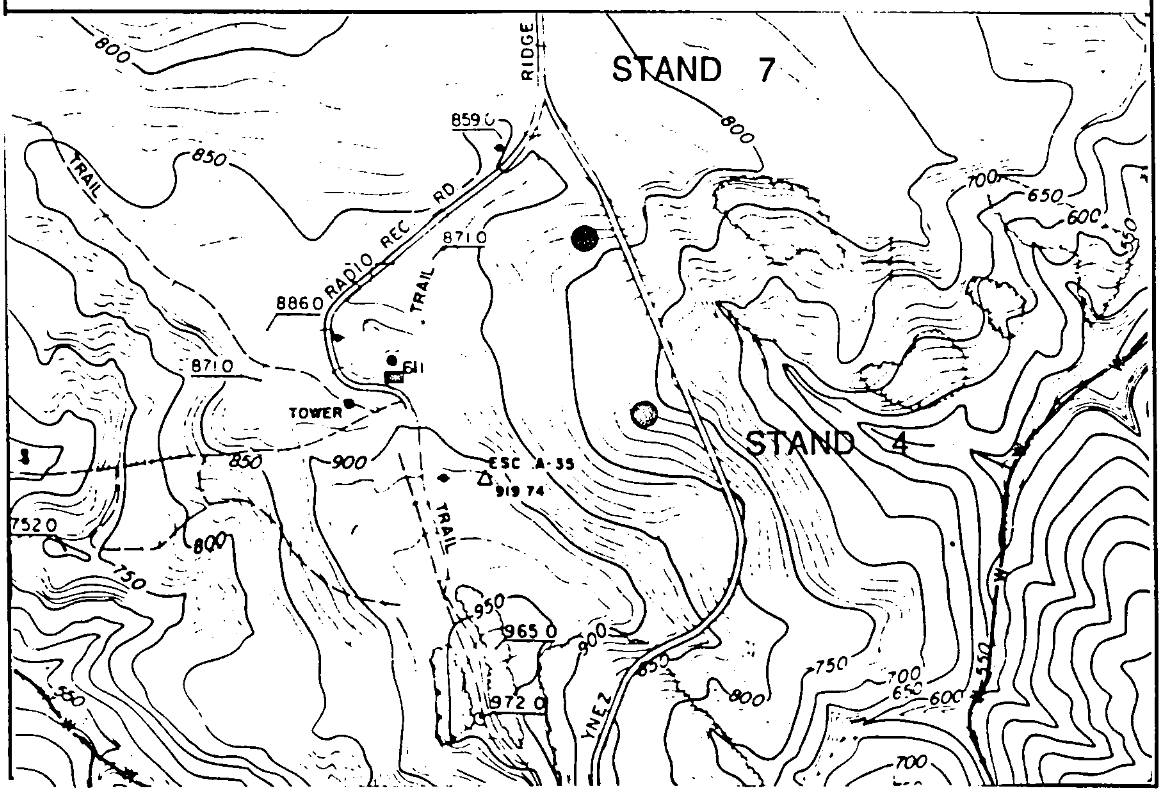


Figure IV-5. Location of Stand 5.

Vegetation type: Chaparral

Master Planning Map No.: 54

Transect Nos.: 64, 65, 66

SDSU Stand No. (if any): 23

Location: About 0.2 mile south of Arguello Boulevard on northwest side of jeep trail to Bear Creek Canyon.

Comments: Very dense stand.

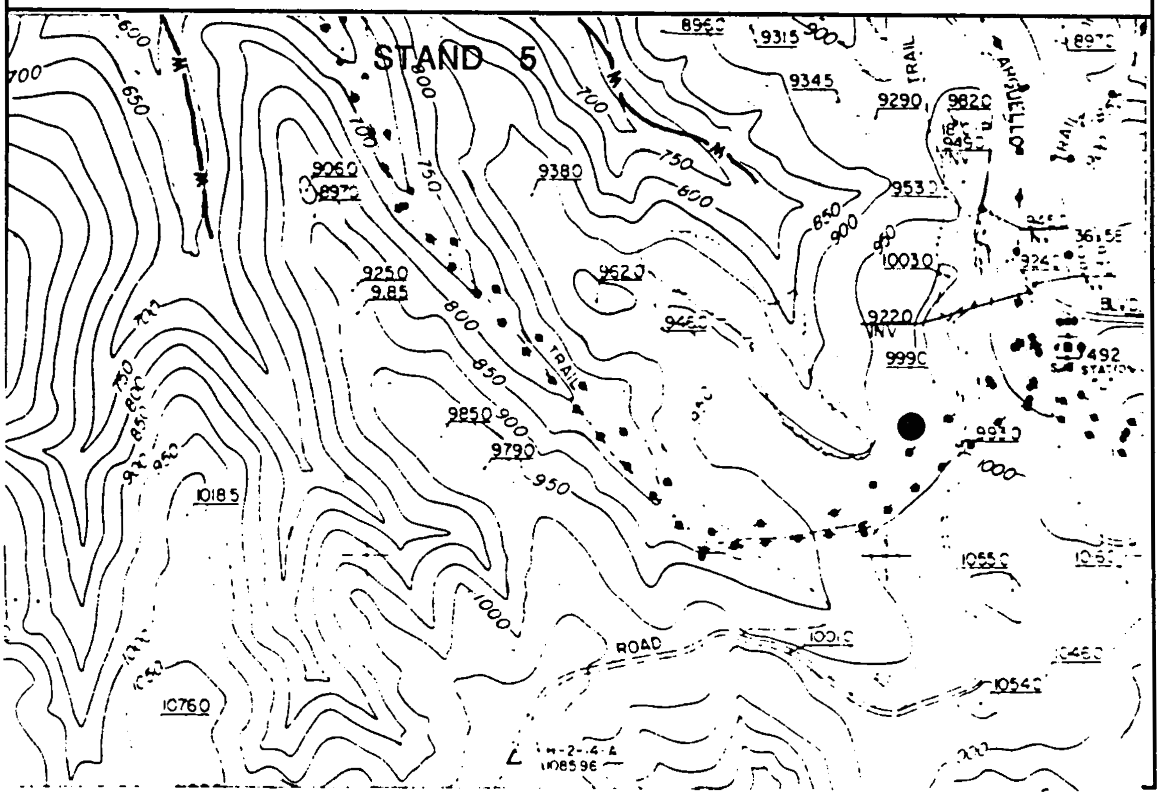


Figure IV-6. Location of Stand 6.

Vegetation type: Bishop pine

Master Planning Map No.: 55

Transect Nos.: 67, 68, 69

SDSU Stand No. (if any): 24

Location: Stand is on east side of Lucio Road about 300 m north of Arguello Boulevard.

Comments: Mature stand with closed canopy.

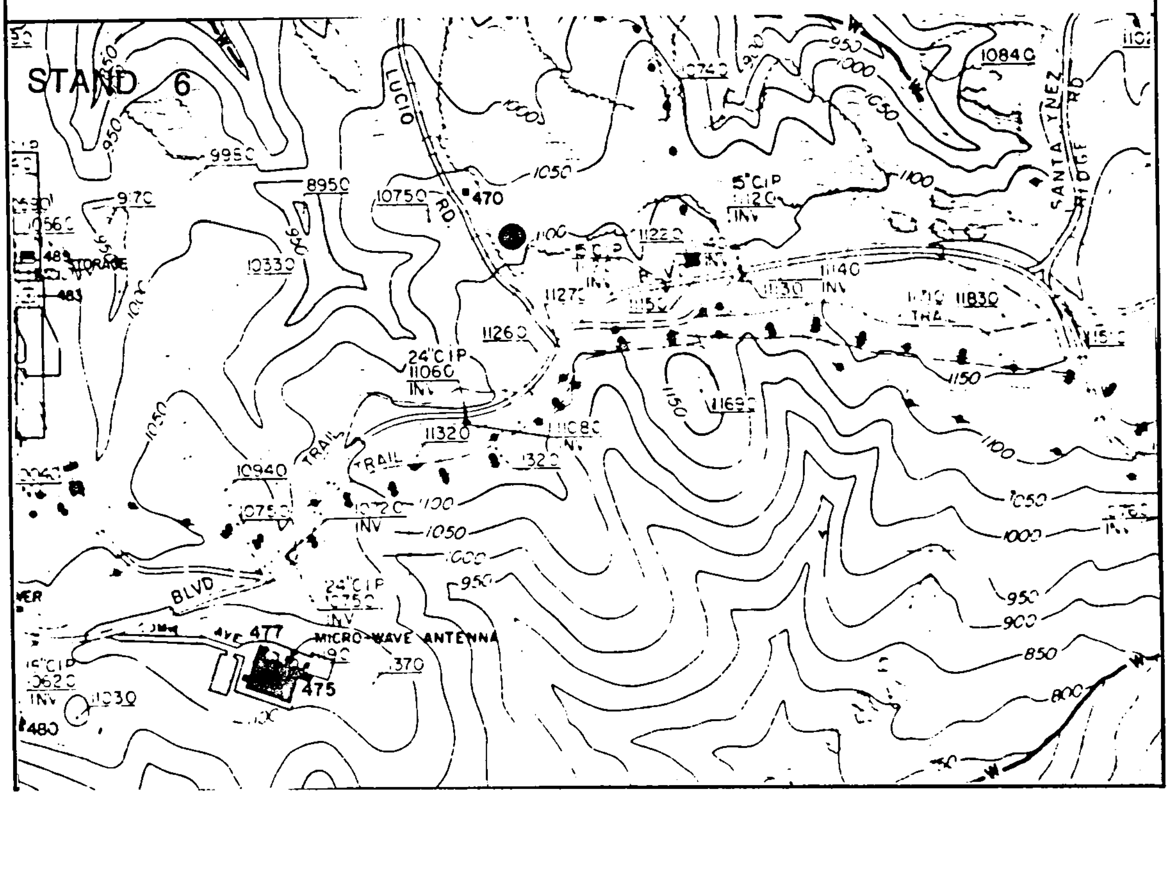


Figure IV-7. Location of Stand 8.

Vegetation type: Grassland

Master Planning Map No.: 8

Transect Nos.: 72, 73, 74

SDSU Stand No. (if any): N/A

Location: Take Soldado Road to end at tower near LF-21. Cross to opposite slope to the northeast. Transects are spaced along slope.

Comments:

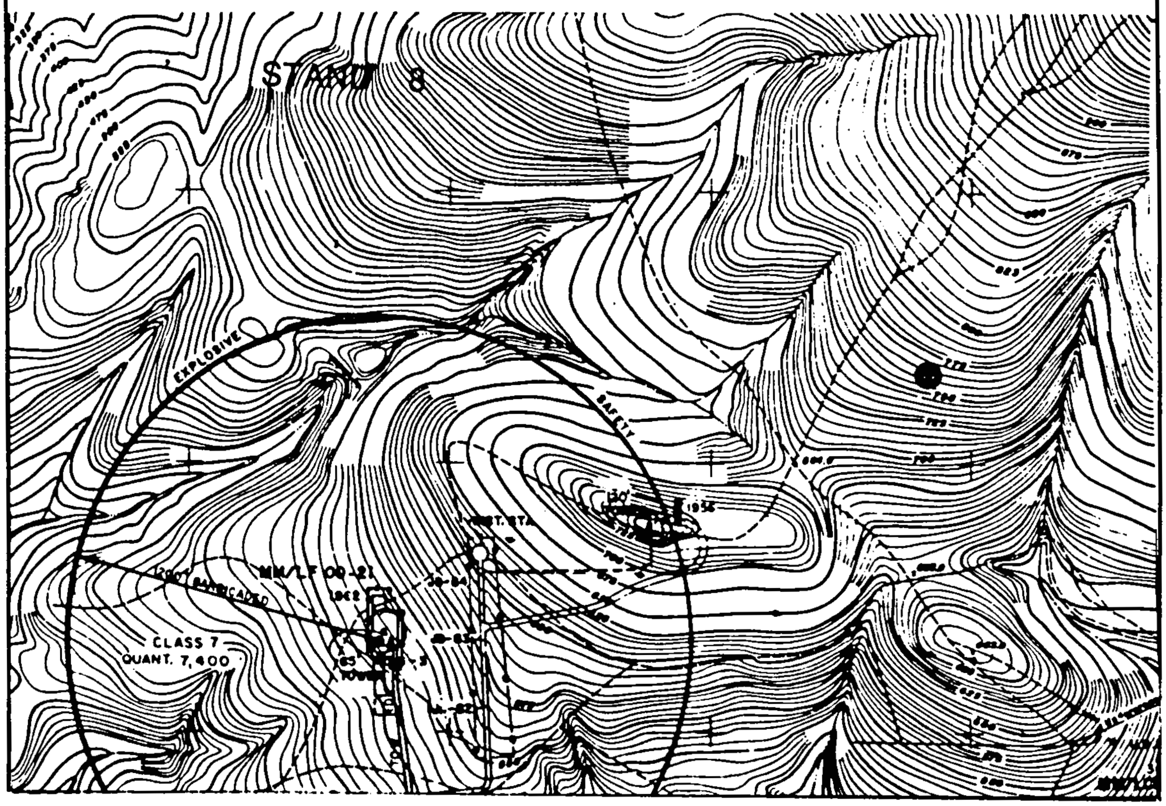


Figure IV-8. Location of Stand 9.

Vegetation type: Grassland

Master Planning Map No.: 5

Transect Nos.: 75, 76, 77

SDSU Stand No. (if any): N/A

Location: Take Combar Road to firebreak and then back firebreak to point where it turns to the north. Transects are west and downslope from this point.

Comments:

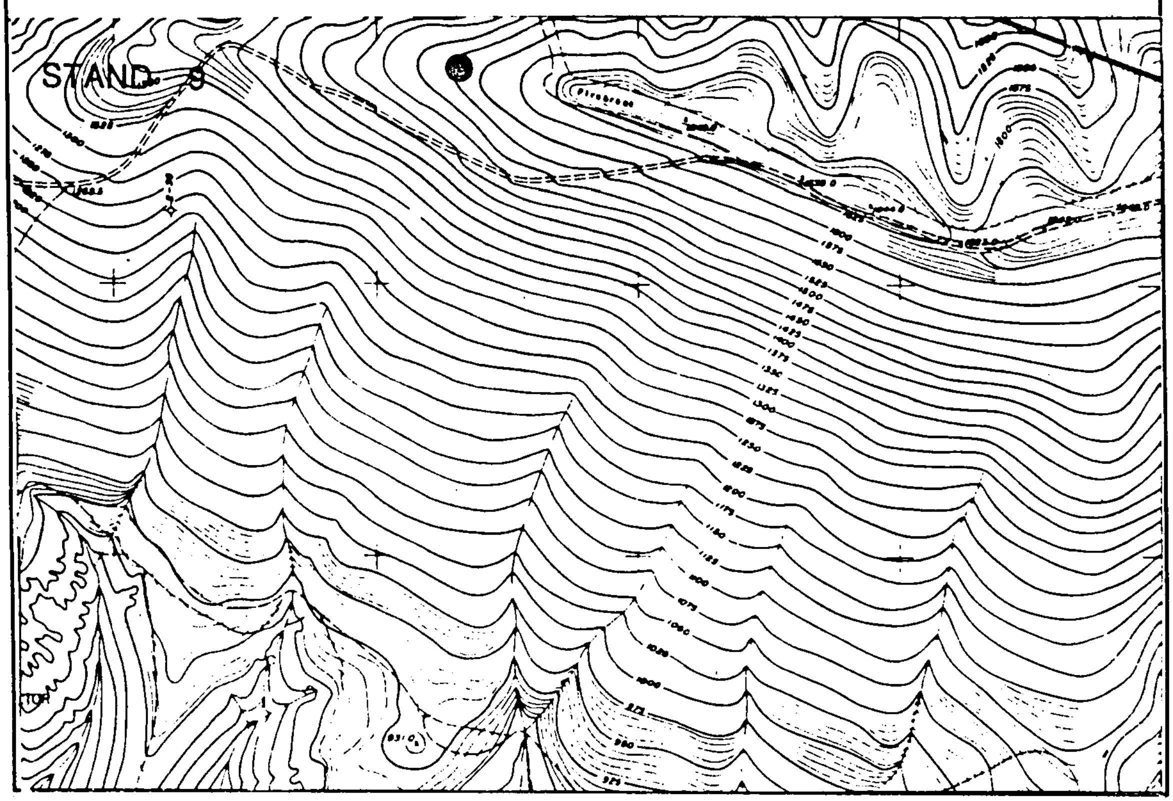


Figure IV-9. Location of Stand 10.

Vegetation type: Grassland

Master Planning Map No.: 8

Transect Nos.: 78, 79, 80

SDSU Stand No. (if any): N/A

Location: Take Globe Road to end at facility near LCF-01, then take dirt road through pasture beyond horse corral. Transects are on bench north of trail.

Comments:

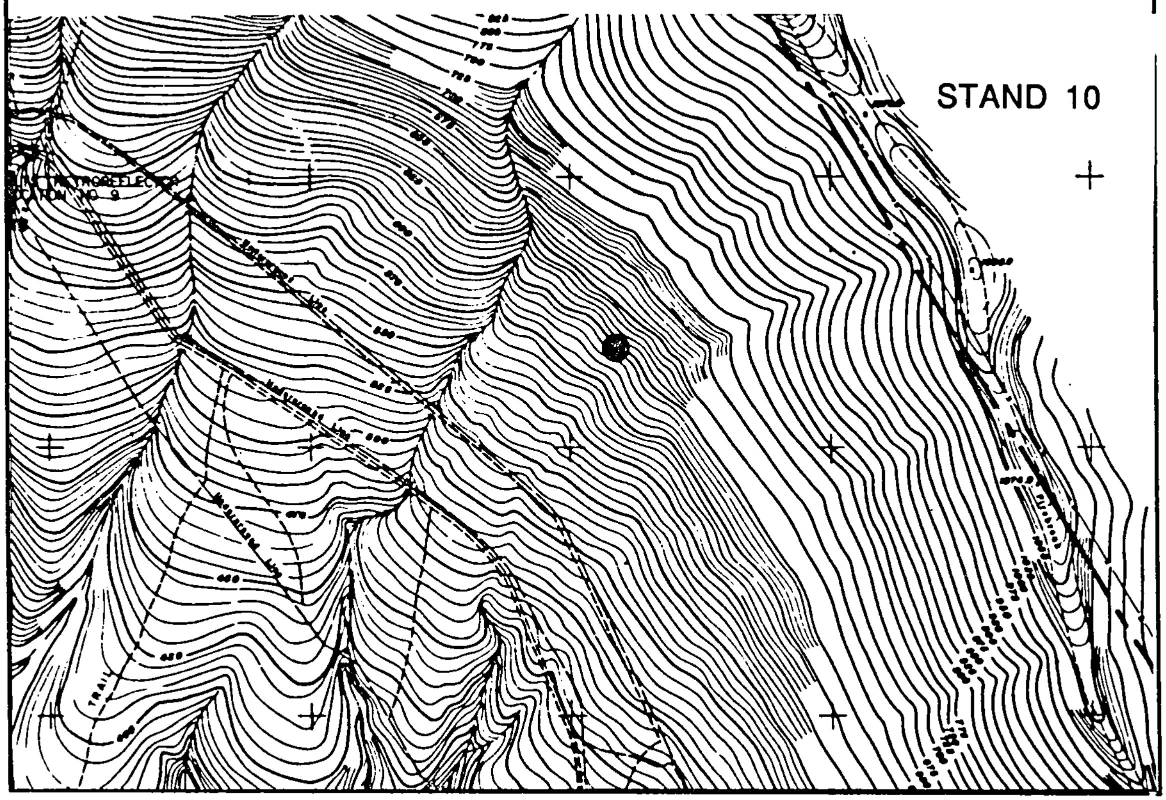


Figure IV-10. Location of Stand 11.

Vegetation type: Coastal dune scrub

Master Planning Map No.: 18

Transect Nos.: 81, 82, 83

SDSU Stand No. (if any): N/A

Location: Take Umbar Road to Perigee Road and then go east. Transects are south of road.

Comments:

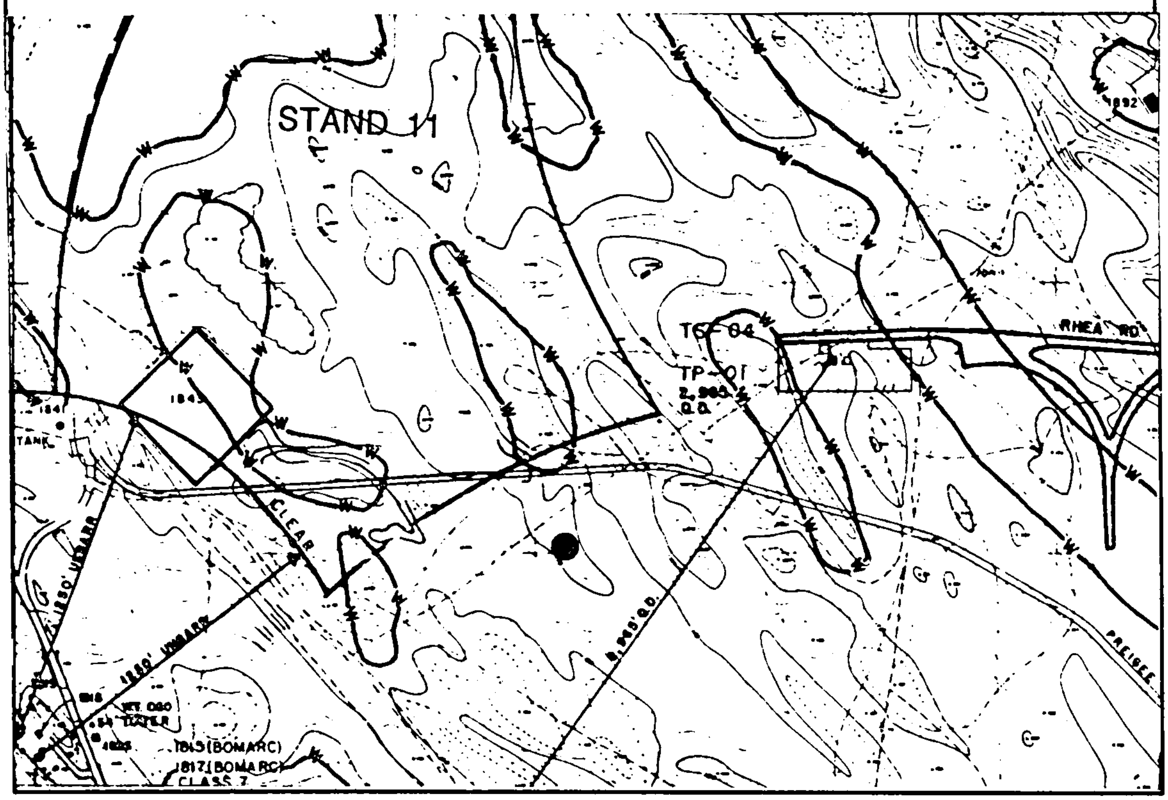


Figure IV-11. Location of Stand 12.

Vegetation type: Tanbark oak

Master Planning Map No.: 59

Transect Nos.: 84, 85

SDSU Stand No. (if any): 27

Location: Honda Ridge Road to Tranquillon Mountain. Take turnoff to right just (ca 0.2 mile) below summit to Building 185. Plots are west and upslope from building.

Comments: Forest with closed canopy and dense understory.

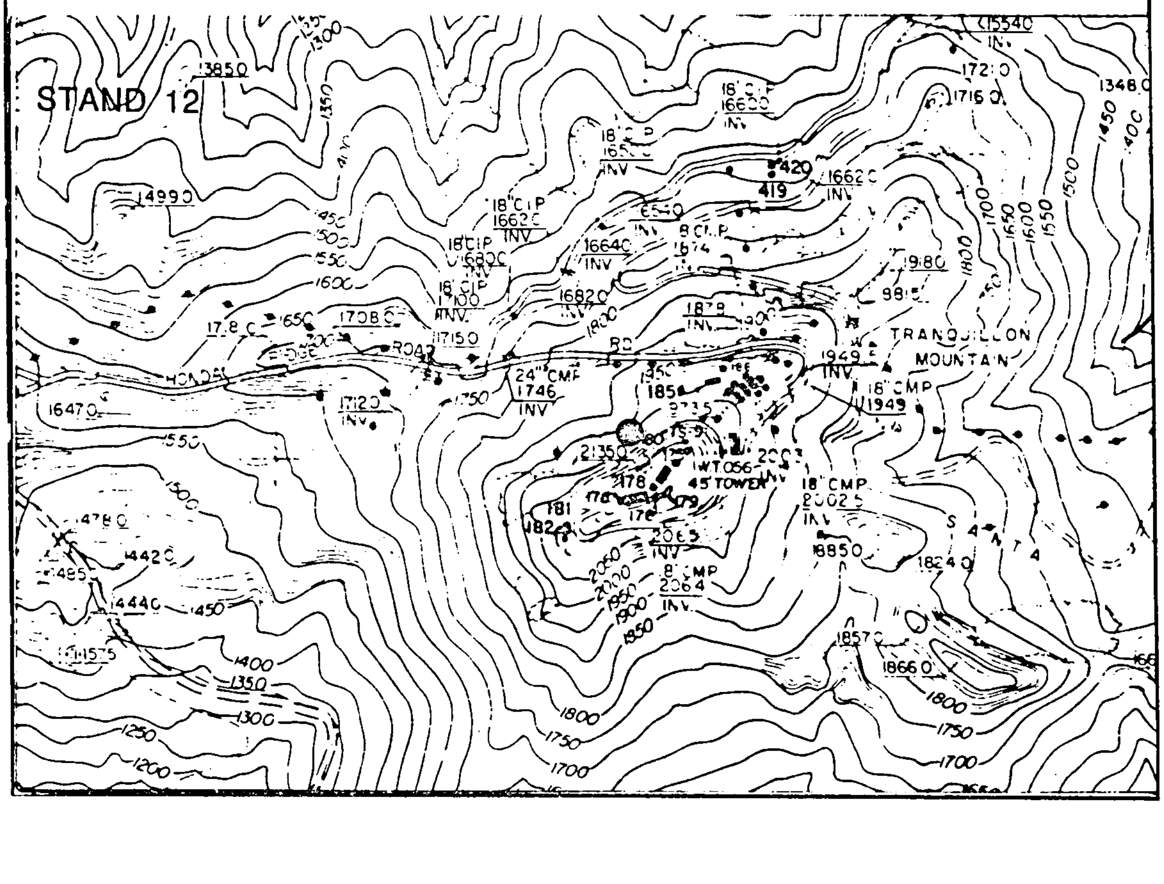


Figure IV-12. Location of Stand 13.

Vegetation type: Coastal sage scrub

Master Planning Map No.: 53

Transect Nos.: 86, 87, 88

SDSU Stand No. (if any): 26

Location: Honda Ridge Road about 0.6 mile east of Coast Road. Transects are northeast of road.

Comments:

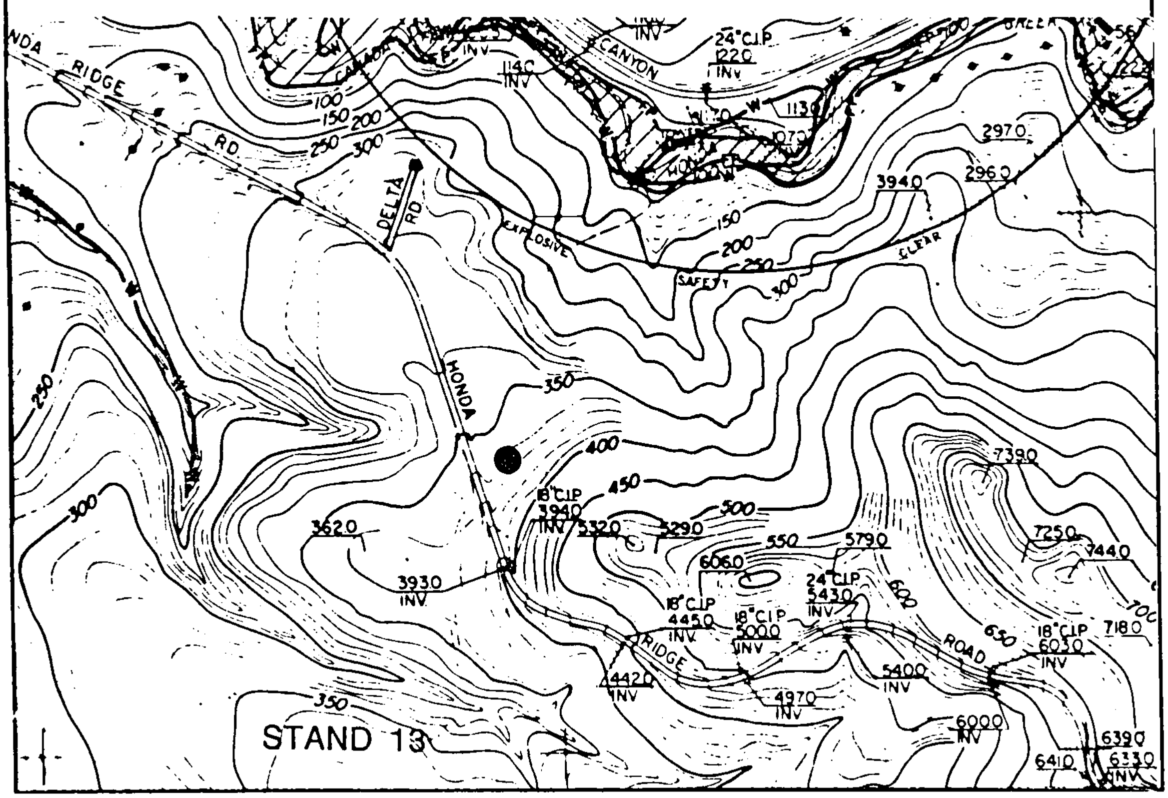


Figure IV-13. Location of Stand 14.

Vegetation type: Oak woodland

Master Planning Map No.: 21

Transect Nos.: 89, 90, 91

SDSU Stand No. (if any): 1

Location: State Route 20 about 2.1 miles northeast of San Antonio Road East, fourth turnoff on right. SDSU marker is by gate.

Comments: Some grazing occurs.

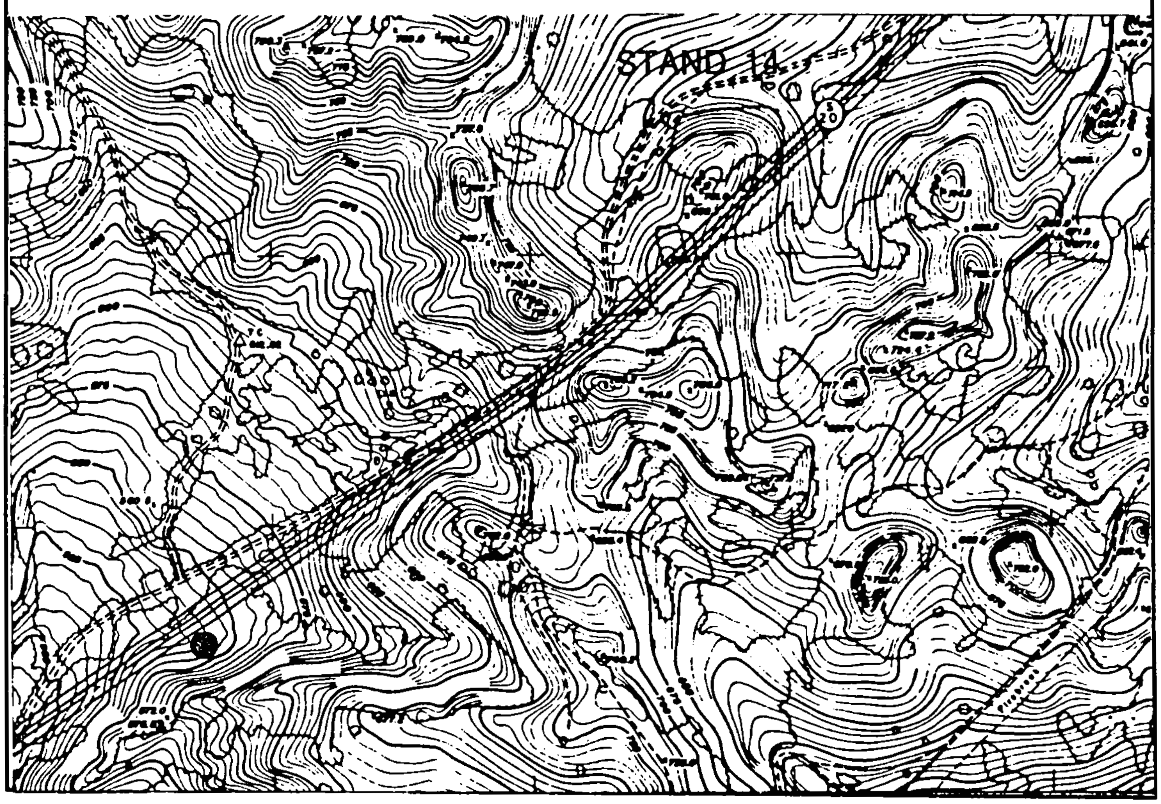


Figure IV-14. Location of Stand 15.

Vegetation type: Coastal dune scrub

Master Planning Map No.: 47

Transect Nos.: 92, 93, 94

SDSU Stand No. (if any): 10

Location: Old Surf Road about 0.1 mile south of Bear Creek Road. Transects are west of road.

Comments: Communication cables and other disturbances have occurred in area.

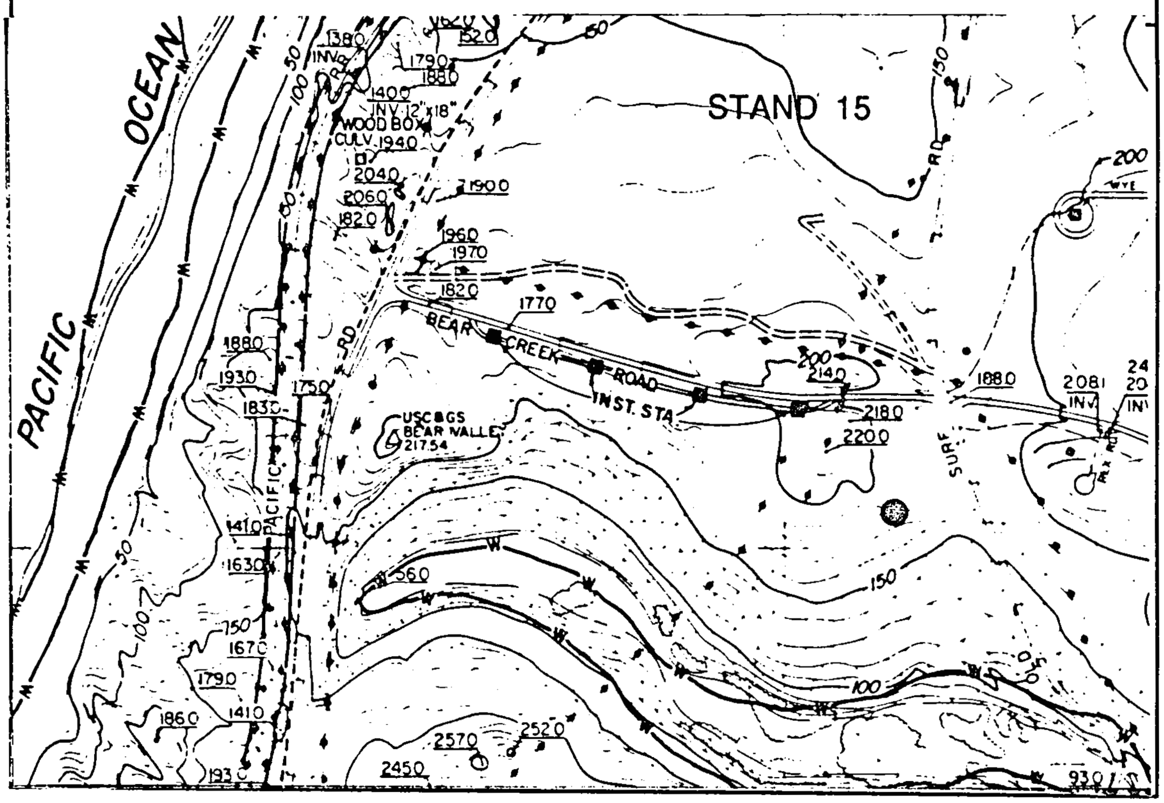


Figure IV-15. Location of Stand 16.

Vegetation type: Willow riparian woodland

Master Planning Map No.: 47

Transect Nos.: 96, 97

SDSU Stand No. (if any): N/A

Location: Bear Creek Canyon jeep trail east of Old Surf Road. Plot 97 is ca 0.4 mile east of junction; plot 96 is ca 1.0 mile east of junction. SLC-3 is upslope from this area.

Comments: Narrow riparian area along Bear Creek.

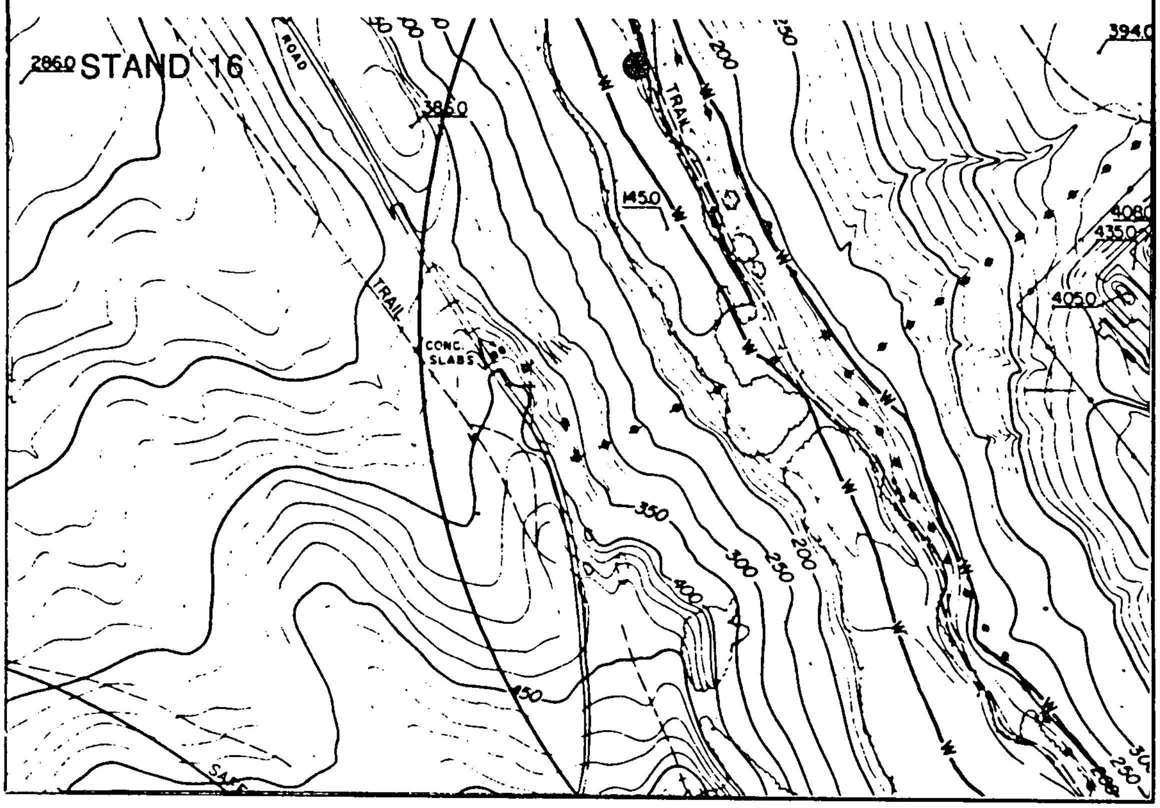


Figure IV-16. Location of Stand 16 (continued).

Vegetation type: Willow riparian woodland

Master Planning Map No.: 50

Transect Nos.: 95

SDSU Stand No. (if any): N/A

Location: Bear Creek Canyon jeep trail east of Old Surf Road. Plot 95 is 1.2 mile east of junction.

Comments: Narrow riparian area along Bear Creek.

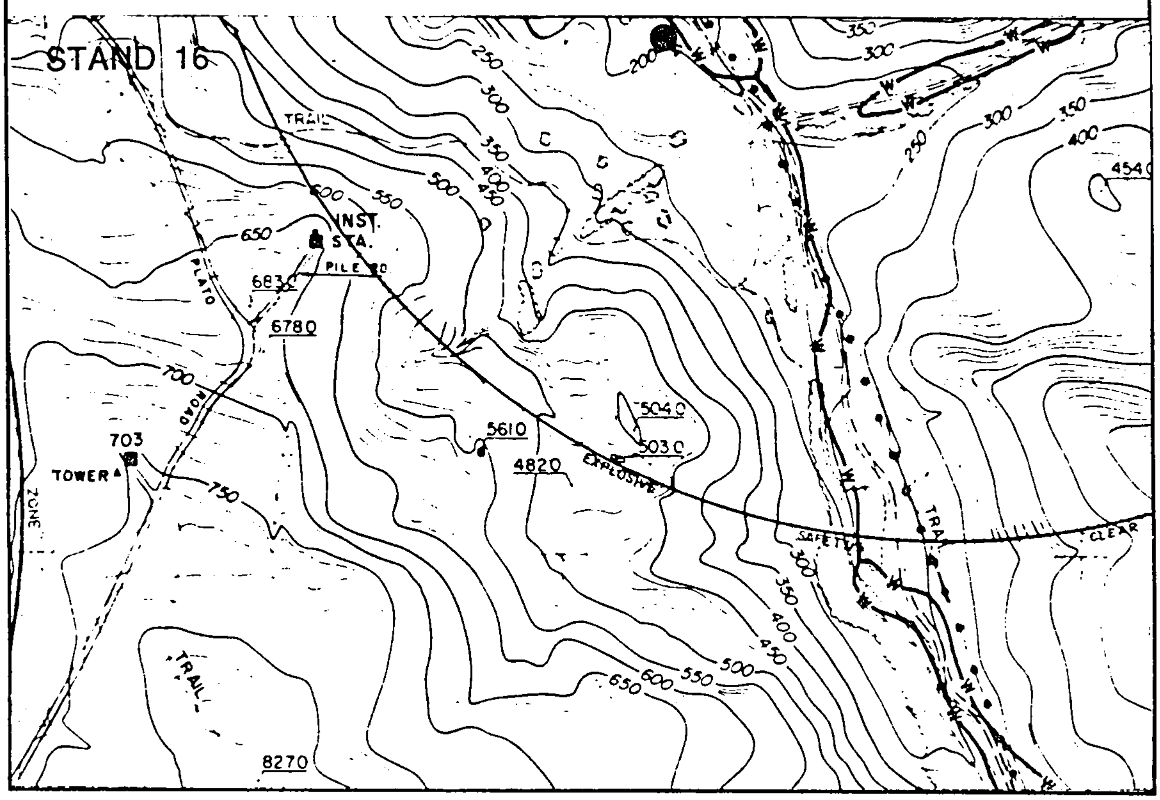


Figure IV-17. Location of Stand 17.

Vegetation type: Grassland

Master Planning Map No.: 64

Transect Nos.: 98, 99, 100

SDSU Stand No. (if any): 30

Location: Miguelito Road about 1.0 mile north of Coast Road. Transects are west of road.

Comments: Grazed at time of sampling.

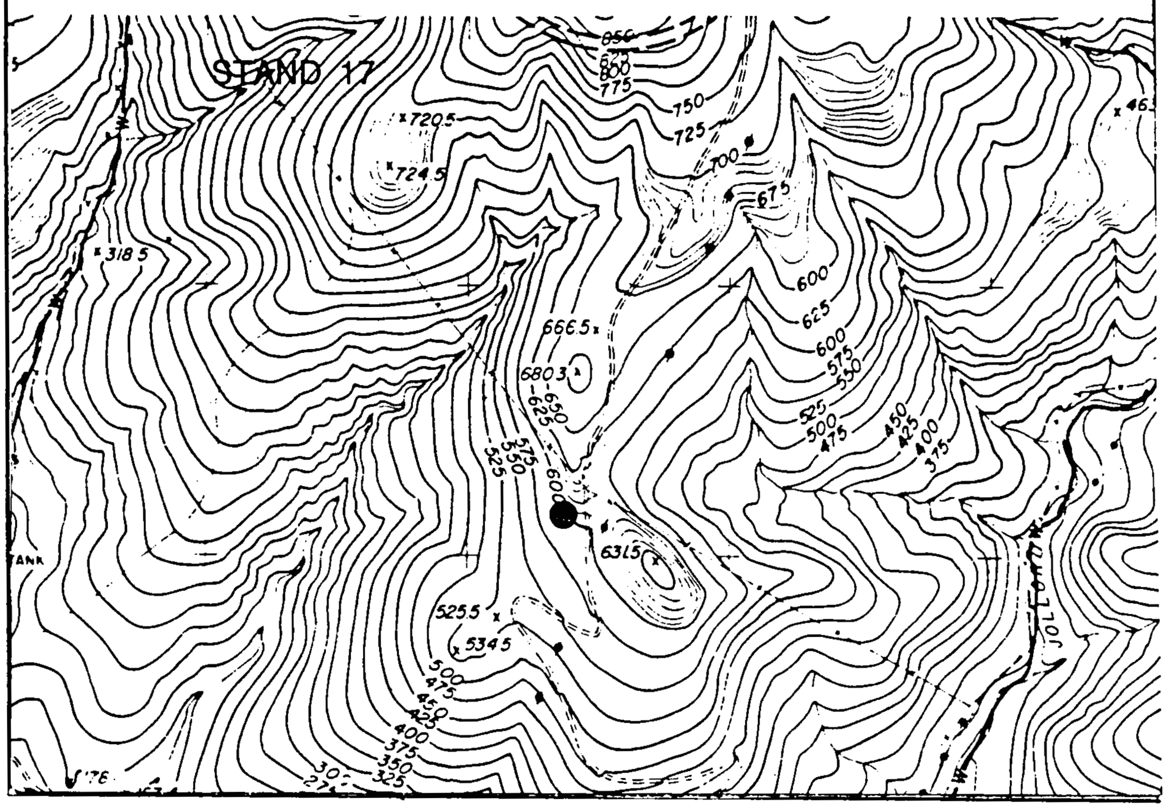


Figure IV-18. Location of Stand 18.

Vegetation type: Grassland

Master Planning Map No.: 62

Transect Nos.: 101, 102, 103

SDSU Stand No. (if any): 31

Location: Miguelito Road about 1.9mile north of Coast Road. Transects are west of road off jeep trail.

Comments: Grazed at time of sampling.

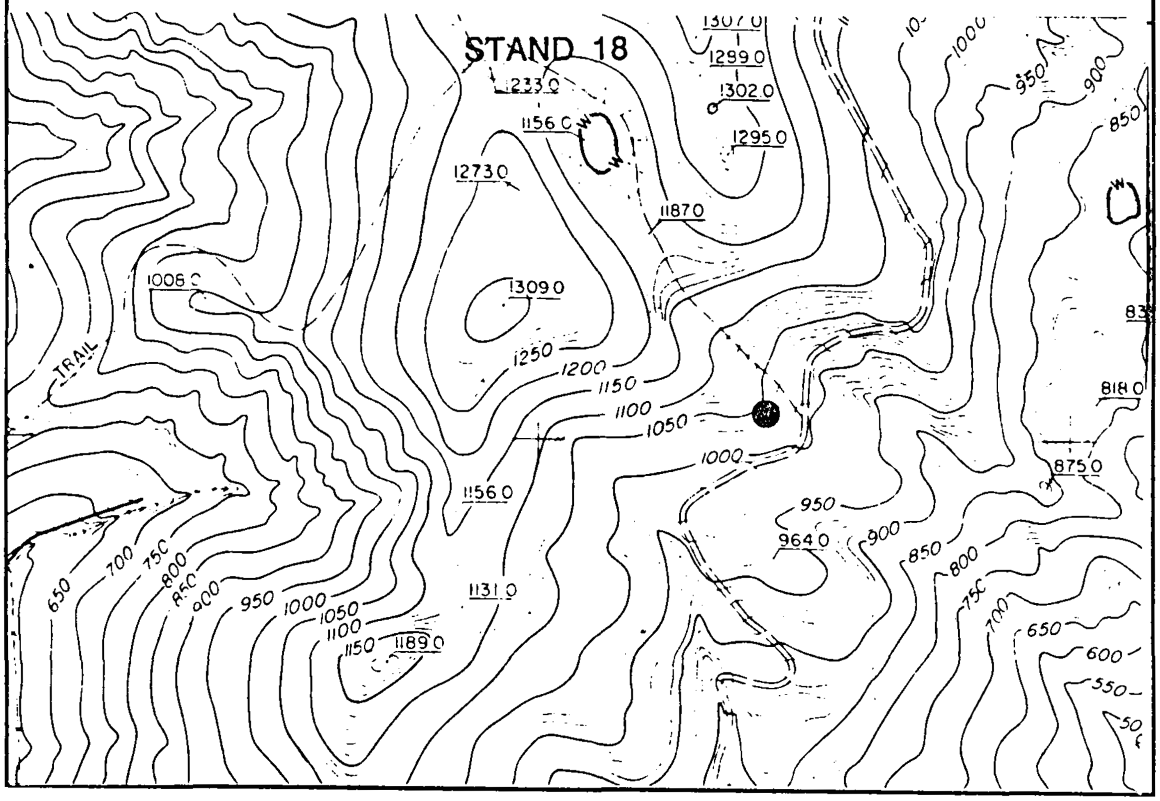


Figure IV-19. Location of Stand 19.

Vegetation type: Purple sage scrub

Master Planning Map No.: 61

Transect Nos.: 104, 105, 106

SDSU Stand No. (if any): 29

Location: Coast Road about 0.5 mile east of road to Boat House. Transects are on steep west-facing slope starting about 120 m north of road.

Comments: Grazed in vicinity.

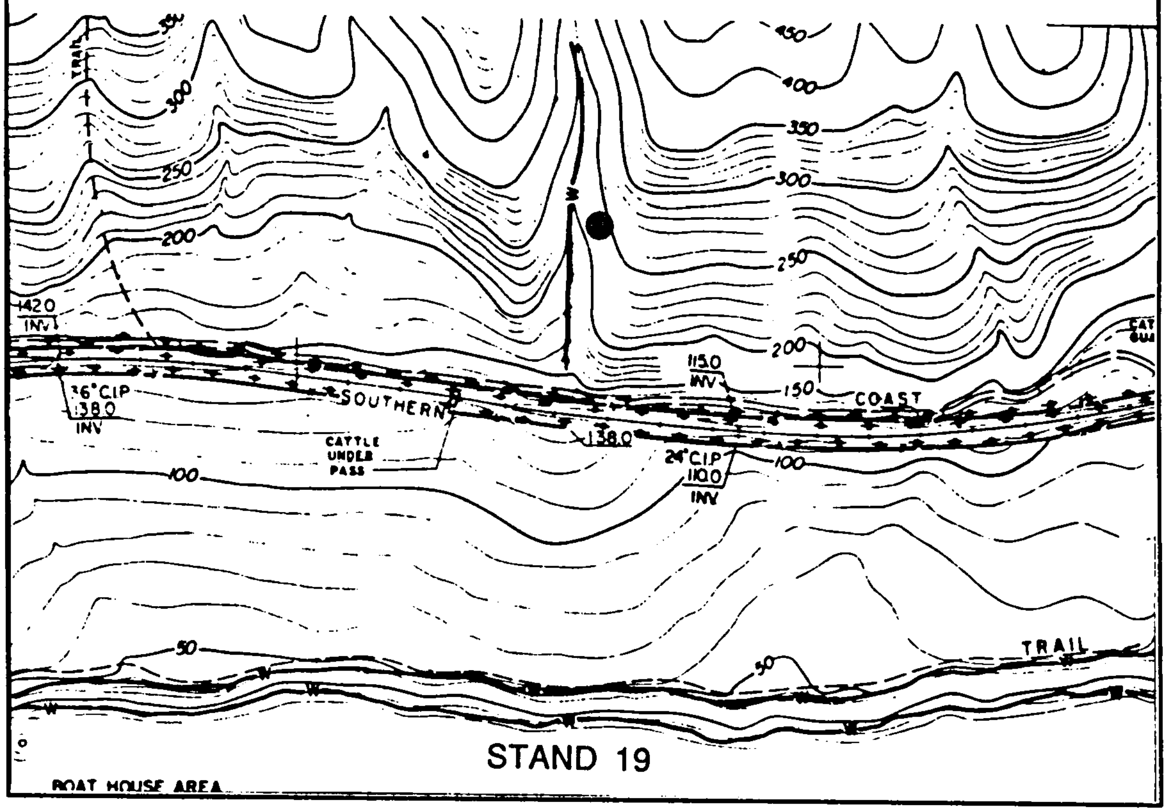


Figure IV-20. Location of Stand 20.

Vegetation type: Salt marsh

Master Planning Map No.: 41

Transect Nos.: 107, 108, 109

SDSU Stand No. (if any): 7

Location: Ocean Park Road about 0.5 mile west of junction with Highway 246. Transects are north of road.

Comments:

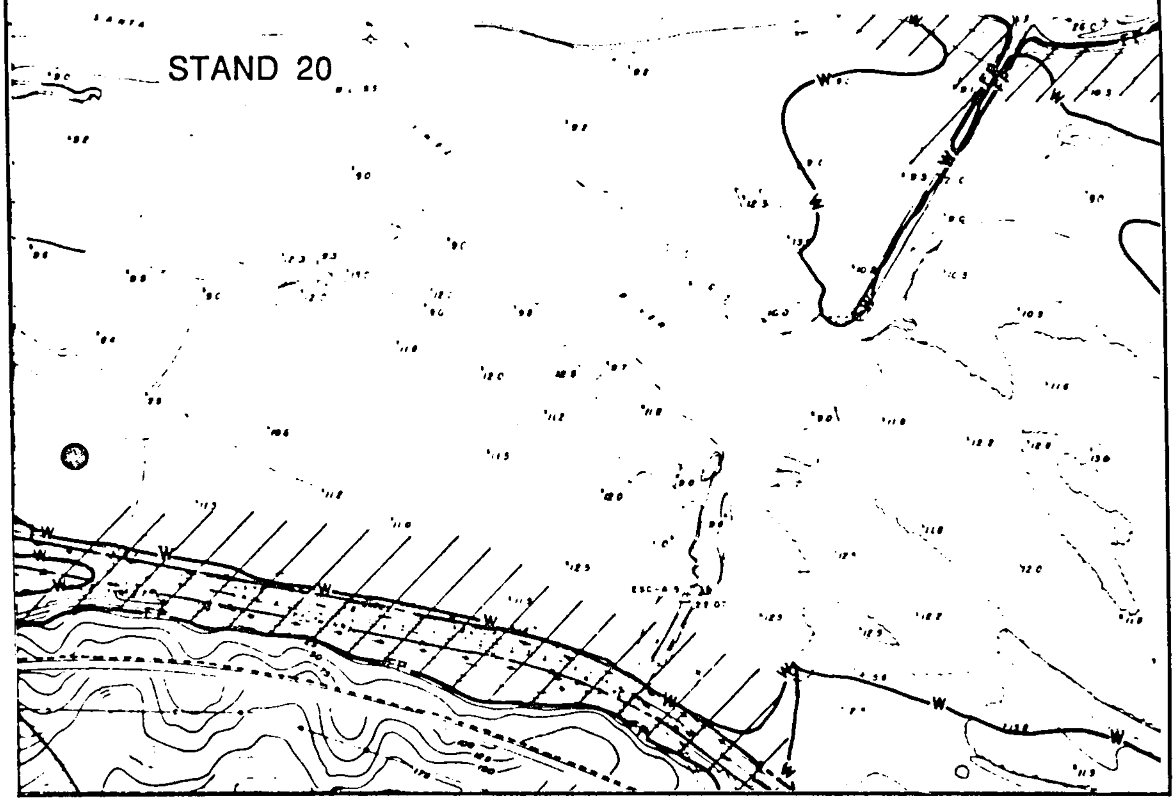


Figure IV-21. Location of Stand 21.

Vegetation type: Oak woodland

Master Planning Map No.: 51

Transect Nos.: 110, 111, 112

SDSU Stand No. (if any): 15

Location: Take La Salle Canyon Road from Highway 246 to gate at VAFB boundary. Continue up dirt road past "y" keeping to the left to barb wire gate in fence at firebreak trail. Take this trail to left for ca 75 m and then turn right on trail going upslope for ca 60 m.

Comments: Plot 110 is upslope from trail while plots 111 and 112 are downslope.

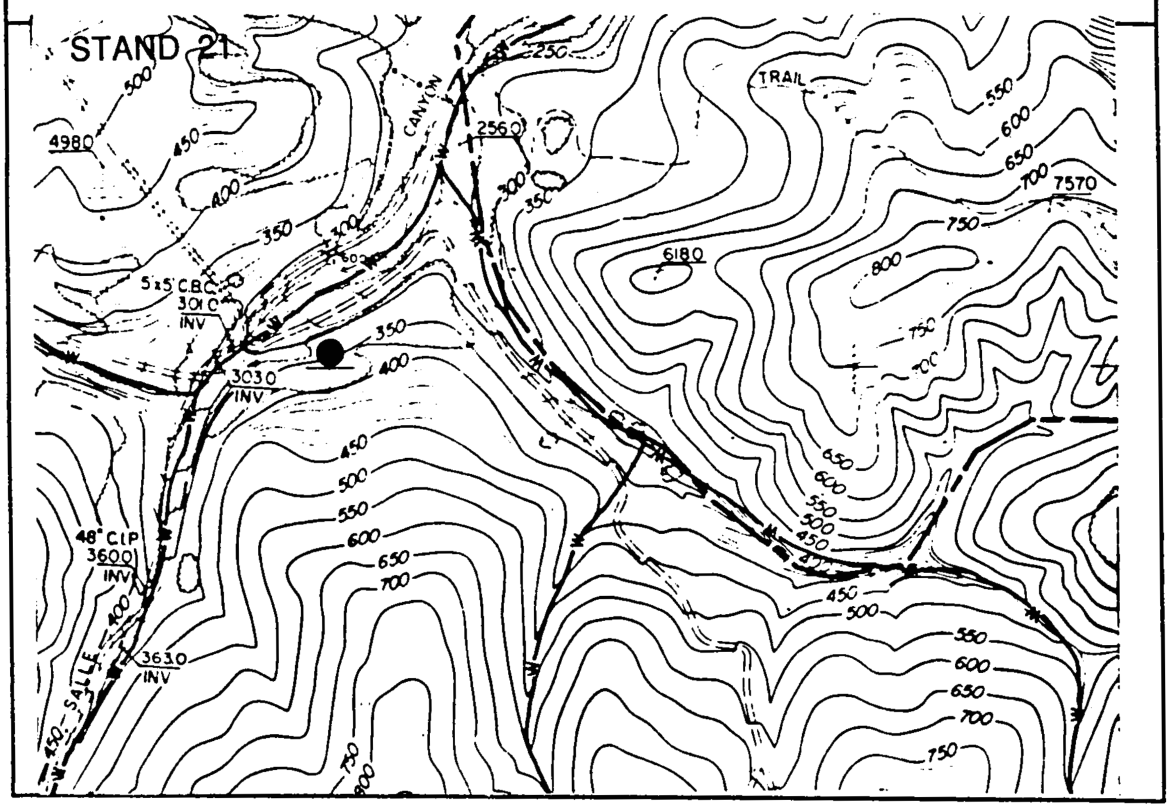


Figure IV-22. Location of Stand 22.

Vegetation type: Freshwater marsh

Master Planning Map No.: 25

Transect Nos.: 113, 114, 115

SDSU Stand No. (if any): N/A

Location: North side of Barka Slough off Well Road about 0.5 m east of State Route 20. Transects are south of road.

Comments: Cracks 1.5 m deep and 1.0 m wide have formed in organic soil

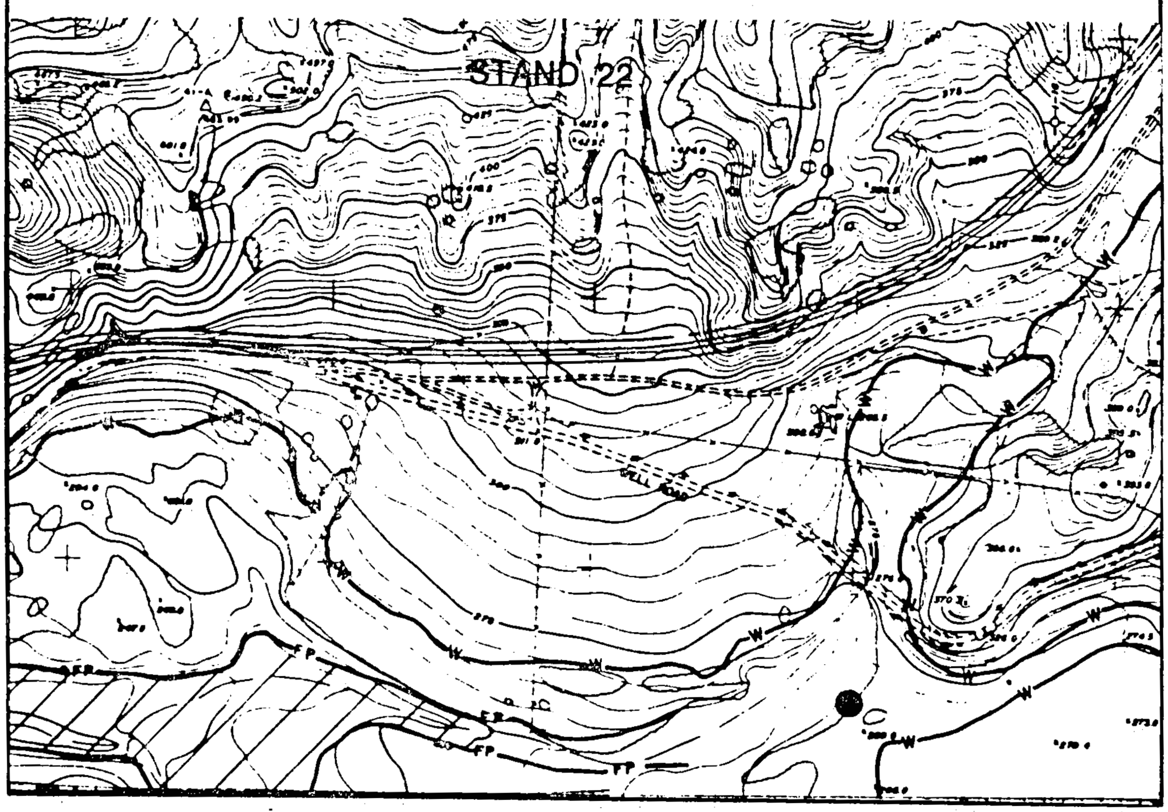


Figure IV-23. Location of Stand 23.

Vegetation type: Coastal dune

Master Planning Map No.: 22

Transect Nos.: 116, 117, 118

SDSU Stand No. (if any): N/A

Location: Take gravel road parallel to Southern Pacific Railroad north of Tangair Road, turn east about 0.4 mile north on this road, continue to end of gravel road, walk along dirt trail toward ocean then cross line of snow fences.

Comments: Part of area planted in Ammophila arenaria.

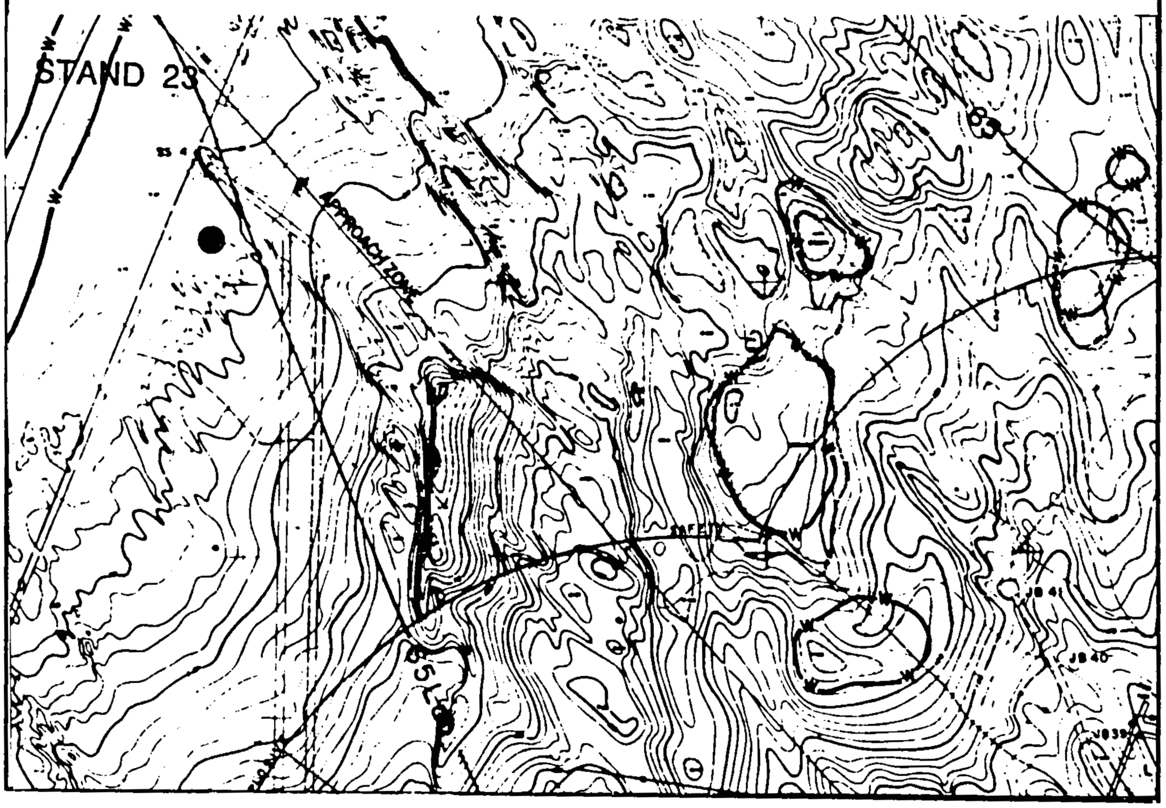


Figure IV-24. Location of Stand 24.

Vegetation type: Coastal dune

Master Planning Map No.: 22

Transect Nos.: 119, 120, 121

SDSU Stand No. (if any): N/A

Location: Take gravel road parallel to Southern Pacific Railroad north of Tangair Road, turn east at sign for least terns nesting area, continue to end, then cross stabilized dunes to coast.

Comments:

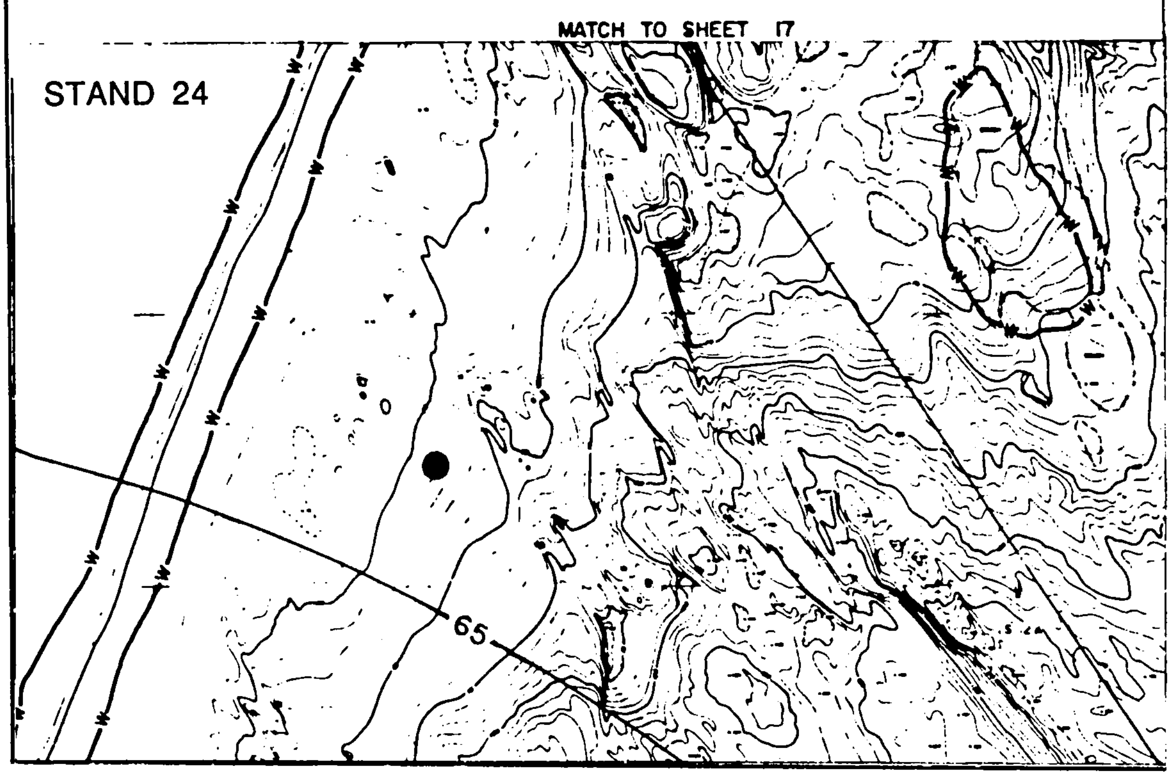


Figure IV-25. Location of Stand 25.

Vegetation type: Coastal dune

Master Planning Map No.: 17

Transect Nos.: 122, 123, 124

SDSU Stand No. (if any): N/A

Location: Take gravel road parallel to Southern Pacific Railroad to San Antonio Creek, follow trail in dunes along San Antonio Creek to coast.

Comments:

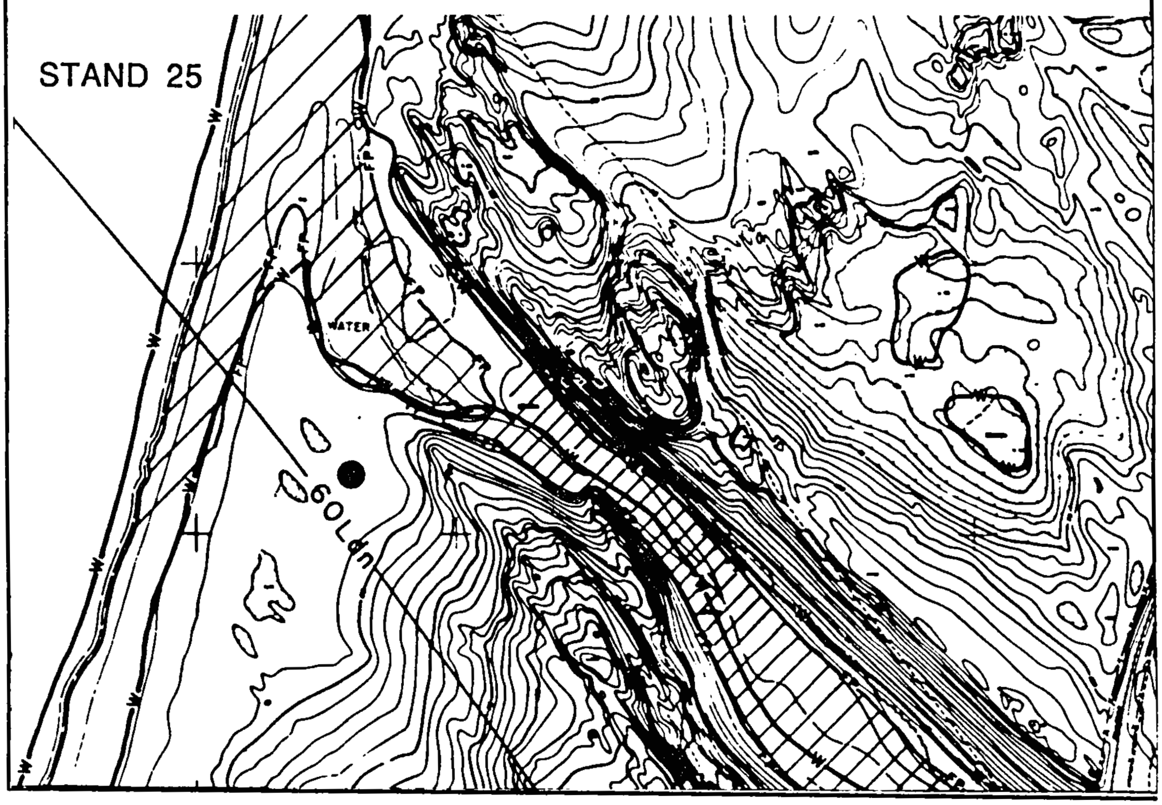


Figure IV-26. Location of Stand 26.

Vegetation type: Box elder riparian woodland

Master Planning Map No.: 15

Transect Nos.: 125, 126, 127

SDSU Stand No. (if any): N/A

Location: South side of Barka Slough, take San Antonio Road-East about 0.9 mile east of State Route 20, cross open, weedy field north of road and narrow fringe of willow to reach box elder.

Comments:

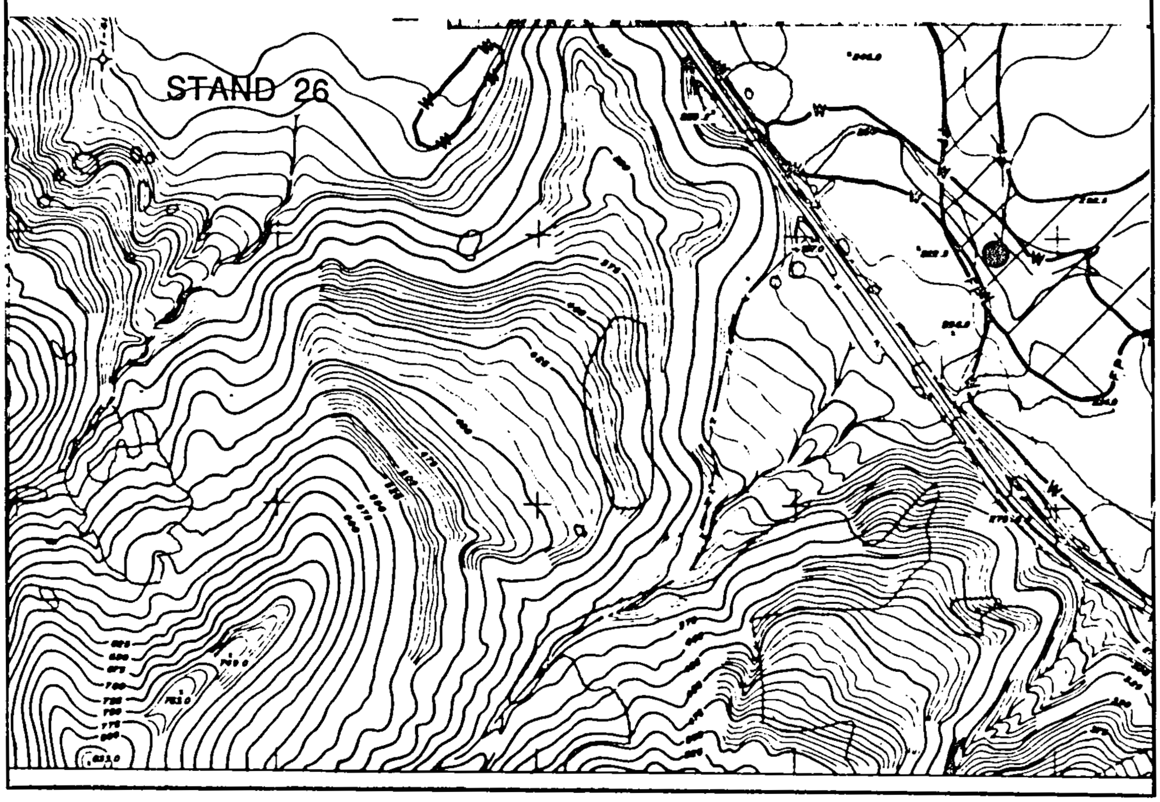


Figure IV-27. Location of Stand 27 and Stand 28.

Vegetation type: 27: Vernal pool; 28: seasonal wetland

Master Planning Map No.: 37

Transect Nos.: 27: 128; 28: 129

SDSU Stand No. (if any): N/A

Location: 35th Street, area of Eriodictyon site. Stand 27: follow grass strip outside of facility fence to large pool. Stand 28: cross disturbed area and chaparral to area of trough-mound topography.

Comments: Single transect at each site, sampled with 1 m2 plots at intervals along transect.

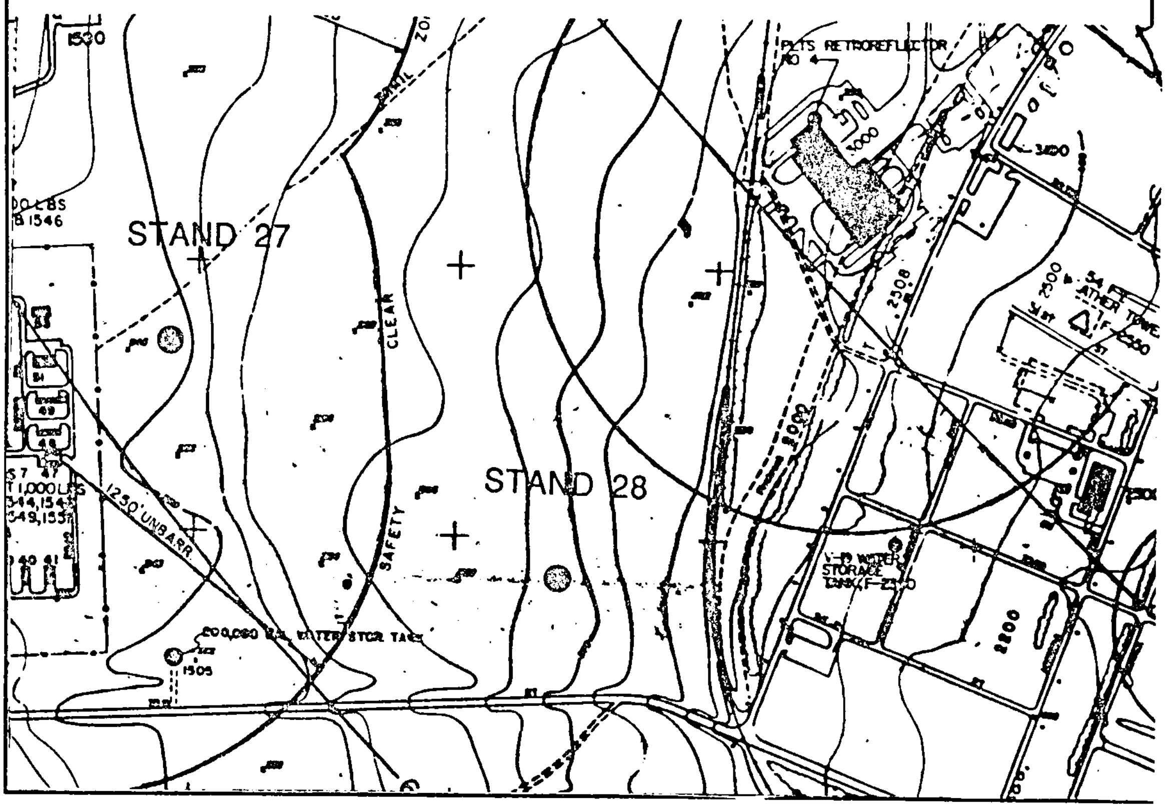


Figure IV-28. Location of Stand 29

Vegetation type: Seasonal wetland

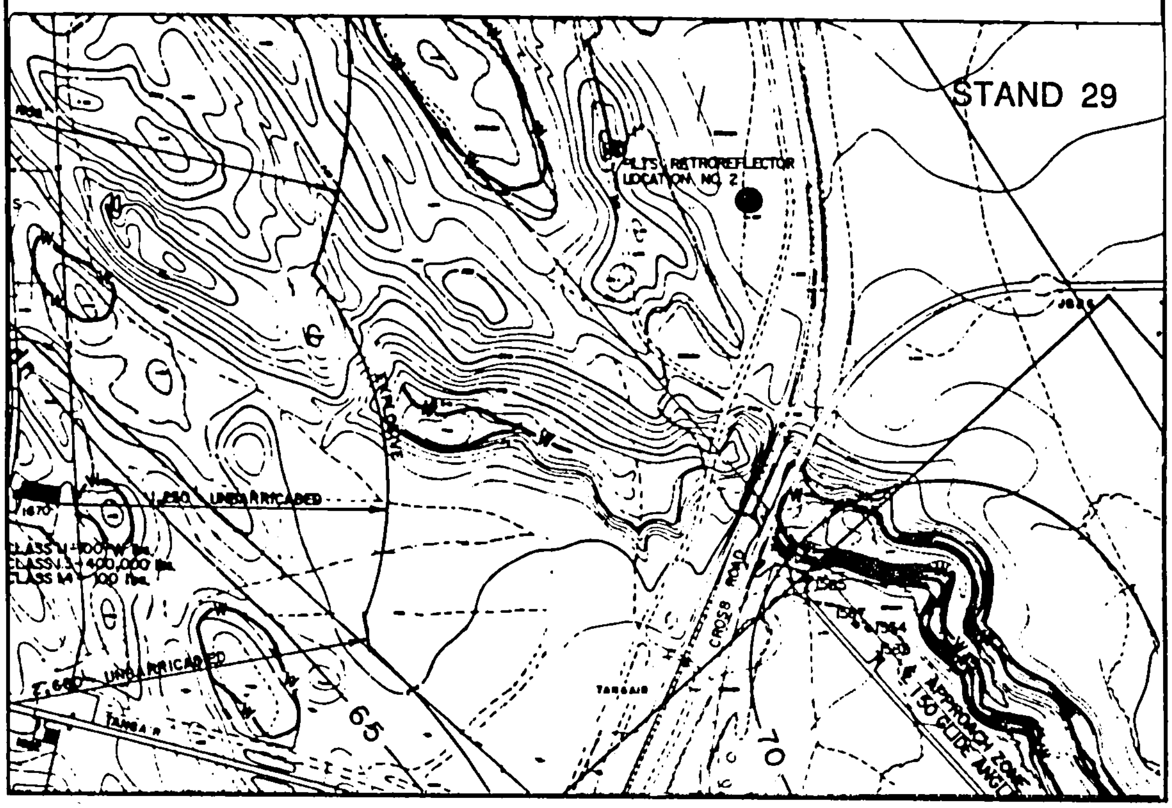
Master Planning Map No.: 27

Transect Nos.: 130

SDSU Stand No. (if any): N/A

Location: Take gravel road parallel to Southern Pacific Railroad north of Tangair Road for about 0.5 mile. Stand is west of road in area of trough-mound topography.

Comments: Single transect, sampled with 1 m2 plots along transect.



APPENDIX V

PERCENT COVER DATA FROM VEGETATION TRANSECTS AND SPECIES PRESENCE IN ASSOCIATED PLOTS

Table V-1. Composition (Percent Cover) of Transect #51.

TAXA	> 0.5m	< 0.5m
Arctostaphylos purissima	51.3	0.0
Ceanothus ramulosus	5.3	0.0
Dead - Ceanothus ramulosus	3.3	0.0
Dead - Ceanothus sp.	3.3	0.0
Mimulus aurantiacus	0.0	2.0
Salvia mellifera	0.0	1.3
Croton californicus	0.0	1.0
Bare ground	0.0	35.7
Total - live	56.6	4.3
Total - dead	6.6	0.0

Table V-2. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #51.

Herbs
- Bromus mollis
- Chorizanthe sp.
- Crassula erecta
- Galium nuttallii
- Gnaphalium californicum/ramosissimum
- Gnaphalium purpureum/luteo-album/chilense/beneolens
- Horkelia cuneata
- Navarretia sp.
- Vulpia octoflora

Shrubs
- Adenostoma fasciculatum

Table V-3. Composition (Percent Cover) of Transect #52.

TAXA	> 0.5m	< 0.5m
Arctostaphylos purissima	55.3	0.0
Arctostaphylos rudis	29.3	0.0
Ericameria ericoides	4.7	2.0
Cortaderia jubata	2.0	0.0
Dead - Arctostaphylos purissima	8.0	0.0
Dead - Arctostaphylos rudis	2.0	14.7
Dead - Ericameria ericoides	2.0	0.0
Mimulus aurantiacus	0.0	2.0
Dead - Mimulus aurantiacus	0.0	1.3
Total - live	91.3	4.0
Total - dead	12.0	16.0

Table V-4. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #52.

Herbs
- Apiastrum sp./Daucus sp.
- Camissonia micrantha
- Chorizanthe sp.
- Crassula erecta
- Erodium cicutarium
- Galium nuttallii
- Gnaphalium californicum/ramosissimum
- Gnaphalium purpureum/luteo-album/chilense/beneolens
- Horkelia cuneata
- Navarretia sp.
- Pityrogramma triangularis
- Vulpia octoflora

Shrubs
- Adenostoma fasciculatum
- Baccharis pilularis ssp. consanguinea
- Salvia mellifera

Table V-5. Composition (Percent Cover) of Transect #53.

TAXA	> 0.5m	< 0.5m
Arctostaphylos purissima	54.7	1.0
Mimulus aurantiacus	8.7	3.7
Arctostaphylos rudis	8.0	0.0
Salvia mellifera	4.7	0.0
Adenostoma fasciculatum	3.3	0.0
Baccharis pilularis ssp. consanguinea	1.0	0.0
Ericameria ericoides	0.3	0.0
Dead - Arctostaphylos purissima	3.3	0.0
Dead - Ceanothus sp.	2.7	1.3
Dead - Mimulus aurantiacus	0.7	0.0
Lotus scoparius	0.0	1.7
Horkelia cuneata	0.0	0.7
Galium nuttallii	0.0	0.3
Bare ground	0.0	13.3
Total - live	80.7	7.4
Total - dead	6.7	1.3

Table V-6. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #53.

Herbs
- Anagallis arvensis
- Apiastrum sp./Daucus sp.
- Camissonia micrantha
- Carex cf. globosa
- Chorizanthe sp.
- Crassula erecta
- Croton californicus
- Cryptantha sp.
- Erodium cicutarium
- Filago sp.
- Gnaphalium californicum/ramosissimum
- Gnaphalium purpureum/luteo-album/chilense/beneolens
- Marah fabaceus
- Navarretia atractyloides
- Stylocline gnaphalioides
- Vulpia octoflora

Shrubs
- Ceanothus ramulosus
- Eriophyllum confertiflorum
- Salvia mellifera

Table V-7. Composition (Percent Cover) of Transect #54.

TAXA	> 0.5m	< 0.5m
Quercus wislizenii	32.0	16.0
Toxicodendron diversilobum	6.7	0.7
Baccharis pilularis ssp. consanguinea	3.3	0.0
Salvia mellifera	1.3	0.0
Dead - Salvia mellifera	18.0	0.0
Dead - Quercus wislizenii	13.3	0.0
Dead - Pteridium aquilinum	8.0	3.7
Dead - Baccharis pilularis ssp. consanguinea	6.0	0.0
Agrostis sp.	0.0	10.0
Carex cf. globosa	0.0	8.7
Artemisia californica	0.0	0.7
Ericameria ericoides	0.0	0.7
Gnaphalium sp.	0.0	0.3
Poaceae - unknown	0.0	0.3
Total - live	43.3	37.4
Total - dead	45.3	3.7

Table V-8. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #54.

Herbs
- Apiastrum sp./Daucus sp.
- Camissonia micrantha
- Chorizanthe sp.
- Claytonia perfoliata
- Crassula erecta
- Cryptantha sp.
- Dichelostemma pulchellum
- Filago sp.
- Galium nuttallii
- Horkelia cuneata
- Pteridium aquilinum
- Sanicula crassicaulis
- Sonchus sp.
- Vulpia octoflora

Shrubs
- Adenostoma fasciculatum
- Arctostaphylos rudis
- Heteromeles arbutifloia
- Rhamnus californica

Table V-9. Composition (Percent Cover) of Transect #55.

TAXA	> 0.5m	< 0.5m
Quercus wislizenii	57.7	6.0
Adenostoma fasciculatum	2.0	5.0
Dead - Ceanothus sp.	19.3	2.7
Dead - Pteridium aquilinum	3.3	0.7
Carex cf. globosa	0.0	21.0
Agrostis sp.	0.0	13.7
Unknown herbs	0.0	4.0
Ericameria ericoides	0.0	1.3
Galium nuttallii	0.0	1.3
Lotus scoparius	0.0	1.0
Gnaphalium sp.	0.0	0.3
Poaceae - unknown	0.0	0.3
Salvia mellifera	0.0	0.3
Dead - Quercus wislizenii	0.0	0.3
Bare ground	0.0	4.0
Total - live	59.7	54.2
Total - dead	22.6	3.7

Table V-10. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #55.

Herbs
- Apiastrum angustifolium
- Camissonia micrantha
- Chorizanthe sp.
- Crassula erecta
- Cryptantha sp.
- Dichelostemma pulchellum
- Eriastrum densifolium
- Filago californica
- Gnaphalium californicum/ramosissimum
- Gnaphalium purpureum
- Horkelia cuneata
- Hypochoeris glabra
- Lathyrus sp.
- Lotus strigosus
- Navarretia sp.
- Plantago erecta
- Pteridium aquilinum
- Sagina occidentalis
- Vulpia myuros
- Vulpia octoflora

Shrubs
- Arctostaphylos rudis
- Baccharis pilularis ssp. consanguinea
- Toxicodendron diversilobum

Table V-11. Composition (Percent Cover) of Transect #56.

TAXA	> 0.5m	< 0.5m
Quercus wislizenii	32.7	5.3
Ceanothus impressus	8.7	0.0
Ericameria ericoides	4.0	3.3
Artemisia californica	1.3	1.0
Dead - Quercus wislizenii	26.7	0.0
Dead - Ceanothus impressus	14.7	0.0
Agrostis sp.	0.0	10.0
Unknown herbs	0.0	5.7
Gnaphalium sp.	0.0	5.0
Carex cf. globosa	0.0	2.7
Dead - Pteridium aquilinum	0.0	3.3
Bare ground	0.0	2.0
Total - live	46.7	33.0
Total - dead	41.4	3.3

Table V-12. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #56.

Herbs
- Achillea millefolium
- Apiastrum angustifolium
- Chorizanthe sp.
- Cirsium sp.
- Claytonia perfoliata
- Cryptantha sp.
- Galium nuttallii
- Gnaphalium californicum/ramosissimum
- Gnaphalium purpureum/luteo-album/chilense/beneolens
- Marah fabaceus
- Paeonia californica
- Pteridium aquilinum
- Pterostegia drymarioides
- Sagina occidentalis
- Sanicula crassicaulis
- Scrophularia californica/atrata
- Stachys bullata

Shrubs
- Baccharis pilularis ssp. consanguinea
- Rhamnus californica
- Toxicodendron diversilobum

Table V-13. Composition (Percent Cover) of Transect #57.

TAXA	> 0.5m	< 0.5m
Arctostaphylos purissima/ refugioensis	78.0	0.0
Quercus wislizenii	12.7	5.3
Baccharis pilularis ssp. consanguinea	2.0	0.0
Dead - Ceanothus sp.	13.0	0.0
Dead - Pteridium aquilinum	5.3	0.0
Dead - Quercus wislizenii	1.3	0.0
Total - live	92.7	5.3
Total - dead	19.9	0.0

Table V-14. Composition (Percent Cover) of Transect #58.

TAXA	> 0.5m	< 0.5m
Lotus scoparius	48.0	0.0
Prunus ilicifolia	34.0	1.3
Heteromeles arbutifolia	10.7	0.0
Encelia californica	8.0	0.0
Solanum xantii var. hoffmannii	4.0	1.3
Dead - Lotus scoparius	6.0	4.7
Dead - Heteromeles arbutifolia	2.7	0.0
Bare ground	0.0	2.0
Total - live	94.0	2.6
Total - dead	8.7	4.7

Table V-15. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #58.

Herbs
  Perezia microcephala

Shrubs
  Salvia leucophylla

Table V-16. Composition (Percent Cover) of Transect #59.

TAXA	> 0.5m	< 0.5m
Lotus scoparius	44.7	0.0
Prunus ilicifolia	34.0	0.0
Heteromeles arbutifolia	24.0	0.0
Encelia californica	1.3	0.0
Dead - Heteromeles arbutifolia	3.3	0.0
Dead - Lotus scoparius	0.0	5.3
Bare ground	0.0	5.3
Total - live	104.0	0.0
Total - dead	3.3	5.3

Table V-17. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #59.

Herbs
Eucrypta chrysanthemifolia var. chrysanthemifolia
Marah fabaceus

Table V-18. Composition (Percent Cover) of Transect #60

TAXA	> 0.5m	< 0.5m
Heteromeles arbutifolia	58.7	0.0
Lotus scoparius	30.7	0.0
Prunus ilicifolia	18.0	0.0
Dead - Lotus scoparius	16.7	0.0
Dead - Heteromeles arbutifolia	2.0	0.0
Total - live	107.4	0.0
Total - dead	18.7	0.0

Table V-19. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #60.

Herbs
Phacelia sp.
Solanum xantii var. hoffmannii

Shrubs
Salvia leucophylla

Table V-20. Composition (Percent Cover) of Transect #61.

TAXA	> 0.5m	< 0.5m
Arctostaphylos purissima/ refugioensis	52.7	1.0
Ceanothus impressus	23.3	0.0
Quercus wislizenii	9.3	13.3
Adenostoma fasciculatum	2.7	0.0
Baccharis pilularis ssp. consanguinea	1.3	0.0
Dead - Ceanothus impressus	20.7	0.0
Dead - Ceanothus sp.	6.7	0.0
Dead - Arctostaphylos purissima/ refugioensis	6.0	0.0
Standing dead	3.3	0.0
Total - live	89.3	14.3
Total - dead	36.7	0.0

Table V-21. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #61.

Herbs
- Carex cf. globosa
- Galium nuttallii
- Gnaphalium californicum/ramosissimum
- Gnaphalium purpureum/luteo-album/chilense/beneolens
- Helianthemum scoparium

Shrubs
- Arctostaphylos rudis
- Ceanothus oliganthus
- Ceanothus ramulosus
- Pinus muricata
- Salvia mellifera

Table V-22. Composition (Percent Cover) of Transect #62.

TAXA	> 0.5m	< 0.5m
Arctostaphylos purissima/ refugioensis	63.3	0.0
Quercus wislizenii	32.7	2.7
Dead - Quercus wislizenii	5.3	0.0
Total - live	96.0	2.7
Total - dead	5.3	0.0

Table V-23. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #62.

Herbs
- Camissonia micrantha
- Chorizanthe sp.
- Erigeron sp.
- Galium nuttallii
- Vulpia octoflora

Shrubs
- Adenostoma fasciculatum
- Mimulus aurantiacus
- Salvia mellifera

Table V-24. Composition (Percent Cover) of Transect #63.

TAXA	> 0.5m	< 0.5m
Quercus wislizenii	29.3	0.0
Arctostaphylos purissima/ refugioensis	24.0	0.0
Adenostoma fasciculatum	10.3	20.7
Ceanothus ramulosus	10.0	0.7
Dead - Ceanothus sp.	6.0	0.0
Dead - Adenostoma fasciculatum	4.7	0.0
Standing dead	0.7	0.0
Bare ground	0.0	7.3
Total - live	73.6	21.4
Total - dead	11.4	0.0

Table V-25. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #63.

Herbs
- Crassula erecta
- Cryptantha sp.
- Filago sp.
- Galium nuttallii
- Gnaphalium californicum/ramosissimum
- Lotus scoparius

Shrubs
- Arctostaphylos rudis
- Salvia mellifera

Table V-26. Composition (Percent Cover) of Transect #64.

TAXA	> 0.5m	< 0.5m
Arctostaphylos tomentosa	34.0	0.0
Adenostoma fasciculatum	29.3	0.0
Arctostaphylos purissima/ refugioensis	26.0	0.0
Vaccinium ovatum	14.7	0.0
Quercus wislizenii	11.3	0.0
Ceanothus ramulosus	4.0	0.0
Dead - Vaccinium ovatum	2.7	0.0
Dead - Arctostaphylos purissima/ refugioensis	1.3	0.0
Total - live	119.3	0.0
Total - dead	4.0	0.0

Table V-27. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #64.

Herbs
- Chorizanthe sp.
- Galium nuttallii
- Vulpia octoflora

Shrubs
- Ceanothus papillosus ssp. roweanus

Table V-28. Composition (Percent Cover) of Transect #65.

TAXA	> 0.5m	< 0.5m
Arctostaphylos purissima/ refugioensis	80.7	0.0
Quercus wislizenii	10.7	0.0
Arctostaphylos tomentosa	8.3	0.0
Adenostoma fasciculatum	6.3	0.0
Dead - Quercus wislizenii	2.0	0.0
Dead - Arctostaphylos tomentosa	1.0	0.0
Total - live	106.0	0.0
Total - dead	3.0	0.0

Table V-29. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #65.

Herbs
- Crassula erecta
- Galium nuttallii
- Gnaphalium purpureum/luteo-album/chilense/beneolens
- Vulpia octoflora

Shrubs
- Ceanothus ramulosus
- Vaccinium ovatum

Table V-30. Composition (Percent Cover) of Transect #66.

TAXA	> 0.5m	< 0.5m
Arctostaphylos purissima / refugioensis	42.7	39.3
Adenostoma fasciculatum	14.0	4.0
Dead - Arctostaphylos purissima / refugioensis	2.7	0.0
Dead - Arctostaphylos sp.	0.0	3.3
Total - live	56.7	43.3
Total - dead	2.7	3.3

Table V-31. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #66.

Herbs
- Chorizanthe sp.
- Galium nuttallii
- Vulpia octoflora

Shrubs
- Ceanothus papillosus ssp. roweanus
- Ceanothus ramulosus
- Quercus wislizenii

Table V-32. Composition (Percent Cover) of Transect #67.

TAXA	> 0.5m	< 0.5m
Quercus agrifolia	27.3	21.0
Arctostaphylos tomentosa	7.3	0.0
Heteromeles arbutifolia	1.3	0.0
Adenostoma fasciculatum	0.7	0.0
Dead - Pinus muricata	17.3	4.0
Dead - Quercus sp.	14.0	0.0
Dead - Arctostaphylos tomentosa	4.0	0.0
Bare ground	0.0	24.0
Total - live	36.6	21.0
Total - dead	35.3	4.0

Table V-33. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #67.

Herbs
- Dryopteris arguta
- Galium nuttallii

Shrubs
- Toxicodendron diversilobum

Table V-34. Composition (Percent Cover) of Transect #68.

TAXA	> 0.5m	< 0.5m
Quercus wislizenii	43.7	15.0
Dead - Pinus muricata	14.0	6.7
Dead - Quercus sp.	5.3	0.0
Galium nuttallii	0.0	0.3
Bare ground	0.0	25.3
Total - live	43.7	15.3
Total - dead	19.3	6.7

Table V-35. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #68.

Herbs
 Chorizanthe sp.

Table V-36 . Composition (Percent Cover) of Transect #69.

TAXA	> 0.5m	< 0.5m
Arctostaphylos tomentosa	35.7	1.0
Adenostoma fasciculatum	26.7	2.0
Arctostaphylos purissima/ refugioensis	9.7	8.7
Quercus wislizenii	9.0	0.0
Standing dead	11.3	0.0
Dead - Arctostaphylos tomentosa	2.3	0.0
Dead - Quercus wislizenii	2.0	0.0
Dead - Arctostaphylos purissima/ refugioensis	1.7	0.0
Dead - Pinus muricata	1.0	0.3
Bare ground	0.0	7.7
Total - live	81.1	11.7
Total - dead	18.3	0.3

Table V-37. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #69.

Herbs
- Galium nuttallii
- Poaceae - unknown
- Sanicula sp.

Table V-38. Composition (Percent Cover) of Transect #70.

TAXA	> 0.5m	< 0.5m
Pinus muricata	77.0	0.0
Adenostoma fasciculatum	10.0	0.0
Arctostaphylos purissima/ refugioensis	7.3	19.7
Arctostaphylos tomentosa	5.0	0.7
Dead - Pinus muricata	6.3	16.7
Quercus wislizenii	0.0	2.7
Ceanothus impressus	0.0	2.0
Galium nuttallii	0.0	0.7
Dead - Lotus scoparius	0.0	0.7
Bare ground	0.0	29.7
Total - live	99.3	25.8
Total - dead	6.3	17.4

Table V-39. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #70.

Herbs
- Carex globosa
- Corizanthe sp.
- Galium nuttallii
- Gnaphalium cf. californicum
- Sanicula sp.

Shrubs
- Baccharis pilularis ssp. consanguinea
- Ericameria ericoides
- Helianthemum scoparium
- Lotus scoparius
- Mimulus aurantiacus
- Vaccinium ovatum

Table V-40. Composition (Percent Cover) of Transect #71.

TAXA	> 0.5m	< 0.5m
Pinus muricata	65.3	0.0
Quercus wislizenii	24.7	9.0
Ceanothus impressus	7.3	0.7
Dead - Ceanothus impressus	12.7	0.0
Dead - Pinus muricata	7.3	9.7
Lotus scoparius	0.0	6.7
Baccharis pilularis ssp. consanguinea	0.0	0.3
Galium nuttallii	0.0	0.3
Unknown herb	0.0	0.3
Bare ground	0.0	35.0
Total - live	97.3	17.3
Total - dead	20.0	9.7

Table V-41. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #71.

Herbs
- Carex globosa
- Gnaphalium californicum
- Gnaphalium purpureum
- Sanicula sp.

Shrubs
- Arctostaphylos tomentosa
- Helianthemum scoparium
- Mimulus aurantiacus
- Toxicodendron diversilobum

Table V-42. Composition (Percent Cover) of Transect #72.

TAXA	< 0.5m
Bromus mollis	49.0
Brassica nigra	30.7
Hordeum leporinum	26.0
Bromus diandrus	16.7
Erodium botrys	8.7
Medicago polymorpha	6.7
Avena barbata	1.3
Silybum marianum	1.3
Malva parviflora	1.0
Unknown thistle	0.7
Erodium cicutarium	0.3
Total - live	142.4
Total - dead	0.0

Table V-43. Composition (Percent Cover) of Transect #73.

TAXA	> 0.5m	< 0.5m
Brassica nigra	0.7	22.0
Hordeum leporinum	0.0	69.7
Medicago polymorpha	0.0	24.7
Bromus mollis	0.0	10.3
Erodium botrys	0.0	8.3
Avena barbata	0.0	2.3
Bare ground	0.0	1.7
Unknown thistle	0.0	1.3
Bromus diandrus	0.0	0.7
Hypochoeris glabra	0.0	0.3
Total - live	0.7	139.6
Total - dead	0.0	0.0

Table V-44. Composition (Percent Cover) of Transect #74.

TAXA	< 0.5m
Hordeum leporinum	53.7
Bromus mollis	24.7
Erodium botrys	16.7
Stipa pulchra	16.0
Medicago polymorpha	9.3
Avena barbata	7.7
Hypochoeris glabra	4.0
Atriplex sp.	3.0
Bare ground	2.3
Brassica nigra	1.3
Erodium cicutarium	1.3
Vulpia bromoides	1.0
Unknown herb	0.3
Total - live	139.0
Total - dead	0.0

Table V-45. Composition (Percent Cover) of Transect #75.

TAXA	< 0.5m
Hordeum leporinum	51.7
Unknown thistle	22.7
Silybum marianum	18.0
Brassica nigra	8.0
Bare ground	4.3
Rock	3.3
Bromus diandrus	3.0
Apiaceae - unknown	1.0
Medicago polymorpha	0.3
Total - live	104.7
Total - dead	0.0

Table V-46 . Composition (Percent Cover) of Transect #76.

TAXA	< 0.5m
Hordeum leporinum	76.7
Bare ground	19.3
Silybum marianum	2.0
Rock	1.7
Brassica nigra	0.7
Calystegia macrostegia ssp. cyclostegia	0.7
Malva parviflora	0.7
Lupinus sp.	0.3
Total - live	81.8
Total - dead	0.0

Table V-47. Composition (Percent Cover) of Transect #77.

TAXA	< 0.5m
Hordeum leporinum	67.0
Brassica nigra	13.3
Bare ground	7.0
Silybum marianum	5.0
Unknown thistle	5.0
Malva parviflora	3.0
Bromus diandrus	2.7
Medicago polymorpha	0.7
Erodium botrys	0.3
Sonchus sp.	0.3
Total - live	97.3
Total - dead	0.0

Table V-48. Composition (Percent Cover) of Transect #78.

TAXA	> 0.5m	< 0.5m
Brassica nigra	11.7	7.0
Avena barbata	0.3	8.7
Bromus diandrus	0.0	81.7
Medicago polymorpha	0.0	14.7
Erodium botrys	0.0	9.7
Bromus mollis	0.0	1.7
Hordeum leporinum	0.0	1.3
Silene gallica	0.0	0.3
Bare ground	0.0	0.3
Total - live	12.0	125.1
Total - dead	0.0	0.0

Table V-49. Composition (Percent Cover) of Transect #79.

TAXA	> 0.5m	< 0.5m
Avena barbata	3.3	24.7
Brassica nigra	2.3	2.0
Bromus diandrus	1.0	52.0
Amsinckia intermedia	0.0	20.3
Medicago polymorpha	0.0	17.7
Bromus mollis	0.0	5.0
Bare ground	0.0	1.7
Erodium botrys	0.0	1.3
Hordeum leporinum	0.0	1.3
Sonchus asper	0.0	0.3
Total - live	6.6	124.6
Total - dead	0.0	0.0

Table V-50. Composition (Percent Cover) of Transect #80.

TAXA	> 0.5m	< 0.5m
Brassica nigra	4.0	3.3
Avena barbata	2.7	20.3
Bromus diandrus	0.0	52.7
Medicago polymorpha	0.0	25.7
Bromus sp.	0.0	7.0
Bromus mollis	0.0	5.7
Erodium botrys	0.0	2.3
Bare ground	0.0	2.0
Total - live	6.7	117.0
Total - dead	0.0	0.0

Table V-51. Composition (Percent Cover) of Transect #81.

TAXA	> 0.5m	< 0.5m
Ericameria ericoides	25.0	0.0
Artemisia californica	4.7	4.7
Dead - Artemisia californica	4.7	3.3
Dead - Ericameria ericoides	2.0	9.7
Corethrogyne filaginifolia	0.0	2.7
Erigonum parvifolium	0.0	2.0
Dudleya sp.	0.0	1.3
Moss	0.0	1.3
Lotus scoparius	0.0	0.3
Poaceae - unknown	0.0	0.3
Crassula erecta*	0.0	0.0
Dead - Ericameria ericoides	0.0	9.7
Dead - Eriogonum parvifolium	0.0	2.7
Standing dead	0.0	2.7
Bare ground	0.0	22.7
Total - live	29.7	12.6
Total - dead	6.7	28.1

*Present

Table V-52. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #81.

Herbs
- Abronia maritima
- Amsinckia spectabilis var. spectabilis
- Bromus rubens
- Calyptridium monandrum
- Camissonia cheiranthifolia
- Cardionema ramosissimum
- Carpobrotus edulis
- Cryptantha leiocarpa
- Descurainia pinnata
- Dudleya caespitosa
- Filago californica
- Phacelia ramosissima
- Senecio californicus
- Stylocline gnaphalioides
- Vulpia octoflora

Shrubs
- Lupinus chamissonis

Table V-53. Composition (Percent Cover) of Transect #82.

TAXA	> 0.5m	< 0.5m
Ericameria ericoides	28.0	0.0
Artemisia californica	17.7	5.7
Phacelia ramosissima	12.0	4.7
Toxicodendron diversilobum	8.7	0.0
Erysimum suffrutescens var. grandifolium	1.3	3.7
Dead - Artemisia californica	8.3	5.7
Standing dead	6.7	0.0
Dead - Phacelia ramosissima	2.0	0.0
Dead - Ericameria ericoides	0.0	1.0
Bare ground	0.0	14.0
Total - live	67.7	14.1
Total - dead	17.0	6.7

Table V-54. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #82.

Herbs
- Achillea millefolium
- Amsinckia spectabilis var. spectabilis
- Camissonia cheiranthifolia
- Chenopodium californicum
- Cirsium californica
- Descurainia pinnata
- Hesperocnide tenella
- Parietaria hespera var. californica

Shrubs
- Eriogonum parvifolium

Table V-55. Composition (Percent Cover) of Transect #83.

TAXA	> 0.5m	< 0.5m
Lupinus chamissonis	23.3	7.0
Artemisia californica	8.3	3.3
Dead - Artemisia californica	8.0	8.3
Corethrogyne filaginifolia	0.0	6.0
Eriogonum parvifolium	0.0	3.7
Crassula erecta*	0.0	0.0
Standing dead	0.0	4.3
Bare ground	0.0	16.7
Total - live	41.6	20.0
Total - dead	8.0	12.6

*Present

Table V-56. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #83.

Herbs
- Abronia maritima
- Calyptridium monandrum
- Camissonia cheiranthifolia
- Camissonia micrantha
- Cirsium californica
- Cryptantha leiocarpa
- Descurainia pinnata
- Dudleya sp.
- Hesperocnide tenella
- Linaria canadensis var. texana
- Lotus scoparius
- Melica imperfecta
- Parietaria hespera var. californica
- Phacelia ramosissimum
- Senecio californicus
- Stylocline gnaphalioides
- Vulpia octoflora

Table V-57. Composition (Percent Cover) of Transect #84.

TAXA	> 0.5m	< 0.5m
Vaccinium ovatum	87.3	0.0
Dead - Vaccinium ovatum	1.3	0.0
Polystichum munitum	0.0	2.0
Bare ground	0.0	10.7
Total - live	87.3	2.0
Total - dead	1.3	0.0

Table V-58. Composition (Percent Cover) of Transect #85.

TAXA	> 0.5m	< 0.5m
Vaccinium ovatum	99.3	0.0
Dead - Lithocarpus densiflora	4.7	0.0
Total - live	99.3	0.0
Total - dead	4.7	0.0

Table V-59. Composition (Percent Cover) of Transect #86.

TAXA	> 0.5m	< 0.5m
Baccharis pilularis ssp. consanguinea	30.3	8.7
Artemisia californica	14.0	2.0
Ribes speciosum	4.7	0.0
Mimulus aurantiacus	0.7	0.7
Dead - Baccharis pilularis ssp. consanguinea	14.7	0.7
Dead - Artemisia californica	1.3	0.0
Poaceae - unknown	0.0	3.0
Unknown herb	0.0	1.3
Achillea millefolium	0.0	1.0
Gnaphalium sp.	0.0	1.0
Solanum sp.	0.0	1.0
Galium nuttallii	0.0	0.7
Rubus sp.	0.0	0.7
Stellaria media	0.0	0.3
Standing dead	0.0	0.3
Bare ground	0.0	9.3
Total - live	49.7	20.4
Total - dead	16.0	1.0

Table V-60. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #86.

Herbs
- Anagallis arvensis
- Calystegia macrostegia ssp. cyclostegia
- Chenopodium californicum
- Chlorogalum pomeridianum
- Cirsium sp.
- Erigeron foliosus
- Gnaphalium californicum/ramosissimum
- Lotus scoparius
- Potentilla sp.
- Pterostegia drymarioides
- Sanicula crassicaulis
- Solanum xanti
- Sonchus asper
- Stachys bullata

Shrubs
- Eriogonum parvifolium
- Rhamnus californica
- Toxicodendron diversilobum

Table V-61. Composition (Percent Cover) of Transect #87.

TAXA	> 0.5m	< 0.5m
Baccharis pilularis ssp. consanguinea	56.3	7.3
Artemisia californica	4.0	0.0
Mimulus aurantiacus	3.0	7.7
Eriogonum parvifolium	0.7	0.7
Dead - Baccharis pilularis ssp. consanguinea	5.3	1.0
Unknown herbs	0.0	15.0
Galium nuttallii	0.0	6.3
Unknown grass	0.0	3.3
Gnaphalium sp.	0.0	1.0
Corethrogyne filaginifolia	0.0	0.7
Solanum sp.	0.0	0.7
Lotus scoparius	0.0	0.3
Achillea millefolium*	0.0	0.0
Stellaria media*	0.0	0.0
Standing dead	0.0	2.0
Dead - Mimulus aurantiacus	0.0	0.7
Dead - Artemisia californica	0.0	0.3
Bare ground	0.0	3.7
Total - live	64.0	43.0
Total - dead	5.3	4.0

*Present

Table V-62. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #87.

Herbs
- Anagallis arvensis
- Apiastrum sp./Daucus sp.
- Chlorogalum pomeridianum
- Claytonia perfoliata
- Erodium cicutarium
- Gnaphalium californicum/ramosissimum
- Gnaphalium purpureum/luteo-album/chilense/beneolens
- Pterostegia drymarioides
- Sanicula crassicaulis
- Solanum xanti
- Stachys bullata

Shrubs
- Toxicodendron diversilobum

Table V-63. Composition (Percent Cover) of Transect #88.

TAXA	> 0.5m	< 0.5m
Artemisia californica	60.7	9.7
Baccharis pilularis ssp. consanguinea	3.3	0.0
Solanum sp.	1.3	1.7
Elymus condensatus	0.7	0.3
Dead - Artemisia californica	4.7	3.3
Dead - Baccharis pilularis ssp. consanguinea	0.7	0.0
Unknown herb	0.0	2.3
Anagallis arvensis	0.0	0.3
Galium nuttallii	0.0	0.3
Oxalis sp.	0.0	0.3
Dead - Elymus condensatus	0.0	2.0
Bare ground	0.0	9.7
Total - live	66.0	14.9
Total - dead	5.4	5.3

Table V-64. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #88.

Herbs
- Achillea millefolium
- Bromus rubens
- Calystegia macrostegia ssp. cyclostegia
- Chlorogalum pomeridianum
- Corethrogyne filaginifolia
- Daucus pusillus
- Eriastrum densifolium ssp. elongatum
- Erodium cicutarium
- Fragaria sp.
- Gnaphalium californicum/ramosissimum
- Gnaphalium purpureum/luteo-album/chilense/beneolens
- Lathrys sp.
- Lotus scoparius
- Pterostegia drymarioides
- Sanicula crassicaulis
- Solanum xanti
- Sonchus asper
- Stellaria media
- Viola sp.

Shrubs
- Coreopsis gigantea
- Eriogonum parvifolium

Table V-65. Composition (Percent Cover) of Transect #89.

TAXA	> 0.5m	< 0.5m
Toxicodendron diversilobum	21.0	8.3
Elymus condensatus	12.0	0.0
Quercus agrifolia	3.3	0.0
Fabaceae - unknown	1.3	4.3
Bromus carinatus	1.3	3.3
Melica imperfecta	0.0	19.3
Salvia spathacea	0.0	18.0
Stachys bullata	0.0	10.0
Bromus diandrus	0.0	7.7
Bromus sp.	0.0	7.0
Pityrogramma triangularis	0.0	4.3
Galium nuttallii	0.0	4.0
Bare ground	0.0	2.3
Cardamine oligosperma	0.0	2.0
Viola pedunculata	0.0	2.0
Galium aparine	0.0	1.7
Avena barbata	0.0	1.3
Pterostegia drymarioides	0.0	1.3
Claytonia perfoliata	0.0	0.7
Silene gallica	0.0	0.7
Achillea millefolium	0.0	0.3
Total - live	38.9	96.2
Total - dead	0.0	0.0

Table V-66. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #89.

Herbs
- Anagallis arvensis
- Bromus arizonicus
- Bromus rubens
- Capsella bursa-pastoris
- Chorizanthe californica
- Crassula erecta
- Cryptantha clevelandii
- Dichelostemma pulchellum
- Erodium cicutarium
- Erodium sp.
- Filago gallica
- Gilia achilleafolia
- Habenaria elegans
- Hypochoeris glabra
- Linaria canadensis var. texana
- Lotus scoparius
- Lotus strigosus
- Lupinus sp.
- Medicago polymorpha
- Melica imperfecta var. reflexa
- Paeonia californica
- Pholistoma auritum
- Platystemon californicus
- Sanicula crassicaulis
- Sisymbrium officinale
- Sonchus oleraceus
- Thysanocarpus curvipes

Shrubs
- Artemisia californica
- Rhamnus crocea

Table V-67. Composition (Percent Cover) of Transect #90.

TAXA	> 0.5m	< 0.5m
Toxicodendron diversilobum	10.0	13.3
Quercus agrifolia	9.3	0.0
Baccharis pilularis ssp. consanguinea	4.0	0.0
Bare ground	0.0	15.3
Salvia spathacea	0.0	14.0
Bromus sp.	0.0	11.7
Melica imperfecta	0.0	10.7
Pteridium aquilinum	0.0	4.3
Stellaria media	0.0	4.0
Pityrogramma triangularis	0.0	3.3
Stachys bullata	0.0	3.3
Cardamine oligosperma	0.0	1.7
Avena barbata	0.0	1.0
Claytonia perfoliata	0.0	1.0
Galium aparine	0.0	1.0
Galium nuttallii	0.0	1.0
Gnaphalium sp.	0.0	1.0
Bromus carinatus	0.0	1.0
Unknown herb	0.0	1.0
Achillea millefolium	0.0	0.7
Carex cf. globosa	0.0	0.3
Pterostegia drymarioides	0.0	0.3
Total - live	23.3	74.6
Total - dead	0.0	0.0

Table V-68. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #90.

Herbs
- Bromus diandrus
- Bromus rubens
- Calystegia macrostegia ssp. cyclostegia
- Carex triquetra
- Cirsium sp.
- Cryptantha sp.
- Daucus pusillus
- Erodium cicutarium
- Gnaphalium californicum
- Horkelia cuneata
- Hypochoeris glabra
- Lupinus sp.
- Marah fabaceus
- Melica imperfecta var. reflexa
- Paeonia californica
- Perezia microcephala
- Sonchus sp.
- Vulpia bromoides

Shrubs
- Ericameria ericoides

Table V-69. Composition (Percent Cover) of Transect #91.

TAXA	< 0.5m
Bromus diandrus	66.7
Stellaria media	11.0
Bromus carinatus	8.3
Claytonia perfoliata	8.0
Silybum marianum	2.0
Bare ground	1.7
Stachys bullata	1.3
Cirsium vulgare	1.3
Chenopodium californicum	1.0
Pholistoma auritum	0.7
Sonchus sp.	0.7
Medicago polymorpha	0.3
Salvia spathacea	0.3
Total - live	101.6
Total - dead	0.0

Table V-70. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #91.

Herbs
- Avena barbata
- Galium aparine
- Hordeum leporinum
- Marah fabaceus
- Pterostegia drymarioides
- Sisymbrium officinale
- Sonchus asper
- Sonchus oleraceus
- Viola pedunculata

Shrubs
- Rhamnus californica
- Toxicodendron diversilobum

Table V-71. Composition (Percent Cover) of Transect #92.

TAXA	> 0.5m	< 0.5m
Artemisia californica	28.7	2.0
Ericameria ericoides	14.7	1.7
Standing dead	6.0	9.3
Dead - Artemisia californica	2.7	0.0
Dead - Ericameria ericoides	2.0	0.0
Dead - Eriophyllum confertiflorum	0.7	2.3
Croton californicus	0.0	4.0
Eriophyllum confertiflorum	0.0	2.7
Conicosia pugioniformis	0.0	2.0
Phacelia ramosissima	0.0	0.7
Fabaceae - unknown	0.0	0.3
Lotus scoparius	0.0	0.3
Moss	0.0	0.3
Dead - Phacelia ramosissima	0.0	6.7
Bare ground	0.0	10.3
Total - live	43.4	14.0
Total - dead	11.4	18.3

Table V-72. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #92.

Herbs
- Astragalus sp.
- Calystegia macrostegia ssp. cyclostegia
- Camissonia cf. micrantha
- Chenopodium californicum
- Chorizanthe sp.
- Corethrogyne filaginifolia
- Crassula erecta
- Cryptantha sp.
- Daucus pusillus
- Descurainia pinnata
- Ehrharta calycina
- Erysimum suffrutescens var. grandifolium
- Gnaphalium bicolor
- Gnaphalium ramosissimum
- Marah fabaceus
- Pterostegia drymarioides
- Solanum xanti
- Stylocline sp./Filago sp.

Table V-73. Composition (Percent Cover) of Transect #93.

TAXA	> 0.5m	< 0.5m
Artemisia californica	17.3	9.0
Calystegia sp.	0.3	0.7
Dead - Artemisia californica	6.7	5.3
Carpobrotus edulis	0.0	14.3
Conicosia pugioniformis	0.0	2.7
Ericameria ericoides	0.0	0.7
Gnaphalium sp.	0.0	0.7
Eriophyllum confertiflorum	0.0	0.3
Moss	0.0	0.3
Standing dead	0.0	4.3
Dead - Conicosia pugioniformis	0.0	3.7
Dead - Eriophyllum confertiflorum	0.0	3.0
Bare ground	0.0	30.0
Total - live	17.6	28.7
Total - dead	6.7	16.3

Table V-74. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #93.

Herbs
- Astragalus sp.
- Bromus diandrus
- Calystegia macrostegia ssp. cyclostegia
- Camissonia sp.
- Chenopodium californicum
- Corethrogyne filaginifolia
- Crassula erecta
- Croton californicus
- Cryptantha sp.
- Daucus pusillus
- Descurainia pinnata
- Ehrharta calycina
- Erysimum suffrutescens var. grandifolium
- Gnaphalium bicolor
- Gnaphalium sp.
- Lotus scoparius
- Monardella crispa
- Rumex salicifolius
- Senecio blochmaniae
- Solanum xanti
- Vulpia octoflora

Table V-75. Composition (Percent Cover) of Transect #94.

TAXA	> 0.5m	< 0.5m
Ericameria ericoides	12.0	11.7
Senecio blochmaniae	6.7	0.0
Dead - Ericameria ericoides	3.3	0.7
Conicosia pugioniformis	0.0	9.0
Croton californicus	0.0	5.7
Artemisia californica	0.0	2.7
Fabaceae - unknown	0.0	1.0
Standing dead	0.0	2.0
Dead - Artemisia californica	0.0	1.0
Dead - Conicosia pugioniformis	0.0	0.7
Bare ground	0.0	30.7
Total - live	18.7	30.1
Total - dead	3.3	4.4

Table V-76. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #94.

Herbs
- Astragalus sp.
- Chenopodium californicum
- Cryptantha sp.
- Descurainia pinnata
- Erysimum suffrutescens var. grandifolium
- Gnaphalium bicolor
- Gnaphalim sp.
- Parietaria hespera var. californica
- Phacelia ramosissima
- Solanum douglasii
- Vulpia octoflora

Shrubs
- Baccharis pilularis ssp. consanguinea

Table V-77. Composition (Percent Cover) of Transect #95.

TAXA	> 0.5m	< 0.5m
Salix sp. (a)	84.7	0.0
Toxicodendron diversilobum	51.0	22.3
Elymus condensatus	7.7	0.0
Artemisia douglasiana	6.7	17.3
Scrophularia californica	3.0	4.0
Bare ground	0.0	3.0
Rubus ursinus	0.0	0.7
Total - live	153.1	44.3
Total - dead	0.0	0.0

a-Canopy

Table V-78. Additional shrubs and herbs present in 150 m^2 plot centere on Transect #95

Herbs
- Brassica nigra
- Scirpus microcarpus
- Sonchus asper
- Urtica holosericea

Shrubs
- Baccharis pilularis ssp. consanguinea
- Ribes divaricatum

Table V-79. Composition (Percent Cover) of Transect #96.

TAXA	>0.5m	< 0.5m
Salix sp. (a)	100.0	0.0
Rubus ursinus	22.0	8.7
Ribes divaricatum	17.0	10.3
Stachys bullata	4.3	0.0
Dead - Salix sp.	2.0	1.0
Urtica holosericea	1.7	0.0
Zantedeschia aethiopica	0.3	0.0
Bare ground/litter	0.0	26.3
Lonicera involucrata var. ledebourii	0.0	0.3
Total - live	145.3	19.3
Total - dead	2.0	1.0

a-Canopy

Table V-80. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #96.

Herbs
- Cirsium brevistylum

Shrubs
- Myrica californica
- Sambucus mexicana
- Toxicodendron diversilobum

Table V-81. Composition (Percent Cover) of Transect #97.

TAXA	>0.5m	< 0.5m
Salix sp. (a)	100.0	0.0
Carex schottii	38.0	3.7
Senecio mikanioides	26.0	12.0
Ribes divaricatum	22.0	3.3
Rubus ursinus	16.0	6.7
Urtica holosericea	10.7	2.7
Scrophularia californica	4.7	3.0
Stachys bullata	3.3	0.3
Dead - Salix sp.	0.3	1.7
Sambucus mexicana	0.0	3.0
Bare ground	0.0	0.3
Total - live	220.7	31.7
Total - dead	0.3	1.7

a-Canopy

Table V-82. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #97.

Herbs
Lathrys sp.
Pteridium aquilinum

Shrubs
Lonicera involucrata var. ledebourii

Table V-83. Composition (Percent Cover) of Transect #98.

TAXA	< 0.5m
Hordeum leporinum	53.0
Bromus diandrus	33.7
Erodium botrys	13.0
Avena barbata	6.3
Medicago polymorpha	4.7
Unknown herb #1	2.7
Brassica nigra	2.3
Unknown herb #2	1.3
Lupinus succulentus	0.7
Stipa pulchra	0.3
Total - live	118.0
Total - dead	0.0

Table V-84. Composition (Percent Cover) of Transect #99.

TAXA	< 0.5m
Hordeum leporinum	45.7
Bromus diandrus	23.7
Erodium botrys	20.3
Rock	10.0
Amsinckia intermedia	5.0
Avena barbata	2.7
Calystegia macrostegia ssp. cyclostegia	1.7
Brassica nigra	1.3
Chenopodium californicum	1.3
Bromus sp.	0.7
Medicago polymorpha	0.7
Bare ground	0.3
Erodium cicutarium	0.3
Malva parviflora	0.3
Total - live	103.7
Total - dead	0.0

Table V-85. Composition (Percent Cover) of Transect #100.

TAXA	< 0.5m
Bromus diandrus	39.0
Hordeum leporinum	36.7
Erodium botrys	35.0
Medicago polymorpha	6.3
Stipa pulchra	4.0
Avena barbata	2.7
Unknown herb	1.3
Chenopodium californicum	1.0
Erodium cicutarium	0.7
Total - live	126.7
Total - dead	0.0

Table V-86. Composition (Percent Cover) of Transect #101.

TAXA	< 0.5m
Bromus diandrus	80.7
Hordeum leporinum	16.3
Silybum marianum	2.3
Bare ground	1.7
Malva parviflora	1.0
Medicago polymorpha	0.7
Total - live	101.0
Total - dead	0.0

Table V-87. Composition (Percent Cover) of Transect #102.

TAXA	< 0.5m
Hordeum leporinum	34.7
Bromus diandrus	31.7
Rock	14.7
Avena barbata	7.3
Medicago polymorpha	7.0
Bare ground	2.7
Sonchus oleraceus	1.3
Brassica nigra	1.0
Bromus mollis	1.0
Unknown herb #1	0.7
Silybum marianum	0.3
Unknown herb #2	0.3
Total - live	85.3
Total - dead	0.0

Table V-88. Composition (Percent Cover) of Transect #103.

TAXA	< 0.5m
Bromus diandrus	68.0
Hordeum leporinum	30.3
Avena barbata	3.3
Silybum marianum	1.0
Medicago polymorpha	0.7
Total - live	103.3
Total - dead	0.0

Table V-89. Composition (Percent Cover) of Transect #104.

TAXA	> 0.5m	< 0.5m
Salvia leucophylla	49.0	5.7
Encelia californica	8.0	7.0
Artemisia californica	6.0	0.3
Dead - Salvia leucophylla	6.0	1.0
Dead - Encelia californica	0.7	0.0
Poaceae - unknown	0.0	14.0
Bare ground	0.0	10.0
Total - live	63.0	27.0
Total - dead	6.7	1.0

Table V-90. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #104.

Herbs
- Avena barbata
- Brassica nigra
- Bromus diandrus
- Bromus rubens
- Chenopodium californicum
- Daucus pusillus
- Erodium sp.
- Eucrypta chrysanthemifolia
- Galium nuttallii
- Marah fabaceus
- Melica imperfecta
- Parietaria hespera var. californica
- Vulpia myuros

Table V-91. Composition (Percent Cover) of Transect #105.

TAXA	> 0.5m	< 0.5m
Artemisia californica	21.3	13.3
Salvia leucophylla	14.3	0.0
Dead - Artemisia californica	14.3	1.7
Dead - Salvia leucophylla	1.3	0.0
Poaceae - unknown	0.0	44.7
Encelia californica	0.0	2.3
Unknown herb*	0.0	0.0
Bare ground	0.0	9.7
Total - live	35.6	60.3
Total - dead	15.6	1.7

*Present

Table V-92. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #105.

Herbs
- Erechtites arguta
- Avena barbata
- Bromus diandrus
- Bromus mollis
- Bromus rubens
- Calystegia macrostegia ssp. cyclostegia
- Chenopodium californicum
- Elymus condensatus
- Galium nuttallii
- Lamarkia aurea
- Lotus scoparius
- Marah fabaceus
- Melica imperfecta
- Pterostegia drymarioides
- Stachys bullata
- Stipa pulchra
- Vulpia myuros

Shrubs
- Haplopappus squarosus

Table V-93. Composition (Percent Cover) of Transect #106.

TAXA	> 0.5m	< 0.5m
Salvia leucophylla	64.7	0.0
Elymus condensatus	17.7	0.0
Encelia californica	16.7	1.7
Artemisia californica	2.0	0.0
Galium nuttalli	0.3	0.3
Dead - Salvia leucophylla	2.7	0.0
Poaceae - unknown	0.0	3.7
Bare ground	0.0	2.0
Total - live	101.4	5.7
Total - dead	2.7	0.0

Table V-94. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #106.

Herbs
- Anagallis arvensis
- Eucrypta chrysanthemifolia
- Hesperocnide tenella
- Melica imperfecta
- Parietaria hespera var. californica
- Pterostegia drymarioides

Table V-95. Composition (Percent Cover) of Transect #107.

TAXA	> 0.5m	< 0.5m
Salicornia virginica	2.7	13.7
Brassica nigra	0.3	0.3
Frankenia grandifolia	0.0	70.3
Atriplex semibaccata	0.0	15.3
Polypogon monospeliensis	0.0	11.0
Melilotus indicus	0.0	2.7
Apiastrum angustifolium	0.0	1.7
Sonchus asper	0.0	1.0
Galium aparine	0.0	0.7
Dead - Salicornia virginica	0.0	0.7
Bare ground	0.0	0.3
Total - live	3.0	116.7
Total - dead	0.0	0.7

Table V-96. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #107.

Herbs
- Atriplex californica
- Atriplex patula
- Conyza coulteri
- Parapholis incurva
- Sonchus asper

Table V-97. Composition (Percent Cover) of Transect #108.

TAXA	> 0.5m	< 0.5m
Salicornia virginica	2.7	16.3
Frankenia grandifolia	0.0	82.0
Dead - Salicornia virginica	0.0	3.0
Bare ground	0.0	0.7
Total - live	2.7	98.3
Total - dead	0.0	3.0

Table V-98. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #108.

Herbs
Brassica nigra

Table V-99. Composition (Percent Cover) of Transect #109.

TAXA	> 0.5m	< 0.5m
Salicornia virginica	12.7	30.3
Dead - Salicornia virginica	0.3	0.3
Frankenia grandifolia	0.0	75.0
Rumex sp.	0.0	0.3
Dead - Frankenia grandiflora	0.0	0.3
Total - live	12.7	105.6
Total - dead	0.3	0.6

Table V-100. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #109.

Herbs
Brassica nigra

Table V-101. Composition (Percent Cover) of Transect #110.

TAXA	> 0.5m	< 0.5m
Dryopteris arguta	1.3	2.7
Bare ground	0.0	66.7
Toxicodendron diversilobum	0.0	12.0
Stachys bullata	0.0	5.7
Galium aparine	0.0	3.7
Bromus diandrus	0.0	2.3
Marah fabaceus	0.0	1.0
Total - live	1.3	27.4
Total - dead	0.0	0.0

Table V-102. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #110.

Herbs
- Claytonia perfoliata
- Conium maculatum
- Pholistoma auritum
- Sonchus asper

Table V-103. Composition (Percent Cover) of Transect #111.

TAXA	> 0.5m	< 0.5m
Osmaronia cerasiformis	25.3	1.0
Quercus agrifolia	16.7	0.7
Dryopteris arguta	8.3	17.0
Bare ground	0.0	11.0
Stachys bullata	0.0	6.0
Symphoricarpos mollis	0.0	5.0
Marah fabaceus	0.0	4.3
Rubus ursinus	0.0	3.3
Toxicodendron diversilobum	0.0	2.7
Galium aparine	0.0	1.0
Total - live	50.3	41.0
Total - dead	0.0	0.0

Table V-104. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #111.

Herbs
- Artemisia douglasiana
- Conium maculatum
- Galium aparine
- Pteridium aquilinum
- Sambucus mexicana
- Scrophularia californica
- Sonchus asper
- Thalictrum polycarpum

Table V-105. Composition (Percent Cover) of Transect #112.

TAXA	< 0.5m
Bare ground	48.7
Bromus diandrus	22.7
Galium aparine	22.3
Claytonia perfoliata	3.7
Silybum marianum	2.3
Stachys bullata	2.0
Cirsium vulgare	1.7
Conium maculatum	0.7
Total - live	55.4
Total - dead	0.0

Table V-106. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #112.

Herbs
- Brassica nigra
- Bromus carinatus
- Dryopteris arguta
- Hordeum leporinum
- Pholistoma auritum
- Sanicula cf. crassicaulis
- Stellaria media

Table V-107. Composition (Percent Cover) of Transect #113.

TAXA	> 0.5m	< 0.5m
Urtica holosericea	28.0	45.0
Dead - Typha latifolia	12.3	14.7
Typha latifolia	2.0	0.3
Eleocharis sp.	0.3	0.0
Dead - Urtica holosericea	0.0	1.0
Total - live	30.3	45.3
Total - dead	12.3	15.7

Table V-108. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #113.

Herbs
- Cicuta douglasii
- Cladium californicum

Shrubs
- Salix sp.

Table V-109. Composition (Percent Cover) of Transect #114.

TAXA	> 0.5m	< 0.5m
Urtica holosericea	52.0	8.7
Dead - Typha latifolia	27.3	15.3
Cladium californicum	15.3	0.0
Typha latifolia	2.7	1.0
Dead - Cladium californicum	2.7	0.0
Rubus ursinus	0.0	0.7
Total - live	70.0	10.4
Total - dead	30.0	15.3

Table V-110. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #114.

Shrubs
- Baccharis pilularis ssp. consanguinea
- Cornus stolonifera var. californica
- Salix sp.

Table V-111. Composition (Percent Cover) of Transect #115.

TAXA	> 0.5m	< 0.5m
Urtica holosericea	59.7	25.0
Dead - Typha latifolia	0.0	13.7
Dead - Urtica holosericea	0.0	4.0
Typha latifolia	0.0	1.3
Total - live	59.7	26.3
Total - dead	0.0	17.7

Table V-112. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #115.

Shrubs
- Salix sp.

Table V-113. Composition (Percent Cover) of Transect #116.

TAXA	< 0.5m
Bare ground	57.0
Haplopappus venetus var. sedoides	16.7
Carpobrotus aequilaterus	11.0
Dead - Haplopappus venetus var. sedoides	4.3
Atriplex sp.	2.7
Abronia maritima	1.7
Dead - Carpobrotus aequilaterus	1.3
Standing dead	1.3
Ambrosia chamissonis	0.3
Total - live	32.4
Total - dead	6.9

Table V-114. Composition (Percent Cover) of Transect #117.

TAXA	< 0.5m
Ammophila arenaria	81.0
Bare ground	10.0
Dead - Ammophila arenaria	8.7
Cryptantha sp.	1.0
Total - live	82.0
Total - dead	8.7

Table V-115. Composition (Percent Cover) of Transect #118.

TAXA	< 0.5m
Bare ground	48.3
Dead - Haplopappus venetus var. sedoides	17.0
Dead - Carpobrotus aequilaterus	8.7
Carpobrotus aequilaterus	8.3
Haplopappus venetus var. sedoides	8.0
Ambrosia chamissonis	4.0
Abronia latifolia	2.7
Standing dead	1.0
Abronia sp.	0.7
Camissonia sp.	0.3
Cryptantha sp.	0.3
Dead - Ambrosia chamissonis	0.3
Total - live	24.3
Total - dead	27.0

Table V-116. Composition (Percent Cover) of Transect #119.

TAXA	< 0.5m
Bare ground	56.2
Carpobrotus aequilaterus	12.8
Ambrosia chamissonis	7.7
Haplopappus venetus var. sedoides	5.7
Senecio blochmaniae	4.7
Dead - Ericameria ericoides	4.2
Lupinus chamissonis	2.7
Cakile maritima	2.3
Ericameria ericoides	1.3
Dead - Ambrosia chamissonis	1.3
Cirsium rhothophilum	1.0
Eriogonum parvifolium	0.7
Malacothrix incana var. succulenta	0.7
Dead - Haplopappus venetus var. sedoides	0.7
Abronia sp.	0.5
Camissonia sp.	0.3
Dead - Camissonia sp.	0.3
Dead - Abronia sp.	0.2
Total - live	40.4
Total - dead	6.7

Table V-117. Composition (Percent Cover) of Transect #120.

TAXA	< 0.5m
Bare ground	32.8
Carpobrotus aequilaterus	17.8
Eriogonum parvifolium	8.5
Haplopappus venetus var. sedoides	6.0
Ambrosia chamissonis	5.8
Cirsium rhothophilum	5.3
Ericameria ericoides	4.0
Camissonia sp.	1.7
Abronia sp.	1.3
Malacothrix incana var. succulenta	1.3
Cakile maritima	1.2
Senecio blochmaniae	1.2
Standing dead	0.8
Dead - Ambrosia chamissonis	0.7
Dead - Cirsium rhothophilum	0.5
Eschscholzia californica var. maritima	0.3
Dead - Haplopappus venetus var. sedoides	0.2
Total - live	54.4
Total - dead	2.2

Table V-118. Composition (Percent Cover) of Transect #121.

TAXA	< 0.5m
Bare ground	85.8
Dead - Carpobrotus aequilaterus	4.5
Cakile maritima	2.3
Carpobrotus aequilaterus	1.8
Dead - Ambrosia chamissonis	1.7
Ambrosia chamissonis	1.5
Haplopappus venetus var. sedoides	1.2
Senecio blochmaniae	1.0
Dead - Camissonia sp.	0.7
Camissonia sp.	0.5
Abronia sp.	0.2
Dead - Haplopappus venetus var. sedoides	0.2
Standing dead	0.2
Total - live	8.5
Total - dead	7.3

Table V-119. Composition (Percent Cover) of Transect #122.

TAXA	< 0.5m
Bare ground	68.0
Ambrosia chamissonis	11.8
Dead - Ambrosia chamissonis	7.5
Carpobrotus aequilaterus	5.3
Dead - Carpobrotus aequilaterus	2.3
Cakile maritima	2.0
Standing dead	0.8
Abronia sp.	0.5
Dead - Cakile maritima	0.5
Total - live	19.6
Total - dead	11.1

Table V-120. Composition (Percent Cover) of Transect #123.

TAXA	< 0.5m
Bare ground	48.8
Carpobrotus aequilaterus	20.7
Standing dead	8.0
Ambrosia chamissonis	7.5
Dead - Carpobrotus aequilaterus	4.5
Camissonia cheiranthifloia	2.8
Corethrogyne filaginifolia	2.0
Haplopappus venetus var. sedoides	1.8
Dead - Ambrosia chamissonis	1.3
Abronia sp.	1.0
Eriastrum densifolium var. densifolium	1.0
Eriophyllum staechadifolium	0.7
Malacothrix incana var. succulenta	0.5
Dithyrea maritima	0.3
Lupinus chamissonis	0.2
Sonchus oleraceus	0.2
Total - live	38.7
Total - dead	13.8

Table V-121. Composition (Percent Cover) of Transect #124.

TAXA	> 0.5m	< 0.5m
Lupinus chamissonis	14.8	25.5
Eriophyllum staechadifolium	8.7	2.5
Standing dead	2.3	6.5
Erigeron foliosus var. blochmaniae	1.3	5.3
Senecio blochmaniae	1.2	4.7
Carpobrotus aequilaterus	0.0	8.5
Bare ground	0.0	8.5
Dead - Lupinus chamissonis	0.0	7.3
Phacelia ramosissima	0.0	2.7
Abronia latifolia	0.0	0.7
Dithyrea maritima	0.0	0.5
Corethrogyne filaginifolia	0.0	0.3
Dead - Carpobrotus aequilaterus	0.0	0.3
Total - live	26.0	50.7
Total - dead	2.3	14.1

Table V-122. Composition (Percent Cover) of Transect #125.

TAXA	> 0.5m	< 0.5m
Acer negundo ssp. californicum (a)	98.7	1.3
Urtica holosericea	8.7	0.0
Rubus ursinus	6.0	3.3
Salix sp.	0.7	0.0
Total - live	114.1	4.6
Total - dead	0.0	0.0

a-Canopy

Table V-123 Additional shrubs and herbs present in 150 m^2 plot centered on Transect #125.

Shrubs
Toxicodendron diversilobum

Table V-124. Composition (Percent Cover) of Transect #126.

TAXA	> 0.5m	< 0.5m
Acer negundo ssp. californicum (a)	100.0	0.0
Rubus ursinus	34.0	29.0
Urtica holosericea	12.0	2.0
Total - live	146.0	31.0
Total - dead	0.0	0.0

a-Canopy

Table V-125. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #126.

Herbs
Conium maculatum

Shrubs
Ribes divaricatum

Table V-126. Composition (Percent Cover) of Transect #127.

TAXA	> 0.5m	< 0.5m
Acer negundo ssp. californicum (a)	77.3	0.0
Rubus ursinus	46.0	16.3
Ribes divaricatum	3.3	1.7
Urtica holosericea	1.3	0.0
Bare ground	0.0	4.0
Dead - Acer negundo	0.0	1.3
Dead - Rubus ursinus	0.0	0.3
Total - live	127.9	18.0
Total - dead	0.0	1.6

a-Canopy

Table V-127. Additional shrubs and herbs present in 150 m^2 plot centered on Transect #127.

Shrubs
Salix sp.

APPENDIX VI

CANOPY VEGETATION DATA

Table VI-1. Diameter distributions of canopy and understory taxa.
Stem per Diameter Classes (mid-points cm) Sapling (5,10) Canopy (15-80)

PLOT	PLOT SIZE*	TAXA	5	10
67	1	Pinus muricata	0	2
67	1	Dead - Pinus muricata	1	4
67	1	Arctostaphylos purissima/refugioensis	2	0
67	1	Total	3	6
68	1	Pinus muricata	8	2
68	1	Dead - Pinus muricata	2	4
68	1	Quercus wislizenii	4	0
68	1	Arctostaphylos tomentosa	1	0
68	1	Total	15	6
69	1	Pinus muricata	1	10
69	1	Dead - Pinus muricata	2	0
69	1	Total	3	10
70	3	Pinus muricata	29	1
70	3	Total	29	1
71	3	Pinus muricata	82	0
71	3	Total	82	0
84	1	Lithocarpus densiflora	4	6
84	1	Vaccinium ovatum	92	0
84	1	Total	96	6
85	1	Lithocarpus densiflora	11	2
85	1	Dead - Lithocarpus densiflora	0	2
85	1	Vaccinium ovatum	108	0
85	1	Total	119	4
89	2	Quercus agrifolia	15	8
89	2	Dead - Quercus agrifolia	1	0
89	2	Total	16	8
90	2	Quercus agrifolia	27	19
90	2	Dead - Quercus agrifolia	0	1
90	2	Baccharis pilularis ssp. consanguinea	1	0
90	2	Total	28	20
91	2	Quercus agrifolia	3	1
91	2	Total	3	1
95	1	Salix sp.	102	30
95	1	Dead - Salix sp.	0	2
95	1	Baccharis pilularis ssp. consanguinea	4	0
95	1	Total	106	32
96	1	Salix sp.	27	11
96	1	Dead - Salix sp.	1	0
96	1	Total	28	11
97	1	Salix sp.	39	33
97	1	Dead - Salix sp.	13	0
97	1	Total	52	33

Table VI-1. (Continued).

PLOT	PLOT SIZE*	TAXA	5	10
110	2	Quercus agrifolia	0	1
110	2	Dead - Quercus agrifolia	0	0
110	2	Sambucus mexicana	9	2
110	2	Total	9	3
111	2	Quercus agrifolia	5	1
111	2	Dead-Quercus agrifolia	1	0
111	2	Toxicodendron diversilobum	2	0
111	2	Total	8	1
112	2	Quercus agrifolia	0	0
112	2	Dead-Quercus agrifolia	0	0
112	2	Total	0	0
125	1	Acer negundo	45	15
125	1	Dead-Acer negundo	2	2
125	1	Salix sp.	0	1
125	1	Total	47	18
126	1	Acer negundo	37	9
126	1	Dead-Acer negundo	1	0
126	1	Total	38	9
127	1	Acer negundo	23	5
127	1	Dead-Acer negundo	1	1
127	1	Total	24	6

* - 1 = 0.1 ac, 2 = 0.2 ac, 3 = 0.016 ac

Table VI-1. (Continued).

PLOT	PLOT SIZE*	TAXA	15	20
67	1	Pinus muricata	5	14
67	1	Dead - Pinus muricata	3	3
67	1	Arctostaphylos purissima/refugioensis	0	0
67	1	Total	8	17
68	1	Pinus muricata	3	6
68	1	Dead - Pinus muricata	1	3
68	1	Quercus wislizenii	0	0
68	1	Arctostaphylos tomentosa	0	0
68	1	Total	4	9
69	1	Pinus muricata	19	9
69	1	Dead - Pinus muricata	0	1
69	1	Total	19	10
70	3	Pinus muricata	0	0
70	3	Total	0	0
71	3	Pinus muricata	0	0
71	3	Total	0	0
84	1	Lithocarpus densiflora	2	9
84	1	Vaccinium ovatum	0	0
84	1	Total	2	9
85	1	Lithocarpus densiflora	1	3
85	1	Dead - Lithocarpus densiflora	0	1
85	1	Vaccinium ovatum	0	0
85	1	Total	1	4
89	2	Quercus agrifolia	12	13
89	2	Dead - Quercus agrifolia	0	0
89	2	Total	12	13
90	2	Quercus agrifolia	14	13
90	2	Dead - Quercus agrifolia	1	0
90	2	Baccharis pilularis ssp. consanguinea	0	0
90	2	Total	15	13
91	2	Quercus agrifolia	7	9
91	2	Total	7	9
95	1	Salix sp.	4	0
95	1	Dead - Salix sp.	0	0
95	1	Baccharis pilularis ssp. consanguinea	0	0
95	1	Total	4	0
96	1	Salix sp.	5	7
96	1	Dead - Salix sp.	1	3
96	1	Total	6	10
97	1	Salix sp.	6	1
97	1	Dead - Salix sp.	0	0
97	1	Total	6	1

Table VI-1. (Continued).

PLOT	PLOT SIZE*	TAXA	15	20
110	2	Quercus agrifolia	0	0
110	2	Dead - Quercus agrifolia	0	0
110	2	Sambucus mexicana	0	0
110	2	Total	0	0
111	2	Quercus agrifolia	2	1
111	2	Dead - Quercus agrifolia	1	1
111	2	Toxicodendron diversilobum	0	0
111	2	Total	3	2
112	2	Quercus agrifolia	2	4
112	2	Dead - Quercus agrifolia	1	2
112	2	Total	3	6
125	1	Acer negundo	6	6
125	1	Dead - Acer negundo	0	0
125	1	Salix sp.	0	0
125	1	Total	6	6
126	1	Acer negundo	0	3
126	1	Dead - Acer negundo	0	0
126	1	Total	0	3
127	1	Acer negundo	6	2
127	1	Dead - Acer negundo	0	0
127	1	Total	6	2

* - 1 = 0.1 ac, 2 = 0.2 ac, 3 = 0.016 ac

Table VI-1. (Continued).

PLOT	PLOT SIZE*	TAXA	25	30
67	1	Pinus muricata	2	0
67	1	Dead - Pinus muricata	2	0
67	1	Arctostaphylos purissima/refugioensis	0	0
67	1	Total	4	0
68	1	Pinus muricata	1	1
68	1	Dead - Pinus muricata	0	0
68	1	Quercus wislizenii	0	0
68	1	Arctostaphylos tomentosa	0	0
68	1	Total	1	1
69	1	Pinus muricata	0	0
69	1	Dead - Pinus muricata	0	0
69	1	Total	0	0
70	3	Pinus muricata	0	0
70	3	Total	0	0
71	3	Pinus muricata	0	0
71	3	Total	0	0
84	1	Lithocarpus densiflora	4	0
84	1	Vaccinium ovatum	0	0
84	1	Total	4	0
85	1	Lithocarpus densiflora	2	1
85	1	Dead - Lithocarpus densiflora	1	0
85	1	Vaccinium ovatum	0	0
85	1	Total	3	1
89	2	Quercus agrifolia	2	1
89	2	Dead - Quercus agrifolia	0	0
89	2	Total	2	1
90	2	Quercus agrifolia	13	4
90	2	Dead - Quercus agrifolia	0	0
90	2	Baccharis pilularis ssp. consanguinea	0	0
90	2	Total	13	4
91	2	Quercus agrifolia	4	4
91	2	Total	4	4
95	1	Salix sp.	0	0
95	1	Dead - Salix sp.	0	0
95	1	Baccharis pilularis ssp. consanguinea	0	0
95	1	Total	0	0
96	1	Salix sp.	3	2
96	1	Dead - Salix sp.	0	0
96	1	Total	3	2
97	1	Salix sp.	0	0
97	1	Dead - Salix sp.	1	1
97	1	Total	1	1
110	2	Quercus agrifolia	1	6

Table VI-1. (Continued).

PLOT	PLOT SIZE*	TAXA	25	30
110	2	Dead - Quercus agrifolia	3	0
110	2	Sambucus mexicana	0	0
110	2	Total	4	6
111	2	Quercus agrifolia	2	4
111	2	Dead - Quercus agrifolia	1	1
111	2	Toxicodendron diversilobum	0	0
111	2	Total	3	5
112	2	Quercus agrifolia	6	15
112	2	Dead - Quercus agrifolia	1	0
112	2	Total	7	15
125	1	Acer negundo	3	1
125	1	Dead - Acer negundo	0	0
125	1	Salix sp.	0	0
125	1	Total	3	1
126	1	Acer negundo	2	2
126	1	Dead - Acer negundo	0	0
126	1	Total	2	2
127	1	Acer negundo	4	1
127	1	Dead - Acer negundo	0	0
127	1	Total	4	1

* - 1 = 0.1 ac, 2 = 0.2 ac, 3 = 0.016 ac

Table VI-1. (Continued).

PLOT	PLOT SIZE*	TAXA	35	40
67	1	Pinus muricata	1	0
67	1	Dead - Pinus muricata	0	0
67	1	Arctostaphylos purissima/refugioensis	0	0
67	1	Total	1	0
68	1	Pinus muricata	0	0
68	1	Dead - Pinus muricata	0	0
68	1	Quercus wislizenii	0	0
68	1	Arctostaphylos tomentosa	0	0
68	1	Total	0	0
69	1	Pinus muricata	0	0
69	1	Dead - Pinus muricata	0	0
69	1	Total	0	0
70	3	Pinus muricata	0	0
70	3	Total	0	0
71	3	Pinus muricata	0	0
71	3	Total	0	0
84	1	Lithocarpus densiflora	1	0
84	1	Vaccinium ovatum	0	0
84	1	Total	1	0
85	1	Lithocarpus densiflora	2	1
85	1	Dead - Lithocarpus densiflora	0	0
85	1	Vaccinium ovatum	0	0
85	1	Total	2	1
89	2	Quercus agrifolia	2	0
89	2	Dead - Quercus agrifolia	0	0
89	2	Total	2	0
90	2	Quercus agrifolia	1	0
90	2	Dead - Quercus agrifolia	0	0
90	2	Baccharis pilularis ssp. consanguinea	0	0
90	2	Total	1	0
91	2	Quercus agrifolia	3	3
91	2	Total	3	3
95	1	Salix sp.	0	0
95	1	Dead - Salix sp.	0	0
95	1	Baccharis pilularis ssp. consanguinea	0	0
95	1	Total	0	0
96	1	Salix sp.	1	1
96	1	Dead - Salix sp.	0	0
96	1	Total	1	1
97	1	Salix sp.	0	0
97	1	Dead - Salix sp.	0	0
97	1	Total	0	0
110	2	Quercus agrifolia	3	6

Table VI-1. (Continued).

PLOT	PLOT SIZE*	TAXA	35	40
110	2	Dead - Quercus agrifolia	0	0
110	2	Sambucus mexicana	0	0
110	2	Total	3	6
111	2	Quercus agrifolia	3	3
111	2	Dead - Quercus agrifolia	0	0
111	2	Toxicodendron diversilobum	0	0
111	2	Total	3	3
112	2	Quercus agrifolia	7	6
112	2	Dead - Quercus agrifolia	0	0
112	2	Total	7	6
125	1	Acer negundo	0	1
125	1	Dead - Acer negundo	0	0
125	1	Salix sp.	0	0
125	1	Total	0	1
126	1	Acer negundo	2	0
126	1	Dead - Acer negundo	0	0
126	1	Total	2	0
127	1	Acer negundo	2	1
127	1	Dead - Acer negundo	0	0
127	1	Total	2	1

* - 1 = 0.1 ac, 2 = 0.2 ac, 3 = 0.016 ac

Table VI-1. (Continued).

PLOT	PLOT SIZE*	TAXA	45	50
67	1	Pinus muricata	0	0
67	1	Dead - Pinus muricata	0	0
67	1	Arctostaphylos purissima/refugioensis	0	0
67	1	Total	0	0
68	1	Pinus muricata	0	0
68	1	Dead - Pinus muricata	0	0
68	1	Quercus wislizenii	0	0
68	1	Arctostaphylos tomentosa	0	0
68	1	Total	0	0
69	1	Pinus muricata	0	0
69	1	Dead - Pinus muricata	0	0
69	1	Total	0	0
70	3	Pinus muricata	0	0
70	3	Total	0	0
71	3	Pinus muricata	0	0
71	3	Total	0	0
84	1	Lithocarpus densiflora	2	2
84	1	Vaccinium ovatum	0	0
84	1	Total	2	2
85	1	Lithocarpus densiflora	3	2
85	1	Dead - Lithocarpus densiflora	0	1
85	1	Vaccinium ovatum	0	0
85	1	Total	3	3
89	2	Quercus agrifolia	1	2
89	2	Dead - Quercus agrifolia	0	0
89	2	Total	1	2
90	2	Quercus agrifolia	0	0
90	2	Dead - Quercus agrifolia	0	0
90	2	Baccharis pilularis ssp. consanguinea	0	0
90	2	Total	0	0
91	2	Quercus agrifolia	3	2
91	2	Total	3	2
95	1	Salix sp.	0	0
95	1	Dead - Salix sp.	0	0
95	1	Baccharis pilularis ssp. consanguinea	0	0
95	1	Total	0	0
96	1	Salix sp.	0	2
96	1	Dead - Salix sp.	0	0
96	1	Total	0	2
97	1	Salix sp.	0	0
97	1	Dead - Salix sp.	0	0
97	1	Total	0	0

Table VI-1. (Continued).

PLOT	PLOT SIZE*	TAXA	45	50
110	2	Quercus agrifolia	7	4
110	2	Dead - Quercus agrifolia	0	0
110	2	Sambucus mexicana	0	0
110	2	Total	7	4
111	2	Quercus agrifolia	4	1
111	2	Dead - Quercus agrifolia	0	0
111	2	Toxicodendron diversilobum	0	0
111	2	Total	4	1
112	2	Quercus agrifolia	1	1
112	2	Dead - Quercus agrifolia	0	0
112	2	Total	1	1
125	1	Acer negundo	1	0
125	1	Dead - Acer negundo	0	0
125	1	Salix sp.	0	0
125	1	Total	1	0
126	1	Acer negundo	0	0
126	1	Dead - Acer negundo	0	1
126	1	Total	0	1
127	1	Acer negundo	0	1
127	1	Dead - Acer negundo	0	0
127	1	Total	0	1

* - 1 = 0.1 ac, 2 = 0.2 ac, 3 = 0.016 ac

Table VI-1. (Continued).

PLOT	PLOT SIZE*	TAXA	55	60
67	1	Pinus muricata	0	0
67	1	Dead - Pinus muricata	0	0
67	1	Arctostaphylos purissima/refugioensis	0	0
67	1	Total	0	0
68	1	Pinus muricata	0	0
68	1	Dead - Pinus muricata	0	0
68	1	Quercus wislizenii	0	0
68	1	Arctostaphylos tomentosa	0	0
68	1	Total	0	0
69	1	Pinus muricata	0	0
69	1	Dead - Pinus muricata	0	0
69	1	Total	0	0
70	3	Pinus muricata	0	0
70	3	Total	0	0
71	3	Pinus muricata	0	0
71	3	Total	0	0
84	1	Lithocarpus densiflora	0	1
84	1	Vaccinium ovatum	0	0
84	1	Total	0	1
85	1	Lithocarpus densiflora	0	0
85	1	Dead - Lithocarpus densiflora	0	0
85	1	Vaccinium ovatum	0	0
85	1	Total	0	0
89	2	Quercus agrifolia	1	0
89	2	Dead - Quercus agrifolia	0	0
89	2	Total	1	0
90	2	Quercus agrifolia	0	0
90	2	Dead - Quercus agrifolia	0	0
90	2	Baccharis pilularis ssp. consanguinea	0	0
90	2	Total	0	0
91	2	Quercus agrifolia	0	0
91	2	Total	0	0
95	1	Salix sp.	0	0
95	1	Dead - Salix sp.	0	0
95	1	Baccharis pilularis ssp. consanguinea	0	0
95	1	Total	0	0
96	1	Salix sp.	1	0
96	1	Dead - Salix sp.	0	0
96	1	Total	1	0
97	1	Salix sp.	0	0
97	1	Dead - Salix sp.	0	0
97	1	Total	0	0

Table VI-1. (Continued).

PLOT	PLOT SIZE*	TAXA	55	60
110	2	Quercus agrifolia	3	2
110	2	Dead - Quercus agrifolia	0	0
110	2	Sambucus mexicana	0	0
110	2	Total	3	2
111	2	Quercus agrifolia	2	1
111	2	Dead - Quercus agrifolia	0	0
111	2	Toxicodendron diversilobum	0	0
111	2	Total	2	1
112	2	Quercus agrifolia	0	0
112	2	Dead - Quercus agrifolia	0	0
112	2	Total	0	0
125	1	Acer negundo	0	0
125	1	Dead - Acer negundo	0	0
125	1	Salix sp.	0	0
125	1	Total	0	0
126	1	Acer negundo	0	0
126	1	Dead - Acer negundo	0	0
126	1	Total	0	0
127	1	Acer negundo	0	0
127	1	Dead - Acer negundo	0	0
127	1	Total	0	0

* - 1 = 0.1 ac, 2 = 0.2 ac, 3 = 0.016 ac

Table VI-1. (Continued).

PLOT	PLOT SIZE*	TAXA	65	70
67	1	Pinus muricata	0	0
67	1	Dead - Pinus muricata	0	0
67	1	Arctostaphylos purissima/refugioensis	0	0
67	1	Total	0	0
68	1	Pinus muricata	0	0
68	1	Dead - Pinus muricata	0	0
68	1	Quercus wislizenii	0	0
68	1	Arctostaphylos tomentosa	0	0
68	1	Total	0	0
69	1	Pinus muricata	0	0
69	1	Dead - Pinus muricata	0	0
69	1	Total	0	0
70	3	Pinus muricata	0	0
70	3	Total	0	0
71	3	Pinus muricata	0	0
71	3	Total	0	0
84	1	Lithocarpus densiflora	0	0
84	1	Vaccinium ovatum	0	0
84	1	Total	0	0
85	1	Lithocarpus densiflora	1	0
85	1	Dead - Lithocarpus densiflora	0	0
85	1	Vaccinium ovatum	0	0
85	1	Total	1	0
89	2	Quercus agrifolia	0	0
89	2	Dead - Quercus agrifolia	0	0
89	2	Total	0	0
90	2	Quercus agrifolia	0	0
90	2	Dead - Quercus agrifolia	0	0
90	2	Baccharis pilularis ssp. consanguinea	0	0
90	2	Total	0	0
91	2	Quercus agrifolia	0	0
91	2	Total	0	0
95	1	Salix sp.	0	0
95	1	Dead - Salix sp.	0	0
95	1	Baccharis pilularis ssp. consanguinea	0	0
95	1	Total	0	0
96	1	Salix sp.	0	0
96	1	Dead - Salix sp.	0	0
96	1	Total	0	0
97	1	Salix sp.	0	0
97	1	Dead - Salix sp.	0	0
97	1	Total	0	0

Table VI-1. (Continued).

PLOT	PLOT SIZE*	TAXA	65	70
110	2	Quercus agrifolia	1	0
110	2	Dead - Quercus agrifolia	0	0
110	2	Sambucus mexicana	0	0
110	2	Total	1	0
111	2	Quercus agrifolia	1	1
111	2	Dead - Quercus agrifolia	0	0
111	2	Toxicodendron diversilobum	0	0
111	2	Total	1	1
112	2	Quercus agrifolia	0	0
112	2	Dead - Quercus agrifolia	0	0
112	2	Total	0	0
125	1	Acer negundo	0	0
125	1	Dead - Acer negundo	0	0
125	1	Salix sp.	0	0
125	1	Total	0	0
126	1	Acer negundo	0	1
126	1	Dead - Acer negundo	0	0
126	1	Total	0	1
127	1	Acer negundo	0	0
127	1	Dead - Acer negundo	0	0
127	1	Total	0	0

* - 1 = 0.1 ac, 2 = 0.2 ac, 3 = 0.016 ac

Table VI-1. (Continued).

PLOT	PLOT SIZE*	TAXA	75	80
67	1	Pinus muricata	0	0
67	1	Dead - Pinus muricata	0	0
67	1	Arctostaphylos purissima/refugioensis	0	0
67	1	Total	0	0
68	1	Pinus muricata	0	0
68	1	Dead - Pinus muricata	0	0
68	1	Quercus wislizenii	0	0
68	1	Arctostaphylos tomentosa	0	0
68	1	Total	0	0
69	1	Pinus muricata	0	0
69	1	Dead - Pinus muricata	0	0
69	1	Total	0	0
70	3	Pinus muricata	0	0
70	3	Total	0	0
71	3	Pinus muricata	0	0
71	3	Total	0	0
84	1	Lithocarpus densiflora	0	1
84	1	Vaccinium ovatum	0	0
84	1	Total	0	1
85	1	Lithocarpus densiflora	0	0
85	1	Dead - Lithocarpus densiflora	1	0
85	1	Vaccinium ovatum	0	0
85	1	Total	1	0
89	2	Quercus agrifolia	0	0
89	2	Dead - Quercus agrifolia	0	0
89	2	Total	0	0
90	2	Quercus agrifolia	0	0
90	2	Dead - Quercus agrifolia	0	0
90	2	Baccharis pilularis ssp. consanguinea	0	0
90	2	Total	0	0
91	2	Quercus agrifolia	0	0
91	2	Total	0	0
95	1	Salix sp.	0	0
95	1	Dead - Salix sp.	0	0
95	1	Baccharis pilularis ssp. consanguinea	0	0
95	1	Total	0	0
96	1	Salix sp.	0	0
96	1	Dead - Salix sp.	0	0
96	1	Total	0	0
97	1	Salix sp.	0	0
97	1	Dead - Salix sp.	0	0
97	1	Total	0	0

Table VI-1. (Continued).

PLOT	PLOT SIZE*	TAXA	75	80
110	2	Quercus agrifolia	0	0
110	2	Dead - Quercus agrifolia	0	0
110	2	Sambucus mexicana	0	0
110	2	Total	0	0
111	2	Quercus agrifolia	0	0
111	2	Dead - Quercus agrifolia	0	0
111	2	Toxicodendron diversilobum	0	0
111	2	Total	0	0
112	2	Quercus agrifolia	0	0
112	2	Dead - Quercus agrifolia	0	0
112	2	Total	0	0
125	1	Acer negundo	0	0
125	1	Dead - Acer negundo	0	0
125	1	Salix sp.	0	0
125	1	Total	0	0
126	1	Acer negundo	0	0
126	1	Dead - Acer negundo	0	0
126	1	Total	0	0
127	1	Acer negundo	0	0
127	1	Dead - Acer negundo	0	0
127	1	Total	0	0

* - 1 = 0.1 ac, 2 = 0.2 ac, 3 = 0.016 ac

Table VI-1. (Continued).

PLOT	PLOT SIZE*	TAXA	85
67	1	Pinus muricata	0
67	1	Dead- Pinus muricata	0
67	1	Arctostaphylos purissima/refugioensis	0
67	1	Total	0
68	1	Pinus muricata	0
68	1	Dead - Pinus muricata	0
68	1	Quercus wislizenii	0
68	1	Arctostaphylos tomentosa	0
68	1	Total	0
69	1	Pinus muricata	0
69	1	Dead - Pinus muricata	0
69	1	Total	0
70	3	Pinus muricata	0
70	3	Total	0
71	3	Pinus muricata	0
71	3	Total	0
84	1	Lithocarpus densiflora	0
84	1	Vaccinium ovatum	0
84	1	Total	0
85	1	Lithocarpus densiflora	1
85	1	Dead - Lithocarpus densiflora	0
85	1	Vaccinium ovatum	0
85	1	Total	1
89	2	Quercus agrifolia	0
89	2	Dead - Quercus agrifolia	0
89	2	Total	0
90	2	Quercus agrifolia	0
90	2	Dead - Quercus agrifolia	0
90	2	Baccharis pilularis ssp. consanguinea	0
90	2	Total	0
91	2	Quercus agrifolia	0
91	2	Total	0
95	1	Salix sp.	0
95	1	Dead - Salix sp.	0
95	1	Baccharis pilularis ssp. consanguinea	0
95	1	Total	0
96	1	Salix sp.	0
96	1	Dead - Salix sp.	0
96	1	Total	0
97	1	Salix sp.	0
97	1	Dead - Salix sp.	0
97	1	Total	0
110	2	Quercus agrifolia	0

Table VI-1. (Continued).

PLOT	PLOT SIZE*	TAXA	85
110	2	Dead - Quercus agrifolia	0
110	2	Sambucus mexicana	0
110	2	Total	0
111	2	Quercus agrifolia	0
111	2	Dead - Quercus agrifolia	0
111	2	Toxicodendron diversilobum	0
111	2	Total	0
112	2	Quercus agrifolia	0
112	2	Dead - Quercus agrifolia	0
112	2	Total	0
125	1	Acer negundo	0
125	1	Dead - Acer negundo	0
125	1	Salix sp.	0
125	1	Total	0
126	1	Acer negundo	0
126	1	Dead - Acer negundo	0
126	1	Total	0
127	1	Acer negundo	0
127	1	Dead - Acer negundo	0
127	1	Total	0

* - 1 = 0.1 ac, 2 = 0.2 ac, 3 = 0.016 ac

Table VI-2. Canopy and understory data for the sample plots.

PLOT	PLOT SIZE*	TAXA	CANOPY CLASS**	STEM DENSITY PER PLOT
67	1	Pinus muricata	1	2
67	1	Dead - Pinus muricata	1	5
67	1	Arctostaphylos purissima/refugioensis	1	2
67	1	Total understory	1	9
67	1	Pinus muricata	2	22
67	1	Dead - Pinus muricata	2	8
67	1	Total canopy	2	30
68	1	Pinus muricata	1	10
68	1	Dead - Pinus muricata	1	6
68	1	Quercus wislizenii	1	4
68	1	Arctostaphylos tomentosa	1	1
68	1	Total understory	1	21
68	1	Pinus muricata	2	11
68	1	Dead - Pinus muricata	2	4
68	1	Total canopy	2	15
69	1	Pinus muricata	1	11
69	1	Dead - Pinus muricata	1	2
69	1	Total understory	1	13
69	1	Pinus muricata	2	28
69	1	Dead - Pinus muricata	2	1
69	1	Total canopy	2	29
70	3	Pinus muricata	1	30
70	3	Total understory	1	30
71	3	Pinus muricata	1	82
71	3	Total understory	1	82
84	1	Lithocarpus densiflora	1	10
84	1	Vaccinium ovatum	1	92
84	1	Total understory	1	102
84	1	Lithocarpus densiflora	2	22
84	1	Total canopy	2	22
85	1	Lithocarpus densiflora	1	13
85	1	Dead - Lithocarpus densiflora	1	2
85	1	Vaccinium ovatum	1	108
85	1	Total understory	1	123
85	1	Lithocarpus densiflora	2	17
85	1	Dead - Lithocarpus densiflora	2	4
85	1	Total canopy	2	21
89	2	Quercus agrifolia	1	23
89	2	Dead - Quercus agrifolia	1	1
89	2	Total understory	1	24
89	2	Quercus agrifolia	2	34
89	2	Total canopy	2	34
90	2	Quercus agrifolia	1	46
90	2	Dead - Quercus agrifolia	1	1

Table VI-2. (continued).

PLOT	PLOT SIZE*	TAXA	CANOPY CLASS**	STEM DENSITY PER PLOT
90	2	Baccharis pilularis ssp. consanguinea	1	1
90	2	Total understory	1	48
90	2	Quercus agrifolia	2	45
90	2	Dead - Quercus agrifolia	2	1
90	2	Total canopy	2	46
91	2	Quercus agrifolia	1	4
91	2	Total understory	1	4
91	2	Quercus agrifolia	2	35
91	2	Total canopy	2	35
95	1	Salix sp.	1	132
95	1	Dead - Salix sp.	1	2
95	1	Baccharis pilularis ssp. consanguinea	1	4
95	1	Total understory	1	138
95	1	Salix sp.	2	4
95	1	Total canopy	2	4
96	1	Salix sp.	1	38
96	1	Dead - Salix sp.	1	1
96	1	Total understory	1	39
96	1	Salix sp.	2	19
96	1	Dead - Salix sp.	2	4
96	1	Total canopy	2	23
97	1	Salix sp.	1	72
97	1	Dead - Salix sp.	1	13
97	1	Total understory	1	85
97	1	Salix sp.	2	7
97	1	Dead - Salix sp.	2	2
97	1	Total canopy	2	9
110	2	Quercus agrifolia	1	1
110	2	Sambucus mexicana	1	11
110	2	Total understory	1	12
110	2	Quercus agrifolia	2	33
110	2	Dead - Quercus agrifolia	2	3
110	2	Total canopy	2	36
111	2	Quercus agrifolia	1	6
111	2	Dead - Quercus agrifolia	1	1
111	2	Toxicodendron diversilobum	1	2
111	2	Total understory	1	9
111	2	Quercus agrifolia	2	25
111	2	Dead - Quercus agrifolia	2	4
111	2	Total canopy	2	29
112	2	Quercus agrifolia	2	42
112	2	Dead - Quercus agrifolia	2	4
112	2	Total canopy	2	46
125	1	Acer negundo	1	60

Table VI-2. (continued).

PLOT	PLOT SIZE*	TAXA	CANOPY CLASS**	STEM DENSITY PER PLOT
125	1	Dead - Acer negundo	1	4
125	1	Salix sp.	1	1
125	1	Total understory	1	65
125	1	Acer negundo	2	18
125	1	Total canopy	2	18
126	1	Acer negundo	1	46
126	1	Dead - Acer negundo	1	1
126	1	Total understory	1	47
126	1	Acer negundo	2	10
126	1	Dead - Acer negundo	2	1
126	1	Total canopy	2	11
127	1	Acer negundo	1	28
127	1	Dead - Acer negundo	1	2
127	1	Total understory	1	30
127	1	Acer negundo	2	17
127	1	Total canopy	2	17

* - 1 = 0.1 ac, 2 = 0.2 ac, 3 = 0.016 ac
** - 1 = Sapling, 2 = Canopy

Table VI-2. (continued).

PLOT	PLOT SIZE*	TAXA	STEM DENSITY PER HA	RELATIVE DENSITY %
67	1	Pinus muricata	49.4	22.2
67	1	Dead - Pinus muricata	123.6	55.6
67	1	Arctostaphylos purissima/refugioensis	49.4	22.2
67	1	Total understory	222.4	0.0
67	1	Pinus muricata	543.6	73.3
67	1	Dead - Pinus muricata	197.7	26.7
67	1	Total canopy	741.3	0.0
68	1	Pinus muricata	247.1	47.6
68	1	Dead - Pinus muricata	148.3	28.6
68	1	Quercus wislizenii	98.8	19.0
68	1	Arctostaphylos tomentosa	24.7	4.8
68	1	Total understory	518.9	0.0
68	1	Pinus muricata	271.8	73.3
68	1	Dead - Pinus muricata	98.8	26.7
68	1	Total canopy	370.6	0.0
69	1	Pinus muricata	271.8	84.6
69	1	Dead - Pinus muricata	49.4	15.4
69	1	Total understory	321.2	0.0
69	1	Pinus muricata	691.9	96.6
69	1	Dead - Pinus muricata	24.7	3.4
69	1	Total canopy	716.6	0.0
70	3	Pinus muricata	4570.5	100.0
70	3	Total understory	4570.5	0.0
71	3	Pinus muricata	12492.7	100.0
71	3	Total understory	12492.7	0.0
84	1	Lithocarpus densiflora	247.1	9.8
84	1	Vaccinium ovatum	2273.3	90.2
84	1	Total understory	2520.4	0.0
84	1	Lithocarpus densiflora	543.6	100.0
84	1	Total canopy	543.6	0.0
85	1	Lithocarpus densiflora	321.2	10.6
85	1	Dead - Lithocarpus densiflora	49.4	1.6
85	1	Vaccinium ovatum	2668.7	87.8
85	1	Total understory	3039.3	0.0
85	1	Lithocarpus densiflora	420.1	81.0
85	1	Dead - Lithocarpus densiflora	98.8	19.0
85	1	Total canopy	518.9	0.0
89	2	Quercus agrifolia	284.2	95.8
89	2	Dead - Quercus agrifolia	12.4	4.2
89	2	Total understory	296.5	0.0
89	2	Quercus agrifolia	420.1	100.0
89	2	Total canopy	420.1	0.0
90	2	Quercus agrifolia	568.3	95.8

Table VI-2. (continued).

PLOT	PLOT SIZE*	TAXA	STEM DENSITY PER HA	RELATIVE DENSITY %
90	2	Dead - Quercus agrifolia	12.4	2.1
90	2	Baccharis pilularis ssp. consanguinea	12.4	2.1
90	2	Total understory	593.0	0.0
90	2	Quercus agrifolia	556.0	97.8
90	2	Dead - Quercus agrifolia	12.4	2.2
90	2	Total canopy	568.3	0.0
91	2	Quercus agrifolia	49.4	100.0
91	2	Total understory	49.4	0.0
91	2	Quercus agrifolia	432.4	100.0
91	2	Total canopy	432.4	0.0
95	1	Salix sp.	3261.7	95.7
95	1	Dead - Salix sp.	49.4	1.4
95	1	Baccharis pilularis ssp. consanguinea	98.8	2.9
95	1	Total understory	3410.0	0.0
95	1	Salix sp.	98.8	100.0
95	1	Total canopy	98.8	0.0
96	1	Salix sp.	939.0	97.4
96	1	Dead - Salix sp.	24.7	2.6
96	1	Total understory	963.7	100.0
96	1	Salix sp.	469.5	82.6
96	1	Dead - Salix sp.	98.8	17.4
96	1	Total canopy	568.3	0.0
97	1	Salix sp.	1779.1	84.7
97	1	Dead - Salix sp.	321.2	15.3
97	1	Total understory	2100.4	0.0
97	1	Salix sp.	173.0	77.8
97	1	Dead - Salix sp.	49.4	22.2
97	1	Total canopy	222.4	0.0
110	2	Quercus agrifolia	12.4	8.3
110	2	Sambucus mexicana	135.9	91.7
110	2	Total understory	148.3	0.0
110	2	Quercus agrifolia	407.7	91.7
110	2	Dead - Quercus agrifolia	37.1	8.3
110	2	Total canopy	444.8	0.0
111	2	Quercus agrifolia	74.1	66.7
111	2	Dead - Quercus agrifolia	12.4	11.1
111	2	Toxicodendron diversilobum	24.7	22.2
111	2	Total understory	111.2	0.0
111	2	Quercus agrifolia	308.9	86.2
111	2	Dead - Quercus agrifolia	49.4	13.8
111	2	Total canopy	358.3	0.0
112	2	Quercus agrifolia	518.9	91.3
112	2	Dead - Quercus agrifolia	49.4	8.7

Table VI-2. (continued).

PLOT	PLOT SIZE*	TAXA	STEM DENSITY PER HA	RELATIVE DENSITY %
112	2	Total canopy	568.3	0.0
125	1	Acer negundo	1482.6	92.3
125	1	Dead - Acer negundo	98.8	6.2
125	1	Salix sp.	24.7	1.5
125	1	Total understory	1606.1	0.0
125	1	Acer negundo	444.8	100.0
125	1	Total canopy	444.8	0.0
126	1	Acer negundo	1136.7	97.9
126	1	Dead - Acer negundo	24.7	2.1
126	1	Total understory	1161.4	0.0
126	1	Acer negundo	247.1	90.9
126	1	Dead - Acer negundo	24.7	9.1
126	1	Total canopy	271.8	0.0
127	1	Acer negundo	691.9	93.3
127	1	Dead - Acer negundo	49.4	6.7
127	1	Total understory	741.3	0.0
127	1	Acer negundo	420.1	100.0
127	1	Total canopy	420.1	0.0

* - 1 = 0.1 ac, 2 = 0.2 ac, 3 = 0.016 ac
** - 1 = Sapling, 2 = Canopy

Table VI-2. (continued).

PLOT	PLOT SIZE*	TAXA	BASAL AREA AREA PER PLOT (cm^2)
67	1	Pinus muricata	157.0
67	1	Dead - Pinus muricata	333.6
67	1	Arctostaphylos purissima/refugioensis	39.2
67	1	Total understory	529.8
67	1	Pinus muricata	7226.2
67	1	Dead - Pinus muricata	2454.5
67	1	Total canopy	9680.7
68	1	Pinus muricata	313.8
68	1	Dead - Pinus muricata	353.2
68	1	Quercus wislizenii	78.4
68	1	Arctostaphylos tomentosa	19.6
68	1	Total understory	765.0
68	1	Pinus muricata	3613.1
68	1	Dead - Pinus muricata	1119.3
68	1	Total canopy	4732.4
69	1	Pinus muricata	804.6
69	1	Dead - Pinus muricata	39.2
69	1	Total understory	843.8
69	1	Pinus muricata	6185.1
69	1	Dead - Pinus muricata	314.2
69	1	Total canopy	6499.3
70	3	Pinus muricata	568.4
70	3	Total understory	568.4
71	3	Pinus muricata	1607.2
71	3	Total understory	1607.2
84	1	Lithocarpus densiflora	549.4
84	1	Vaccinium ovatum	1803.2
84	1	Total understory	2352.6
84	1	Lithocarpus densiflora	21064.7
84	1	Total canopy	21064.7
85	1	Lithocarpus densiflora	372.6
85	1	Dead - Lithocarpus densiflora	157.0
85	1	Vaccinium ovatum	2116.8
85	1	Total understory	2646.4
85	1	Lithocarpus densiflora	23675.2
85	1	Dead - Lithocarpus densiflora	7184.2
85	1	Total canopy	30859.4
89	2	Quercus agrifolia	922.0
89	2	Dead - Quercus agrifolia	19.6
89	2	Total understory	941.6
89	2	Quercus agrifolia	17709.9
89	2	Total canopy	17709.9
90	2	Quercus agrifolia	2020.7

Table VI-2. (continued).

PLOT	PLOT SIZE*	TAXA	BASAL AREA AREA PER PLOT (cm^2)
90	2	Dead - Quercus agrifolia	78.5
90	2	Baccharis pilularis ssp. consanguinea	19.6
90	2	Total understory	2118.8
90	2	Quercus agrifolia	16729.8
90	2	Dead - Quercus agrifolia	176.7
90	2	Total canopy	16906.5
91	2	Quercus agrifolia	137.3
91	2	Total understory	137.3
91	2	Quercus agrifolia	24210.2
91	2	Total canopy	24210.2
95	1	Salix sp.	4354.2
95	1	Dead - Salix sp.	157.0
95	1	Baccharis pilularis ssp. consanguinea	78.4
95	1	Total understory	4589.6
95	1	Salix sp.	706.8
95	1	Total canopy	706.8
96	1	Salix sp.	1392.7
96	1	Dead - Salix sp.	19.6
96	1	Total understory	1412.3
96	1	Salix sp.	8188.1
96	1	Dead - Salix sp.	1119.3
96	1	Total canopy	9307.4
97	1	Salix sp.	3354.9
97	1	Dead - Salix sp.	254.8
97	1	Total understory	3609.7
97	1	Salix sp.	1374.4
97	1	Dead - Salix sp.	1197.8
97	1	Total canopy	2572.2
110	2	Quercus agrifolia	78.5
110	2	Sambucus mexicana	333.4
110	2	Total understory	411.9
110	2	Quercus agrifolia	50237.4
110	2	Dead - Quercus agrifolia	1472.7
110	2	Total canopy	51710.1
111	2	Quercus agrifolia	176.5
111	2	Dead - Quercus agrifolia	19.6
111	2	Toxicodendron diversilobum	39.2
111	2	Total understory	235.3
111	2	Quercus agrifolia	34196.5
111	2	Dead - Quercus agrifolia	1688.7
111	2	Total canopy	35885.2
112	2	Quercus agrifolia	32987.3
112	2	Dead - Quercus agrifolia	1296.0

Table VI-2. (continued).

PLOT	PLOT SIZE*	TAXA	BASAL AREA AREA PER PLOT (cm^2)
112	2	Total canopy	34283.3
125	1	Acer negundo	2059.5
125	1	Dead - Acer negundo	196.2
125	1	Salix sp.	78.5
125	1	Total understory	2334.2
125	1	Acer negundo	7972.0
125	1	Total canopy	7972.0
126	1	Acer negundo	1431.7
126	1	Dead - Acer negundo	19.6
126	1	Total understory	1451.3
126	1	Acer negundo	9108.9
126	1	Dead - Acer negundo	1963.5
126	1	Total canopy	11072.4
127	1	Acer negundo	843.3
127	1	Dead - Acer negundo	98.1
127	1	Total understory	941.4
127	1	Acer negundo	9503.4
127	1	Total canopy	9503.4

* - 1 = 0.1 ac, 2 = 0.2 ac, 3 = 0.016 ac
** - 1 = Sapling, 2 = Canopy

Table VI-2. (continued).

PLOT	PLOT SIZE*	TAXA	BASAL AREA PER HECTARE (m2/ha)	RELATIVE BASAL AREA
67	1	Pinus muricata	0.39	29.6
67	1	Dead - Pinus muricata	0.82	63.0
67	1	Arctostaphylos purissima/ refugioensis	0.10	7.4
67	1	Total understory	1.31	0.0
67	1	Pinus muricata	17.86	74.6
67	1	Dead - Pinus muricata	6.06	25.4
67	1	Total canopy	23.92	0.0
68	1	Pinus muricata	0.78	41.0
68	1	Dead - Pinus muricata	0.87	46.2
68	1	Quercus wislizenii	0.19	10.2
68	1	Arctostaphylos tomentosa	0.05	2.6
68	1	Total understory	1.89	0.0
68	1	Pinus muricata	8.93	76.3
68	1	Dead - Pinus muricata	2.77	23.7
68	1	Total canopy	11.69	0.0
69	1	Pinus muricata	1.99	95.4
69	1	Dead - Pinus muricata	0.10	4.6
69	1	Total understory	2.09	0.0
69	1	Pinus muricata	15.28	95.2
69	1	Dead - Pinus muricata	0.78	4.8
69	1	Total canopy	16.06	0.0
70	3	Pinus muricata	8.66	100.0
70	3	Total understory	8.66	0.0
71	3	Pinus muricata	24.49	100.0
71	3	Total understory	24.49	0.0
84	1	Lithocarpus densiflora	1.36	23.4
84	1	Vaccinium ovatum	4.45	76.6
84	1	Total understory	5.81	0.0
84	1	Lithocarpus densiflora	52.05	100.0
84	1	Total canopy	52.05	0.0
85	1	Lithocarpus densiflora	0.92	14.1
85	1	Dead - Lithocarpus densiflora	0.39	5.9
85	1	Vaccinium ovatum	5.23	80.0
85	1	Total understory	6.54	0.0
85	1	Lithocarpus densiflora	58.50	76.7
85	1	Dead - Lithocarpus densiflora	17.75	23.3
85	1	Total canopy	76.25	0.0
89	2	Quercus agrifolia	1.14	97.9
89	2	Dead - Quercus agrifolia	0.02	2.1
89	2	Total understory	1.16	0.0
89	2	Quercus agrifolia	21.88	100.0

Table VI-2. (continued).

PLOT	PLOT SIZE*	TAXA	BASAL AREA PER HECTARE (m2/ha)	RELATIVE BASAL AREA
89	2	Total canopy	21.88	0.0
90	2	Quercus agrifolia	2.50	95.4
90	2	Dead - Quercus agrifolia	0.10	3.7
90	2	Baccharis pilularis ssp. consanguinea	0.02	0.9
90	2	Total understory	2.62	0.0
90	2	Quercus agrifolia	20.67	99.0
90	2	Dead - Quercus agrifolia	.22	1.0
90	2	Total canopy	20.89	0.0
91	2	Quercus agrifolia	0.17	100.0
91	2	Total understory	0.17	0.0
91	2	Quercus agrifolia	29.91	100.0
91	2	Total canopy	29.91	0.0
95	1	Salix sp.	10.76	94.9
95	1	Dead - Salix sp.	0.39	3.4
95	1	Baccharis pilularis ssp. consanguinea	0.19	1.7
95	1	Total understory	11.34	0.0
95	1	Salix sp.	1.75	100.0
95	1	Total canopy	1.75	0.0
96	1	Salix sp.	3.44	98.6
96	1	Dead - Salix sp.	0.05	1.4
96	1	Total understory	3.49	0.0
96	1	Salix sp.	20.23	88.0
96	1	Dead - Salix sp.	2.77	12.0
96	1	Total canopy	23.00	0.0
97	1	Salix sp.	8.29	92.9
97	1	Dead - Salix sp.	0.63	7.1
97	1	Total understory	8.92	0.0
97	1	Salix sp.	3.40	53.4
97	1	Dead - Salix sp.	2.96	46.6
97	1	Total canopy	6.36	0.0
110	2	Quercus agrifolia	0.10	19.1
110	2	Sambucus mexicana	0.41	80.9
110	2	Total understory	0.51	0.0
110	2	Quercus agrifolia	62.07	97.2
110	2	Dead - Quercus agrifolia	1.82	2.8
110	2	Total canopy	63.89	0.0
111	2	Quercus agrifolia	0.22	75.0
111	2	Dead - Quercus agrifolia	0.02	8.3
111	2	Toxicodendron diversilobum	0.05	16.7
111	2	Total understory	0.29	0.0

Table VI-2. (continued).

PLOT	PLOT SIZE*	TAXA	BASAL AREA PER HECTARE (m2/ha)	RELATIVE BASAL AREA
111	2	Quercus agrifolia	42.25	95.3
111	2	Dead - Quercus agrifolia	2.09	4.7
111	2	Total canopy	44.34	0.0
112	2	Quercus agrifolia	40.76	96.2
112	2	Dead - Quercus agrifolia	1.60	3.8
112	2	Total canopy	42.36	0.0
125	1	Acer negundo	5.09	88.2
125	1	Dead - Acer negundo	0.48	8.4
125	1	Salix sp.	0.19	3.4
125	1	Total understory	5.77	0.0
125	1	Acer negundo	19.70	100.0
125	1	Total canopy	19.70	0.0
126	1	Acer negundo	3.54	98.6
126	1	Dead - Acer negundo	0.05	1.4
126	1	Total understory	3.59	0.0
126	1	Acer negundo	22.51	82.3
126	1	Dead - Acer negundo	4.85	17.7
126	1	Total canopy	27.36	0.0
127	1	Acer negundo	2.08	89.6
127	1	Dead - Acer negundo	0.24	10.4
127	1	Total understory	2.33	0.0
127	1	Acer negundo	23.48	100.0
127	1	Total canopy	23.48	0.0

* - 1 = 0.1 ac, 2 = 0.2 ac, 3 = 0.016 ac

Table VI-2. (continued).

PLOT	PLOT SIZE*	TAXA	IMPORTANCE VALUE
67	1	Pinus muricata	51.8
67	1	Dead - Pinus muricata	118.6
67	1	Arctostaphylos purissima/refugioensis	29.6
67	1	Total understory	0.0
67	1	Pinus muricata	147.9
67	1	Dead - Pinus muricata	52.1
67	1	Total canop	0.0
68	1	Pinus muricata	88.6
68	1	Dead - Pinus muricata	74.8
68	1	Quercus wislizenii	29.2
68	1	Arctostaphylos tomentosa	7.4
68	1	Total understory	0.0
68	1	Pinus muricata	149.6
68	1	Dead - Pinus muricata	50.4
68	1	Total canopy	0.0
69	1	Pinus muricata	180.0
69	1	Dead - Pinus muricata	20.0
69	1	Total understory	0.0
69	1	Pinus muricata	191.8
69	1	Dead - Pinus muricata	8.2
69	1	Total canopy	0.0
70	3	Pinus muricata	200.0
70	3	Total understory	0.0
71	3	Pinus muricata	200.0
71	3	Total understory	0.0
84	1	Lithocarpus densiflora	33.2
84	1	Vaccinium ovatum	166.8
84	1	Total understory	0.0
84	1	Lithocarpus densiflora	200.0
84	1	Total canopy	0.0
85	1	Lithocarpus densiflora	24.7
85	1	Dead - Lithocarpus densiflora	7.5
85	1	Vaccinium ovatum	167.8
85	1	Total understory	0.0
85	1	Lithocarpus densiflora	157.7
85	1	Dead - Lithocarpus densiflora	42.3
85	1	Total canopy	0.0
89	2	Quercus agrifolia	193.7
89	2	Dead - Quercus agrifolia	6.3
89	2	Total understory	0.0
89	2	Quercus agrifolia	200.0
89	2	Total canopy	0.0
90	2	Quercus agrifolia	191.2
90	2	Dead - Quercus agrifolia	5.8

Table VI-2. (continued).

PLOT	PLOT SIZE*	TAXA	IMPORTANCE VALUE
90	2	Baccharis pilularis ssp consanguinea	3.0
90	2	Total understory	0.0
90	2	Quercus agrifolia	196.8
90	2	Dead - Quercus agrifolia	3.2
90	2	Total canopy	0.0
91	2	Quercus agrifolia	200.0
91	2	Total understory	0.0
91	2	Quercus agrifolia	200.0
91	2	Total canopy	0.0
95	1	Salix sp.	190.6
95	1	Dead - Salix sp.	4.8
95	1	Baccharis pilularis ssp. consanguinea	4.6
95	1	Total understory	0.0
95	1	Salix sp.	200.0
95	1	Total canopy	0.0
96	1	Salix sp.	196.0
96	1	Dead - Salix sp.	4.0
96	1	Total understory	0.0
96	1	Salix sp.	170.6
96	1	Dead - Salix sp.	29.4
96	1	Total canopy	0.0
97	1	Salix sp.	177.6
97	1	Dead - Salix sp.	22.4
97	1	Total understory	0.0
97	1	Salix sp.	131.2
97	1	Dead - Salix sp.	68.8
97	1	Total canopy	0.0
110	2	Quercus agrifolia	27.4
110	2	Sambucus mexicana	172.6
110	2	Total understory	0.0
110	2	Quercus agrifolia	188.9
110	2	Dead - Quercus agrifolia	11.1
110	2	Total canopy	0.0
111	2	Quercus agrifolia	141.7
111	2	Dead - Quercus agrifolia	19.4
111	2	Toxicodendron diversilobum	38.9
111	2	Total understory	0.0
111	2	Quercus agrifolia	181.5
111	2	Dead - Quercus agrifolia	18.5
111	2	Total canopy	0.0
112	2	Quercus agrifolia	187.5
112	2	Dead - Quercus agrifolia	12.5
112	2	Total canopy	0.0
125	1	Acer negundo	180.5

Table VI-2. (continued).

PLOT	PLOT SIZE*	TAXA	IMPORTANCE VALUE
125	1	Dead - Acer negundo	14.6
125	1	Salix sp.	4.9
125	1	Total understory	0.0
125	1	Acer negundo	200.0
125	1	Total canopy	0.0
126	1	Acer negundo	196.5
126	1	Dead - Acer negundo	3.5
126	1	Total understory	0.0
126	1	Acer negundo	173.2
126	1	Dead - Acer negundo	26.8
126	1	Total canopy	0.0
127	1	Acer negundo	182.9
127	1	Dead - Acer negundo	17.1
127	1	Total understory	0.0
127	1	Acer negundo	200.0
127	1	Total canopy	0.0

* - 1 = 0.1 ac, 2 = 0.2 ac, 3 = 0.016 ac

Table VI-3. Summary of stem and individual densities for the sample plots.

PLOT	PLOT SIZE*	TAXA	CANOPY CLASS**	STEM DENSITY PER PLOT
67	1	Pinus muricata	3	24
67	1	Dead - Pinus muricata	3	13
67	1	Arctostaphylos purissima/ refugioensis	3	2
67	1	Total	3	39
68	1	Pinus muricata	3	21
68	1	Dead - Pinus muricata	3	10
68	1	Quercus wislizenii	3	4
68	1	Arctostaphylos tomentosa	3	1
68	1	Total	3	36
69	1	Pinus muricata	3	39
69	1	Dead - Pinus muricata	3	3
69	1	Total	3	42
70	3	Pinus muricata	3	30
70	3	Total	3	30
71	3	Pinus muricata	3	82
71	3	Total	3	82
84	1	Lithocarpus densiflora	3	32
84	1	Vaccinium ovatum	3	92
84	1	Total	3	124
85	1	Lithocarpus densiflora	3	30
85	1	Dead - Lithocarpus densiflora	3	6
85	1	Vaccinium ovatum	3	108
85	1	Total	3	144
89	2	Quercus agrifolia	3	57
89	2	Dead - Quercus agrifolia	3	1
89	2	Total	3	58
90	2	Quercus agrifolia	3	91
90	2	Dead - Quercus agrifolia	3	2
90	2	Baccharis pilularis ssp. consanguinea	3	1
90	2	Total	3	94
91	2	Quercus agrifolia	3	39
91	2	Total	3	39
95	1	Salix sp.	3	136
95	1	Dead - Salix sp.	3	2
95	1	Baccharis pilularis ssp. consanguinea	3	4
95	1	Total	3	142
96	1	Salix sp.	3	57
96	1	Dead - Salix sp.	3	5
96	1	Total	3	62
97	1	Salix sp.	3	79

Table VI-3. (continued).

PLOT	PLOT SIZE*	TAXA	CANOPY CLASS**	STEM DENSITY PER PLOT
97	1	Dead - Salix sp.	3	15
97	1	Total	3	94
110	2	Quercus agrifolia	3	34
110	2	Dead - Quercus agrifolia	3	3
110	2	Sambucus mexicana	3	11
110	2	Total	3	48
111	2	Quercus agrifolia	3	31
111	2	Dead - Quercus agrifolia	3	5
111	2	Toxicodendron diversilobum	3	2
111	2	Total	3	38
112	2	Quercus agrifolia	3	42
112	2	Dead - Quercus agrifolia	3	4
112	2	Total	3	46
125	1	Acer negundo	3	78
125	1	Dead - Acer negundo	3	4
125	1	Salix sp.	3	1
125	1	Total	3	83
126	1	Acer negundo	3	56
126	1	Dead - Acer negundo	3	2
126	1	Total	3	58
127	1	Acer negundo	3	45
127	1	Dead - Acer negundo	3	2
127	1	Total	3	47

* - 1 = 0.1 ac, 2 = 0.2 ac, 3 = 0.016 ac
** - 1 = Sapling, 2 = Canopy, 3 = Combined

Table VI-3. (continued).

PLOT	PLOT SIZE*	TAXA	STEM DENSITY PER HECTARE	INDIVIDUAL DENSITY PER PLOT***
67	1	Pinus muricata	593.0	24
67	1	Dead - Pinus muricata	321.2	12
67	1	Arctostaphylos purissima/ refugioensis	49.4	2
67	1	Total	963.7	0
68	1	Pinus muricata	518.9	21
68	1	Dead - Pinus muricata	247.1	10
68	1	Quercus wislizenii	98.8	4
68	1	Arctostaphylos tomentosa	24.7	1
68	1	Total	889.6	0
69	1	Pinus muricata	963.7	36
69	1	Dead - Pinus muricata	74.1	3
69	1	Total	1037.8	0
70	3	Pinus muricata	741.3	30
70	3	Total	741.3	0
71	3	Pinus muricata	2062.2	82
71	3	Total	2062.2	0
84	1	Lithocarpus densiflora	790.7	30
84	1	Vaccinium ovatum	2273.3	-99
84	1	Total	3064.0	0
85	1	Lithocarpus densiflora	741.3	25
85	1	Dead - Lithocarpus densiflora	148.3	6
85	1	Vaccinium ovatum	2668.7	-99
85	1	Total	3558.2	0
89	2	Quercus agrifolia	1408.5	36
89	2	Dead - Quercus agrifolia	24.7	1
89	2	Total	1433.2	0
90	2	Quercus agrifolia	2248.6	52
90	2	Dead - Quercus agrifolia	49.4	2
90	2	Baccharis pilularis ssp. consanguinea	24.7	1
90	2	Total	2322.7	0
91	2	Quercus agrifolia	963.7	24
91	2	Total	963.7	0
95	1	Salix sp.	3360.6	106
95	1	Dead - Salix sp.	49.4	2
95	1	Baccharis pilularis ssp. consanguinea	98.8	4
95	1	Total	3508.8	112
96	1	Salix sp.	1408.5	39
96	1	Dead - Salix sp.	123.6	5

Table VI-3. (continued).

PLOT	PLOT SIZE*	TAXA	STEM DENSITY PER HECTARE	INDIVIDUAL DENSITY PER PLOT***
96	1	Total	1532.0	44
97	1	Salix sp.	1952.1	47
97	1	Dead - Salix sp.	370.7	12
97	1	Total	2322.7	59
110	2	Quercus agrifolia	840.1	21
110	2	Dead - Quercus agrifolia	74.1	3
110	2	Sambucus mexicana	271.8	1
110	2	Total	1186.1	0
111	2	Quercus agrifolia	766.0	21
111	2	Dead - Quercus agrifolia	123.6	5
111	2	Toxicodendron diversilobum	49.4	2
111	2	Total	939.0	0
112	2	Quercus agrifolia	1037.8	32
112	2	Dead - Quercus agrifolia	98.8	4
112	2	Total	1136.7	0
125	1	Acer negundo	1927.4	28
125	1	Dead - Acer negundo	98.8	4
125	1	Salix sp.	24.7	1
125	1	Total	2050.9	0
126	1	Acer negundo	1383.8	23
126	1	Dead - Acer negundo	49.4	2
126	1	Total	1433.2	0
127	1	Acer negundo	1112.0	10
127	1	Dead - Acer negundo	49.4	2
127	1	Total	1161.4	0

* - 1 = 0.1 ac, 2 = 0.2 ac, 3 = 0.016 ac
*** - -99 = Not determined

Table VI-3. (continued).

PLOT	PLOT SIZE*	TAXA	INDIVIDUAL DENSITY PER HECTARE
67	1	Pinus muricata	593.0
67	1	Dead - Pinus muricata	296.5
67	1	Arctostaphylos purissima/refugioensis	49.4
67	1	Total	0.0
68	1	Pinus muricata	518.9
68	1	Dead - Pinus muricata	247.1
68	1	Quercus wislizenii	98.8
68	1	Arctostaphylos tomentosa	24.7
68	1	Total	0.0
69	1	Pinus muricata	889.6
69	1	Dead - Pinus muricata	74.1
69	1	Total	0.0
70	3	Pinus muricata	741.3
70	3	Total	0.0
71	3	Pinus muricata	2026.2
71	3	Total	0.0
84	1	Lithocarpus densiflora	741.3
84	1	Vaccinium ovatum	0.0
84	1	Total	0.0
85	1	Lithocarpus densiflora	617.8
85	1	Dead - Lithocarpus densiflora	148.3
85	1	Vaccinium ovatum	0.0
85	1	Total	0.0
89	2	Quercus agrifolia	889.6
89	2	Dead - Quercus agrifolia	24.7
89	2	Total	0.0
90	2	Quercus agrifolia	1284.9
90	2	Dead - Quercus agrifolia	49.4
90	2	Baccharis pilularis ssp. consanguinea	24.7
90	2	Total	0.0
91	2	Quercus agrifolia	593.0
91	2	Total	0.0
95	1	Salix sp.	2619.3
95	1	Dead - Salix sp.	49.4
95	1	Baccharis pilularis ssp. consanguinea	98.8
95	1	Total	2767.5
96	1	Salix sp.	963.7
96	1	Dead - Salix sp.	123.6
96	1	Total	1087.2
97	1	Salix sp.	1161.4
97	1	Dead - Salix sp.	296.5
97	1	Total	1457.9

Table VI-3. (continued).

PLOT	PLOT SIZE*	TAXA	INDIVIDUAL DENSITY PER HECTARE
110	2	Quercus agrifolia	518.9
110	2	Dead - Quercus agrifolia	74.1
110	2	Sambucus mexicana	24.7
110	2	Total	0.0
111	2	Quercus agrifolia	518.9
111	2	Dead - Quercus agrifolia	123.6
111	2	Toxicodendron diversilobum	49.4
111	2	Total	0.0
112	2	Quercus agrifolia	790.7
112	2	Dead - Quercus agrifolia	98.8
112	2	Total	0.0
125	1	Acer negundo	691.9
125	1	Dead - Acer negundo	98.8
125	1	Salix sp.	24.7
125	1	Total	0.0
126	1	Acer negundo	568.3
126	1	Dead - Acer negundo	49.4
126	1	Total	0.0
127	1	Acer negundo	247.1
127	1	Dead - Acer negundo	49.4
127	1	Total	0.0

* - 1 = 0.1 ac, 2 = 0.2 ac, 3 = 0.016 ac

APPENDIX VII

COVER CLASS DATA FOR SEASONAL WETLANDS

Table VII-1. Composition (Cover classes) in 1 m^2 plots along Transect #128 in vernal pool at 35th Street site.

PLOT #1 — LOCATION ALONG TRANSECT: 0m

Taxa	Cover Class (%)
Elymus triticoides ssp. triticoides	75-100
Frankenia grandifolia	1-5

PLOT #2 — LOCATION ALONG TRANSECT: 10m

Taxa	Cover Class (%)
Juncus phaeocephalus	75-100
Phalaris lemmonii	10-25
Bromus mollis	5-10
Koeleria macrantha	5-10
Sida leprosa var. hederacea	5-10
Atriplex semibaccata	1-5
Bromus diandrus	1-5

PLOT#3 — LOCATION ALONG TRANSECT: 20m

Taxa	Cover Class (%)
Avena barbata	10-25
Bromus diandrus	10-25
Juncus phaeocephalus	10-25
Koeleria macrantha	10-25
Sida leprosa var. hederacea	5-10
Distichlis spicata	1-5
Phalaris lemmonii	0-1
Sonchus sp.	0-1

Table VII-1. (Continued)

PLOT#4 LOCATION ALONG TRANSECT: 30m

Taxa	Cover Class (%)
Phalaris lemmonii	25-50
Distichlis spicata	10-25
Juncus phaeocephalus	10-25
Avena barbata	1-5
Bromus mollis	1-5
Koeleria macrantha	0-1

PLOT#5 LOCATION ALONG TRANSECT: 40m

Taxa	Cover Class (%)
Phalaris lemmonii	50-75
Juncus phaeocephalus	25-50
Distichlis spicata	1-5
Sida leprosa var. hederacea	1-5
Bromus mollis	0-1
Sonchus sp.	0-1

PLOT#6* LOCATION ALONG TRANSECT: 50m

Taxa	Cover Class (%)
Juncus phaeocephalus	25-50
Phalaris lemmonii	25-50
Sida leprosa var. hederacea	10-25
Eryngium armatum	1-5

* formerly disturbed area

Table VII-1. (Continued)

PLOT#7* — LOCATION ALONG TRANSECT: 60m

Taxa	Cover Class (%)
Juncus phaeocephalus	50-75
Phalaris lemmonii	10-25
Sida leprosa var. hederacea	5-10

* formerly disturbed area

PLOT#8 — LOCATION ALONG TRANSECT: 70m

Taxa	Cover Class (%)
Juncus phaeocephalus	50-75
Phalaris lemmonii	50-75
Distichlis spicata	1-5
Sida leprosa var. hederacea	1-5

PLOT#9 — LOCATION ALONG TRANSECT: 80m

Taxa	Cover Class (%)
Phalaris lemmonii	50-75
Juncus phaeocephalus	10-25
Distichlis spicata	5-10
Eleocharis cf. palustris	5-10
Sida leprosa var. hederacea	5-10
Eryngium armatum	0-1

Table VII-1. (Continued)

PLOT#10 — LOCATION ALONG TRANSECT: 90m

Taxa	Cover Class (%)
Distichlis spicata	25-50
Phalaris lemmonii	10-25
Avena barbata	5-10
Eleocharis cf. palustris	1-5

PLOT#11 — LOCATION ALONG TRANSECT: 100m

Taxa	Cover Class (%)
Phalaris lemmonii	75-100
Distichlis spicata	1-5
Eleocharis cf. palustris	1-5
Sida leprosa var. hederacea	1-5
Conyza canadensis	0-1
Koeleria macrantha	0-1

PLOT#12 — LOCATION ALONG TRANSECT: 110m

Taxa	Cover Class (%)
Eleocharis cf. palustris	25-50
Phalaris lemmonii	25-50
Distichlis spicata	10-25
Bromus mollis	0-1
Sida leprosa var. hederacea	0-1

Table VII-1. (Continued)

PLOT#13 LOCATION ALONG TRANSECT: 120m

Taxa	Cover Class (%)
Hordeum californicum	50-75
Distichlis spicata	5-10
Eleocharis cf. palustris	1-5
Phalaris lemmonii	0-1

PLOT#14 LOCATION ALONG TRANSECT: 130m

Taxa	Cover Class (%)
Elymus triticoides ssp. triticoides	75-100
Eleocharis cf. palustris	1-5
Rumex crispus	0-1
Sonchus sp.	0-1

PLOT#15 LOCATION ALONG TRANSECT: 140m

Taxa	Cover Class (%)
Avena barbata	10-25
Hypochoeris glabra	1-5
Vulpia octoflora	1-5
Anagallis arvensis	0-1
Bromus diandrus	0-1
Bromus mollis	0-1
Carpobrotus edulis	0-1
Conyza canadensis	0-1
Elymus triticoides ssp. triticoides	0-1
Gnaphalium luteo-album	0-1
Juncus falcatus	0-1
Sonchus sp.	0-1
Unknown herb	0-1

Table VII-2. Other plant species present in 35th Street vernal pool.

Species Also Present in "Pool" Area
- Herbs
  - Centaurium davyi
  - Cirsium brevistylum
  - Erechtites glomerata
- Shrubs
  - Baccharis pilularis ssp. consanguinea

Species Also Present in "Edge" Areas
- Herbs
  - Achillea millefolium
  - Astragalus sp.
  - Baccharis douglasii
  - Carex praegracilis *
  - Chorizanthe diffusa
  - Cirsium arvense
  - Cortaderia jubata
  - Crassula erecta
  - Dudleya sp.
  - Gnaphalium californicum
  - Gnaphalium purpureum
  - Gnaphalium ramosissimum
  - Helenium puberulum
  - Heliotropium curassavicum var. occulatum
  - Horkelia cuneata
  - Juncus cf. falcatus
  - Juncus patens *
  - Juncus textilis *
  - Lolium perenne ssp. multiflorum
  - Navarretia sp.
  - Parapholis incurva
  - Polypogon monospeliensis *
  - Sisyrinchium bellum
  - Sonchus asper

* From list compiled by Wayne R. Ferren, Jr.
(University of California, Santa Barbara) May 22, 1987

Table VII-3. Composition (Cover classes) in 1 m^2 plots along Transect #129 in seasonal wetland at 35th Street site.

PLOT#1 LOCATION ALONG TRANSECT: 0m

Taxa	Cover Class (%)
Baccharis pilularis ssp. consanguinea	5-10
Elymus sp.	5-10
Anagallis arvensis	1-5
Avena barbata	1-5
Eryngium armatum	1-5
Lotus junceus	1-5
Stipa pulchra	1-5
Bromus diandrus	0-1
Bromus mollis	0-1
Dudleya lanceolata	0-1
Filago gallica	0-1
Gnaphalium luteo-album	0-1
Gnaphalium purpureum	0-1
Hypochoeris glabra	0-1
Linaria canadensis var. texana	*
Sonchus sp.	0-1
Spergularia macrotheca	0-1
Vulpia sp.	0-1

* dead

PLOT#2 LOCATION ALONG TRANSECT: 3m

Taxa	Cover Class (%)
Baccharis pilularis ssp. consanguinea	5-10
Carpobrotus edulis	5-10
Avena barbata	1-5
Lotus junceus	1-5
Stipa pulchra	1-5
Dudleya lanceolata	0-1
Hypochoeris glabra	0-1
Sonchus sp.	0-1
Bromus mollis	*
Bromus rubens	*

* dead

TABLE VII-3. (Continued)

PLOT#3 — LOCATION ALONG TRANSECT: 6m

Taxa	Cover Class (%)
Avena barbata	5-10
Lotus junceus	5-10
Baccharis pilularis ssp. consanquinea	1-5
Anagallis arvensis	0-1
Dichondra donnelliana	0-1
Hypochoeris glabra	0-1
Sonchus sp.	0-1
Bromus rubens	*
Dichelostemma pulchellum	*

* dead

PLOT#4 — LOCATION ALONG TRANSECT: 9m

Taxa	Cover Class (%)
Anagallis arvensis	1-5
Baccharis pilularis ssp. consanguinea	1-5
Elymus sp.	1-5
Eryngium armatum	1-5
Hemizonia sp.	1-5
Hypochoeris glabra	1-5
Bromus mollis	0-1
Centaurium davyi	0-1
Conyza sp.	0-1
Filago gallica	0-1
Juncus phaeocephalus	0-1
Lotus junceus	0-1
Sisyrinchium bellum	0-1
Sonchus asper	0-1
Sonchus oleraceus	0-1

Table VII-3. (Continued)

PLOT#5 LOCATION ALONG TRANSECT: 10m

Taxa	Cover Class (%)
Eryngium armatum	5-10
Avena barbata	1-5
Elymus sp.	1-5
Juncus phaeocephalus	1-5
Koeleria macrantha	1-5
Sisyrinchium bellum	1-5
Anagallis arvensis	0-1
Centaurium davyi	0-1
Cotula coronopifolia	0-1
Dudleya blochmaniae ssp. blochmaniae	0-1
Filago gallica	0-1
Hemizonia sp.	0-1
Hypochoeris glabra	0-1
Sonchus sp.	0-1
Spergularia macrotheca	0-1

PLOT#6 LOCATION ALONG TRANSECT: 11m

Taxa	Cover Class (%)
Eryngium armatum	10-25
Sisyrinchium bellum	10-25
Stipa pulchra	5-10
Anagallis arvensis	0-1
Centaurium davyi	0-1
Cotula coronopifolia	0-1
Filago gallica	0-1
Hypochoeris glabra	0-1
Juncus phaeocephalus	0-1
Navarretia sp.	0-1
Plantago coronopus	0-1
Sonchus sp.	0-1

TABLE VII-3. (Continued)

PLOT#7 LOCATION ALONG TRANSECT: 12m

Taxa	Cover Class (%)
Sisyrinchium bellum	10-25
Eryngium armatum	5-10
Stipa pulchra	5-10
Anagallis arvensis	0-1
Centaurium davyi	0-1
Dudleya blochmaniae ssp. blochmaniae	0-1
Dudleya lanceolata	0-1
Filago gallica	0-1
Hypochoeris glabra	0-1
Koeleria macrantha	0-1
Parapholis incurva	0-1
Sonchus sp.	0-1

PLOT#8 LOCATION ALONG TRANSECT: 13m

Taxa	Cover Class (%)
Sisyrinchium bellum	10-25
Centaurium davyi	1-5
Eryngium armatum	1-5
Stipa pulchra	1-5
Anagallis arvensis	0-1
Centaurium davyi	0-1
Dudleya blochmaniae ssp. blochmaniae	0-1
Filago gallica	0-1
Gnaphalium purpureum	0-1
Hypochoeris glabra	0-1
Koeleria macrantha	0-1
Navarretia sp.	0-1
Sonchus sp.	0-1

TABLE VII-3. (Continued)

PLOT#9 — LOCATION ALONG TRANSECT: 14m

Taxa	Cover Class (%)
Carpobrotus edulis	50-75
Sisyrinchium bellum	10-25
Stipa pulchra	5-10
Filago gallica	1-5
Anagallis arvensis	0-1
Centaurium davyi	0-1
Eryngium armatum	0-1
Gnaphalium sp.	0-1
Sonchus sp.	0-1

PLOT#10 — LOCATION ALONG TRANSECT: 15m

Taxa	Cover Class (%)
Carpobrotus edulis	25-50
Sisyrinchium bellum	10-25
Filago gallica	1-5
Plantago coronopus	1-5
Stipa pulchra	1-5
Anagallis arvensis	0-1
Elymus sp.	0-1
Eryngium armatum	0-1
Juncus falcatus	0-1
Sonchus sp.	0-1

Table VII-3. (Continued)

PLOT#11 LOCATION ALONG TRANSECT: 16m

Taxa	Cover Class (%)
Sisyrinchium bellum	5-10
Elymus sp.	1-5
Eryngium armatum	1-5
Filago gallica	1-5
Plantago coronopus	1-5
Sonchus sp.	1-5
Stipa pulchra	1-5
Centaurium davyi	0-1
Dudleya blochmaniae ssp. blochmaniae	0-1
Juncus falcatus	0-1
Spergularia macrotheca	0-1

PLOT#12 LOCATION ALONG TRANSECT: 17m

Taxa	Cover Class (%)
Eryngium armatum	10-25
Filago gallica	5-10
Sisyrinchium bellum	5-10
Stipa pulchra	5-10
Elymus sp.	1-5
Spergularia macrotheca	1-5
Anagallis arvensis	0-1
Centaurium davyi	0-1
Dudleya lanceolata	0-1
Hypochoeris glabra	0-1
Juncus falcatus	0-1
Sonchus sp.	0-1

Table VI-3. (Continued)

PLOT#13 LOCATION ALONG TRANSECT: 20m

Taxa	Cover Class (%)
Elymus sp.	1-5
Eryngium armatum	1-5
Filago gallica	1-5
Hypochoeris glabra	1-5
Lotus junceus	1-5
Sonchus sp.	1-5
Stipa pulchra	1-5
Anagallis arvensis	0-1
Carpobrotus edulis	0-1
Centauria melitensis	0-1
Erodium cicutarium	0-1
Juncus falcatus	0-1
Parapholis incurva	0-1
Plantago coronopus	0-1

PLOT#14 LOCATION ALONG TRANSECT: 23m

Taxa	Cover Class (%)
Carpobrotus edulis	10-25
Lotus junceus	10-25
Stipa pulchra	5-10
Dichondra donnelliana	1-5
Dudleya lanceolata	1-5
Anagallis arvensis	0-1

Table VII-4. Composition (Cover classes) in 1 m^2 plots along Transect #130 in seasonal wetland at Tangair Road site.

PLOT#1 LOCATION ALONG TRANSECT: 0m

Taxa	Cover Class (%)
Baccharis pilularis ssp. consanguinea	25-50
Artemisia californica	1-5
Daucus pusillus	1-5
Eriogonum parvifolium	1-5
Koeleria macrantha	1-5
Rhamnus californica	1-5
Stipa pulchra	1-5
Toxicodendron diversilobum	1-5
Agrostis diegoensis	0-1
Anagallis arvensis	0-1
Corethrogyne filaginifolia	0-1
Erodium cicutarium	0-1
Galium nuttallii	0-1
Gnaphalium purpureum	0-1
Horkelia cuneata	0-1
Hypochoeris glabra	0-1
Solidago sp.	0-1
Stylocline gnaphalioides	0-1
Navarretia sp.	* (1-5)
Vulpia sp.	* (0-1)

* dead

Table VII-4. (Continued)

PLOT#2 LOCATION ALONG TRANSECT: 1m

Taxa	Cover Class (%)
Baccharis pilularis ssp. consanguinea	5-10
Stipa pulchra	5-10
Calystegia sp.	1-5
Hypochoeris glabra	1-5
Koeleria macrantha	1-5
Solidago sp.	1-5
Agrostis diegoensis	0-1
Cardionema ramosissimum	0-1
Daucus pusillus	0-1
Erodium cicutarium	0-1
Galium nuttallii	0-1
Gnaphalium purpureum	0-1
Horkelia cuneata	0-1
Silene (gallica?)	0-1
Sisyrinchium bellum	0-1
Stylocline gnaphalioides	0-1
Vulpia sp.	* (1-5)
Bromus mollis	* (0-1)
Plantago erecta	* (0-1)

* dead

Table VII-4. (Continued)

PLOT#3 LOCATION ALONG TRANSECT: 2m

Taxa	Cover Class (%)
Horkelia cuneata	5-10
Koeleria macrantha	5-10
Solidago sp.	5-10
Stipa pulchra	1-5
Agrostis diegoensis	0-1
Eriogonum parvifolium	0-1
Erodium cicutarium	0-1
Gnaphalium luteo-album	0-1
Gnaphalium purpureum	0-1
Hypochoeris glabra	0-1
Orthocarpus sp.	0-1
Sisyrinchium bellum	0-1
Vulpia sp.	* (1-5)
Bromus mollis	* (0-1)
Plantago erecta	* (0-1)

* dead

PLOT#4 LOCATION ALONG TRANSECT: 3m

Taxa	Cover Class (%)
Baccharis pilularis ssp. consanguinea	10-25
Solidago sp.	10-25
Koeleria macrantha	5-10
Sisyrinchium bellum	5-10
Stipa pulchra	5-10
Agrostis diegoensis	1-5
Erodium cicutarium	1-5
Eryngium armatum	1-5
Horkelia cuneata	1-5
Clarkia purpurea	0-1
Dichelostemma pulchellum	0-1
Hypochoeris glabra	0-1
Orthocarpus sp.	0-1
Rumex angiocarpus	0-1
Vulpia sp.	* (0-1)

* dead

Table VII-4. (Continued)

PLOT#5 LOCATION ALONG TRANSECT: 4m

Taxa	Cover Class (%)
Sisyrinchium bellum	10-25
Baccharis pilularis ssp. consanguinea	5-10
Solidago sp.	5-10
Gnaphalium purpureum	1-5
Horkelia cuneata	1-5
Artemisia californica (seedling)	0-1
Erodium cicutarium	0-1
Erodium sp.	0-1
Gnaphalium luteo-album	0-1
Gnaphalium sp. (seedlings)	0-1
Hypochoeris glabra	0-1
Koeleria macrantha	0-1
Juncus falcatus	0-1
Juncus phaeocephalus	0-1
Rumex angiocarpus	0-1
Spergularia macrotheca	0-1

PLOT#6 LOCATION ALONG TRANSECT: 5m

Taxa	Cover Class (%)
Eryngium armatum	10-25
Sisyrinchium bellum	10-25
Baccharis pilularis ssp. consanguinea	1-5
Erodium botrys	1-5
Gnaphalium purpureum	1-5
Rumex angiocarpus	1-5
Gnaphalium luteo-album	0-1
Hypochoeris glabra	0-1
Juncus falcatus	0-1
Juncus phaeocephalus	0-1
Solidago sp.	0-1
Stipa pulchra	0-1
Vulpia sp.	* (1-5)

* dead

Table VII-4. (Continued)

PLOT#7 LOCATION ALONG TRANSECT: 6m

Taxa	Cover Class (%)
Baccharis pilularis ssp. consanguinea	10-25
Eryngium armatum	5-10
Sisyrinchium bellum	5-10
Rumex angiocarpus	1-5
Achillea millefolium	0-1
Artemisia californica (seedling)	0-1
Erodium cicutarium	0-1
Gnaphalium luteo-album	0-1
Gnaphalium purpureum	0-1
Hypochoeris glabra	0-1
Juncus falcatus	0-1
Juncus phaeocephalus	0-1
Vupia sp.	*

* dead

PLOT#8 LOCATION ALONG TRANSECT: 7m

Taxa	Cover Class (%)
Baccharis pilularis ssp. consanguinea	25-50
Koeleria macrantha	5-10
Sisyrinchium bellum	5-10
Achillea millefolium	1-5
Eryngium armatum	1-5
Juncus falcatus	1-5
Juncus phaeocephalus	1-5
Stipa pulchra	1-5
Anagallis arvensis	0-1
Rumex angiocarpus	0-1
Vulpia sp.	* (5-10)
Bromus diandrus	* (0-1)
Bromus mollis	* (0-1)

* dead

Table VII-4. (Continued)

PLOT#9 LOCATION ALONG TRANSECT: 8m

Taxa	Cover Class (%)
Baccharis pilularis ssp. consanguinea	25-50
Galium nuttallii	1-5
Gnaphalium ramosissimum	1-5
Koeleria macrantha	1-5
Sisyrinchium bellum	1-5
Stipa pulchra	1-5
Achillea millefolium	0-1
Anagallis arvensis	0-1
Artemisia californica	0-1
Clarkia purpurea	0-1
Eriogonum parvifolium	0-1
Erodium botrys	0-1
Gnaphalium luteo-album	0-1
Hypochoeris glabra	0-1
Juncus falcatus	0-1
Juncus phaeocephalus	0-1
Gastridium ventricosum	0-1
Bromus mollis	*
Vulpia sp.	*

* dead

PLOT#10 LOCATION ALONG TRANSECT: 9m

Taxa	Cover Class (%)
Artemisia californica	25-50
Baccharis pilularis ssp. consanguinea	25-50
Eriogonum parvifolium	25-50
Galium nuttallii	1-5
Horkelia cuneata	1-5
Stipa cf. pulchra	1-5
Agrostis diegoensis	0-1
Anagallis arvensis	0-1
Erodium botrys	0-1
Hypochoeris glabra	0-1

APPENDIX VIII

ENVIRONMENTAL PARAMETERS FROM VEGETATION TRANSECTS

Table VIII-1. Selected environmental variables for the study transects.

PLOT	ASPECT*	SLOPE ANGLE UP (%)	SLOPE ANGLE DOWN (%)	SLOPE ANGLE RIGHT (%)
51	-99	0	0	0
52	-99	0	0	0
53	-99	0	0	0
54	108	5	-9	4
55	90	4	-8	5
56	98	4	-5	3
57	340	10	-8	-5
58	70	10	-20	15
59	90	32	-25	5
60	78	38	-30	12
61	54	13	-12	5
62	64	18	-15	-5
63	80	12	-20	-6
64	300	15	-20	10
65	310	12	-15	8
66	320	15	-18	15
67	310	15	-13	0
68	336	16	-10	10
69	336	8	-24	0
70	120	8	-14	-8
71	130	14	-12	-14
72	167	14	-13	-2
73	194	15	-14	-5
74	204	12	-13	-5
75	276	21	-21	-25
76	274	20	-18	-5
77	244	28	-16	-10
78	204	15	-12	-1
79	210	12	-8	-9
80	206	20	-12	2
81	200	8	-6	-2
82	-99	0	0	0
83	-99	5	7	0
84	324	55	-40	2
85	312	64	-63	-28
86	344	11	-11	1

* -99 = slope flat, aspect not defined
-999 = dune topography, aspect and slope not defined

Table VIII-1. (continued).

PLOT	ASPECT*	SLOPE ANGLE UP (%)	SLOPE ANGLE DOWN (%)	SLOPE ANGLE RIGHT (%)
87	340	18	-18	1
88	320	34	-30	0
89	-99	5	-4	0
90	310	12	-18	-10
91	270	11	-9	4
92	124	17	-19	-6
93	26	10	-5	-2
94	94	25	-30	1
95	-99	0	0	0
96	-99	0	0	0
97	-99	0	0	0
98	78	12	-15	-6
99	254	-15	-25	-4
100	204	8	-6	0
101	104	12	-15	22
102	134	10	-25	-8
103	78	45	-25	-20
104	260	44	-41	-2
105	260	55	-50	3
106	244	35	-30	-7
107	-99	0	0	0
108	-99	0	0	0
109	-99	0	0	0
110	348	60	-60	-5
111	320	50	-49	-3
112	328	27	-28	-5
113	-99	2	-2	-1
114	-99	2	-2	0
115	-99	5	-5	0
116	-999			
117	-99	0	-4	0
118	-999			
119	-999			
120	-999			
121	-999			
122	-999			

* -99 = slope flat, aspect not defined
-999 = dune topography, aspect and slope not defined

Table VIII-1. (continued).

PLOT	ASPECT*	SLOPE ANGLE UP (%)	SLOPE ANGLE DOWN (%)	SLOPE ANGLE RIGHT (%)
123	-999			
124	-999			
125	-99	0	0	0
126	-99	0	0	0
127	-99	0	0	0
128	-99	0	0	0
129**	-99	0	0	0
130**	-99	0	0	0

* - 99 = slope flat, aspect not defined
-999 = dune topography, aspect and slope not defined
**mound/trough topography, slope angles not defined

Table VIII-1. (continued).

PLOT	SLOPE ANGLE LEFT (%)	SHAPE	LITTER LAYER	FIRE*	GRAZING**
51	0	flat	mor	1	1
52	0	flat	mor	1	1
53	0	flat	mor	1	1
54	-6	flat	mor	1	2
55	-4	flat	mor	1	2
56	-5	flat	mor	1	2
57	8	flat	mor	2	1
58	-13	flat	thin mor	2	1
59	-8	flat	thin mor	2	1
60	-8	flat	thin mor	2	1
61	-10	flat	mor	2	1
62	2	flat	mor	2	1
63	5	flat	mor	1	2
64	-10	flat	mor	1	1
65	-9	flat	mor	1	2
66	-14	flat	mor	1	2
67	5	concave	pine	1	1
68	-8	flat	pine	1	1
69	-14	flat	pine	1	1
70	3	flat	pine	1974	1
71	15	flat	pine	1974	1
72	2	flat	thatch	1	5
73	4	flat	thatch	1	5
74	3	flat	thatch	1	5
75	-1	sl convex	thatch	1	5
76	-18	convex	thatch	1	5
77	0	sl convex	thatch	1	5
78	2	flat	thatch	1	5
79	5	flat	thatch	1	5
80	0	flat	thatch	1	5
81	0	flat	scattered	1	1
82	0	flat	scattered	1	1
83	8	flat	scattered	1	1
84	-2	flat	thick mor	1	1

* -1 = No evidence, 2 = Yes, but not recent
** -1 = No evidence, 2 = Deer, no cattle, 3 = In vicinity, not in plot
** -4 = Rabbit, no cattle, 5 = Cattle, 6 = Pig rooting

Table VIII-1. (continued).

PLOT	SLOPE ANGLE LEFT (%)	SHAPE	LATTER LAYER	FIRE*	GRAZING**
85	2	flat	thick mor	1	1
86	-4	flat	no data	1977?	4
87	-1	flat	no data	1977?	1
88	-2	flat	no data	1977?	1
89	0	flat	mor	1	5
90	1	flat	mor	1	5
91	-4	flat	none	1	5
92	-7	convex	scattered	1977?	1
93	5	flat	scattered	1977?	4
94	-5	flat	scattered	1977?	4
95	0	flat	mor	1977	1
96	0	flat	mor	1	1
97	0	flat	mor	1977	1
98	5	sl convex	thatch	2	5
99	-10	convex	thatch	2	5
100	-4	flat	thatch	2	5
101	-14	flat	thatch	1	5
102	-8	convex	thatch	1	5
103	12	flat	thatch	1	5
104	2	flat	scattered	1	5
105	-2	flat	scattered	1	5
106	5	flat	scattered	1	5
107	0	flat	mor	1	1
108	0	flat	mor	1	1
109	0	flat	mor	1	1
110	-3	flat	scattered	1	3
111	2	sl convex	scattered	1	3
112	5	flat	thin mor	1	5
113	-1	flat	thatch	1	1
114	0	flat	thatch	1	1
115	2	flat	thatch	1	1
116		dune	none	1	1
117	2	flat	thatch	1	1
118		dune	none	1	1

* -1 = No evidence, 2 = Yes, but not recent
** -1 = No evidence, 2 = Deer, no cattle, 3 = In vicinity, not in plot
** -4 = Rabbit, no cattle, 5 = Cattle, 6 = Pig rooting

Table VIII-1. (continued).

PLOT	SLOPE ANGLE LEFT (%)	SHAPE	LITTER LAYER	FIRE*	GRAZING**
119		dune	none	1	1
120		dune	none	1	1
121		dune	none	1	1
122		dune	none	1	1
123		dune	none	1	1
124		dune	none	1	1
125	0	flat	mor	1	6
126	0	flat	mor	1	6
127	0	flat	mor	1	6
128	0	flat	thatch	1	4
129	0	hum./tro.	thatch	1982	1
130	0	hum./tro.	thatch	1	4

* -1 = No evidence, 2 = Yes, but not recent

** -1 = No evidence, 2 = Deer, no cattle, 3 = In vicinity, not in plot

** -4 = Rabbit, no cattle, 5 = Cattle, 6 = Pig rooting

APPENDIX IX

DESCRIPTIONS OF DATA BASES AND GEOGRAPHIC INFORMATION SYSTEM FILES

Table IX-1. Vegetation, species list, and bibliographic data bases.

All original vegetation data, species lists, and the bibliography are given in ASCII files on two double-sided, high-density floppy disks (data on deposit with Vandenberg Environmental Task Force Office). Data are arranged as described below.

Disk 1 files are:

HERBxxx, where xxx = plot numbers from 51 through 127. Additional shrubs and herbs present in 150 m^2 plots as given in Appendix V.

CANOPYxx, where xx = 1 through 18. Diameter distribution data as given in Appendix VI, Table V1-1.

DIAMxx, where xx = 1 through 15. Canopy and understory data as given in Appendix VI, Table VI-2.

STEMxx, where xx = 1 through 5. Stem and individual density data as given in Appendix VI, Table VI-3.

POOLxx, where xx = 1 through 15. Cover class data from Transect 128, plots 1 through 15 as in Appendix VII, Table VII-1.

WETxx, where xx = 1 through 14. Cover class data from Transect 129, plots 1 through 14 as in Appendix VII, Table VII-3.

ROADxx, where xx = 1 through 10. Cover class data from Transect 130, plots 1 through 10 as in Appendix VII, Table VII-4.

Disk 2 files are:

TABLExxx, where x = plot numbers from 51 through 127. Transect data as in Appendix V.

TRANSxx, where x = plot numbers 1 through 50. Transect data from SLC-6 transects as in Appendix I of that report (Schmalzer andl Hinkle 1987a).

MSOILSx, where x = 1 through 6. Soils data (wet season) from SLC-6 transects as in Appendix, Table II-2 of that report (Schmalzer and Hinkle 1987a).

SSOILSx, where x = 1 through 3. Soils data (dry season) from SLC-6 transects as in Appendix II, Table II-3 of that report (Schmalzer and Hinkle 1987a).

ENVIRONM, Environmental data from SLC-6 transects as in Appendix II, Table II-1 of that report (Schmalzer andl Hinkle 1987a).

PLOTx, where x = 1 through 6. Environmental data from plots 51 through 127 as in Appendix VIII.

BIB.LIST, Bibliography as in Appendix I.

PLANTGEN.TXT, Preliminary plant species list, arranged by genera as in Appendix II.

PLANTFAM.TXT, Preliminary plant species list, arranged by families as in Appendix III.

Table IX-2. Descriptions of Geographic Information System files.

GIS File Specifications

The digital map files (GIS data layers) presented to the Air Force in this project have a spatial resolution of 30 meters, determined by the resolution of Landsat Thematic Mapper data that was used to create the vegetation map of Vandenberg. The following specifications are needed to create new data layers compatible with the current GIS (ERDAS Version 7.2.08):

SIZE:	1533 rows, 721 columns
REFERENCE:	State Plane Coordinate System
	Upper left pixel x,y: 1199842, 525590.6
RESOLUTION:	x,y in feet: 98.425, 98.425 (30 m x 30 m)

All files are included on a single 9 track, 1600 bpi magnetic tape. This tape is in the TIP format and was created using the TBACKUP utility program using the command "TBACKUP D:\STRAD1*.* TAPE:"; restore files from this tape using the TRESTORE utility program with the command "TRESTORE TAPE:D:\STRAD1\filename or *.*". The tape is on deposit with the Vandenberg Environmental Task Force Office.

Vegetation and Land Use Type Map

Thematic mapper data, September 1986 (Scene ID Y5092817550X0), and aerial color infrared imagery (ACIR) (NASA/Ames High Altitude Aircraft Program, December 1986) were used for image processing and photointerpretation. A subscene including Vandenberg was rectified to State Lambert Conformal Projection, 405 California V, at a pixel resolution of 98.425 by 98.425 feet (0.222 ac). An unsupervised classification was performed on bands 1, 4, and 5. Following final data reduction, draft maps were printed and classes verified via ground truth field work; misclassified areas were identified on the draft maps. ACIR was used in conjunction with a zoom transfer scope to define more exactly the boundaries of areas noted in the field as misclassified. Reclassified areas were then updated in the data base via screen editing and final maps printed (Provancha 1988). Extensive ground truthing was conducted but no formal assessment of map accuracy was made. The file, VEGMAPSM.GIS, contains the vegetation map for all areas within the perimeter boundaries of the base; the file, VEGMAPEX.GIS, contains the vegetation map for Air Force property within the perimeter boundaries, excluding the section of privately owned land in the Purisima Hills.

Code	Class and Description
1	Light coastal dune scrub Dominants include *Ericamaria ericoides*, *Artemisia californica.*
2	Moderate coastal dune scrub
3	Dense coastal dune scrub
4	*Carpobrotus* spp. (coastal dunes) Primarily *Carpobrotus edulis* but may include *C. aequilaterus* and hybrids.
5	*Ammophila arenaria* (planted)
6	*Acacia* spp.
7	Coastal strand Dominated by *Haplopappus venetus* ssp. *sedoides, Carpobrotus aequilaterus, Abronia maritima. A. latifolia, Cakile maritima, Ambrosia chamissonis.* Occurs on beaches and active dunes.
8	Oaks (stabilized dunes) *Quercus agrifolia* thickets in dune swales.
9	Grassland Dominants include introduced annual grasses (*Hordeum* spp., *Avena* spp., and *Bromus* spp.) and forbs (*Erodium* spp., *Medicago* spp., *Brassica nigra, Silybum marianum, Foeniculum vulgare*).
10	Grassland with exposed soil
11	Grassland with light coastal sage scrub
12	Light coastal sage scrub Dominants include *Salvia mellifera, Artemisia californica, Baccharis pilularis ssp. consanguinea, Mimulus aurantiacus.*
13	Moderate coastal sage scrub

14 Dense coastal sage scrub
15 Mixed coastal sage scrub/*Carpobrotus* spp.
16 Mixed coastal sage scrub/*Salvia leucophylla*
17 Coastal sage scrub/Homogeneous *Salvia leucohylla*
18 Moderate Burton Mesa (Maritime) chaparral
Dominants include *Arctostaphylos purissima, A. rudis, Ceanothus ramulosus* var. *fascicularis, C. impressus* var. *impressus, Adenostoma fasciculatum, Quercus agrifolia.*
19 Dense Burton Mesa (Maritime) chaparral
20 Recently burned Burton Mesa (Maritime) chaparral
Burned in 1986
21 Mixed chaparral
Dominants include *Ceanothus thyrsiflorus, Adenostoma fasciculatum, Arctostaphylos tomentosa*, and *Vaccinium ovatum.*
22 *Ceanothus impressus* chaparral
23 Light chamise chaparral
Dominated by *Adenostoma fasciculatum.*
24 Coast live oak woodland
Dominated by *Quercus agrifolia.*
25 Coast live oak savanna
26 Tanbark oak forest
Dominated by *Lithocarpus densiflora*, with an understory of *Vaccinium ovatum.*
27 Bishop pine forest
Dominated by *Pinus muricata*, with an understory (if present) that includes *Arctostaphylos* spp. and *Quercus wislizenii.*
28 Monterey pine (*Pinus radiata*)
29 *Eucalyptus* spp.
30 Mixed Monterey pine/*Eucalyptus* spp.
31 Riparian woodland
Dominated by *Salix* spp., *Acer negundo* spp. *californica, Populus trichocarpa.*
32 Graminoid Wetlands
Typha spp., *Juncus* spp., *Scirpus* spp., *Carex* spp., and associated forbs.
33 Salt marsh
Salicornia virginica-dominated.
34 Mixed salt marsh/upland species
Dominated by *Salicornia virginica, Frankenia grandifolia, Atriplex semibaccata, Brassica nigra.*
35 Light *Baccharis*/mixed scrub
This class covers primarily areas that have been disturbed; it may be dominated by *Baccharis pilularis* ssp. *consanguinea* or other disturbance-following species. Some of the original type species may be present.
36 Dense *Baccharis* scrub
Nearly pure *Baccharis pilularis* ssp. *consanguinea.*
37 *Carpobrotus* spp.
Carpobrotus edulis dominated; *C. aequilaterus* and hybrids may occur.

38 Pampas grass/Mixed grasses
Cortaderia jubata dominated areas.
39 Agriculture
40 Firebreaks
41 Golf course
42 Sand (beach/exposed active/stabilized dunes)
43 Exposed soils/rocks
44 Coastal cliffs/exposed rocks
45 Freshwater
46 Estuarine
47 Mudflats
48 Cantonment
49 Major roads and facilities
50 Landfill
51 School/playgrounds
52 Residential
53 Railroad

SDSU Vegetation Map

The digital vegetation map of Vandenberg produced in the SDSU study in 1975-76 (Reilly et al. 1976) was converted to ERDAS-compatible form. Judy Paddon, Department of Geography, University of California, Santa Barbara developed the software used to convert the SDSU data to ERDAS-compatible format with assistance from Diana Hickson, The Bionetics Corporation. Because the resolution of the SDSU map is much coarser than the map produced in the current study (1000 ft vs. 98.425 ft), only general observations for vegetation changes over the 10-year period will be possible based on these maps.

The SDSU map is presented in two forms. The first is the original data converted into ERDAS-readable format, at the original resolution (1000 ft x 1000 ft cells); the size is 207 x 444 pixels. This file, SDSUORIG.GIS, can be displayed on ERDAS, but cannot be used for analysis in conjunction with other GIS files from this study. In the second form, the file SDSURECO.GIS, the map has been registered to the other GIS files using the ERDAS programs COORD2 and RECTIFY (using the nearest neighbor algorithm). It is important to note that since approximately 9 pixels were created for each original pixel, SDSURECO.GIS exhibits false accuracy.

The original data were divided by 10 to correspond to the vegetation type codes presented in Reilly et al. (1976). The SDSU original and recoded vegetation map codes are reproduced here:

SDSU Original Code	New Code	Vegetation category
1	1	Bishop pine forest
72	2	Bishop pine forest - sparse phase
2	3	Tanbark oak forest
3	4	Foothill woodland
31	5	Foothill woodland-dense phase
4	6	Riparian woodland
42	7	Riparian woodland-sparse phase
5	8	Chaparral
52	9	Chaparral-sparse phase
6	10	Coastal sage scrub-normal phase
62	11	Coastal sage scrub-sparse phase
7	12	Coastal sage scrub-*Salvia leucophylla* phase
8	13	Coastal sage scrub-stabilized dune phase
82	14	Coastal sage scrub-stabilized dune phase-sparse
9	15	Wet soil scrub
10	16	Huckleberry scrub
11	17	Coastal bluff
12	18	Coastal strand
13	19	Coastal salt marsh
14	20	Freshwater marsh
16	21	Grassland-annual
17	22	Miscellaneous native herb communities
18	23	Ruderal vegetation
19	24	Planted trees
20	25	Agricultural plantings
21	26	Non-agricultural plantings
22	27	Freshwater
23	28	Man-made facilities and cantonment
24	29	Disked areas
25	30	Naturally bare soil
26	31	*Acer negundo* stands
99	-	Land not within the base boundary

-	32	Lost data

Category 1 and 2 Plants:

Federal Category 1 and 2 plant species distribution data were entered into the GIS file "PLANT.GIS". This file contains: 1) the center points (digitized as single pixels) of the species distributions from California Natural Diversity Data Base (CNDDB) 1:24000 scale map overlays, 2) sites from the literature when locations were precisely described, and 3) the locations of plots from this study that contained Category 1 or 2 species. When multiple species shared the same CNDDB distribution circle, each species was given a separate pixel near the center of the circle. The file from which the hard copy map was produced, CATEGO12.GIS, was modified for display purposes since single pixels could not be seen at the composite map scale; this file should not be used for analysis.

Following are the species codes for PLANT.GIS.

Code	Species
1	On base
2	*Arctostaphylos rudis*
3	*Castilleja mollis*
4	*Cirsium loncholepis*
5	*Cirsium rhothophilum*
6	*Cordylanthus rigidus* ssp. *littoralis*
7	*Dithyrea maritima*
8	*Eriodictyon capitatum*
9	*Monardella crispa*
10	*Monardella undulata* var. *frutescens*
11	*Nasturtium gambelii*

Digital Elevation Model Data

Digital Elevation Model (DEM) data derived from U.S. Geological Survey tapes are supplied in two formats. A 1:250000 scale map was derived from the DEM tape for the Santa Maria East Quadrangle, since ERDAS programs directly access tapes in this format. This is given in the file TOPOEXBN.GIS.

Topographic scale (1:24000) data are available for six quadrangles on Vandenberg (Guadalupe, Lompoc, Point Sal, Lompoc Hills, Orcutt, Tranquillon Mountain); however, ERDAS software does not currently support this format. These data were converted to be ERDAS-compatible at the University of California, Santa Barbara by Diana Hickson with assistance from Judy Paddon using either the QDIPS program or a conversion to binary fractions and then to raw integers (2-byte). In either case, negative numbers were converted to zero. These are in 16-byte data. Images have not been rectified. Information regarding these quadrangles is listed below.

Quadrangle	Filename	No.Pixels Wide	No. Lines	Low	High
Guadalupe	90GUAD.LAN	472	392	0	503
Lompoc	90LOM.LAN	475	398	0	386
Pt. Sal	90PTSAL.LAN	471	391	0	386
Lompoc Hills	90LOMHIL.LAN	475	398	0	638
Orcutt	90ORCUTT.LAN	476	397	0	<660
Tranquillon Mt.	90TRANQM.LAN	476	399	0	660

GIS File Locations

A list of all GIS files presented to the Air Force in this project follows. Descriptions of the GIS files containing soil erosion and fire history data are in the reports on those subjects (Butterworth 1988, Hickson 1988).

Filename

Vegetation map files:

VEGMAPSM.GIS
VEGMAPEX.GIS

SDSU map files:

SDSUORIG.GIS
SDSURECO.GIS

Special interest plant files:

PLANT.GIS
CATEGO12.GIS

Soil erosion files:

SOILAREA.GIS
ROADCUT.GIS
SOILCUT.GIS
SOILSSEV.GIS

Fire history files:

FIRES.GIS
1940CA.GIS
1952CA.GIS
1957CA.GIS
1968.GIS
1970CA.GIS
1971CA.GIS
1974.GIS
1977.GIS
1978.GIS
1979.GIS
1980CA.GIS
1981.GIS
1982.GIS
1983.GIS
1984.GIS
1985.GIS
1986.GIS
1987.GIS

Digital elevation model files:

TOPOEXBN.LAN
90GUAD.LAN
90LOM.LAN
90PTSAL.LAN
90LOMHIL.LAN
90ORCUTT.LAN
90TRANQM.LAN

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Report Documentation Page

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15. Supplementary Notes

16. Abstract

Vandenberg Air Force Base, located in coastal central California with an area of 98,400 ac (39822 ha), contains resources of considerable biological significance. In this report, available information on the vegetation and flora of Vandenberg is summarized and new data collected in this project are presented.

A bibliography of 621 references dealing with vegetation and related topics related to Vandenberg was compiled from computer and manual literature searches and a review of past studies of the base.

A preliminary floristic list of 624 taxa representing 311 genera and 80 families was compiled from past studies and plants identified in the vegetation sampling conducted in this project. The actual flora of the base may be substantially larger than this, since no comprehensive, basewide floristic survey has been conducted.

Fifty-two special interest plant species are known to occur or have been suggested to occur on Vandenberg by past studies. Two Category 1 plants and 12 Category 2 plants occur on the base, as well as 23 species listed by the California Native Plant Society. Taxonomic or nomenclatural problems exist with some of these species.

17. Key Words (Suggested by Author(s)): California, Bishop pine, chaparral, coastal dune scrub, coastal sage scrub, dunes, flora, special interest plants, tanbark oak, Vandenberg, vegetation	18. Distribution Statement: Unlimited National Technical Information Service Subject Category 51

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16. Abstract (continued).

Vegetation was sampled using permanent plots and transects in all major plant communities including chaparral, Bishop pine forest, tanbark oak forest, annual grassland, oak woodland, coastal sage scrub, purple sage scrub, coastal dune scrub, coastal dunes, box elder riparian woodland, willow riparian woodland, freshwater marsh, salt marsh, and seasonal wetlands. Twenty-nine stands were sampled; 15 of these had been sampled by San Diego State University (SDSU) in 1974-75. Comparison of the new vegetation data to the composite SDSU data does not indicate major changes in most communities since the original study. However, wetlands vegetation on the north side of Barka Slough has deteriorated, dried out, compared to conditions documented in a 1980 survey by the Fish and Wildlife Service. This decline appears to be related to withdrawal of groundwater from the San Antonio aquifer.

Certain plant communities are of particular significance. Tanbark oak forest is a relict community restricted to the Tranquillon Mountain area where frequent fog allows it to persist at the southern extreme of its range. Bishop pine forest is also a relict community, south of its general range. Burton Mesa chaparral is a regionally endemic form of maritime chaparral mush reduced from its former extent and poorly represented in nature reserves. Coastal dunes and coastal dune scrub are considered regionally rare and declining plant communities whose extent have been reduced due to development, recreational use, and displacement by exotic species. Riparian wetlands, salt marshes, and other wetlands vegetation are of limited extent in an area of low rainfall, are important animal habitats, and have been greatly reduced on a regional basis by development.

Recommendations are made for additional studies needed to maintain and extend the environmental data base and for management actions to improve resource protection.