

**REPORT ON BIOLOGICAL SURVEYS  
FOR UPPER CHIQUITA CANYON  
CONSERVATION EASEMENT  
2007**

**Prepared for:**

**TRANSPORTATION CORRIDOR AGENCIES**

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## EXECUTIVE SUMMARY

2007 was the eleventh year of active management of Upper Chiquita Canyon Conservation Easement by the Transportation Corridor Agencies. During spring and summer 2007, Harmsworth Associates conducted vegetation surveys in Upper Chiquita Canyon Conservation Easement, in the 2002 Burn Areas only.

In 2007, only 3.84 inches of precipitation was recorded for the region, the lowest on record this century. Drought stress was evident in both cactus recovery and cover of native and non-native species in the 2002 Burn Area. Accordingly, the most dominant cover type in 2007 was dead vegetation material. Despite the sparse rainfall, the 2002 burn area continues to follow a typical pattern of vegetation cover for post-burn coastal sage scrub communities. Mid- to late-successional species such as laurel sumac (*Malosma laurina*), coastal sagebrush (*Artemisia californica*), and California buckwheat (*Eriogonum fasciculatum*) are increasing in dominance as they become established through germination and resprouting.

The total number of plant species detected in the transects in 2007 continued to decrease to 27, from 53 in 2006, 64 in 2005 from 36 recorded in 2004. This represents a 49.1% decrease in plant species richness, from 2006, and a 57.8% decline in species richness from 2005, which is expected in drought years and as pioneering fire followers are outcompeted by shrubs, grasses and root-crown resprouting which occurs in the post-fire environment. Although some variation occurred between years and between transects, species diversity was significantly greatest in 2005, relative to any other year.

Prickly pear cactus (*Opuntia littoralis*) has exhibited a slow rate of recovery. Following the initial burn event, the percent cover of healthy green pads has fluctuated, indicating both resprouting and growth of new pads, and senescence and mortality of pads that initially survived the blaze but withered due to long-term stress. For each consecutive year since the burn, the mean absolute cover of live, green cactus has increased, from 4.68% to 6.24% to 6.48% to 8.14% in 2004, 2005, 2006 and 2007, respectively. Although live green cactus cover increased 25.6 percent in 2007, only 13 transects contain live cactus, compared with 14 transects in 2006. Furthermore, the mean cover value of green live cactus in 2007 (8.14%) suggests that only 16.8 percent of the preburn maximum cactus cover has recovered to green live cactus. Nonetheless, field observations indicate that growth of green cactus is vigorous, and percent cover is expected to increase significantly in future survey years.

Despite the fluctuation in live cactus cover since the burn, cactus is recovering, and the average annual change in live cactus cover values, between 2002 and 2007, is an increase of 16%. If this average annual increase in green cactus continues at 16% per year, it is predicted that it will take until 2019 for cactus patches to reach preburn levels, or 21 years, from the burn date.

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## 1.0 INTRODUCTION

### 1.1 Background To Survey Requirements

The Transportation Corridor Agencies (TCA) purchased an approximately 1,200-acre Conservation Easement in Upper Chiquita Canyon, Orange County, California. The purchase was a partial fulfillment of the mitigation requirements for the construction of the Foothill Transportation Corridor-North (FTCN) Oso Section. This section of the FTCN divides the Conservation Easement and runs from Antonio Parkway to Oso Parkway. TCA are required to manage the Conservation Easement in perpetuity or until such time that it becomes part of the reserve system for the Orange County Natural Communities Conservation Plan/Habitat Conservation Plan for the Southern Subregion (NCCP/HCP). The TCA prepared a Resource Management Plan in order to effectively manage the Conservation Easement according to sound conservation practices (Harmsworth Associates 1997a). The plan outlines how TCA proposes to manage the Conservation Easement during the interim period prior to the implementation of the NCCP/HCP. The plan also outlines management/administrative practices that will be implemented if the NCCP/HCP is not implemented.

The Resource Management Plan (Harmsworth Associates 1997a), the original Biological Opinion issued on the proposed FTCN-Oso Section in May 1996 (1-6-96-F-06) and the revised Biological Opinions issued on April 18, 1997 (1-6-97-TA-101) and May 22, 1997 (1-6-97-TA-129) include requirements that TCA conduct a brown-headed cowbird (*Molothrus ater*) trapping and removal program, California gnatcatcher (*Poliioptila californica californica*) and cactus wren (*Campylorhynchus brunneicapillus*) surveys and vegetation surveys in the Conservation Easement.

Analyzed data from the first two years of management activities and biological surveys was used to direct subsequent surveys and amend the RMP in 1998, as follows:

- The California gnatcatcher and cactus wren census will be conducted every second year, instead of annually, beginning in 2000. The population changes between 1997, 1998 and 2000 were within the range of normal fluctuations for the species, and surveys every second year should be sufficient to evaluate whether populations of these species in the Conservation Easement are stable.
- Cowbird trapping was discontinued. Cowbirds are uncommon in the Conservation Easement and trapping is therefore a poor use of management funds. Furthermore, a subset of California gnatcatcher pairs within the Conservation Easement were nest-monitored in 1999, and no incidences of cowbird parasitism were documented.
- Vegetation surveys in the mature CSS will be conducted every 5 years. Data collection in 1998 and 2003 provide adequate baseline data for comparison with the CSS/Grassland Ecotone and Burn Areas. Significant changes in species composition and cover are

unlikely to occur in the mature CSS, and annual data would be a poor use of management funds. Vegetation surveys were conducted annually in the CSS/grassland (volunteer revegetation areas) and 1996/1997/2002 Burn Areas.

- In 2004, vegetation surveys in the CSS/grassland (volunteer revegetation areas) and 1996/1997 burn areas were discontinued. Between 1998 and 2003, five years of data was collected in the CSS/grassland areas (plus one additional year of baseline data) and six years of data was collected in the 1996/1997 burn areas. The quantity of data collected is sufficient to document trends in the CSS/grassland areas and to document the recovery of CSS in the 1996 and 1997 burn areas. Analysis and final discussion of these results can be found in the 2003 annual report. Vegetation surveys are being continued in the 2002 burn area to document the recovery of cactus.

In order to fulfill these obligations, TCA contracted Harmsworth Associates in 2007 to continue to document cover and abundance of plant species present in the 2002 Burn Areas.

## ***1.2 Site Description***

### **1.2.1 Site Location**

Chiquita Canyon is located in Orange County, California. The Conservation Easement, located in Upper Chiquita Canyon, is comprised of two segments bisected by the Foothill Transportation Corridor-North (Figure 1). Rancho Santa Margarita is at the border to the north and west, Coto de Caza is to the east and Oso Parkway to the south. The Conservation Easement consists of a series of north-south orientated ridges and valleys with elevations ranging from 670 to 1,217 feet above sea level. Primarily native coastal sage scrub community sub-associations cover the ridges and non-native grasslands cover the valleys. The climate is typically Mediterranean, with warm dry summers and cool wet winters.

### **1.2.2 Wildfires**

Since the TCA acquired the Conservation Easement, three wildfires have occurred, one in 1996, one in 1997 and one in 2002, refer to Figure 2, (TCA 1996, Harmsworth Associates 1997b). None of the wildfires overlapped each other. The August 1996 wildfire occurred in the northern portion of the Conservation Easement, along the scrub covered ridges and steep canyons located between Coto de Caza and upper Tijeras Creek. The 1996 wildfire burned over 98.5 acres, approximately 16 acres of the burned coastal sage scrub occurred within the Conservation Easement. The May 29, 1997 wildfire burned approximately 155 acres, of which 114 acres occurred in the Conservation Easement. The remaining burned acreage in 1997 included 21 acres in the Coto de Caza Conservation Easement, and 19 acres in the Coto de Caza Non-Easement Area. The May 13, 2002 wildfire burned approximately 1,462 acres, of which 715 acres occurred in the Conservation Easement. This fire was located in the central and southern portions of the Conservation Easement. As a result of these fires the Conservation Easement now supports vegetation communities of mixed age structure, including mature unburned communities, communities recovering from fire and recently burned areas.



**Figure 1:** Site vicinity of Upper Chiquita Canyon Conservation Easement.



**Figure 2:** Upper Chiquita Canyon Conservation Easement, showing 1996, 1997 and 2002 burn areas.

### 1.3 Biological Resources

#### 1.3.1 Vegetation communities

Six habitat types/vegetation communities occur in the Conservation Easement, coastal sage scrub, scrub/grassland ecotone, perennial grassland, annual grassland, oak woodland and willow/mulefat scrub (Table 1; Figure 3). Most of the Conservation Easement is comprised of coastal sage scrub or annual grassland. Scrub/grassland ecotone areas occur in valleys along the eastern ridges (smaller ecotone areas occur in narrow bands along the coastal sage scrub edge in many parts of the site). A few perennial grasslands and small oak woodlands also occur in the Conservation Easement. Two very small riparian areas (willow and mulefat scrub) occur in the Conservation Easement and there are also a number of intermittent drainages present. Each vegetation community present in the Conservation Easement is discussed below.

**Table 1:** Habitat types/vegetation communities in the Conservation Easement.

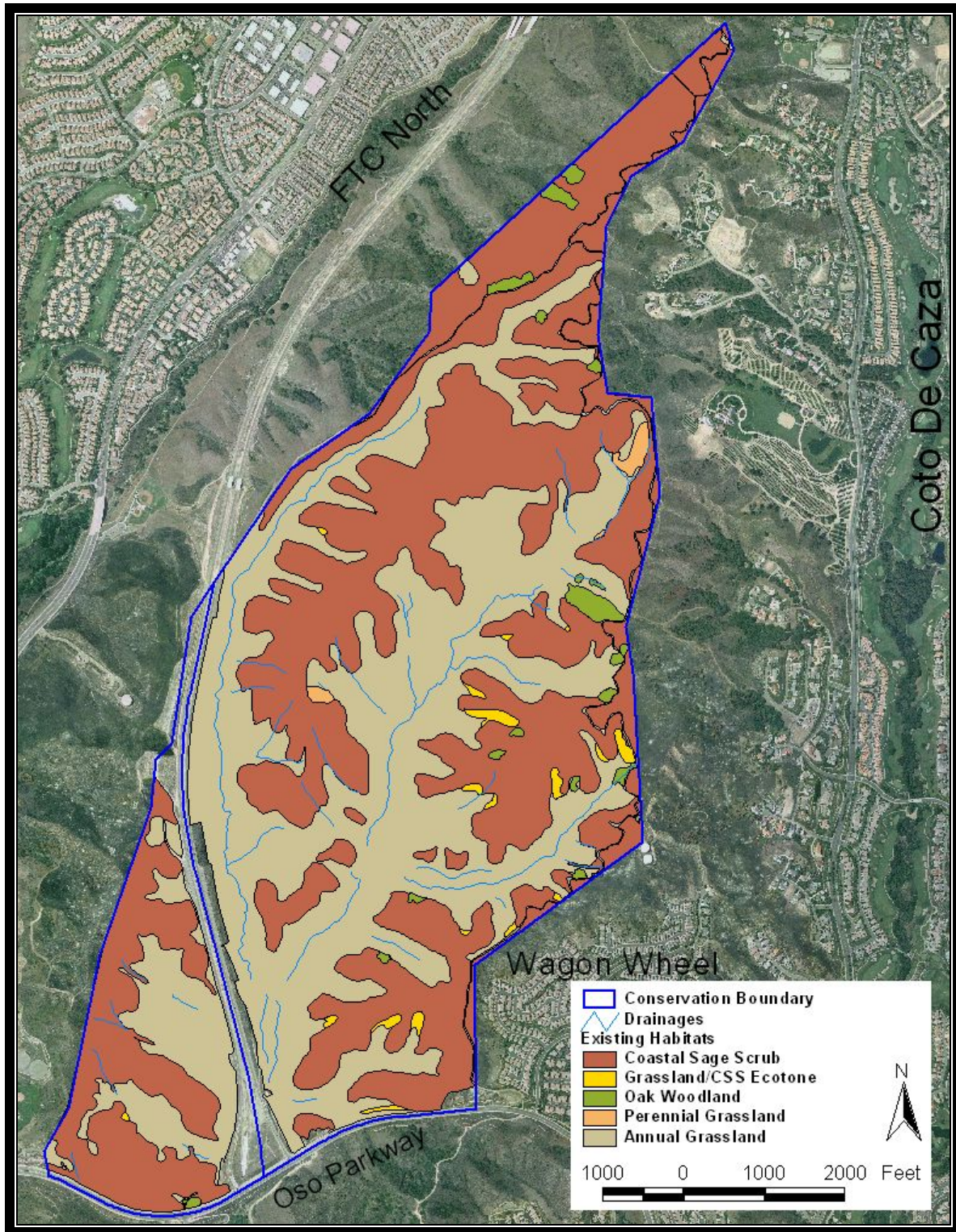
<b>HABITAT</b>	<b>ACRES</b>
Coastal Sage Scrub	631.0
Ecotone	9.3
Oak Woodland	14.7
Perennial Grassland	4.4
Annual Grassland	547.3
Willow/Mulefat scrub	< 0.5
<b>Total</b>	<b>1,206.7*</b>

\* = includes acreage for SMWD reservoir easement

#### **Coastal Sage Scrub**

Coastal Sage Scrub is a soft-leafed (malacophyllous) shrub community that occurs as a narrow discontinuous band along the northern California coast and is limited in its distribution in southern California to the coastal areas and inland as far as Riverside County. The elevational distribution of this community ranges from sea level to approximately 2,000 feet. As a community, it supports a number of plant and animal species that are recognized as sensitive by the USFWS and/or the California Department of Fish and Game (CDFG 1993).

Within the Conservation Easement, coastal sage scrub (CSS) occurs on the ridges and slopes and comprises a community of low growing, soft woody drought-deciduous sub-shrubs and herbaceous plants that typically grow on thin, rocky soils (Figure 3). CSS occupies approximately 631 acres of the Conservation Easement and is generally dominated by coastal sagebrush (*Artemisia californica*) and California buckwheat (*Eriogonum fasciculatum*). Composition varies according to aspect, slope, edaphic conditions, and burn history; coastal sage scrub subassociations that occur onsite are briefly described below.



**Figure 3:** Existing habitats/vegetation communities in the Conservation Easement (Source = Earthworks Restoration, Inc.).

The Sagebrush-Buckwheat subassociation is the dominant climax community within the Conservation Easement occurring along ridgelines and a variety of slopes and aspects. Important shrub representatives within this subassociation include coastal sagebrush, California buckwheat, white sage (*Salvia apiana*), black sage (*S. mellifera*) and species of sclerophyll-leaved small trees such as lemonadeberry (*Rhus integrifolia*), toyon (*Heteromeles arbutifolia*), laurel sumac (*Malosma laurina*) and Mexican elderberry (*Sambucus mexicana*). Two native bunchgrasses, foothill needlegrass (*Nassella lepida*) and California melic grass (*Melica imperfecta*) are important herbaceous components of the vegetative cover, occurring in openings within and often beneath the mature shrubs. The predominance of these two grasses within the scrub indicates a high level of habitat quality.

The Sagebrush-Monkeyflower subassociation is common on steep north and northeast facing aspects in the central and eastern ridges of the Conservation Easement. This subassociation, as indicated by its namesake, is dominated by coastal sagebrush and monkeyflower (*Mimulus aurantiacus*) that co-dominate the relatively mesic slopes along with poison oak (*Toxicodendron diversilobum*) occurring along the mid to lower portions of the slopes. Small trees associated with CSS, namely lemonadeberry, toyon, laurel sumac and Mexican elderberry are scattered on these slopes and in the bottoms of the shallow drainages. Mosses and cryptogammic crusts may be found beneath the shrub layer in less disturbed areas along with several other moisture loving herbaceous species generally absent in xeric coastal sage scrub subassociations.

Black Sage Scrub occurs in a few scattered locations throughout the Conservation Easement on primarily south facing aspects. Black sage dominates the community although coastal sagebrush, Mexican elderberry and monkeyflower comprise an important part of the total vegetation cover. Soils are typically sandy and rocky. Species diversity within this subassociation onsite is lower than other scrub types since the herbaceous vegetation component is poorly developed.

White Sage Scrub occurs in two isolated locations on the eastern ridges. Native herbaceous vegetation such as foothill needlegrass and melic grass comprise the understory layer beneath the dominant shrub white sage and co-dominant coastal sagebrush. Summer mustard (*Hirschfeldia incana*), soft chess (*Bromus hordeaceus*) and ripgut brome are common exotic components of the herbaceous vegetation.

Coyote Brush occurs in one location onsite - a west-facing slope along the eastern ridges in the southeastern portion of the Conservation Easement. The subassociation is dominated by coyote bush (*Baccharis pilularis*), coastal sagebrush and monkeyflower; foothill needlegrass, totalote (*Centaurea melitensis*) and foxtail fescue (*Vulpia myuros* var. *hirsuta*) comprise the understory herbaceous vegetation. The slope supporting coyote brush scrub is relatively steep and the average vegetation height exceeds that of other subassociations with the exception of those areas where small trees comprise a significant proportion of the vegetative cover.

Southern Cactus Scrub dominated by prickly pear cactus (*Opuntia littoralis*) is locally common on south facing slopes, especially those steeper gradients throughout the Conservation Easement. Although not indicated on the vegetation map prepared by MBA (1995), Southern Cactus Scrub is also present west of the ETC on both south and east facing aspects on sandy and rocky soils. Prickly pear cactus comprises over 20 percent of the vegetation cover within this subassociation, and the community often intergrades with other scrub habitats. Coastal sagebrush, California buckwheat, foothill needlegrass and Mexican elderberry are common components found amongst the large and often extensive patches of cactus. Along ridgelines and where rocky and sandy barrens preclude establishment of shrubs and trees, perennial grasses and liliaceous species persist including giant needlegrass (*Achnatherum coronatum*), silver beard grass (*Bothriochloa barbinodis*) and wavy-leaved soap plant (*Chlorogalum pomeridianum* var. *pomeridianum*).

Scrub-Chaparral Ecotone. Some north-facing slopes and some shallow canyons in the northern portions of the central ridges are best classified as scrub-chaparral ecotone (Jones & Stokes 1993). These areas are partially dominated by laurel sumac, lemonadeberry, poison oak and toyon, with understory vegetation consisting of coastal sage scrub representatives. In post-fire recovering coastal sage scrub habitats, vegetation composition is highly varied depending on age of the stand. However, in general deerweed (*Lotus scoparius*) and morning-glory (*Calystegia macrostegia*) are the most abundant species within the more recent burn areas, and other native fire following herbs common within the Conservation Easement included miniature lupine (*Lupinus bicolor*), common eucrypta (*Eucrypta chrysanthemifolia*), Sparse-flowered lupine (*Lupinus sparsiflorus*) littleseed muhly (*Muhlenbergia microsperma*), and giant wild-rye (*Leymus condensatus*). Three non-native species common in disturbed areas (including recently burned areas) within the scrub subassociations including summer mustard, red brome (*Bromus madritensis* ssp. *rubens*) and star thistle. Other non-native species, less common within the scrub, included black mustard (*Brassica nigra*), rip-gut brome (*Bromus diandrus*), and soft chess.

### **Scrub/Grassland Ecotone**

Scrub/grassland ecotone is an open shrub/grassland with 5-20% shrub cover. Common shrubs include sagebrush, buckwheat, grassland goldenbush (*Ericameria palmeri* var. *pachylepis*) and coastal goldenbush (*Isocoma menziesii* var. *vernonioides*). In the Conservation Easement the scrub/grassland ecotone occurs along the coastal sage scrub edge. Historical annual disking was conducted up to the edge of the coastal sage scrub and, in general, maintained a sharp boundary between the scrub and the adjacent annual grassland community. Since management of the Conservation Easement was established and disking/grazing discontinued, this sharp boundary has blurred and in many areas grassland has converted to scrub/grassland ecotone. The extent of the ecotone area varies throughout the Conservation Easement likely due to variation in slope, aspect, soil type and species composition in the immediate vicinity.

In general, the larger ecotone areas occur in valleys along the eastern ridges and these areas total approximately 9 acres (Figure 3). In the remaining areas the ecotone occurs in narrow bands (between 0 and 100 feet wide) and is most pronounced along the eastern ridges. Many

of the north facing slopes have no ecotone area. Within the CSS/grassland ecotone, the most abundant species are ripgut brome, wild oats, Italian ryegrass (*Lolium multiflorum*), smooth cat's ear (*Hypochaeris glabra*), star thistle and soft chess (*Bromus hordeaceus*) and native shrubs such as coastal sagebrush, California buckwheat and deerweed.

### **Coast Live Oak Woodland**

Coast Live Oak Woodland occur on the site as small inclusions on primarily north-facing aspects and along shallow canyon and drainages in the lowland grasslands. Woodlands are defined as having tree canopy cover between 20 and 80 percent (Jones & Stokes 1993). A total of 16 small oak woodlands totaling approximately 15 acres occur in the Conservation Easement (Figure 3). These small inclusions of oaks provide a spatial and structural diversity to the area and often intergrade into coastal sage scrub, chaparral and grassland habitats. Vegetation composition of the woodland association is varied across the conservation easement depending upon the level of disturbance by cattle grazing or other human activities.

The community is dominated by coast live oak (*Quercus agrifolia*) while non-native species such as ripgut brome (*Bromus diandrus*), horehound (*Marrubium vulgare*) and Italian thistle (*Carduus pycnocephalus*) overwhelmingly comprised the dominant cover of understory vegetation. Chaparral and CSS intergrade with the oak woodland community and often compose a small percentage of the understory shrub layer. Other non-native and native herbaceous understory components consisted of melic grass (*Melica imperfecta*), milk thistle (*Silybum marianum*), foxtail barley (*Hordeum murianum*) and common chickweed (*Stellaria media*). Several large isolated coast live oaks are scattered in the grasslands and CSS throughout the Easement.

Woodlands where cattle-disturbance was high contained exotic species such as Italian thistle, milo grass (*Piptatherum miliaceum*), horehound, lamb's quarters (*Chenopodium album*), milk thistle (*Silybum marianum*), bristly ox-tongue (*Picris echioides*), cheeseweed (*Malva parviflora*), blessed thistle (*Cnicus benedictus*), and prickly lettuce (*Lactuca serriola*). Native species diversity and abundance in the woodland understory was low or non-existent due to tendencies for cattle to utilize these resources for shade and forage.

Undisturbed woodland understory consisted of shade tolerant native shrubs and smaller trees such as poison oak, lemonadeberry and several other native grasses and forbs. Lightly disturbed oak woodlands contained native forbs such as cliff brake (*Pellaea mucronata*), common eucrypta (*Eucrypta chrysanthemifolia*), sacapellote (*Acourtia microcephala*), blue-eyed grass (*Sisyrinchium bellum*), Western verbena (*Verbena lasiostachys*), melic grass (*Melica imperfecta*), and California brome grass (*Bromus carinatus*). Other native forbs in the CSS that were also encountered in the woodland included sand aster (*Lessingia filaginifolia*), foothill needlegrass, Indian milkweed (*Asclepias eriocarpa*), and golden stars (*Bloomeria crocea*).

A few western sycamores (*Platanus racemosa*) and coast live oaks occur in very steep, northwest-trending canyon drainages in the north ridges.

## Grasslands

Grasslands are characterized by low herbaceous vegetation dominated by annual, ruderal and perennial grass species, which typically occur in deep, well-developed, well-drained soils on gentle slopes and valleys (Jones & Stokes 1993). Within the Conservation Easement, grasslands consisting of non-native annual species occur on approximately half of the site at the lowest elevations and on moderate to gentle slopes (Figure 3). Historically, these areas probably supported coastal sage scrub. Prior to the acquisition of the Conservation Easement, the lowlands were extensively dry-farmed for several decades and the resulting vegetation community that followed the agricultural practice was rolling fields of annual non-native grasses and herbs, collectively referred to as Annual Grassland (Jones & Stokes 1993).

The Annual Grasslands onsite cover approximately 547 acres and are comprised of annual non-native grass species of Mediterranean origin, including oats (*Avena fatua*), brome grasses (*Bromus diandrus*, *B. hordeaceus* and *Bromus madritensis* ssp. *rubens*), fescue (*Vulpia* spp), and ryegrass (*Lolium* spp.). Other species present in the community include native and non-native forbs and herbs including summer mustard (*Hirschfeldia incana*), western ragweed (*Ambrosia psilostachya*), telegraph weed (*Heterotheca grandiflora*), wild radish (*Raphanus sativus*), burclover (*Medicago polymorpha*), and filaree (*Erodium* spp.).

A rare grassland subassociation within the easement is Perennial Grasslands. Three small perennial grasslands totaling approximately 4 acres occur onsite. These perennial bunchgrass grassland inclusions occur on north and east-facing aspects in heavy clay soils surrounded by coastal sage scrub habitat, the dense clay soils presumably precluding the establishment of deep-rooted shrubs and trees. These areas are dominated by 10 percent or more cover of perennial needlegrass bunchgrasses (*Nassella pulchra* and *N. lepida*). Although the perennial needlegrasses dominated these grasslands, other annual and perennial native forbs made up a diverse grassland flora. Other grasses that occurred within the community included, melic (*Melica imperfecta*), vulpia (*Vulpia myuros*), soft chess (*Bromus hordeaceus*), Italian ryegrass (*Lolium* spp) and oats (*Avena fatua*). Native forbs commonly observed in the needlegrass grasslands included splendid mariposa lily (*Calochortus splendens*), Catalina mariposa lily (*Calochortus catalinae*), morning-glory (*Calystegia macrostegia*), blue dicks (*Dichelostemma capitatum*), soap plant (*Chlorogalum* spp.), golden stars (*Bloomeria crocea*), and blue-eyed grass (*Sisyrinchium bellum*).

## Drainages

A number of intermittent drainages occur in the Conservation Easement (Figure 3). Typical riparian vegetation like willows (*Salix* spp.) and sycamores (*Platanus racemosa*), that usually indicate subsurface water flow, are generally absent from these drainages. The drainages consist primarily of annual grasses. Two of the drainage channels are highly incised at the upper parts of the valleys, and consist of scattered lemonadeberry, coast live oak, Mexican elderberry (*Sambucus mexicanus*) and other large shrubby coastal sage scrub representatives, that occur in mesic areas of many communities. At the southern end of the main drainage, where the drainage enters the culvert under the tollroad, a small area of Willow Scrub (less

than one quarter acre) has developed since the completion of the toll road. The willow scrub consists of arroyo willow (*Salix lasiolepis*) mulefat (*Baccharis salicifolius*).

A small area of Mulefat Scrub (less than one quarter acre) occurs in the vicinity of the old dike in the central portion of the Conservation Easement. During periods of high precipitation, water pools behind the dike creating conditions suitable for the establishment and persistence of mulefat. Annual grassland representatives and cocklebur (*Xanthium strumarium*) comprise the primary understory components of the mulefat scrub community. Neither willow scrub or mulefat scrub areas are shown upon the vegetation map (Figure 3) due to the small size of these communities.

### 1.3.2 Plant species richness

Since surveys commenced in 1998, a total of 239 vascular plant species, representing 51 families have been detected in the Conservation Easement (Appendix A). This total includes species recorded within the study plots as well as species encountered during other field surveys. A total of 177 (74.1%) were native and the remaining 62 species (25.9%) were exotic. Over half of the species (136 species, 57.1%) belong to seven families, namely Asteraceae (58 species, 42 native) represented 24.4% of the species, Poaceae (32 species, 12 native) represented 13.4%, Fabaceae (19 species, 17 native) represented 8%, Scrophulariaceae (8 species, 7 native) represented 3.7 %, Liliaceae (7 species, 7 native) represented 3.4%, Polygonaceae (6 species, 4 native) and Brassicaceae (6 species 2 native) each represented 2.5%. Four new species, all exotic, were found in the 2002 burn area in 2006, namely sweet fennel (*Foeniculum vulgare*), Mediterranean Schismus (*Schismus barbatus*), London rocket (*Sisymbrium irio*), and bicolored cudweed (*Gnaphalium bicolor*). No new species were found in 2007.

The Conservation Easement has a similar pattern in proportions of natives to non-native species as other natural areas in Orange County and the Santa Ana Mountains (Table 3). The average percent of native species in all areas is 71.6 %, and exotic are 28.4 %. Furthermore, the varying number of species is correlated to the size of the study area, therefore, the larger areas are more likely to support more diverse habitats and result in greater number of species recorded.

**Table 2:** Plant Species Diversity in the Chiquita Canyon Conservation Easement and nearby areas.

Location	Total Number of Species	Natives (%)	Non-Natives (%)	Number of Families
Chiquita Canyon Conservation Easement	239	177 (74.1)	62 (25.9)	51
North Ranch Policy Plan Area <sup>1</sup>	506	383 (76)	123 (24)	85
Flora of the Santa Ana Mnts <sup>2</sup>	818	666 (81)	152 (19)	97
Flora of Orange County <sup>3</sup>	1,269	806 (64)	387 (36)	130
San Joaquin Hills Burn Area <sup>4</sup>	209	147 (70)	62 (29)	50
Crystal Cove State Park <sup>5</sup>	304	210 (69)	94 (31)	63
UCI Ecological Preserve <sup>6</sup>	120	82 (68)	38 (32)	---
Laguna Canyon <sup>6</sup>	110	87 (79)	23 (21)	---
<sup>1</sup> Harmsworth Associates 2001; <sup>2</sup> Lathrop & Thorne (1978); <sup>3</sup> Roberts (1998); <sup>4</sup> Harmsworth Associates 1999; <sup>5</sup> Unpublished data from Crystal Cove State Park; <sup>6</sup> Bowler and Wolf (1994)				

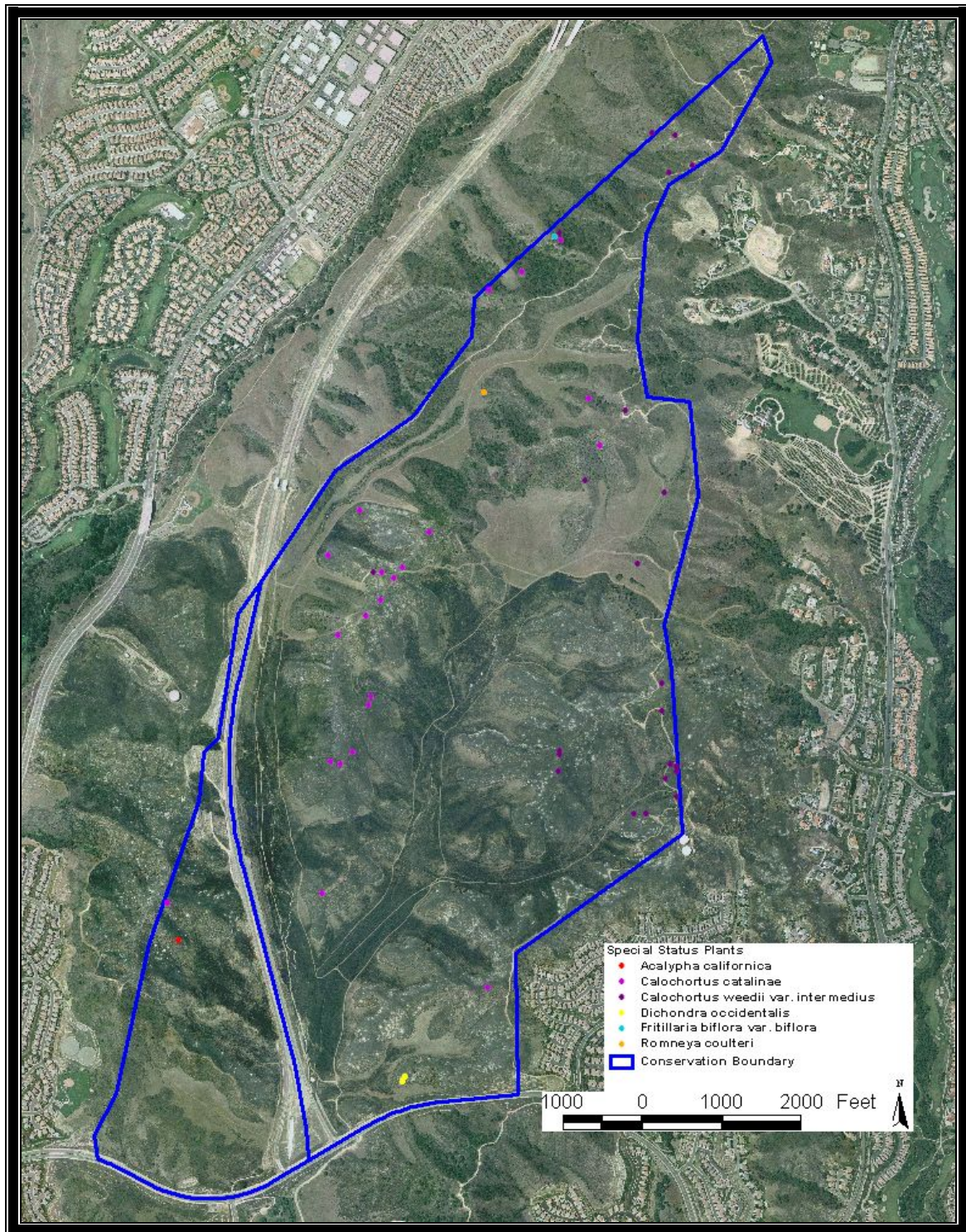
### 1.3.3 Special Status Plant Species

Surveys for special status plant species were conducted in the entire Conservation Easement in 2003. The surveys in 2003 represented an excellent opportunity to assess the population of special status plants within the Conservation Easement. The weather conditions during 2003 (little winter rain and significant spring rain accompanied by relatively low temperatures) proved ideal for native plants.

In total seven (7) special status species occur within the Conservation Easement (Table 2, Figure 4). These include: California copperleaf (*Acalypha californica*), Catalina mariposa lily (*Calochortus catalinae*), intermediate mariposa lily (*Calochortus weedii* var. *intermedius*), paniculate tarplant (*Deinandra paniculata*), western dichondra (*Dichondra occidentalis*), California chocolate lily (*Fritillaria biflora*), and Coulter's matilija poppy (*Romneya coulteri*). Paniculate tarplant has been recently added to the California Native Plant Societies Inventory of Rare and Endangered Species of California (CNPS 2006). Species location information and brief descriptions on the biology and ecology for each special status species, other than paniculate tarplant, can be found in Harmsworth Associates (2004).

**Table 3:** Special status plant species known to occur at Chiquita Canyon Conservation Easement.

Species/Common Name	CNPS Status <sup>1, 3</sup>	Federal & State <sup>2, 3</sup>	Other	Habitat in the Study Area	Approx. # of individuals observed
<i>Acalypha californica</i> California Cooperleaf			Locally rare	Occurs within coastal sage scrub. Plants were located on the west side of the project site on a southeast-facing slope.	60
<i>Calochortus catalinae</i> Catalina mariposa lily	List 4.2	S3.2		Occurs in coastal sage scrub, native and annual grassland. Generally found throughout the study area but more prevalent in recently burned areas, especially on the center ridgeline.	6,638
<i>Calochortus weedii</i> var. <i>intermedius</i> intermediate mariposa lily	List 1B.2	S2.2		Occurs in openings of coastal sage scrub and native grasslands, often on sandy rocky substrates. Generally most abundant in recently burned coastal sage scrub area on the eastern ridgeline.	590
<i>Dichondra occidentalis</i> western dichondra	List 4.2	S3.2		Occurs in openings of coastal sage scrub. Recorded in recently burned area of coastal sage scrub habitat in rocky sandy soil.	845
<i>Fritillaria biflora</i> var. <i>biflora</i> Chocolate lily			Locally rare	Occurs in clay soils in coastal sage scrub and native perennial grasslands. Known on north ridge.	25
<i>Hemizonia paniculata</i> (= <i>Deinandra p.</i> ) Paniculate tarplant	List 4	S3.2		Vernally mesic grasslands and vernal pools, between sea-level and 984 feet; grassy openings in chaparral and coastal sage scrub.	Unknown
<i>Romneya coulteri</i> Coulter's matilija poppy	List 4.2	S3.2		Occurs in coastal sage scrub. Recorded from one area in the northern portion of the center ridge.	500
<sup>1</sup> - Based on the 7 <sup>th</sup> Edition of the CNPS Inventory (CNPS 2006: <a href="http://cnps.web.aplus.net/cgi-bin/inv/inventory.cgi">http://cnps.web.aplus.net/cgi-bin/inv/inventory.cgi</a> ); <sup>2</sup> - Based on the CDFG CNDDb 2007b. Special Vascular Plants, Bryophytes, and Lichens List. Quarterly publication. 89 pp.; <sup>3</sup> - See Appendix B for CNPS, Federal and State Plant Status Categories; State Rank (CDFG 2007a,b): The S-rank reflects the overall condition of an element in California. S1 = less than 6 element occurrences (Eos) OR less than 1,000 individuals OR less than 2,000 acres, S2 = 6-20 Eos OR 1,000-3,000 individuals OR 2,000-10,000 acres; S3 = 21-80 Eos or 3,000-10,000 individuals OR 10,000-50,000 acres; S2S3 – intermediate between S2 and S3; decimal placing codes: .1 = very threatened, .2 = threatened; CNPS, California Native Plant Society (CNPS 2006); List 1B = Plants rare, threatened, or endangered in California and elsewhere; List 2 = Plants rare, threatened, or endangered in California but more common elsewhere; List 3 = Plants for which more information is needed; a review list; and List 4 = Plants of limited distribution; a watch list; 0.1 = seriously endangered in California; 0.2 = fairly endangered in California; 0.3 = not very endangered in California.					



**Figure 4:** Locations of special status plant species in Conservation Easement, 2003.

## 2.0 BIOLOGICAL SURVEYS

In 2007, vegetation surveys continued to document the conditions of the plant communities within the Conservation Easement. Plant community composition and structure were assessed in the 2002 burn areas only. Methods and results of the 2007 surveys are provided below.

### 2.1 2002 BURN AREA

#### 2.1.1 Surveys Methods

Botanical surveys in the 2002 burn area were performed in the twenty grids established after the 2002 fire (Figure 5). The grids were selected by dividing the 2002 burn area into 25 by 25 meter grids. Grids to be sampled were randomly selected (random generator) from areas mapped as southern cactus scrub. The aim of the vegetation surveys was to quantitatively evaluate the cover and diversity of vegetation within the burn area, in particularly the cactus patches. Within each grid, one 25-meter line-intercept transect was performed. Each transect was randomly oriented and a photograph was taken for photomonitoring purposes. Represented photographs are shown in Appendix C. The line-intercept methodology is the most efficient technique to evaluate shrub-dominated vegetation cover and diversity (Bonham 1989). It is as accurate as traditional quadrates and as statistically robust, but less time consuming. Surveys were conducted between 23 May through 22 June 2006.

Collected data included the total cover of coast prickly pear according to three categories, severe, moderate and mildly burned; the height of vegetation along each transect at 2.5 meter intervals; height of the tallest patch of each cactus encountered within the transect; and any extant species that occurred in the near vicinity of the transect.

The categories of cactus were defined by the following:

1. **Black:** severely burned cactus totally consumed by fire, exhibiting black color.
2. **Yellow:** moderately burned cactus partially consumed by fire, exhibiting yellow color.
3. **Green:** mildly or unburned-cactus not consumed by fire, exhibiting green color.

Collected data also included the cover for each plant species encountered along the transect. Records were maintained for all species occurring on the transect and additional species located in the near vicinity of the transect (for the floral inventory - see Appendix A). Additional transect data on aspect, elevation, slope, soil texture and a general site description were also noted.

The transects also served as permanent photomonitoring stations. Photomonitoring is a relatively cost-effective technique employed to estimate vegetation height and density (Van Horn and Van Horn 1996). A photodocumentation density panel constructed of plywood, 0.3

meter wide and 2.5 meters tall with alternating 0.5 meter black and white bands served as the reference marker. Estimates of cover by species that occurred within each band were made onsite. A photograph of the transect was then taken with the panel centered in the middle of the frame. Representative photographs are provided in Appendix E.

For analysis purpose each species was subdivided into categories: growth forms that included shrubs, trees and herbaceous/grass, further subdivided by annual and perennial; and native vegetation (occurring naturally in an area, not as either a direct or indirect consequence of human activity [Hickman 1996]), or non native species (occurring in an area as a direct or indirect consequence of human activity).

The data was analyzed by the actual cover and percent absolute cover of each species and category encountered along the transects. All variation among the grid types are presented as standard error ( $SE = \text{standard deviation}/(\text{sample size})^{1/2}$ ), which incorporates the sample size into the variation assessment. Analyses included:

- The cover of the top 20 species in the 2002 burn area compared to the mature CSS plots.
- Species diversity in 2002 burn area.
- Cover of cactus exhibiting black, yellow and green color.

Where appropriate, Paired Student T-Tests, the Wilcoxon Signed Rank Sum Test, Friedman Test, and the ANOVA tests for significant statistical differences between years and mature coastal sage scrub, were performed. The Shannon diversity index was computed with PC-ORD, version 5 (MjM Software Design, Gleneden Beach, Oregon).

To assess mortality/survivorship, the incidence of black and yellow cactus cover types encountered along the 2007 transect was reviewed. When either black or yellow cactus was encountered along the transect, the data was analyzed to determine whether live green cactus occurred immediately adjacent to/or within the immediate vicinity of the black or yellow cactus. If no green cactus occurred immediately adjacent to a unique black or yellow cactus occurrence along that portion of the transect, that incident/occurrence was considered a mortality. Conversely, if green cactus occurred immediately adjacent to a unique black or yellow cactus occurrence along that portion of the transect, that incident/occurrence was considered a survivor.



**Figure 5:** Locations of vegetation transects.

### 2.1.2 2002 Burn Area Results

The 2002 burn occurred throughout the southern portion of the Conservation Easement, burning approximately 715.2 acres of coastal sage scrub, annual grasslands and oak woodlands (Harmsworth Associates 2003). In 2007, data was collected from twenty permanent transects located in cactus scrub.

A total of 27 plant species were observed in the 2002 burn area transects in 2006, down from 53 and 64 in 2006 and 2005, respectively. Species richness in 2007 is similar to that observed in the first growing season after the fire (Table 4). Of the 27 species observed in 2007, 22 species were native (81.5%) and 5 species were non-native (18.5%; Table 8, Appendix A). These 22 native species represent a 40% decline in both native species richness and native species cover, relative to 2006. Much of the decline in species richness can be explained by the reduced cover and presence of both native and exotic annual herbs and is directly related to the low rainfall totals in 2006/2007. Similar patterns were observed in 2002 which was also a very dry year (Harmsworth Associates 2003). Total percent cover of live vegetation also decreased in 2007.

The most dominant cover type in 2007 was dead vegetation material (litter or duff, at 21.3%; Table 4). Although deerweed (*Lotus scoparius*) occurred in 85% of the transects in 2007, it was relegated to the fourth most abundant cover type, at 11.3%. Deerweed comprised the most abundant cover type in 2006, and the decline in this common fire-follower is expected to continue, barring additional disturbances. Although the native shrubs, California buckwheat (*Eriogonum fasciculatum*) and coastal sagebrush (*Artemisia californica*) did not increase in cover in 2007, they remain the second and fifth most abundant cover types and most abundant native shrub on the transects (Table 4). The combined cover of California buckwheat and coastal sagebrush decreased slightly to 24.5% in 2007 (Figure 9). In 2006, the second most common cover type was the non-native biennial herb, summer mustard (*Hirschfeldia incana*), however, in 2007 summer mustard was documented in only half of the transects, and declined drastically in cover to 4.2%, from 22.0% in 2006, due to low rainfall.

The most marked changes in cover values between 2007 and 2006 were seen in leaf litter/duff and bareground cover values, increasing 105% and 100%, respectively (Table 4, Figure 9). In addition, most annual herbaceous species documented in 2006 were all but absent in 2007. For instance, herbs such as California dodder (*Cuscuta californica*), popcorn flower (*Cryptantha* sp.) and wreath plant (*Stephanomeria virgata*) which all occurred in the list of top 20 cover types in 2006, were not recorded in any of the 20 transects in 2007.

Several herbaceous species that were common in 2005, less common in 2006, were absent from the transaction in 2007. These included California everlasting (*Gnaphalium californicum*), red brome (*Bromus madritensis*), scarlet pimpernel (*Anagallis arvensis*), white everlasting (*Gnaphalium canescens* subsp. *microcephalum*), popcorn flower (*Cryptantha* spp.), and telegraph weed (*Heterotheca grandiflora*). These top-twenty ranked species in

2005 were replaced by mid to late seral species in 2007, including coyote brush (*Baccharis pilularis*), laurel sumac (*Malosma laurina*), bush monkeyflower (*Mimulus aurantiacus*), foothill needlegrass (*Nassella pulchra*), and black sage (*Salvia mellifera*). Prickly pear cactus (*Opuntia littoralis*) remains a dominant species (8.14%), when counting the green (live) portions of the stems. This indicates that the 2002 burn area is continuing to mature, and the mid- to late-successional species are continuing to exclude the fire-following species that dominated immediately after the fire.

**Table 4:** Mean absolute percent cover, standard error (SE), sample size (n), and frequency of occurrence of the top 20 cover types/species within the 2002 Burn Area in 2006, and mature coastal sage scrub.

Cover Type	2002 Burn Area in 2007			Mature Coastal Sage Scrub		
	Mean Abs. % Cover	SE (n=20)	% Freq.	Mean Abs. % Cover	SE (n=20)	% Freq.
Litter	21.30	3.16	1.0	6.88	0.14	85
<i>Eriogonum fasciculatum</i>	13.36	4.14	0.65	22.73	0.23	80
Bareground	12.92	1.86	0.95	2.9	0.09	60
<i>Lotus scoparius</i>	11.32	2.18	0.85	1.95	0.08	55
<i>Artemisia californica</i>	11.13	2.19	0.85	32.99	0.19	95
<i>Opuntia littoralis</i> (black)	10.18	1.49	0.9	--	--	--
<i>Opuntia littoralis</i> (green)	8.14	1.84	0.65	7.87	0.15	65
<i>Malosma laurina</i>	5.92	1.79	0.6	1.92	0.15	--
<i>Calystegia macrostegia</i>	4.81	2.78	0.4	0.02	0.01	10
<i>Hirschfeldia incana</i> *	4.2	1.29	0.5	7.43	0.16	70
<i>Baccharis pilularis</i>	2.71	1.28	0.3	0.81	0.09	--
<i>Brickellia californica</i>	1.86	0.85	0.3	--	--	--
<i>Sambucus mexicana</i>	1.45	0.8	0.15	1.1	0.11	10
<i>Nicotiana glauca</i> *	1.24	1.24	0.05	0.01	0.01	--
<i>Nassella lepida</i>	0.9	0.47	0.25	22.02	0.25	--
<i>Opuntia littoralis</i> (yellow)	0.82	0.42	0.2	--	--	--
<i>Galium angustifolium</i>	0.59	0.55	0.1	1.69	0.1	--
<i>Mimulus aurantiacus</i>	0.58	0.4	0.1	11.38	4.03	62
<i>Salvia mellifera</i>	0.57	0.4	0.1	3.10	2.50	8
<i>Rhamnus californicus</i>	0.55	0.55	0.05	--	--	--
<i>Melica imperfecta</i>	0.5	0.38	0.1	0.02	0.02	8
* Indicates non-native species. <sup>1</sup> CSS data collected in 1998						

## Shrub Height

For the purpose of the study, only the shrub heights of the important coastal sage scrub species<sup>1</sup> were analyzed. Cumulatively, the mean shrub height and the ranges in the 2002 Burn Area remains slightly less than mature coastal sage scrub (Table 5). A total of 106 individual shrubs were measured within the 2002 Burn Area in 2007 which accounted for the wide range in height. Approximately one third (30%) of the individuals measured were prickly pear cactus, *Opuntia littoralis*, and the height of the species in the burn area, is slightly greater than mature coastal sage scrub. Possible explanations for this increase might be a function of sample size since all the 2002 Burn Area transects are located in a specific subtype of coastal sage scrub, namely southern cactus scrub. Conversely, the locations of the transects in the mature CSS in 1998 were not specific to a coastal sage scrub subassociation or subtype and were rather a broad representation of the CSS habitat across the site. Hence the mature CSS and cactus scrub sites are not directly comparable, but do provide an index of development. Furthermore, sample sizes for many of the important CSS shrub species are relatively low for the cactus scrub, and these values should not be considered representative of each species height contributions.

Notwithstanding, the mean height of coastal sagebrush (*Artemisia californica*) in the 2002 Burn Area in 2007 remains greater than mature coastal sage scrub. This is expected since coastal sagebrush is a prolific stump sprouter and seeder following wildfire, and the lack of competition, that is the relatively low cover of prickly pear cactus in the southern cactus scrub, may account for the increased height of coastal sagebrush in the burn area. However, the mean height of coastal sagebrush in 2007 is slightly less than values in 2006. Likely explanations could be stress due to drought conditions or increased competition from other later seral species, or a combination of both variables. The mean height of deerweed (*Lotus scoparius*) in the 2002 Burn Area declined to 50.0 cm in 2007, down from 61cm in 2006. The vertical profile of deerweed is no longer greater than mature coastal sage scrub, which is expected since deerweed is a pioneering plant, and is being displaced by late seral species. Drought stress could also be a factor. The height of California buckwheat (*Eriogonum fasciculatum*) declined slightly from 2006, and remains still lower than values from mature coastal sage scrub. However, as the cover of buckwheat increases in the following years, the height of the shrubs will reflect that of mature coastal sage scrub. The height of bush monkeyflower (*Mimulus aurantiacus*) exceeds those values of CSS, although the sample size of one should preclude any definite conclusions. This is the second year, post burn, that bush monkeyflower was encountered along portions of the transects where height measurements were collected.

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<sup>1</sup> Dominant shrubs important to the California gnatcatcher.

**Table 5:** Comparison of mean height (cm,  $X \pm SE$ ) and range (cm) of shrub species in the 2002 Burn Area in 2007 and mature coastal sage scrub.

Species	2002 Burn in 2007		Mature CSS in 1998	
	$X \pm SE$	Range	$X \pm SE$	Range
<i>Artemisia californica</i>	$90 \pm 8$	31-140	$75 \pm 27$	20-135
<i>Eriogonum fasciculatum</i>	$54 \pm 5$	12-94	$70 \pm 21$	30-111
<i>Lotus scoparius</i>	$50 \pm 4$	31-94	$55 \pm 17$	35-67
<i>Mimulus aurantiacus</i>	$103 \pm 0$	103*	$92 \pm 22$	55-125
<i>Opuntia littoralis</i>	$80 \pm 7$	34-208	$64 \pm 23$	30-97
<i>Salvia apiana</i>	- -	- -	$86 \pm 47$	22-160
<i>Salvia mellifera</i>	$123 \pm 0$	123*	$94 \pm 28$	73-144
<b>Mean for all shrubs</b>	<b><math>74 \pm 5</math></b>	<b>12 <math>\pm</math> 208</b>	<b><math>77 \pm 21</math></b>	<b>48-160</b>
* = only one plant encountered/measured				

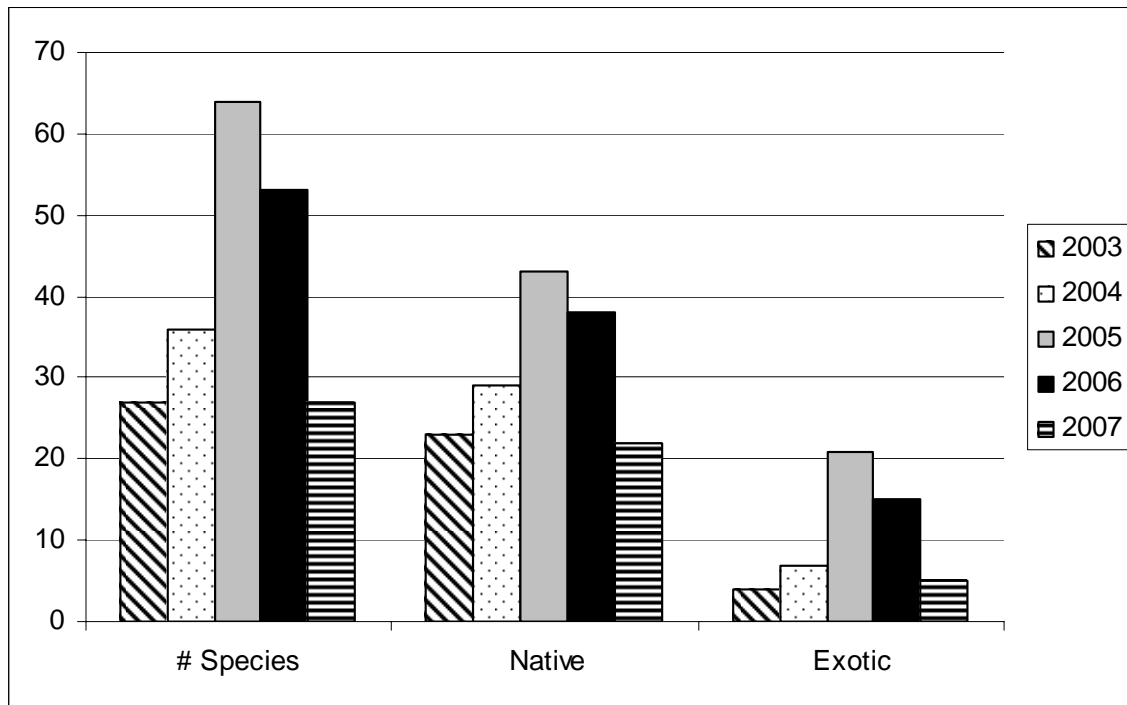
The cumulative means of herb and shrub cover declined 83% and 31%, respectively in 2007, from 2006 cover values (Figures 6, 7 and 8). Differences between years were statistically significant, although the decline in herb cover (7.0% in 2007, from 41% in 2006, students T-test,  $P < 0.001$ ) was more dramatic than the decline in shrub cover (51.4% in 2007, from 74.0% in 2006, students T-test,  $P < 0.001$ ). Furthermore, cumulative means of herb and shrub cover in the 2002 Burn Area in 2007 are significantly less than cover values from mature CSS (CSS herb cover = 76.1%,  $P < 0.001$ ; shrub cover = 83.3%,  $P = 0.001$ ). In order to account for non-normal data distribution, the non-parametric Friedman test was conducted on herb and shrub differences between 2006 and 2007. Results of these tests showed statistically significant differences, reflecting the student t-Tests (Friedman tests: shrubs,  $P = 0.0001$ ; herbs,  $P = <0.0001$ ).

Shannon's diversity index was calculated to compare species richness across transects and between years (Table 7). The cover types utilized for generating the indices were live vegetation cover types only – all non-living vegetation cover such as bare ground, litter and the non-green cactus cover were excluded from this analysis. Although some variation occurred between years and between transects, species diversity was significantly greatest in 2005, relative to any other year (Friedman Test,  $Fr = 29.6$ ,  $P < 0.0001$ ). Following, mean species richness peaked at 16.4 in 2005, two years after the fire, and was significantly higher than any other year (Friedman Test,  $P < 0.0001$ ). After the third year of recovery (2005), the increasing trend reversed, and species richness declined, from 14 in 2006 to 6.8 in 2007.

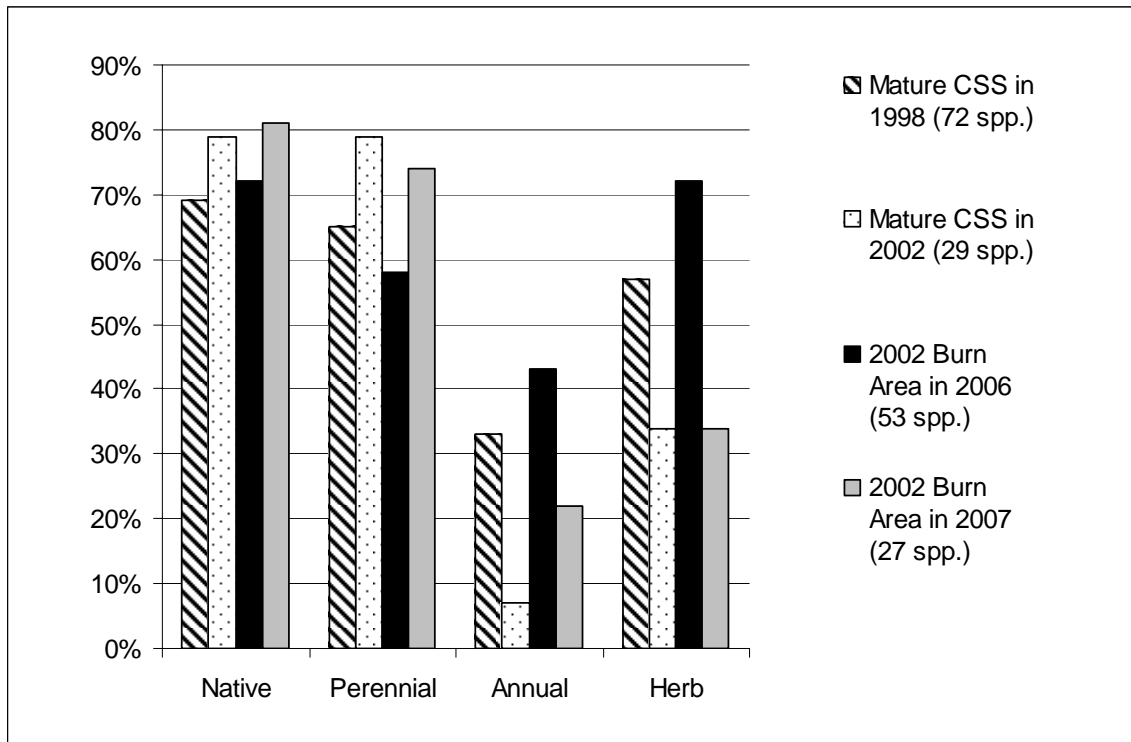
**Table 6:** Comparison of native, non-native shrubs and herbs and total vegetation in the 2002 Burn Area in 2007 with mature coastal sage scrub, and cover values in 2006.

Cover Type	2002 Burn Area in 2007		2002 Burn Area in 2006		Mature Coastal Sage Scrub <sup>2</sup>	
	Abs. % cvr	# species	Abs. % cvr	# species	Abs. % cvr	# species
Native	65.1	22	108.5	37	127.2	50
Non-Native	5.8	5	31.1	16	32.7	22
Native Shrubs	57.6	13	84.2	13	85.3	14
Native Herbs	2.4	6	24.3	24	41.9	33
Total Live Vegetation	117.0	27	139.6	53	159.9	72

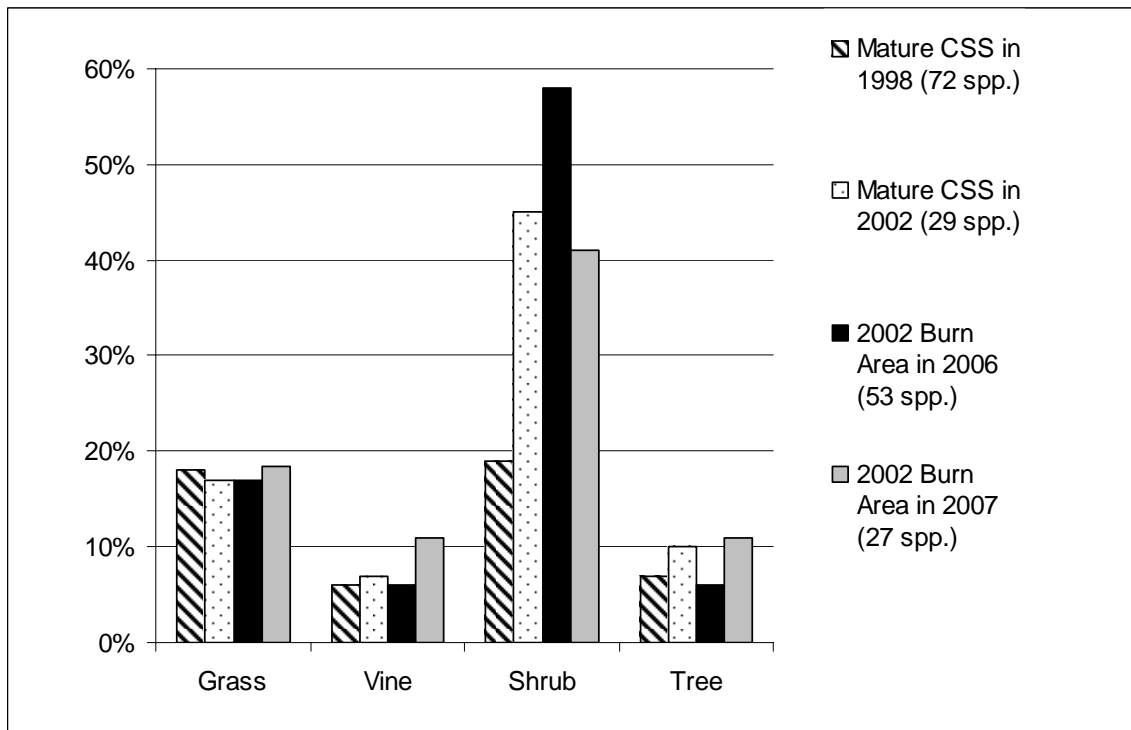
<sup>1</sup> No statistical differences between cover types in the 2002 Burn Area and CSS; <sup>2</sup> CSS data collected in 1998



**Figure 6:** Number of native, exotic and total species encountered on transects in the 2002 Burn Area, 2003 to 2007.



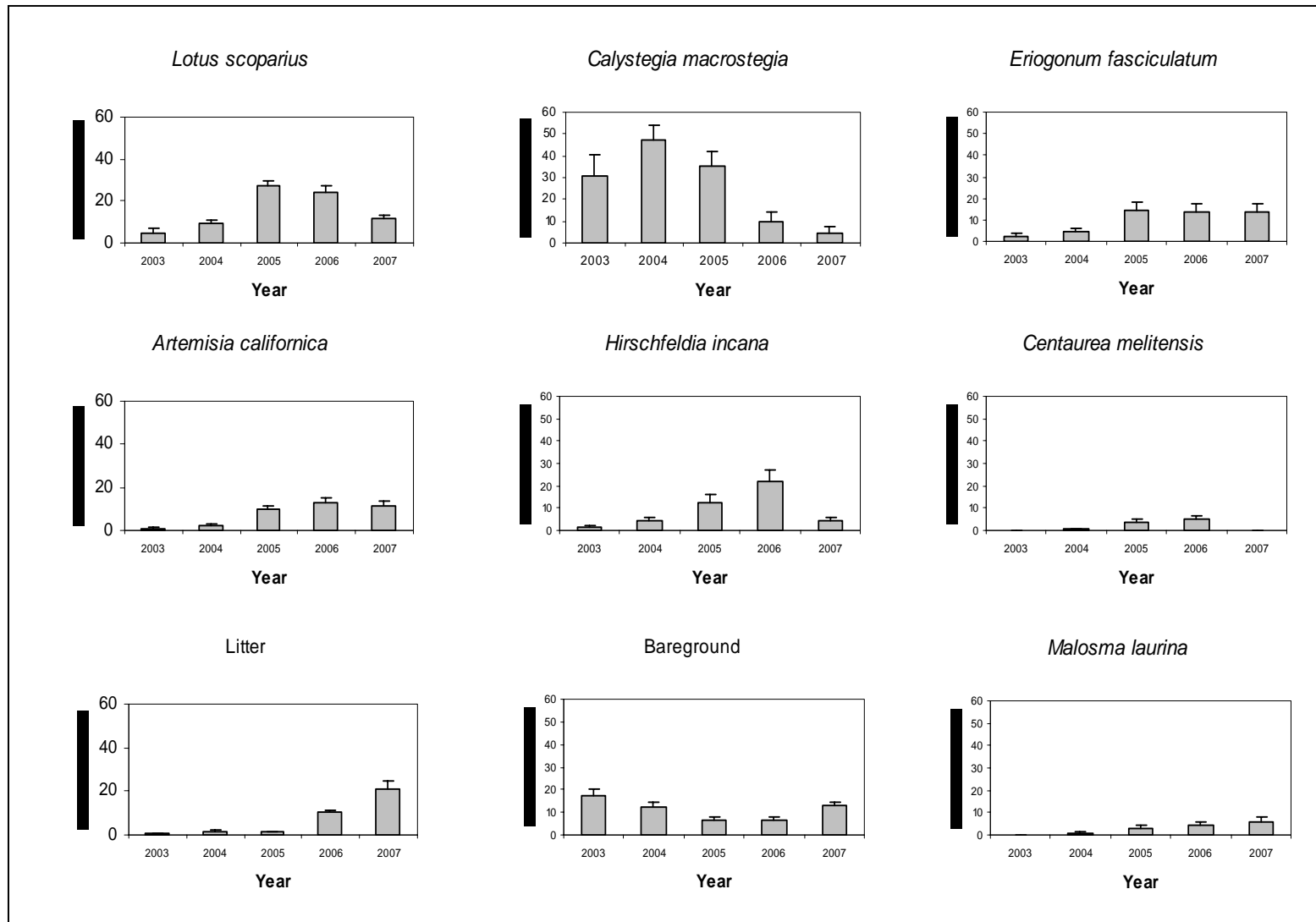
**Figure 7:** Percent of annual number of native, perennial, annual and herb species encountered on transects in the 2002 Burn Area and mature coastal sage scrub



**Figure 8:** Percent of annual number of grass, vine, shrub and tree species encountered on transects in the 2002 Burn Area and two mature coastal sage scrub areas.

**Table 7:** Species diversity (Shannon's diversity index) by transect in the 2002 Burn Area, 2004 to 2007.

<b>Transect Number</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>
N1	2.04	2.34	2.38	1.97
N2	2.06	1.98	1.94	1.89
N3	1.64	1.42	1.69	0.87
N4	1.81	2.58	1.71	1.54
N5	1.77	2.19	2.11	1.74
N6	0.42	1.12	1.43	1.45
N7	1.64	2.26	1.66	1.13
N8	1.11	1.90	1.58	1.34
N9	0.74	2.15	2.41	1.85
N10	1.01	1.73	1.49	1.23
N11	1.99	2.06	1.83	1.32
N12	1.58	2.44	2.19	1.59
N13	0.84	2.17	2.01	1.70
N14	0.74	1.88	1.34	1.39
N15	1.42	2.09	1.81	1.51
N16	0.56	1.43	1.66	1.24
N17	1.08	2.44	2.41	2.14
N18	1.22	1.84	2.16	1.44
N19	1.71	1.65	1.94	1.35
N20	1.30	---	1.87	1.83
<b>Average</b>	<b>1.33 ± 0.11</b>	<b>1.98 ± 0.09</b>	<b>1.88 ± 0.07</b>	<b>1.53 ± 0.07</b>



**Figure 9:** Mean absolute percent cover (and SE) of 9 cover types/species within the 2002 Burn Area, 2003 to 2007

### 2.1.3 Southern Cactus Scrub Assessment

Coastal prickly pear (*Opuntia littoralis*) is found on the south facing slopes on low foothills away from the immediate coast, associated with xeric conditions. This species is not only an important component of the coastal sage scrub but it also serves as primary habitat for the cactus wren (*Campylorhynchus brunneicapillus*). Information on fire effects and survivorship are lacking for coast prickly pear. In general, *Opuntia* species are able to endure following light fires. As with most shrubs and perennial herbs in the shrublands of southern California, *Opuntia* species recover from fire by regenerating from their bud “bank”, the root crown and surviving stems (Zedler 1995). However, low frequency fires could provide sufficient time to regenerate individuals (ramets and genets) from the dormant seed “bank”. Conversely, moderate to severe fires kill this species (Benson 1969). Further, studies done on a related species, the brownspine eastern prickly pear (*Opuntia humifusa*), found initial fire mortality was 20 percent after the first year and by the third year, due to insect infestation, the mortality exceeded 70 percent (U.S. Department of Agriculture *et al.* 2002).

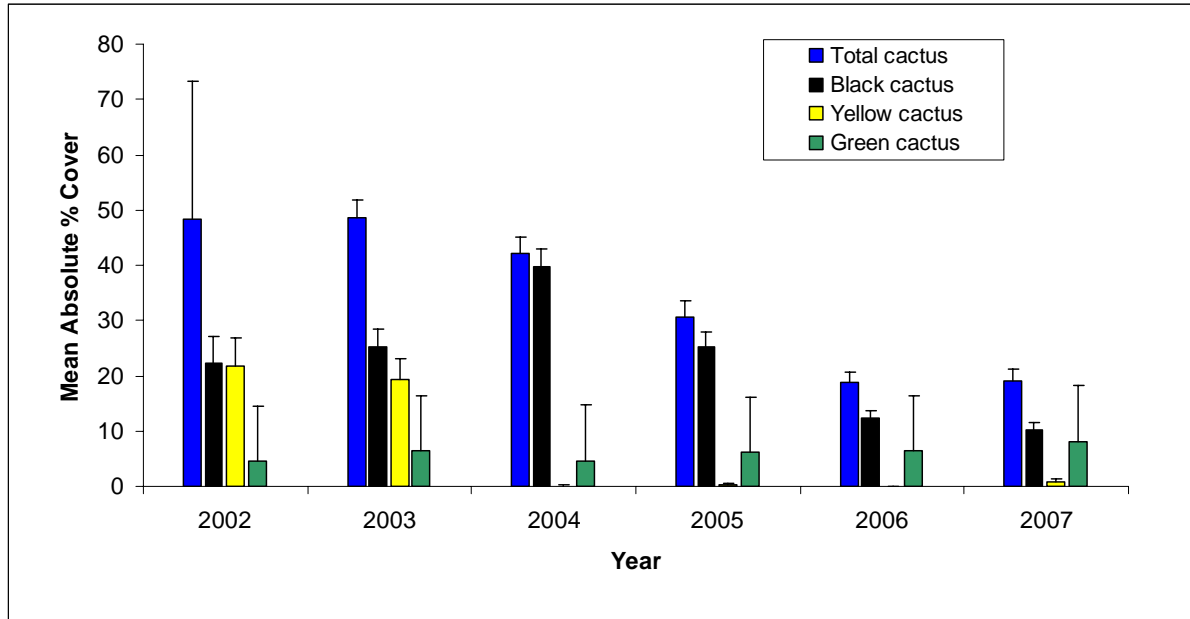
Cactus stands that were burnt in the 2002 fire were assessed by color in three categories for 2007 data collection. These categories were: Black, Yellow, and Green (Table 8). Burnt, black cactus pads were the most abundant (10.18% cover); yellow senescing pads comprising only 0.82% cover. Healthy green pads comprised 8.14% of the cover in 2007 Burn Area. For each consecutive year since the burn, the mean absolute cover of live, green cactus has increased, up to 8.14% in 2007 (Figures 10 and 13). When the 2007 green cactus cover values for each transect are compared with the 2006 values, the one year, mean absolute cover increase of 1.7% is statistically significant (Paired Students t-test, t-Stat = -1.89, df = 19, p = 0.04). Although the increase appears minimal, and several stressed, yellowing cactus were observed, healthy cactus pads were observed in the field, indicating cactus growth is proceeding following the initial stress and dieback.

**Table 8:** Cactus assessment for 2007.

<i>Opuntia littoralis</i> category	Mean Absolute % Cover		
	Mean	Standard error (n=20)	Frequency
Black	10.18	1.49	90%
Yellow	0.82	0.42	20%
Green	8.14	1.84	65%

However, the mean cactus cover in 2007 remains only a fraction of the preburn cactus cover (Figure 10). Note that the mean preburn cactus cover values were calculated by tallying all three cactus class cover values in 2002. Because the cumulative totals of all black, yellow and green cactus cover classes in 2002 were greater than subsequent years, these totals in

2002 were thus considered the best estimate of preburn cactus cover. Accordingly, the mean maximum cactus cover for the 20 transects was estimated to be approximately 48.4%. Thus, cactus comprised almost half of the area sampled in the mature, preburn, cactus scrub. The 2007 mean cover value of green live cactus in 2007 (8.14%) suggests that only 16.8 percent of the preburn maximum cactus cover recovered to green live cactus.



**Figure 10:** Mean absolute percent cover (and standard error) of cactus cover from 2002 Burn Area. 2002 data collected within six weeks after the fire.

Although live green cactus cover increased 25.6 percent in 2007, relative to 2006, green cactus was not recorded in seven (7) of the 20 transects (Table 9). Thus, 13 transects no longer contain cactus (35% mortality), compared with 12 transects in 2006 (Photograph 6). In 2007, a total of nine transects reported increases in live cactus cover, whereas five transects reported declines (Table 9). The five transects with the most cactus recovery were Transects #1, #10, #15, #16 and #17 (Photographs 1 and 2). Possible explanations for the decline in green cactus cover for these ten transects might be drought stress due to the unseasonal low rainfall received in 2007.

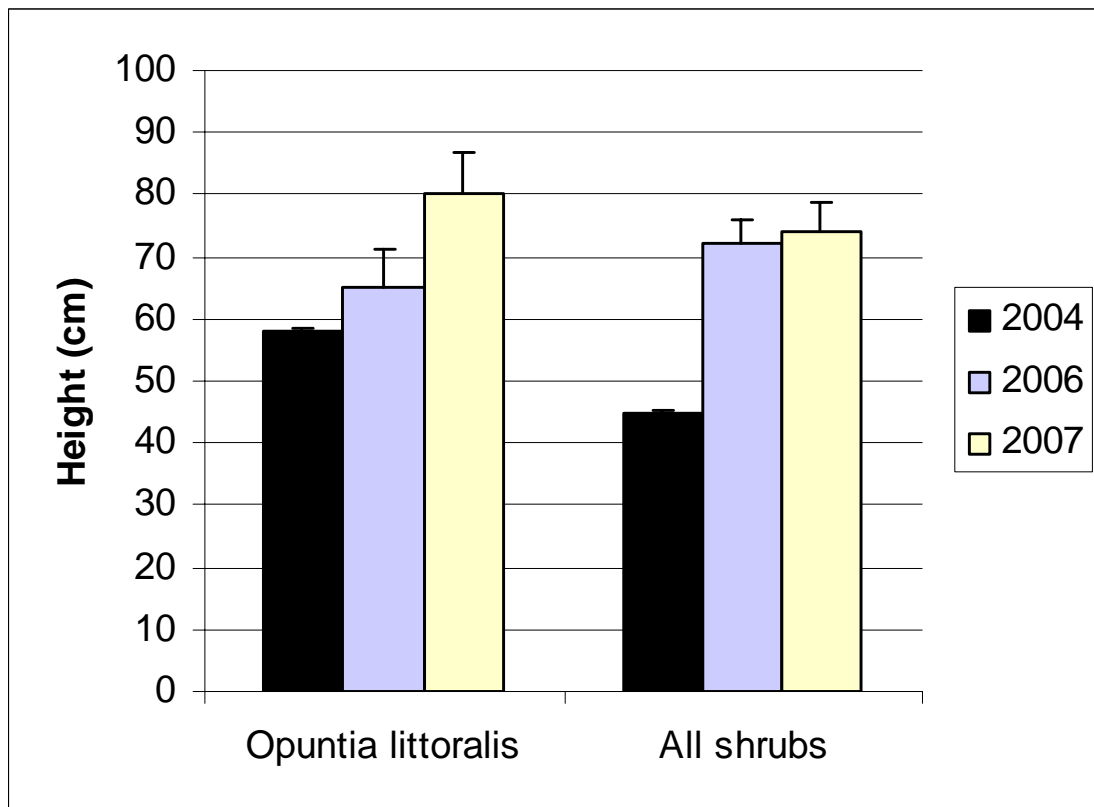
Black cactus cover increased in cover for the first three years post-burn, and then decreased thereafter (Figure 13). The long-term decrease in black cactus cover was statistically significant (ANOVA,  $F = 33.97$ ,  $df = 78$ ,  $p < 0.001$ ). Yellow cactus declined annually through 2006, and then increased slightly to in 2007. However, the differences were not statistically significant (ANOVA,  $P = 0.1$ ). The four year decline in yellow and black cactus is consistent with much of the yellow cactus dying (becoming black) and the black cactus

decomposing over time, or being classified as litter. The one year increase in yellow cactus in 2007 is likely due to drought stress.

**Table 9:** Mean absolute percent cover of live green cactus cover by transect in the 2002 Burn Area, 2004 through 2007.

<b>Transect Number</b>	<b>2004 (n=20)</b>	<b>2005 (n=19)</b>	<b>2006 (n=20)</b>	<b>2007 (n=20)</b>
T1	2.64	5.88	4.12	11.44
T2	14.56	18.84	19.44	23.8
T3	3.12	4.12	4.12	2.88
T4	0.2	--	--	--
T5	9.44	15.16	15.48	16.84
T6	--	--	--	--
T7	18.28	21.44	23.36	19.2
T8	3.96	10.08	9.68	8.2
T9	--	--	--	--
T10	1.4	1.08	3.6	5.36
T11	--	--	--	0
T12	13.12	13.68	12.2	13.68
T13	3	11	7.8	7.72
T14	--	--	--	--
T15	15.8	--	15.56	20.8
T16	0.16	0.88	1.84	7.24
T17	3.16	8.84	5.88	19.6
T18	1.0	3.32	1.0	--
T19	3.8	4.16	5.48	6
T20	--	--	--	--
Mean	<b>4.68 ± 1.35</b>	<b>6.24 ± 1.60</b>	<b>6.48 ± 1.61</b>	<b>8.14 ± 1.84</b>

In general, the vertical profile of cactus and other CSS vegetation increased in 2007, from 2006 (Table 5, Figure11). The mean height of live green cactus increased to 80cm in 2007 from 65cm in 2006, although the difference was not statistically significant (Students' t-Test, t Stat = 1.11, df = 19, P = 0.14).



**Figure 11:** Mean height ( $\pm$ SE) of cactus and all shrubs in the 2002 Burn Area, 2004 to 2007.

#### 2.1.4 2002 Burn Area Discussion

In the fifth post-fire year, the 2002 burn area is following a typical pattern of vegetation cover for post-burn coastal sage scrub communities, summarized as follows:

- An initial increase in species richness in the first few years following fire, due to seed bank germination, resprouting, and seed dispersal and colonization. Then, a decline in species richness, as long-lived, perennial shrubs, herbs and grasses outcompete pioneering species (Figures 6 and 7). Still, native, herb and shrub species richness in the 2002 Burn Area in 2006 remains less than mature coastal sage scrub (Table 4).
- Rapid proliferation and colonization of native fire-following species such as morning-glory (*Calystegia macrostegia*) and deerweed (*Lotus scoparius*) which are adapted to rapid colonization, growth and propagation in bare soils and full sun (Figure 9). Following initial establishment and proliferation, fire following species often exhibit a long-term decline; in the 2002 burn area, morning-glory continues to decline. Deerweed, following four years of continued increase, is decreasing in cover, as expected.
- A long-term increase in percent cover of shrub vegetation and leaf litter accumulation, with a corresponding decrease in bare ground (Figures 9). However, since 2007 was a drought year, the increase in litter and bareground cover and decrease in perennial shrub cover is not surprising, and these levels of change are not expected to continue during periods of normal precipitation.
- Continued recovery of mid- to late-successional species such as laurel sumac (*Malosma laurina*), coastal sagebrush (*Artemisia californica*), California buckwheat (*Eriogonum fasciculatum*), bush monkeyflower (*Mimulus aurantiacus*) and black sage (*Salvia mellifera*) which are able to out-compete the fire-following species and establish dominance over time (Figure 9). Mid- to late – successional species are often adapted to fire survival through root or stump resprouting, and invest fewer resources in seed dispersal.
- The absolute cover of shrubs and herbs in the 2002 Burn Area in 2007 remains less than shrub and herb cover in mature coastal sage scrub, partially due to low rainfall in 2007. However, there is no significant difference between the ranking of top 20 species cover in the 2002 Burn Area in 2002 and mature CSS (Wilcoxon Rank Sum Test,  $p = 0.47$ ).
- Similar proportions and number of tree species in the 2002 Burn Area (3), relative to mature coastal sage scrub (4) (Figure 8). Increased cover of tree species in the 2002 Burn Area (7.9%) relative to mature coastal sage scrub (3.43%). Laurel sumac (*Malosma laurina*) and Mexican elderberry (*Sambucus mexicana*) are relatively common, dominant trees in cactus scrub. Tree cover is expected to increase in future years, as the Mexican elderberry and laurel sumac develop over time. Both species are relatively abundant in the 2002 Burn Area, relative to mature coastal sage scrub (Table 4).

- When all shrubs are considered, mean shrub height in the 2002 Burn Area has increased 3 percent to 74cm in 2007, following a 60 percent increase to 72cm in 2006, from 45m in 2004 (Figure 7). However, this increase is still less than the shrub profile in mature coastal sage scrub (Table 5).
- Significant decrease in the cover of non-native species, such as summer mustard (*Hirschfeldia incana*), and tocalote (*Centaurea melitensis*), however this is likely due to below average rainfall received in 2007. Only five non-native species occurred in the 2002 Burn Area transects in 2007, compared with 16 species in 2006 (Table 4). Sweet fennel (*Foeniculum vulgare*), classified as a high priority exotic species by The California Exotic Pest Plant Council (Cal-IPC 2006), was not detected 2007. However, this species is likely to withstand periodic droughts, and should be closely monitored.

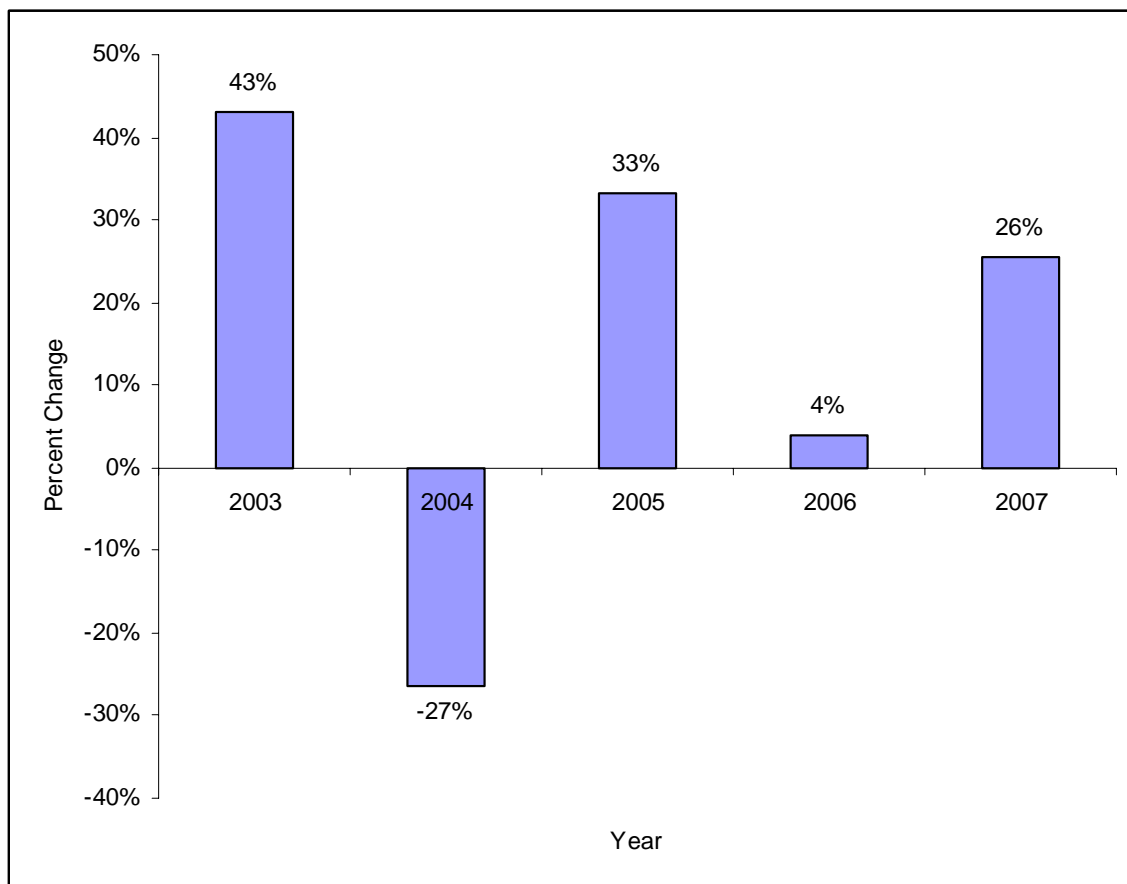
#### Cactus scrub:

- Prickly pear cactus (*O. littoralis*) has exhibited a slow rate of recovery (Table 8, Figure 10). Following the initial burn event, the percent cover of healthy green pads has fluctuated, indicating both resprouting and growth of new pads, and senescence and mortality of pads that initially survived the blaze but withered due to long-term stress. Between 2002 and 2007, the average annual change in live cactus cover values is an increase of 16%. Field observations indicate that growth of green cactus is currently vigorous, and percent cover is expected to increase significantly in future survey years.
- The mean height of the live/green cactus in the Burn Area increased to 80cm in 2007, from 65cm in 2006, and from 58cm in 2004 (Figure 11). The mean height of cactus in the 2002 Burn Area is slightly higher than measurements conducted in mature coastal sage scrub (Table 5). This suggests that the cactus in the burn area comprises a similar vertical profile of mid to late seral cactus patches in non-cactus scrub coastal sage scrub.
- When the concomitant incidence of cactus encountered along the transects were considered (see method section), the prickly pear cactus post-fire survivorship estimate was 35.0%. Thus, prickly pear cactus mortality exceeded 60 percent, the 5<sup>th</sup> year after wildfire. In addition, live cactus no longer occurs in 7 of the 20 transects (35%).

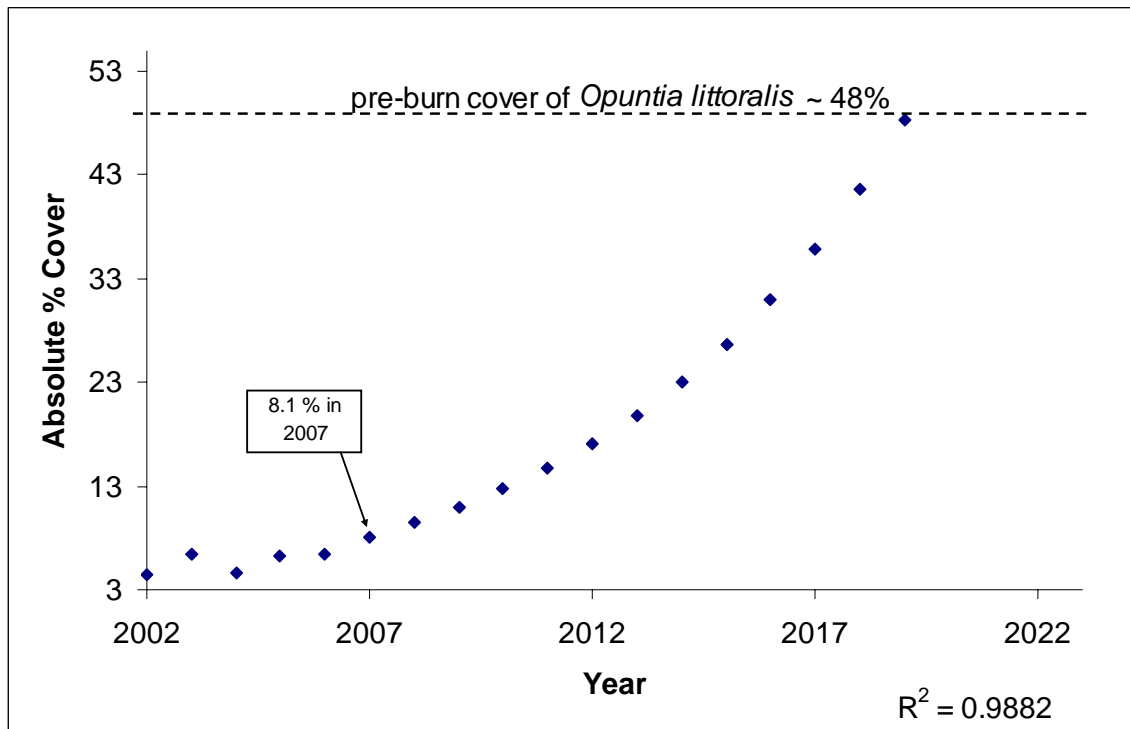
#### **Projected time for cactus to return to pre-burn conditions**

Although preburn cactus data does not exist for the cactus scrub in the conservation easement, the pre-burn conditions of *Opuntia littoralis* could be assumed to be the combined cactus cover value (black, green and yellow) measured in greatest abundance in the post burn data. With this assumption, a prediction can be made to determine the time it would take for the pre-burn conditions to return. This year, 2007, is the greatest cover of green cactus

measured since the 2002 burn. Yet this value of 8.1% is only a fraction, between 16.8% and 18.3%, of the pre-burn cactus cover value. Despite the fluctuation in live cactus cover since the burn (Figure 12), cactus is recovering, and the average annual change in live cactus cover values, between 2002 and 2007, is an increase of 16%. Since post burn recovery was initiated, annual changes in green cactus cover between 2002 and 2007 have been highly variable, ranging from an increase of 43% in 2003 to a decline of 27% in 2004 (Figure 12). If this average annual increase in green cactus continues at 16% per year, we can predict that the pre burn conditions will be reached in another 12 to 13 years (Figure 13). In summary, using this model, it is predicted that it will take until 2019 for cactus patches to reach preburn levels, or 21 years, from the burn date.



**Figure 12:** Annual change in green cactus cover, 2003 through 2007.



**Figure 13:** Projected time for live cactus (*Opuntia littoralis*) to recover to pre-burn cover values, assuming an average annual increase of 16%.

## **2.2 WILDLIFE SURVEYS**

Focused wildlife surveys were not conducted in 2007, previous surveys conducted in 1997, 1998, 2000, 2002, 2004 and 2006 had documented regionally important populations of California gnatcatcher and cactus wren in the Conservation Easement (Tables 10 and 11). General wildlife observations were made during vegetation surveys and other monitoring, management activities conducted in 2007.

The 1996, 1997 and 2002 wildfires burned a significant portion of suitable gnatcatcher and wren habitat in the Conservation Easement. Populations of both gnatcatchers and cactus wrens declined following the fires, particularly the 2002 fire. Since that time habitat in all burn areas has started to recover and bird populations have responded accordingly. Gnatcatcher populations in both the 1996 and 1997 burn areas appear to have fully recovered (now supporting two and eight pairs respectively), and the 1997 burn area even supports a few cactus wrens. The habitat in the 2002 burn area is recovering well and now supports a significant population of breeding gnatcatchers (64 pairs and 4 unpaired males). The healthy population of gnatcatchers in the unburned portions of the Conservation Easement has provided a source population for the recovering habitat in the burn areas.

Cactus recovers more slowly from fires than other scrub plants and it is not surprising the cactus wrens have not returned to the burn area in any significant numbers. However, cactus wren numbers in unburned areas have also declined, especially number of paired birds. The reasons for this are unknown. Monitoring of wrens over the coming years will document if the population starts to recover.

The Conservation Easement supports a diverse fauna. To date, a total of 129 species of wildlife have been observed or detected since surveys started in 1998, the majority of which were avifauna (99 species, Appendix D). Three amphibians, fourteen reptiles and thirteen species of mammals have been detected within the Conservation Easement.

**Table 10:** Numbers of California gnatcatcher breeding pairs and total gnatcatcher locations in Chiquita Canyon Conservation Easement from 1989 through 2004.

Year	# of Breeding Pairs	Total # of Locations
1989 <sup>1</sup>	-	33
1993 <sup>2</sup>	-	32
1995 <sup>3</sup>	-	43
1997	113	116
1998	103	111
2000	69	92
2002 – prefire	72	81
2002 – prefire estimated <sup>4</sup>	92	104
2002 - postfire	39	42
2004	29	31
2006	64	68

<sup>1</sup> Bontrager 1989; <sup>2,3</sup> = MBA 1993, 1995. Data collected in 1989, 1993 and 1995 represent gnatcatcher sightings, comparable directly with 1997 and 1998 Total Locations, <sup>4</sup> = previous surveys have shown that approximately 70% of gnatcatchers are detected during the first survey and 90% by the second survey; these figures were used to calculate the estimated pre-fire population in 2002.

**Table 11:** Numbers of cactus wren breeding pairs and total wren locations in Chiquita Canyon Conservation Easement, 1997 and 2004.

Year	# of Breeding Pairs	Total # of Locations
1997	79	80
1998	60	63
2000	41	62
2002 – prefire*	54	65
2002 – postfire	27	30
2004	19	23
2006	8	19

\* likely an underestimate as not all cactus wrens are detected during the first or second surveys.

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## 5.0 APPENDICES

**5.1 Appendix A:** Mean absolute percent cover, standard error (SE), and frequency of occurrence of all cover types/species within the 2002 Burn Area in 2007.

Species	Absolute % cover $\pm$ SE	Frequency
<i>Artemisia californica</i>	11.13 $\pm$ 2.19	0.85
<i>Baccharis pilularis</i>	2.71 $\pm$ 1.28	0.3
Bareground	12.92 $\pm$ 1.86	0.95
<i>Brickellia californica</i>	1.86 $\pm$ 0.85	0.3
<i>Bromus diandrus</i> *	0.08 $\pm$ 0.08	0.05
<i>Bromus madritensis</i> *	0.01 $\pm$ 0.01	0.05
<i>Calystegia macrostegia</i>	4.81 $\pm$ 2.78	0.4
<i>Centaurea melitensis</i> *	0.24 $\pm$ 0.12	0.2
<i>Eriogonum fasciculatum</i>	13.36 $\pm$ 4.14	0.65
<i>Galium angustifolium</i>	0.59 $\pm$ 0.55	0.1
<i>Gnaphalium californicum</i>	0.06 $\pm$ 0.06	0.05
<i>Gnaphalium canescens</i>	0.32 $\pm$ 0.25	0.1
<i>Hirschfeldia incana</i> *	4.2 $\pm$ 1.29	0.5
<i>Leymus condensatus</i>	0.06 $\pm$ 0.06	0.05
Litter	21.3 $\pm$ 3.16	1
<i>Lotus scoparius</i>	11.32 $\pm$ 2.18	0.85
<i>Malosma laurina</i>	5.92 $\pm$ 1.79	0.6
<i>Marah macrocarpus</i>	0.27 $\pm$ 0.16	0.15
<i>Melica imperfecta</i>	0.5 $\pm$ 0.38	0.1
<i>Mimulus aurantiacus</i>	0.58 $\pm$ 0.4	0.1
<i>Nassella lepida</i>	0.9 $\pm$ 0.47	0.25
<i>Nicotiana glauca</i> *	1.24 $\pm$ 1.24	0.05
<i>Opuntia littoralis</i> (black)	10.18 $\pm$ 1.49	0.9
<i>Opuntia littoralis</i> (green)	8.14 $\pm$ 1.84	0.65
<i>Opuntia littoralis</i> (yellow)	0.82 $\pm$ 0.42	0.2
<i>Rhamnus californica</i>	0.55 $\pm$ 0.55	0.05
<i>Salvia mellifera</i>	0.57 $\pm$ 0.4	0.1
<i>Sambucus mexicana</i>	1.45 $\pm$ 0.8	0.15
<i>Sarcostemma cyanchoides</i>	0.39 $\pm$ 0.39	0.05
<i>Toxidendron diversilobum</i>	0.28 $\pm$ 0.28	0.05
<i>Yucca whipplei</i>	0.19 $\pm$ 0.19	0.05
<b>GRAND TOTAL</b>	116.96 $\pm$ 2.17	
<b>KEY:</b> Asterisk (*) indicates non-native species; see Appendix B for common names.		

## 5.2 Appendix B: Plant Species Recorded In Chiquita Canyon Conservation Easement, 1997-2007.

SCIENTIFIC NAME	COMMON NAME	FORM	HABITAT
<b>PTERIDOPHYTES</b>	<b>FERNS &amp; ALLIES</b>		
<b>DRYOPTERIDACEAE</b>	<b>WOOD FERN FAMILY</b>		
<i>Dryopteris arguta</i>	Coastal Wood Fern	NF	OW
<b>POLYPODIACEAE</b>	<b>POLYPODY FAMILY</b>		
<i>Polypodium californicum</i>	California Polypody	NF	OW
<b>PTERIDACEAE</b>	<b>BRAKE FAMILY</b>		
<i>Pellaea andromedifolia</i>	Coffee Fern	NF	CSS, OW
<i>Pellaea mucronata</i> var. <i>mucronata</i>	Bird's Foot Cliff Brake	NF	OW
<i>Pentagramma triangularis</i> subsp. <i>triangularis</i>	Goldback Fern	NF	CSS, OW
<b>SELAGINELLACEAE</b>	<b>SPIKE-MOSS FAMILY</b>		
<i>Selaginella bigelovii</i>	Bigelow's Spike-Moss	NF	CSS
<b>ANGIOSPERMAE</b>	<b>FLOWERING PLANTS</b>		
<b>ANGIOSPERMS - DICOTYLEDONES</b>	<b>DICOTS</b>		
<b>ANACARDIACEAE</b>	<b>SUMAC or CASHEW FAMILY</b>		
<i>Malosma laurina</i>	Laurel Sumac	NPST	CSS
<i>Rhus integrifolia</i>	Lemonadeberry	NPS	CSS
<i>Toxicodendron diversilobum</i>	Poison Oak	NPSV	CSS, OW
<b>APIACEAE</b>	<b>CARROT FAMILY</b>		
<i>Apiastrum angustifolium</i>	Mock Parsley	NAH	CSS
<i>Daucus pusillus</i>	Rattlesnake Weed	NAH	Gr, CSS
<i>Foeniculum vulgare</i> *	Sweet Fennel	EPS	CSS
<i>Sanicula arguta</i>	Sharp-Toothed Sanicle	NPH	CSS
<i>Sanicula crassicaulis</i>	Pacific Sanicle	NPH	Gr, CSS, OW
<b>ASCLEPIADACEAE</b>	<b>MILKWEED FAMILY</b>		
<i>Asclepias eriocarpa</i>	Indian Milkweed	NPH	Gr
<i>Asclepias fascicularis</i>	Narrow-Leaved Milkweed	NPH	Gr
<i>Sarcostemma cyanchoides</i> ssp. <i>hartwegii</i>	Climbing Milkweed	NPHV	CSS
<b>ASTERACEAE</b>	<b>SUNFLOWER FAMILY</b>		
<i>Acourtia microcephala</i>	Sacapellote	NPH	CSS, OW
<i>Ambrosia acanthicarpa</i>	Sand-Bur or Annual Burweed	NAH	Gr
<i>Ambrosia psilostachya</i>	Western Ragweed	NPH	Gr
<i>Artemisia californica</i>	Coastal Sagebrush	NPS	CSS
<i>Artemisia dracunculus</i>	Dragon Sagewort or Tarragon	NPH	CSS
<i>Baccharis pilularis</i>	Coyote Brush or Chaparral Broom	NPS	CSS
<i>Baccharis salicifolia</i>	Mulefat	NPS	WS, MS, CSS
<i>Bebbia juncea</i> var. <i>aspera</i>	Scabrid Sweetbush	NPS	CSS
<i>Brickellia californica</i>	California Brickellbush	NPS	CSS
<i>Carduus pycnocephalus</i> *	Italian Thistle	EAH	OW
<i>Centaurea melitensis</i> *	Tocalote	EAH	Gr, OW

SCIENTIFIC NAME	COMMON NAME	FORM	HABITAT
<i>Chaenactis artemisiifolia</i>	Artemisia-Leaved Pincushion	NAH	CSS
<i>Cirsium occidentale</i> var. <i>occidentale</i>	Cobweb Thistle	NPH	CSS
<i>Cirsium</i> sp.	Thistle	EPH	Gr
<i>Cirsium vulgare</i> *	Bull Thistle	EAH	Gr
<i>Cnicus benedictus</i> *	Blessed Thistle	EAH	OW, Gr
<i>Conyza bonariensis</i> *	Flax-Leaved Horseweed	EAH	Gr, CSS
<i>Conyza canadensis</i>	Common Horseweed	NAH	Gr
<i>Cynara cardunculus</i> *	Cardoon, Globe Artichoke	EPH	Gr, CSS
<i>Encelia californica</i>	California Encelia	NPS	CSS
<i>Encelia farinosa</i>	Inciense or Brittlebush	NPS	CSS
<i>Ericameria palmeri</i> var. <i>pachylepis</i>	Grassland Goldenbush	NPS	Gr
<i>Ericameria pinifolia</i>	Pine Goldenbush	NPS	CSS
<i>Erigeron foliosus</i> var. <i>foliosus</i>	Leafy Daisy	NPH	CSS
<i>Eriophyllum confertiflorum</i> var. <i>confertiflorum</i>	Long-Stemmed Golden Yarrow	NAH	CSS
<i>Euthamia occidentalis</i>	Western Goldenrod	NPH	OW
<i>Filago californica</i>	California Filago or Fluffweed	NAH	Gr, CSS
<i>Filago gallica</i> *	Narrow-Leaved Filago	EAH	Gr
<i>Gnaphalium bicolor</i> #	Bioletti's or Bicolored Cudweed	NAH	Gr, CSS
<i>Gnaphalium californicum</i>	California Everlasting	NAH	CSS
<i>Gnaphalium canescens</i> subsp. <i>microcephalum</i>	White Everlasting	NPH	CSS
<i>Gnaphalium luteo-album</i> *	Weedy Cudweed	EAH	Gr
<i>Gnaphalium palustre</i>	Lowland Cudweed	NAH	CSS
<i>Gnaphalium stramineum</i>	Cotton-Batting Plant	NAPH	CSS
<i>Gutierrezia californica</i>	California Matchweed	NPS	CSS
<i>Hazardia squarrosa</i> var. <i>grindelioides</i>	Saw-Toothed Goldenbush	NPS	CSS
<i>Hemizonia fasciculata</i>	Fascicled Tarweed	NAH	Gr, CSS
<i>Hemizonia paniculata</i> (= <i>Deinandra</i> p.)	San Diego Tarweed	NAH	Gr
<i>Heterotheca grandiflora</i>	Telegraph Weed	NAPH	Gr
<i>Hypochaeris glabra</i> *	Smooth Cat's Ear	EAH	Gr, CSS
<i>Isocoma menziesii</i> var. <i>vernonioides</i>	Coastal Goldenbush	NPH	Gr, CSS
<i>Lactuca serriola</i> *	Prickly or Wild Lettuce	EAH	Gr
<i>Lasthenia californica</i>	Coastal Goldfields	NAH	CSS, Gr
<i>Layia glandulosa</i>	White Tidy Tips	NAH	Gr
<i>Lessingia filaginifolia</i> var. <i>filaginifolia</i>	Common Sand Aster	NPH	Gr, CSS
<i>Malacothrix saxatilis</i> var. <i>commutata</i>	Malacothrix	NPH	CSS
<i>Osmadenia tenella</i>	Southern Rosinweed	NAH	CSS
<i>Picris echioides</i> *	Bristly Ox-Tongue	EAPH	Gr
<i>Porophyllum gracile</i>	Poreleaf or Odora	NPH	CSS
<i>Rafinesquia californica</i>	California Chicory	NAH	CSS
<i>Senecio vulgaris</i> *	Groundsel, Ragwort	EAH	Gr, CSS
<i>Silybum marianum</i> *	Milk Thistle	EAPH	Gr, OW
<i>Sonchus asper</i> subsp. <i>asper</i> *	Prickly Sow Thistle	EAH	Gr, CSS
<i>Sonchus oleraceus</i> *	Common Sow Thistle	EAH	Gr, CSS
<i>Stephanomeria exigua</i> subsp. <i>exigua</i>	Small Wreath Plant	NAH	CSS

SCIENTIFIC NAME	COMMON NAME	FORM	HABITAT
<i>Stephanomeria virgata</i> subsp. <i>virgata</i>	Tall Wreath Plant	NAH	CSS
<i>Uropappus lindleyi</i>	Silver Puffs	NAH	Gr
<i>Xanthium strumarium</i>	Cocklebur	NAH	MS
<b>BORAGINACEAE</b>	<b>BORAGE FAMILY</b>		
<i>Amsinckia menziesii</i> var. <i>intermedia</i>	Common Fiddleneck	NAH	Gr, CSS
<i>Cryptantha intermedia</i>	Common Cryptantha	NAH	Gr, CSS
<i>Cryptantha maritima</i>	White-Haired Cryptantha	NAH	Gr, CSS
<i>Plagiobothrys canescens</i>	Valley Popcorn-Flower	NAH	Gr
<i>Plagiobothrys collinus</i> var. <i>californicus</i>	California Popcorn-Flower	NAH	Gr
<b>BRASSICACEAE</b>	<b>MUSTARD FAMILY</b>		
<i>Arabis glabra</i> var. <i>glabra</i>	Tower Mustard	NPH	CSS
<i>Brassica nigra</i> *	Black Mustard	EAH	Gr, CSS
<i>Caulanthus heterophyllus</i> var. <i>pseudosimulans</i>	San Diego Jewel Flower	NAH	CSS
<i>Hirschfeldia incana</i> *	Shortpod/Summer Mustard	EBH	Gr, CSS, OW
<i>Raphanus sativus</i> *	Wild Radish	EABH	Gr
<i>Sisymbrium iri</i> *	London Rocket	EAH	GR, CSS
<b>CACTACEAE</b>	<b>CACTUS FAMILY</b>		
<i>Opuntia littoralis</i>	Mesa Prickly Pear	NPS	CSS
<i>Opuntia prolifera</i>	Coastal Cholla	NPS	CSS
<b>CAMPANULACEAE</b>	<b>BELLFLOWER FAMILY</b>		
<i>Triodanis biflora</i>	Small Venus's Looking-Glass	NAH	CSS
<b>CAPRIFOLIACEAE</b>	<b>HONEYSUCKLE FAMILY</b>		
<i>Sambucus mexicana</i>	Mexican Elderberry	NPST	CSS, OW
<b>CARYOPHYLLACEAE</b>	<b>PINK FAMILY</b>		
<i>Cerastium glomeratum</i> *	Sticky Mouse-Ear Chickweed	EAH	Gr, CSS
<i>Silene antirrhina</i>	Snapdragon Catchfly	NAH	CSS
<i>Silene gallica</i> *	Windmill Pink /Common Catchfly	EAH	Gr, CSS
<i>Silene laciniata</i> subsp. <i>major</i>	Mexican Pink or Southern Pink	NAH	CSS, OW
<i>Spergula arvensis</i> subsp. <i>arvensis</i> *	Corn Spurry	EAH	Gr
<i>Spergularia marina</i>	Salt-March Sand Spurry	NAH	Gr, MS
<i>Stellaria media</i> *	Common Chickweed	EAH	CSS, OW
<b>CHENOPODIACEAE</b>	<b>GOOSEFOOT FAMILY</b>		
<i>Chenopodium album</i> *	Lamb's Quarter	EAH	OW
<i>Chenopodium murale</i> *	Nettle-Leaved Goosefoot	EAH	Gr
<i>Salsola tragus</i> *	Russian-Thistle	EAH	Gr
<b>CONVOLVULACEAE</b>	<b>MORNING-GLORY FAMILY</b>		
<i>Calystegia macrostegia</i>	Morning-Glory	NPHV	CSS
<i>Convolvulus arvensis</i> *	Field Bindweed	EPHV	Gr
<i>Dichondra occidentalis</i> <sup>+</sup>	Western Dichondra	NPH	CSS
<b>CRASSULACEAE</b>	<b>STONECROP FAMILY</b>		
<i>Crassula connata</i>	Sand Pygmy-Stonecrop	NAH	CSS
<i>Dudleya lanceolata</i>	Lanceleaf / Coastal Live-Forever	NPH	CSS
<i>Dudleya pulverulenta</i> subsp. <i>pulverulenta</i>	Chalky Live-Forever	NPH	CSS

SCIENTIFIC NAME	COMMON NAME	FORM	HABITAT
<b>CUCURBITACEAE</b>	<b>GOURD FAMILY</b>		
<i>Marah macrocarpus</i> var. <i>macrocarpus</i>	Man-Root, Wild Cucumber	NPHV	CSS, OW
<b>CUSCUTACEAE</b>	<b>DODDER FAMILY</b>		
<i>Cuscuta californica</i> var. <i>californica</i>	California Witch's Hair	NAH(P)	CSS
<b>EUPHORBIACEAE</b>	<b>SPURGE FAMILY</b>		
<i>Acalypha californica</i> <sup>+</sup>	California Copperleaf	NPS	CSS
<i>Chamaesyce albomarginata</i>	Rattlesnake Spurge	NAH	CSS, Gr
<i>Eremocarpus setigerus</i>	Doveweed	NAH	Gr
<b>FABACEAE</b>	<b>LEGUME FAMILY</b>		
<i>Astragalus didymocarpus</i> var. <i>didymocarpus</i>	White Dwarf Locoweed	NPH	Gr, CSS
<i>Astragalus gambelianus</i>	Gambel's Locoweed	NAH	CSS
<i>Lotus hamatus</i>	San Diego / Grab Lotus	NAH	Gr, CSS
<i>Lotus purshianus</i> var. <i>purshianus</i>	Spanish Lotus	NAH	Gr
<i>Lotus salsuginosus</i> var. <i>salsuginosus</i>	Alkali Lotus	NAH	CSS
<i>Lotus scoparius</i> var. <i>scoparius</i>	Coastal Deerweed	NPH	CSS
<i>Lotus strigosus</i>	Strigose Lotus	NAH	Gr, CSS
<i>Lupinus bicolor</i>	Miniature Lupine	NAH	Gr, CSS
<i>Lupinus excubitus</i> var. <i>hallii</i>	Guard Lupine	NPS	Gr, CSS
<i>Lupinus hirsutissimus</i>	Stinging Lupine	NAH	CSS
<i>Lupinus sparsiflorus</i>	Sparse-Flowered Lupine	NAH	CSS
<i>Lupinus succulentus</i>	Arroyo Lupine	NAH	Gr, CSS
<i>Lupinus truncatus</i>	Collar Lupine	NAH	Gr, CSS
<i>Medicago polymorpha</i> *	California Burclover	EAH	Gr, CSS
<i>Melilotus indicus</i> *	Yellow Sweet-Clover	EAH	Gr
<i>Trifolium gracilentum</i> var. <i>gracilentum</i>	Pin-Point Clover	NAH	Gr
<i>Trifolium</i> sp.	Unknown Clover	NAH	Gr
<i>Trifolium willdenovii</i>	Valley Clover	NAH	CSS
<i>Vicia ludoviciana</i> var. <i>ludoviciana</i>	Southern Slender Vetch	NAH	CSS
<b>FAGACEAE</b>	<b>OAK FAMILY</b>		
<i>Quercus agrifolia</i> var. <i>agrifolia</i>	Coast Live Oak	NPT	OW
<i>Quercus berberidifolia</i>	Scrub Oak	NPT	CSS, OW
<b>GERANIACEAE</b>	<b>GERANIUM FAMILY</b>		
<i>Erodium botrys</i> *	Long-Beaked Filaree	EAH	Gr, CSS
<i>Erodium cicutarium</i> *	Red-Stemmed Filaree	EAH	Gr, CSS
<i>Erodium moschatum</i> *	White-Stemmed Filaree	EAH	Gr, CSS
<i>Geranium carolinianum</i>	Carolina Geranium	NAH	CSS, OW
<b>HYDROPHYLLACEAE</b>	<b>WATERLEAF FAMILY</b>		
<i>Emmenanthe penduliflora</i> var. <i>penduliflora</i>	Whispering Bells	NAH	OW
<i>Eucrypta chrysanthemifolia</i>	Common Eucrypta	NAH	CSS
<i>Phacelia distans</i>	Common Phacelia	NAH	CSS
<i>Phacelia parryi</i>	Parry's Phacelia	NAH	CSS
<i>Phacelia ramosissima</i> var. <i>latifolia</i>	Branching Phacelia	NAH	CSS
<b>LAMIACEAE</b>	<b>MINT FAMILY</b>		
<i>Marrubium vulgare</i> *	Common Horehound	EPH	Gr, OW

SCIENTIFIC NAME	COMMON NAME	FORM	HABITAT
<i>Salvia apiana</i>	White Sage	NPS	CSS
<i>Salvia columbariae</i>	Chia	NAH	CSS
<i>Salvia mellifera</i>	Black Sage	NPH	CSS
<i>Stachys ajugoides</i> var. <i>rigida</i>	Rigid Hedge-Nettle	NPH	Gr
<i>Trichostema lanceolatum</i>	Vinegar Weed	NAH	Gr
<b>MALVACEAE</b>	<b>MALLOW FAMILY</b>		
<i>Malva parviflora</i> *	Cheeseweed	EAH	Gr
<b>MYRSINACEAE</b>	<b>MYRSINE FAMILY</b>		
<i>Anagallis arvensis</i> *	Scarlet Pimpernel	EAH	CSS, Gr
<b>NYCTAGINACEAE</b>	<b>FOUR O'CLOCK FAMILY</b>		
<i>Mirabilis californica</i>	California Wishbone Bush	NPH	CSS
<b>ONAGRACEAE</b>	<b>EVENING PRIMROSE FAMILY</b>		
<i>Camissonia californica</i>	Mustard-Like Evening Primrose	NAH	CSS
<i>Camissonia hirtella</i>	Field Sun Cup	NAH	CSS
<i>Camissonia</i> sp.	Primrose	NAH	CSS
<i>Epilobium canum</i> subsp. <i>canum</i>	Narrow-Leaved Fuchsia	NPH	OW
<i>Epilobium ciliatum</i> subsp. <i>ciliatum</i>	Green Willow-Herb	NPH	CSS
<b>OXALIDACEAE</b>	<b>WOOD-SORREL FAMILY</b>		
<i>Oxalis albicans</i> subsp. <i>californica</i>	California Wood-Sorrel	NPH	CSS
<b>PAEONIACEAE</b>	<b>PEONY FAMILY</b>		
<i>Paeonia californica</i>	California Peony	NPH	CSS
<b>PAPAVERACEAE</b>	<b>POPPY FAMILY</b>		
<i>Romneya coulteri</i> <sup>+</sup>	Coulter's Matilija Poppy	NPH	CSS
<b>PLATANACEAE</b>	<b>SYCAMORE FAMILY</b>		
<i>Platanus racemosa</i>	Western Sycamore	NPT	OW
<b>POLEMONIACEAE</b>	<b>PHLOX FAMILY</b>		
<i>Gilia angelensis</i> cf.	Los Angeles Gilia	NAH	Gr, CSS
<i>Linanthus dianthiflorus</i>	Ground-Pink	NAH	CSS
<i>Linanthus parviflorus</i>	Coast Baby-Star	NAH	CSS
<b>POLYGONACEAE</b>	<b>BUCKWHEAT FAMILY</b>		
<i>Chorizanthe staticoides</i>	Turkish Rugging	NAH	CSS
<i>Chorizanthe</i> sp.	Spineflower	NAH	CSS
<i>Eriogonum fasciculatum</i> var. <i>fasciculatum</i>	California Buckwheat	NPS	CSS
<i>Polygonum arenastrum</i> *	Common Knotweed	EAPH	Gr
<i>Pterostegia drymarioides</i>	Pterostegia or Granny's Hairnet	NAH(V)	CSS
<i>Rumex crispus</i> *	Curly Dock	EPH	Gr
<b>PORTULACACEAE</b>	<b>PURSLANE FAMILY</b>		
<i>Calandrinia ciliata</i>	Red Maids	NAH	CSS
<i>Claytonia perfoliata</i> subsp. <i>perfoliata</i>	Common Miner's-Lettuce	NAH	CSS, OW
<b>RANUNCULACEAE</b>	<b>CROWFOOT FAMILY</b>		
<i>Clematis lasiantha</i>	Pipestem Virgin's Bower	NPHV	CSS, OW
<i>Delphinium parryi</i> subsp. <i>parryi</i>	Parry's Larkspur	NPH	OW, Gr
<b>RHAMNACEAE</b>	<b>BUCKTHORN FAMILY</b>		
<i>Rhamnus californica</i> subsp. <i>californica</i>	California Coffeeberry	NPS	CSS, OW

SCIENTIFIC NAME	COMMON NAME	FORM	HABITAT
<i>Rhamnus ilicifolia</i>	Holly-Leaved Redberry	NPS	CSS, OW
<b>ROSACEAE</b>	<b>ROSE FAMILY</b>		
<i>Heteromeles arbutifolia</i>	Toyon or Christmas Berry	NPS	CSS
<i>Potentilla glandulosa</i> subsp. <i>glandulosa</i>	Sticky Cinquefoil	NPH	CSS
<b>RUBIACEAE</b>	<b>MADDER FAMILY</b>		
<i>Galium angustifolium</i> subsp. <i>angustifolium</i>	Chaparral Bedstraw	NPH	CSS
<i>Galium aparine</i>	Common Bedstraw	NAH	CSS, OW
<i>Galium nuttallii</i> subsp. <i>nuttallii</i>	San Diego Bedstraw	NPH	Gr, CSS
<b>SALICACEAE</b>	<b>WILLOW FAMILY</b>		
<i>Salix lasiolepis</i>	Arroyo Willow	NPS	WS
<b>SCROPHULARIACEAE</b>	<b>FIGWORT FAMILY</b>		
<i>Antirrhinum nuttallianum</i> subsp. <i>nuttallianum</i>	Nuttall's Snapdragon	NAH	CSS
<i>Castilleja exserta</i> subsp. <i>exserta</i>	Owl's Clover	NAH	Gr, CSS
<i>Collinsia heterophylla</i>	Purple Chinese Houses	NAH	CSS
<i>Keckiella cordifolia</i>	Heart-Leaved Bush-Penstemon	NPS	CSS
<i>Kickxia elatine</i> *	Sharp-Leaved Fluellin	EPH	Gr
<i>Linaria canadensis</i>	Larger Blue Toad-Flax	NAPH	Gr, CSS
<i>Mimulus aurantiacus</i>	Bush Monkey-Flower	NPS	CSS
<i>Mimulus brevipes</i>	Slope Semaphore	NAH	CSS
<b>SOLANACEAE</b>	<b>NIGHTSHADE FAMILY</b>		
<i>Datura wrightii</i>	Jimsonweed	NPH	Gr, OW
<i>Nicotiana glauca</i> *	Tree Tobacco	EPST	CSS
<i>Solanum douglasii</i>	Douglas' Nightshade	NPH	CSS, OW
<i>Solanum rostratum</i> *	Buffalo-Bur	EAH	Gr
<b>URTICACEAE</b>	<b>NETTLE FAMILY</b>		
<i>Parietaria hespera</i> var. <i>californica</i> cf.	California Pellitory	NAH	CSS
<i>Urtica dioica</i> subsp. <i>holosericea</i>	Hoary Nettle	NPH	CSS
<b>VERBENACEAE</b>	<b>VERVAIN FAMILY</b>		
<i>Verbena lasiostachys</i> var. <i>scabrida</i>	Robust Vervain	NPH	CSS
<b>VIOLACEAE</b>	<b>VIOLET FAMILY</b>		
<i>Viola pedunculata</i>	Johnny Jump-Ups	NPH	CSS
<b>ANGIOSPERMS - MONOCOTYLENDONES</b>	<b>MONOCOTS</b>		
<b>CYPERACEAE</b>	<b>SEDGE FAMILY</b>		
<i>Eleocharis</i> sp.	Spikerush	NPH	Gr
<b>IRIDACEAE</b>	<b>IRIS FAMILY</b>		
<i>Sisyrinchium bellum</i>	California Blue-Eyed Grass	NPH	Gr
<b>JUNCACEAE</b>	<b>RUSH FAMILY</b>		
<i>Juncus bufonius</i> var. <i>bufonius</i>	Common Toad-Rush	NAH	OW, MS
<i>Juncus rugulosus</i>	Wrinkled Rush	NPH	Gr, MS
<b>LILIACEAE</b>	<b>LILY FAMILY</b>		
<i>Bloomeria crocea</i>	Common Goldenstar	NPH	Gr, CSS
<i>Calochortus catalinae</i> <sup>+</sup>	Catalina Mariposa Lily	NPH	Gr, CSS
<i>Calochortus splendens</i>	Splendid Mariposa Lily	NPH	Gr, CSS
<i>Calochortus weedii</i> var. <i>intermedius</i> <sup>+</sup>	Intermediate Mariposa Lily	NPH	CSS

SCIENTIFIC NAME	COMMON NAME	FORM	HABITAT
<i>Chlorogalum pomeridianum</i> var. <i>pomeridianum</i>	Wavy-Leaved Soap Plant	NPH	CSS
<i>Fritillaria biflora</i> var. <i>biflora</i> <sup>+</sup>	California Chocolate Lily	NPH	CSS, Gr
<i>Yucca whipplei</i>	Our Lord's Candle	NPS	CSS
<b>POACEAE</b>	<b>GRASS FAMILY</b>		
<i>Achnatherum coronatum</i>	Giant Needlegrass	NPH(G)	CSS
<i>Agrostis pallens</i>	Leaf or San Diego Bentgrass	NPH(G)	CSS
<i>Aristida</i> sp.	Three Awned Grass	NAPH(G)	CSS
<i>Avena barbata</i> *	Slender Wild Oat	EAPH(G)	Gr, CSS
<i>Avena fatua</i> *	Wild Oat	EAH(G)	Gr, CSS
<i>Bothriochloa barbinodis</i>	Silver Beardgrass	NPH(G)	CSS
<i>Brachypodium distachyon</i> *	Purple False Brome	EAPH(G)	Gr
<i>Bromus carinatus</i> var. <i>carinatus</i>	Smooth Brome Grass	NAH(G)	Gr, OW
<i>Bromus diandrus</i> *	Common Ripgut Grass	EAH(G)	Gr, OW
<i>Bromus hordeaceus</i> *	Soft Chess	EAH(G)	Gr, CSS
<i>Bromus madritensis</i> subsp. <i>rubens</i> *	Foxtail Chess or Red Brome	EAH(G)	Gr, CSS
<i>Cortaderia selloana</i> *	Sellow's Pampas Grass	EPH(G)	CSS
<i>Cynodon dactylon</i> *	Bermuda Grass	EPH(G)	OW, Gr
<i>Ehrharta calycina</i> *	Veldtgrass	EPH(G)	CSS
<i>Festuca arundinacea</i> *	Reed Fescue	EPH(G)	CSS
<i>Gastridium ventricosum</i> *	Nitgrass	EAH(G)	Gr, CSS
<i>Hordeum murinum</i> subsp. <i>glaucum</i> *	Glaucous Barley	EAH(G)	Gr
<i>Hordeum vulgare</i> *	Cultivated Barley	EAH(G)	Gr
<i>Koeleria macrantha</i>	Junegrass	NPH(G)	CSS
<i>Lamarckia aurea</i> *	Goldentop	EAH(G)	Gr
<i>Leymus condensatus</i>	Giant Wild-Rye	NPH(G)	CSS
<i>Lolium multiflorum</i> *	Italian Ryegrass	EAH(G)	Gr
<i>Lolium temulentum</i> *	Darnel	EAH(G)	Gr
<i>Melica imperfecta</i>	Small-Flowered Melic Grass	NPH(G)	CSS
<i>Muhlenbergia microsperma</i>	Littleseed Muhly	NAH(G)	CSS
<i>Nassella lepida</i>	Foothill Needlegrass	NPH(G)	CSS
<i>Nassella pulchra</i>	Purple Needlegrass	NPH(G)	CSS, Gr
<i>Phalaris aquatica</i> *	Harding Grass	EPH(G)	CSS
<i>Piptatherum miliaceum</i> *	Smilo Grass or Millett Ricegrass	EPH(G)	OW
<i>Poa secunda</i> subsp. <i>secunda</i>	Malpais Bluegrass	NPH(G)	Gr
<i>Schismus barbatus</i> * <sup>#</sup>	Mediterranean Schismus	EAH(G)	Gr, CSS
<i>Vulpia myuros</i> var. <i>hirsuta</i> *	Foxtail Fescue	EAH(G)	Gr
<b>KEY:</b> Asterisk (*) = non-native species; <sup>+</sup> = sensitive species, (#) = new record for the study area; Sources: Taxonomy - Hickman (1993), <a href="http://ucjeps.berkeley.edu/interchange.html">http://ucjeps.berkeley.edu/interchange.html</a> , November 2005; Common names and non-native species designations according to Roberts (1998), then Hickman (1993); Definitions of Habitats: CSS = Coastal Sage Scrub, OW = Oak Woodland, Gr = Grassland, MS = Mulefat Scrub, WS = Willow Scrub; Definitions of Forms: N = Native, E = Exotic, P = Perennial, B = Biennial, A = Annual, G = Grass, H = Herb, V = Vine, F = Fern, S = Shrub, T = Tree, P = Parasitic.			

### 5.3 Appendix C: State and Federal Rare Plant Categories and California Native Plant Society Categories

#### *Federal and State Rare Plant Status Categories*

##### **FEDERAL**

FE = Federally-listed, endangered  
FT = Federally-listed threatened  
FPE = Federally-proposed, endangered  
FPT = Federally-proposed, threatened  
FSC = Federal Special Concern Species

##### **STATE**

SE = State-listed, endangered  
ST = State-listed, threatened  
SR = State-listed, rare  
SCE = State candidate for listing, endangered  
SCT = State candidate for listing, threatened

#### *California Native Plant Society (CNPS) Status*

CNPS Status based on California Native Plant Society's Inventory of Rare and Endangered Vascular Plants of California (CNPS 2006, Skinner and Pavilk 1994).

##### **List 1A: Plants Presumed Extinct in California**

The plants of List 1A are presumed extinct because they have not been seen or collected in the wild for many years. Although most of them are restricted to California, a few are found in other states as well. There is a difference between "extinct" and "extirpated." A plant is extirpated if it has been locally eliminated. It may be doing quite nicely elsewhere in its range. All of the plants constituting List 1A meet the definitions of Sec. 1901, Chapter 10 (Native Plant Protection) of the California Department of Fish and Game Code and are eligible for state listing.

##### **List 1B: Plants Rare, Threatened or Endangered in California and Elsewhere**

The plants of List 1B are rare throughout their range. All but a few are endemic to California. All of them are judged to be vulnerable under present circumstances or to have a high potential for becoming so because of their limited or vulnerable habitat, their low numbers of individuals per population (even though they may be wide ranging), or their limited number of populations. All of the plants constituting List 1B meet the definitions of Sec. 1901, Chapter 10 (Native Plant Protection) of the California Department of Fish and Game Code and are eligible for state listing.

##### **List 2: Plants Rare, Threatened or Endangered in California, But More Common Elsewhere**

Except for being common beyond the boundaries of California, the plants of List 2 would have appeared on List 1B. Based on the "Native Plant Protection Act," plants are considered without regard to their distribution outside the state. All of the plants constituting List 2 meet the definitions of Sec. 1901, Chapter 10 (Native Plant Protection) of the California Department of Fish and Game Code and are eligible for state listing.

##### **List 3: Plants About Which We Need More Information—A Review List**

The plants that comprise List 3 are an assemblage of taxa that have been transferred from other lists or that have been suggested for consideration. The necessary information that would assign most to a sensitivity category is missing.

**List 4: Plants of Limited Distribution—A Watch List**

The plants in this category are of limited distribution in California and their vulnerability or susceptibility to threat appears low at this time. While these plants cannot be called "rare" from a statewide perspective, they are uncommon enough that their status should be monitored regularly. Many of them may be significant locally. Should the degree of endangerment or rarity of a plant change, they will be transferred to a more appropriate list.

**New Threat Code extensions and their meanings:**

- .1 - Seriously endangered in California (over 80% of occurrences threatened / high degree and immediacy of threat)
- .2 – Fairly endangered in California (20-80% occurrences threatened)
- .3 – Not very endangered in California (<20% of occurrences threatened or no current threats known)

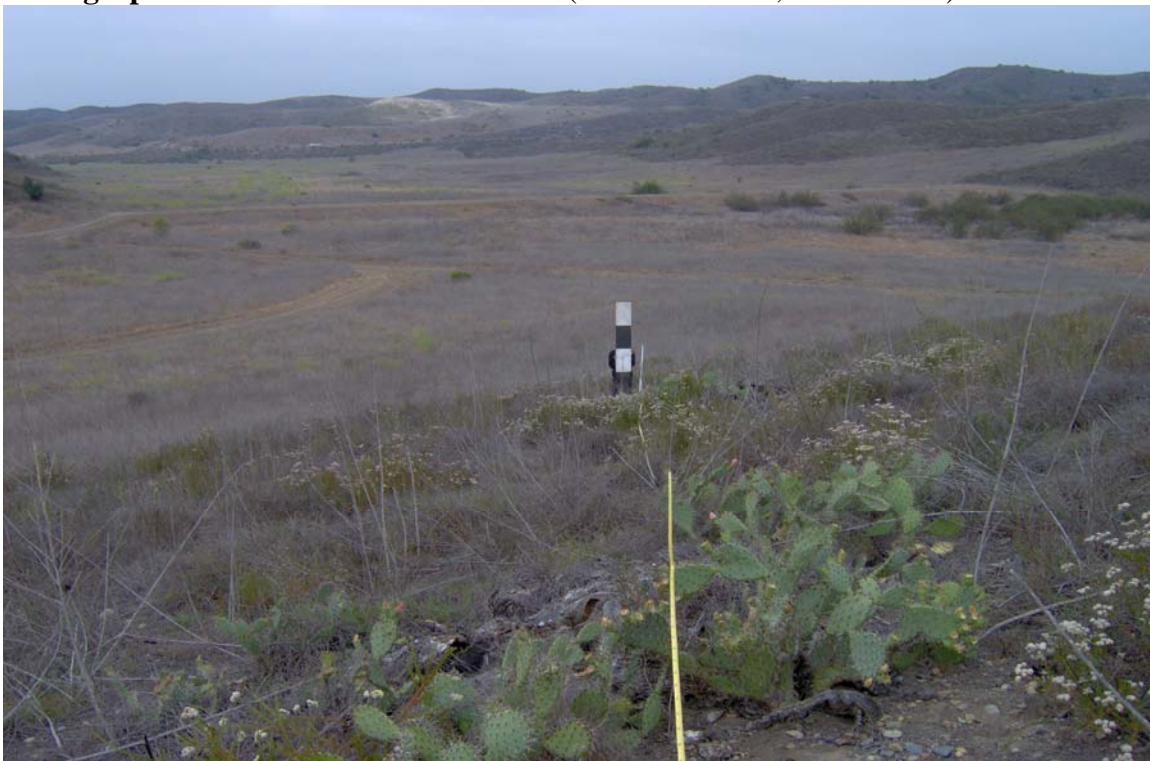
**OTHER**

- LR -Locally rare, Rare in Orange County (Dames & Moore and Bramlet 1994)
- LC - Local concern, Uncommon in Orange County
- UNCOMMON – listed as uncommon by Jepson Manual (Hickman 1993)

#### **5.4 Appendix D: Representative Photographs**



**Photograph 1:** Transect in 2002 burn area (Transect #02b1, 6 June 2007).



**Photograph 2:** Transect in 2002 burn area with live cactus (Transect #02b16, 11 June 2007).



**Photograph 3:** Transect in 2002 burn area (Transect #02b19, 21 June 2007).



**Photograph 4:** Transect in 2002 burn area without live cactus (Transect #02b6, 23 May 2007).



**Photograph 5:** Transect in 2002 burn area with live cactus (Transect #02b3, 23 May 2007).



**Photograph 6:** Transect in 2002 burn area without live cactus (Transect #02b4, 6 June 2007).

**5.5 Appendix E: Wildlife Species Recorded in Chiquita Canyon Conservation Easement, 1997-2007.**

FAMILY/SPECIES NAME	COMMON NAME
<b>AMPHIBIA</b>	<b>AMPHIBIANS</b>
<b>ANURA</b>	<b>FROGS &amp; TOADS</b>
<b>SCAPHIOPODIDAE</b>	<b>SPADEFoot TOADS</b>
<i>Spea hammondi</i> <sup>+</sup>	Western Spadefoot
<b>BUFONIDAE</b>	<b>TRUE TOADS</b>
<i>Bufo boreas</i>	Western Toad
<b>HYLIDAE</b>	<b>TREE FROGS &amp; RELATIVES</b>
<i>Pseudacris regilla</i>	Pacific Chorus Frog
<b>REPTILIA</b>	<b>REPTILES</b>
<b>PHRYNOSOMATIDAE</b>	<b>NORTH AMERICAN SPINY LIZARDS &amp; RELATIVES</b>
<i>Phrynosoma coronatum blainvillei</i>	San Diego Horned Lizard
<i>Sceloporus occidentalis</i>	Western Fence Lizard
<i>Uta stansburiana</i>	Side-Blotched Lizard
<b>SCINCIDAE</b>	<b>SKINKS</b>
<i>Eumeces skiltonianus</i>	Western Skink
<i>Eumeces gilberti</i>	Gilbert's Skink
<b>TEIIDAE</b>	<b>WHIPTAILS &amp; RACERUNNERS</b>
<i>Cnemidophorus tigris</i>	Western Whiptail
<b>ANGUIDAE</b>	<b>ALLIGATOR LIZARDS &amp; RELATIVES</b>
<i>Elgaria multicarinata</i>	Southern Alligator Lizard
<b>COLUBRIDAE</b>	<b>COLUBRIDS (EGG-LAYING SNAKES)</b>
<i>Diadophis punctatus amabilis</i>	Pacific Ring-Necked Snake
<i>Lampropeltis getula californiae</i>	California Kingsnake
<i>Masticophis flagellum piceus</i>	Red Racer
<i>Masticophis lateralis</i>	California Striped Racer
<i>Masticophis taeniatus</i>	Striped Whipsnake
<i>Pituophis catenifer</i>	Gopher Snake
<b>VIPERIDAE</b>	<b>VIPERS &amp; PITVIPERS</b>
<i>Crotalus ruber</i> <sup>+</sup>	Northern Red Diamond Rattlesnake
<b>AVES</b>	<b>BIRDS</b>
<b>ANATIDAE</b>	<b>SWANS, GEESE &amp; DUCKS</b>
<i>Bucephala albeola</i>	Bufflehead
<b>ODONTOPHORIDAE</b>	<b>NEW WORLD QUAIL</b>
<i>Callipepla californica</i>	California Quail
<b>ARDEIDAE</b>	<b>HERONS &amp; BITTERNS</b>
<i>Ardea herodias</i>	Great Blue Heron
<i>Egretta thula</i>	Snowy Egret
<b>CATHARTIDAE</b>	<b>NEW WORLD VULTURES</b>
<i>Cathartes aura</i>	Turkey Vulture
<b>ACCIPITRIDAE</b>	<b>HAWKS, OLD WORLD VULTURES &amp; HARRIERS</b>

FAMILY/SPECIES NAME	COMMON NAME
<i>Pandion haliaetus</i> <sup>+</sup>	Osprey
<i>Accipiter cooperii</i> <sup>+</sup>	Cooper's Hawk
<i>Accipiter striatus</i> <sup>+</sup>	Sharp-Shinned Hawk
<i>Buteo jamaicensis</i>	Red-Tailed Hawk
<i>Buteo lineatus</i>	Red-Shouldered Hawk
<i>Circus cyaneus</i> <sup>+</sup>	Northern Harrier
<i>Elanus leucurus</i> <sup>+</sup>	White-tailed Kite
<b>FALCONIDAE</b>	<b>CARACARAS &amp; FALCONS</b>
<i>Falco sparverius</i>	American Kestrel
<i>Falco peregrinus anatum</i> <sup>+</sup>	American Peregrine Falcon
<b>CHARADRIIDAE</b>	<b>PLOVERS &amp; RELATIVES</b>
<i>Charadrius vociferus</i>	Killdeer
<b>COLUMBIDAE</b>	<b>PIGEONS &amp; DOVES</b>
<i>Columba livia</i>	Rock Pigeon
<i>Zenaida macroura</i>	Mourning Dove
<b>CUCULIDAE</b>	<b>TYPICAL CUCKOOS</b>
<i>Geococcyx californianus</i>	Greater Roadrunner
<b>TYTONIDAE</b>	<b>BARN OWLS</b>
<i>Tyto alba</i>	Barn Owl
<b>STRIGIDAE</b>	<b>TYPICAL OWLS</b>
<i>Bubo virginianus</i>	Great Horned Owl
<b>CAPRIMULGIDAE</b>	<b>GOATSUCKERS</b>
<i>Phalaenoptilus nuttallii</i>	Common Poorwill
<b>APODIDAE</b>	<b>SWIFTS</b>
<i>Chaetura vauxi</i> <sup>+</sup>	Vaux's Swift
<i>Aeronautes saxatalis</i>	White-Throated Swift
<b>TROCHILIDAE</b>	<b>HUMMINGBIRDS</b>
<i>Archilochus alexandri</i>	Black-Chinned Hummingbird
<i>Calypte anna</i>	Anna's Hummingbird
<i>Calypte costae</i> <sup>+</sup>	Costa's Hummingbird
<i>Selasphorus sasin</i> <sup>+</sup>	Allen's Hummingbird
<b>PICIDAE</b>	<b>WOODPECKERS</b>
<i>Melanerpes formicivorus</i>	Acorn Woodpecker
<i>Picoides nuttallii</i> <sup>+</sup>	Nuttall's Woodpecker
<i>Colaptes auratus</i>	Northern Flicker
<b>TYRANNIDAE</b>	<b>TYRANT FLYCATCHERS</b>
<i>Contopus cooperi</i> <sup>+</sup>	Olive-Sided Flycatcher
<i>Contopus sordidulus</i>	Western Wood-Pewee
<i>Empidonax traillii</i> <sup>+</sup>	Willow Flycatcher
<i>Empidonax difficilis</i>	Pacific-Slope Flycatcher
<i>Sayornis nigricans</i>	Black Phoebe
<i>Sayornis saya</i>	Say's Phoebe
<i>Myiarchus cinerascens</i>	Ash-Throated Flycatcher
<i>Tyrannus vociferans</i>	Cassin's Kingbird
<i>Tyrannus verticalis</i>	Western Kingbird

FAMILY/SPECIES NAME	COMMON NAME
<b>LANIIDAE</b>	<b>SHRIKES</b>
<i>Lanius ludovicianus</i> <sup>+</sup>	Loggerhead Shrike
<b>VIREONIDAE</b>	<b>TYPICAL VIREOS</b>
<i>Vireo cassinii</i>	Cassin's Vireo
<i>Vireo huttoni</i>	Hutton's Vireo
<b>CORVIDAE</b>	<b>JAYS, MAGPIES &amp; CROWS</b>
<i>Aphelocoma californica</i>	Western Scrub-Jay
<i>Corvus brachyrhynchos</i>	American Crow
<i>Corvus corax</i>	Common Raven
<b>ALAUDIDAE</b>	<b>LARKS</b>
<i>Eremophila alpestris actia</i> <sup>+</sup>	California Horned Lark
<b>HIRUNDINIDAE</b>	<b>SWALLOWS</b>
<i>Stelgidopteryx serripennis</i>	Northern Rough-Winged Swallow
<i>Petrochelidon pyrrhonota</i>	Cliff Swallow
<i>Hirundo rustica</i>	Barn Swallow
<b>PARIDAE</b>	<b>TRUE TITS</b>
<i>Baeolophus inornatus</i> <sup>+</sup>	Oak Titmouse
<b>AEGITHALIDAE</b>	<b>LONG-TAILED TITS</b>
<i>Psaltiriparus minimus</i>	Bushtit
<b>TROGLODYTIDAE</b>	<b>WRENS</b>
<i>Campylorhynchus brunneicapillus sandiegensis</i> <sup>+</sup>	San Diego Cactus Wren
<i>Thryomanes bewickii</i>	Bewick's Wren
<i>Troglodytes aedon</i>	House Wren
<b>REGULIDAE</b>	<b>KINGLETS</b>
<i>Regulus calendula</i>	Ruby-Crowned Kinglet
<b>SYLVIIDAE</b>	<b>OLD-WORLD WARBLERS &amp; GNATCATCHERS</b>
<i>Poliophtila caerulea</i>	Blue-Gray Gnatcatcher
<i>Poliophtila californica californica</i> <sup>+</sup>	Coastal California Gnatcatcher
<b>TURDIDAE</b>	<b>THRUSHES</b>
<i>Sialia mexicana</i>	Western Bluebird
<i>Catharus guttatus</i>	Hermit Thrush
<b>TIMALIIDAE</b>	<b>BABBLERS</b>
<i>Chamaea fasciata</i>	Wrentit
<b>MIMIDAE</b>	<b>MOCKINGBIRDS &amp; THRASHERS</b>
<i>Mimus polyglottos</i>	Northern Mockingbird
<i>Toxostoma redivivum</i> <sup>+</sup>	California Thrasher
<b>STURNIDAE</b>	<b>STARLINGS &amp; ALLIES</b>
<i>Sturnus vulgaris</i>	European Starling
<b>PTILOGONATIDAE</b>	<b>SILKY-FLYCATCHERS</b>
<i>Phainopepla nitens</i>	Phainopepla
<b>PARULIDAE</b>	<b>WOOD WARBLERS &amp; RELATIVES</b>
<i>Vermivora celata</i>	Orange-Crowned Warbler
<i>Dendroica petechia</i> <sup>+</sup>	Yellow Warbler
<i>Dendroica coronata</i>	Yellow-Rumped Warbler
<i>Oporornis tolmiei</i>	MacGillivray's Warbler

FAMILY/SPECIES NAME	COMMON NAME
<i>Geothlypis trichas</i>	Common Yellowthroat
<i>Wilsonia pusilla</i>	Wilson's Warbler
<b>THRAUPIDAE</b>	<b>TANAGERS &amp; HONEYCREEPERS</b>
<i>Piranga ludoviciana</i>	Western Tanager
<b>EMBERIZIDAE</b>	<b>EMBERIZINES</b>
<i>Pipilo maculatus</i>	Spotted Towhee
<i>Pipilo crissalis</i>	California Towhee
<i>Aimophila ruficeps canescens</i> <sup>+</sup>	Southern California Rufous-Crowned Sparrow
<i>Spizella passerina</i> <sup>+</sup>	Chipping Sparrow
<i>Spizella atrogularis</i> <sup>+</sup>	Black-Chinned Sparrow
<i>Chondestes grammacus</i> <sup>+</sup>	Lark Sparrow
<i>Passerculus sandwichensis</i>	Savannah Sparrow
<i>Ammodramus savannarum</i> <sup>+</sup>	Grasshopper Sparrow
<i>Melospiza melodia</i>	Song Sparrow
<i>Melospiza lincolni</i>	Lincoln's Sparrow
<i>Zonotrichia leucophrys</i>	White-Crowned Sparrow
<i>Zonotrichia atricapilla</i>	Golden-Crowned Sparrow
<b>CARDINALIDAE</b>	<b>CARDINALS, GROSBEAKS &amp; ALLIES</b>
<i>Cardinalis cardinalis</i> <sup>+</sup>	Northern Cardinal
<i>Pheucticus melanocephalus</i>	Black-Headed Grosbeak
<i>Passerina caerulea</i>	Blue Grosbeak
<i>Passerina amoena</i>	Lazuli Bunting
<b>ICTERIDAE</b>	<b>BLACKBIRDS, ORIOLES &amp; ALLIES</b>
<i>Agelaius phoeniceus</i>	Red-Winged Blackbird
<i>Agelaius tricolor</i> <sup>+</sup>	Tricolored Blackbird
<i>Sturnella neglecta</i>	Western Meadowlark
<i>Euphagus cyanocephalus</i>	Brewer's Blackbird
<i>Molothrus ater</i>	Brown-Headed Cowbird
<i>Icterus cucullatus</i>	Hooded Oriole
<i>Icterus bullockii</i>	Bullock's Oriole
<b>FRINGILLIDAE</b>	<b>FRINGILLINE FINCHES</b>
<i>Carpodacus purpureus</i>	Purple Finch
<i>Carpodacus mexicanus</i>	House Finch
<i>Carduelis psaltria</i>	Lesser Goldfinch
<i>Carduelis tristis</i>	American Goldfinch
<b>PASSERIDAE</b>	<b>OLD WORLD SPARROWS</b>
<i>Passer domesticus</i>	House Sparrow
<b>MAMMALIA</b>	<b>MAMMALS</b>
<b>LEPORIDAE</b>	<b>RABBITS &amp; HARES</b>
<i>Sylvilagus audubonii</i>	Desert Cottontail
<i>Lepus californicus</i>	Black-Tailed Jackrabbit
<b>SCIURIDAE</b>	<b>SQUIRRELS, CHIPMUNKS &amp; MARMOTS</b>
<i>Spermophilus beecheyi</i>	California Ground Squirrel
<b>MURIDAE</b>	<b>MICE, RATS &amp; VOLES</b>
<i>Peromyscus maniculatus</i>	Deer Mouse
<i>Neotoma fuscipes</i>	Dusky-Footed Woodrat

FAMILY/SPECIES NAME	COMMON NAME
<i>Microtus californicus</i>	California Vole
<b>CANIDAE</b>	<b>FOXES, WOLVES &amp; RELATIVES</b>
<i>Canis latrans</i>	Coyote
<b>MUSTELIDAE</b>	<b>WEASELS &amp; RELATIVES</b>
<i>Mustela frenata</i>	Long-Tailed Weasel
<i>Taxidea taxus</i> <sup>+</sup>	American Badger
<b>MEPHITIDAE</b>	<b>SKUNKS</b>
<i>Mephitis mephitis</i>	Striped Skunk
<b>FELIDAE</b>	<b>CATS</b>
<i>Puma concolor</i>	Mountain Lion or Puma
<i>Lynx rufus</i>	Bobcat
<b>CERVIDAE</b>	<b>DEER</b>
<i>Odocoileus hemionus</i>	Mule Deer

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