

FINAL REPORT

**CALIFORNIA GNATCATCHER AND
COASTAL CACTUS WREN
MONITORING REPORT FOR
THE SAN JOAQUIN HILLS BURN AREA
1996 - 1998**

Prepared for:

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January, 1999

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Reference: Biological Opinion 1-6-93-F-98R;
San Joaquin Hills Transportation Corridor

Subject: SJHTC California Gnatcatcher and Coastal Cactus Wren Monitoring
Report for the Joaquin Hills Burn Area 1996-1998

Dear Mr. Bartel:

In compliance with condition 11 of the referenced biological opinion, the TCA transmits to USFWS the subject report prepared by Harmsworth Associates.

The TCA is pleased to report a 4-fold increase in gnatcatcher habitat between 1996 and 1998. The 2,810 acres present in 1998 represent 41% of the gnatcatcher habitat present prior to the 1993 fire. The gnatcatcher population has also dramatically increased to 57% of the pre-fire total (73 pairs). If current rates of increase continue the population will exceed the pre-fire total by the year 2000.

The TCA is also happy to report the first successful nesting of gnatcatchers at Coyote Canyon, with 8 young fledged. Three additional pairs bred successfully at the adjacent 18-acre restoration site.

Please note this is the final report to be submitted by TCA on this activity. Per our recent MOU, this activity will be managed by the Nature Reserve of Orange County (NROC) in the future. The TCA appreciates the opportunity to study the recovery of the gnatcatcher in the San Joaquin Hills and extends to USFWS and the NROC best wishes for future studies in this area. Should you have any questions regarding this report, please contact me at (714) 513-3482.

Sincerely,


Laura Coley Eisenberg
Principal of Resource Management

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EXECUTIVE SUMMARY

Harmsworth Associates conducted a three year study (1996-1998) of the California gnatcatcher (*Polioptila californica californica*), the cactus wren (*Campylorhynchus brunneicapillus*) and their habitat in those portions of the San Joaquin Hills that burned in the 1993 Laguna Beach fire. The study was funded by the Transportation Corridor Agencies as part of the mitigation measures for the construction of the San Joaquin Hills Transportation Corridor. Results of the three year study are presented in this report.

All areas of historic coastal sage scrub were observed to be recovering from the effects of the fire by the process of natural revegetation. Over the course of the study “fire following” species decreased in cover, early successional shrubs such as deerweed and bush mallow remained stable but appeared past their peak cover and climax CSS shrubs (California sagebrush, California buckwheat, black sage, monkeyflower, laurel sumac and cactus) increased in cover. Only five years after the fire, the burn area has already returned to a community dominated by climax CSS shrubs.

There were differences in vegetation cover within the burn area. Areas where gnatcatchers were present had the highest cover of climax CSS shrubs and the lowest cover of early successional shrubs throughout the study period. The vegetation in these areas was indistinguishable from climax CSS communities by 1998, five years after the fire.

There was a 4-fold increase in gnatcatcher habitat between 1996 and 1998. The 2,810 acres present in 1998 represents 41% of the gnatcatcher habitat present prior to the fire in 1993. The gnatcatcher population has also increased dramatically, with the current estimate of 73 pairs representing 57% of the pre-fire total. The new birds appear to be a combination of offspring from resident breeding pairs and immigration from surrounding populations. If current rates of increase continue the population will exceed the pre-fire total by the year 2000. However, population growth could be checked by saturation of existing habitat and/or poor weather conditions over the winter.

Gnatcatcher breeding success (expressed as fledglings/pair) was significantly higher in the burn area, ranging from 4.3 to 5.55 fledglings/pair, than in other studies. Low nest failure rates, perhaps due to depressed predator populations in the burn area, appear to be responsible for the high nesting success.

The gnatcatchers in the burn area appeared to be utilizing the best available habitat. The mean cover of climax shrubs in the gnatcatchers sites ranged from 59 to 72.5%, over the course of the study. The chi-squared analysis of gnatcatcher distribution against the habitat classification indicated a strong preference for the habitat with most cover of the four important shrub species. In general it seems that gnatcatchers started utilizing post burn areas when the cover of climax shrubs reached 50-60%.

The population of cactus wrens in the burn area also increased over the course of the study, however, the rate of increase was much slower than for the gnatcatcher. Cactus wrens exclusively used areas with cactus patches and the slow recovery of these plants from the fire may be limiting the population recovery of the wrens. The current wren population is about 22% of the pre-fire total for the burn area. Nesting success for the monitored wren pairs was high, with the mean fledglings/pair ranging from 4.0 to 4.30. All wren nests were located in tall cactus (mean nest substrate height was 1.54 m) even in areas dominated by low growing cactus.

Two pairs of gnatcatchers fledged a total of 8 young at the TCA's revegetation site in Coyote Canyon. These were the first birds fledged at this five year old site. Three additional pairs bred successfully in the restoration sites located there.

It should be noted that this is the last year the TCA will conduct gnatcatcher/cactus wren studies under the terms and conditions of Biological Opinion 1-6-93-F-98R. With the cooperation of the USFWS and CDFG, this obligation is being transferred to The Nature Reserve of Orange County (NROC). Future gnatcatcher/cactus wren studies in the San Joaquin Hills burn area will be incorporated into the NROC management program. The TCA is providing an endowment to NROC for this purpose.

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1.0 INTRODUCTION

1.1 Introduction

During the 1993 Laguna Beach Fire approximately 13,000 acres of natural vegetation in the San Joaquin Hills burned, including 6,800 acres of coastal sage scrub (Bontrager *et al.* 1995a). Only 470 acres of coastal sage scrub within the burn area was unburned or lightly burned in the fire (LSA 1994). Prior to the fire an estimated 127 pairs of California gnatcatchers (*Polioptila californica californica*) and 282 pairs of cactus wrens (*Campylorhynchus brunneicapillus*) occupied the burn area of the San Joaquin Hills (Bontrager *et al.* 1995a, LSA 1994, 1995). The fire resulted in the loss or displacement of many of the resident California gnatcatchers and cactus wrens.

In an attempt to characterize the natural recovery of the burn areas as sensitive bird habitat, the U.S. Fish and Wildlife Service (USFWS) required the Transportation Corridor Agencies (TCA) to monitor the burn sites to detect the natural restoration of the habitat and the return of the gnatcatcher and the cactus wren. This requirement was part of the mitigation measures for the construction of the San Joaquin Hills Transportation Corridor (Term and Condition #11 of the FWS Biological Opinion (1-6-93-F-98R) and Mitigation Measure FWS 17 of the SJHTC Mitigation Monitoring Program. The monitoring program was initiated in 1993. Under the current program, which finishes this year, Harmsworth Associates continues the monitoring efforts on behalf of the TCA, as required in the Biological Opinion. In addition to monitoring the burn areas, the TCA revegetation areas along the Corridor cut and fill slopes and at Coyote Canyon landfill were also surveyed for avifauna.

The objectives of this year's surveys were:

- to conduct quantitative vegetation surveys within the burn area,
- to accurately assess the distribution and abundance of the California gnatcatcher and cactus wren in the burn area of the San Joaquin Hills and in the TCA revegetation areas at Coyote Canyon landfill, the SJHTC cut and fill slopes,
- to monitor gnatcatcher breeding biology, with the aim of determining nesting success, and;
- to monitor cactus wren breeding biology, with the aim of determining nesting success.

This report documents the results of the 1998 surveys and provides a summary of all findings during the three years (1996 through 1998) of the current study.

1.2 Target species biology

The California gnatcatcher is an obligate resident of coastal sage scrub in southern California and northwestern Baja California. This small, non-migratory, insectivorous bird nests and forages in moderately dense stands of coastal sage scrub occurring on arid hillsides, mesas, and in washes. It generally occurs below 250 m in elevation (Atwood and Bolsinger 1992). Coastal sage scrub communities dominated by California sagebrush (*Artemisia californica*), California buckwheat (*Eriogonum fasciculatum*), white sage (*Salvia apiana*), and black sage (*Salvia mellifera*) seem to be preferred by this species. The current population of California gnatcatchers throughout their range is estimated to be between 2,000 and 3,000 pairs (Atwood 1990; Atwood 1992). Loss and fragmentation of suitable habitat due to expanding development have been major factors in the declining numbers of this species in southern California. The California gnatcatcher is currently listed as a Threatened Species by the USFWS (USFWS 1991).

The cactus wren is also an obligate resident of coastal sage scrub but, is further restricted in its distribution to large patches of prickly pear cactus (*Opuntia littoralis* and *O. oricola*) and cholla cactus (*O. prolifera*) within the scrub. The coastal population of cactus wrens are believed to be in decline but, this subspecies currently has no standing on the Endangered Species list primarily due to lack of taxonomic separation from other wren subspecies (Rea and Weaver 1990). However, this species was one of the target species around which the Orange County Natural Community Conservation Planning program was designed. Much of its remaining habitat in Orange County has been protected through this program.

1.3 Study area

The San Joaquin Hills are located in southwestern Orange County, east of Newport Beach and north of Laguna Beach and are traversed by the San Joaquin Hills Transportation Corridor (Figure 1). The area encompasses 25,000 acres of mostly undeveloped land, used primarily for cattle ranching, local, regional and state parks. The landscape is dominated by steep-sided canyons and hillsides, with elevations ranging from sea level along the Pacific shoreline to 1,200 feet in the interior. The climate is typically Mediterranean, with warm dry summers and cool wet winters. Early morning coastal fog frequently cloud the hillsides during Spring. Prior to the 1993 Laguna Beach Fire the San Joaquin Hills were covered by a mosaic of plant communities with chaparral, coastal sage scrub and grassland dominating. Oak woodland, riparian woodland and marshes were also present. Due to the fire many of these communities are no longer present in their climax form, but are present in various stages of recovery.

The study area included all the burned portions of the San Joaquin Hills and the TCA revegetation areas at Coyote Canyon landfill and the SJHTC cut and fill slopes.

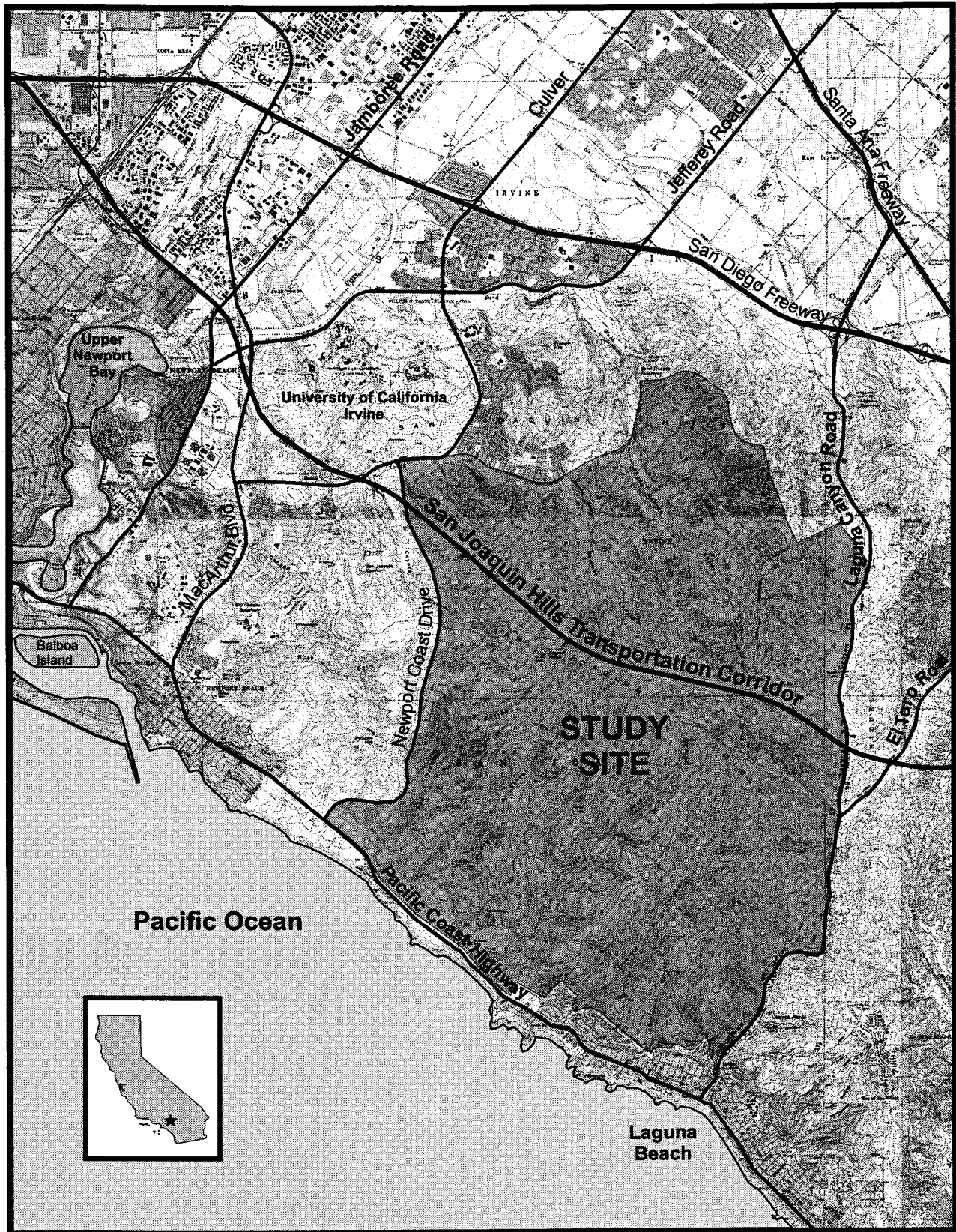


Figure 1
Location of study site for the San Joaquin Hills Transportation Corridor Sensitive Bird Surveys, 1996 through 1998.



2.0 METHODS

2.1 *Vegetation analysis*

Botanical surveys were performed in those areas historically known to support the coastal sage scrub community prior to the fire of 1993, as documented by the Natural Community Conservation Plan (NCCP) of Orange County. No surveys were conducted in those areas known to support other vegetation types prior to the 1993 fire. The aim of the vegetation surveys were to quantitatively evaluate the cover and diversity of the post-burn coastal sage scrub. Botanical surveys were performed annually during the months of April, May and June. In 1998 surveys were conducted between May 18 and June 20. The line-intercept methodology was used to collect data along 25-meter transects. This methodology is the most efficient technique to evaluate shrub-dominated vegetation cover and diversity (Bonham 1989). It is as accurate as traditional quadrats and as statistically robust, but less-time-consuming. A total of 84 transects were used in 1998.

For the purpose of selecting the locations of the transects, the project area was divided into 800 by 800 meter grids. These grids were divided into three categories:

- **good habitat - gnatcatchers present grids**
these were grids containing good gnatcatcher habitat (as qualitatively identified by the ornithologists) with breeding pairs of gnatcatchers present
- **good habitat - gnatcatchers absent grids**
these were grids containing good gnatcatcher habitat (as qualitatively identified by the ornithologists) with breeding pairs of gnatcatchers absent
- **poor habitat - gnatcatchers absent grids**
these were grids containing poor gnatcatcher habitat (as qualitatively identified by the ornithologists) with breeding pairs of gnatcatchers absent.

These were selected to assess the post-fire vegetation succession and gnatcatcher utilization of the area.

Grids to be sampled from each of the three categories were randomly selected using a random number generator. The total number of grids selected in all categories was twenty-eight; nine grids from the good habitat - gnatcatchers present category, nine grids from the good habitat - gnatcatchers absent category, and nine grids from the poor habitat - gnatcatchers absent category. Within each grid, three 25-meter line-intercept transects were performed. The placement of these transects was randomly selected from one corner of the grid (north, south, east or west). Each transect was approximately 100 m from each other. The location of each grid is shown in Figure 2, representative photographs from each grid type are shown in Figures 3, 4 and 5.

Data were collected on the cover for each plant species encountered along the transect, the height of the vegetation along the transect at 2.5 meter intervals, the height of four important coastal sage scrub species California sagebrush (*Artemisia californica*), California sunflower (*Encelia californica*), California buckwheat (*Eriogonum fasciculatum*), and black sage (*Salvia mellifera*), and additional species not on the transect but located nearby (for the floral inventory - see Appendix A). Additional data on aspect of the transect, elevation, slope, soil texture, grazing and a general site description were also noted.

The collected data were analyzed by three grid types. All variation among the grid types are presented as standard error, which incorporates the sample size into the variation assessment. Analyses include:

1. Total cover in meters for each cover type (individual plant species and bare ground, rock substrate, and litter (dead or detrital organic material).
2. Total absolute cover for each cover type.
3. Frequency of occurrence of each cover type in the grid types.
4. Total live absolute cover for each grid type.
5. Determination of the dominant and important species in each grid type. Species/cover types providing at least 25% absolute cover in the grid were classified as **dominant** (Paysen *et al.* 1980). Those species/cover types that provide over 5% cover were classified as **important** in this report to compare with a similar category in "A Manual of California Vegetation" (Sawyer and Keeler-Wolf, 1995).
6. Absolute cover of native vegetation (occurring naturally in an area, not as either a direct or indirect consequence of human activity [Hickmann 1996]), non-native vegetation (occurring in an area as a direct or indirect consequence of human activity), bare areas, rocky areas and litter (dead, detrital vegetation), by grid type.
7. Absolute cover of herbaceous vegetation and shrubby vegetation. Herbs are defined as plants with little or no wood above ground and above ground parts are of less than one year or growing season duration (Hickmann 1996). Herbs can be perennial, but tend to be biennial or annual. Shrubs are defined as woody plants of relatively short maximum height or are much branched from the base (Hickmann 1996).
8. Mean height at 2.5meter intervals along transects for each grid type. The standard error of this measurement indicates the heterogeneity of the community with regards to height.
9. Absolute cover and height in each grid type for four shrub species: California sagebrush, California sunflower, California buckwheat and black sage. These four species have been identified to serve as the substrate for over 85% of gnatcatcher nesting attempts in most studies in southern California (Atwood *et al.* 1995; Bontrager *et al.* 1995b; Galvin 1998). These species are also characteristic of coastal sage scrub associations (O'Leary 1989).

For the aspect analysis, data from all grid types were pooled. Aspects were selected as follows:

NORTH ASPECTS (n = 15) = north of northwest, north and north of northeast
SOUTH ASPECTS (n = 9) = south of southwest, south and south of southeast
WEST ASPECTS (n = 12) = west of southwest, west, and west of northwest
EAST ASPECTS (n= 7) = east of southeast, east and east of northeast

All NW, NE, SE and SW aspects were omitted from the analysis

Statistical analyses were performed between grid types and within grids between years using Tukey's test and ANOVA. Statistical significance was established at the 0.05 level.

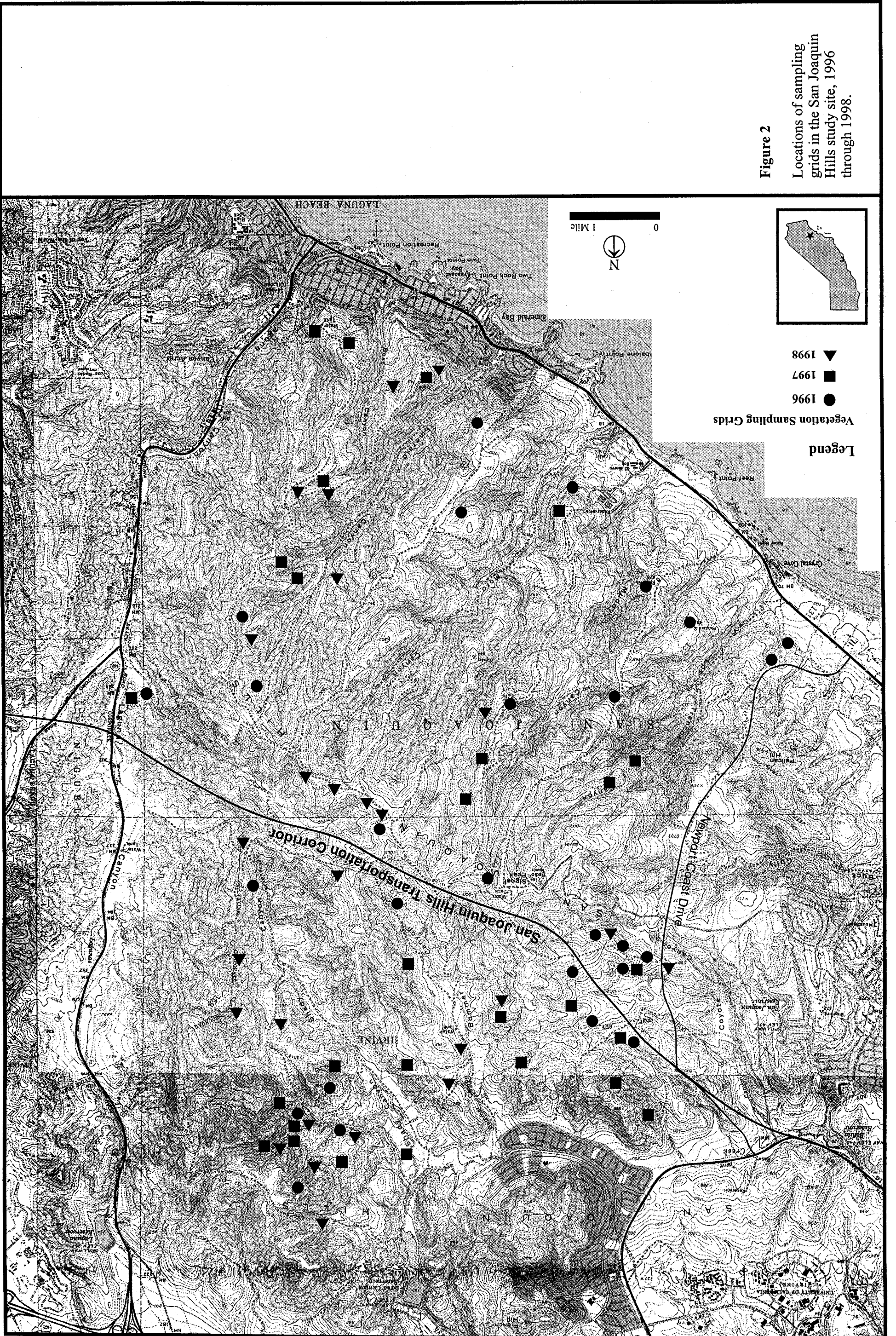


Figure 2
 Locations of sampling
 grids in the San Joaquin
 Hills study site, 1996
 through 1998.

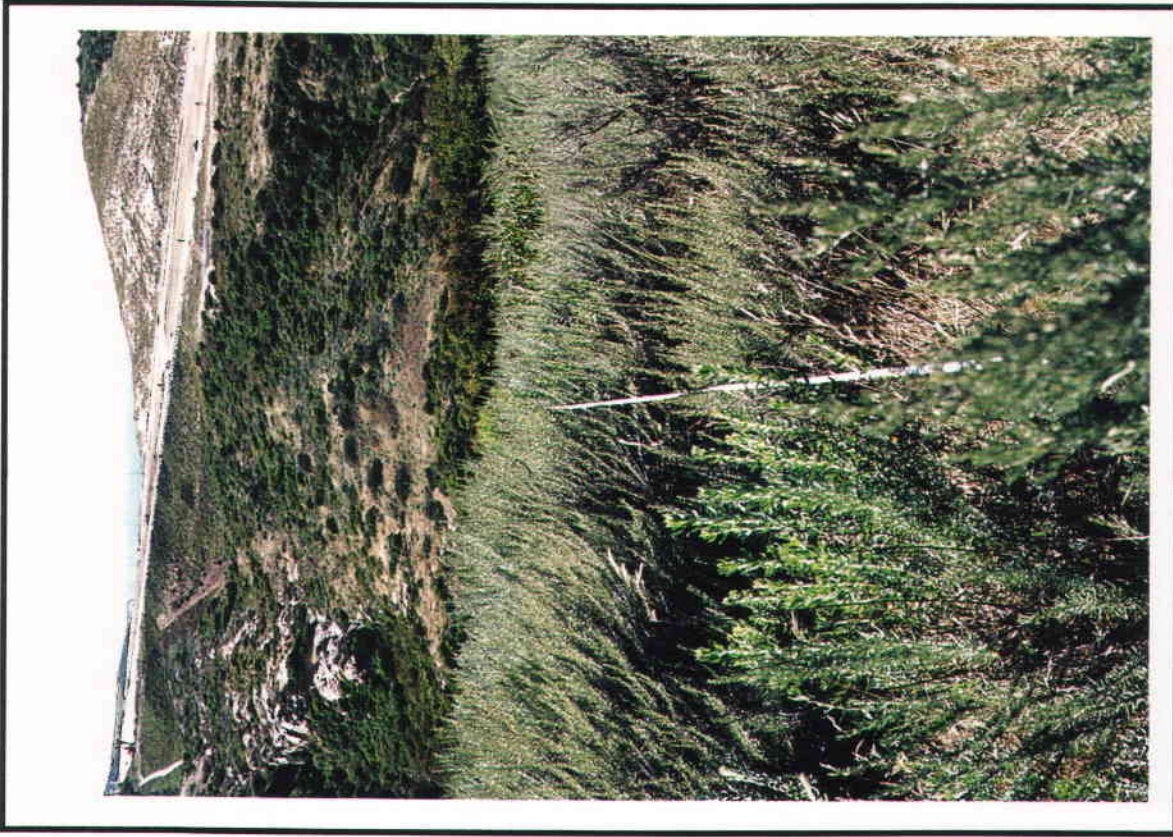


Figure 3: Transects through grids containing good gnatcatcher habitat with breeding pairs of gnatcatchers present.

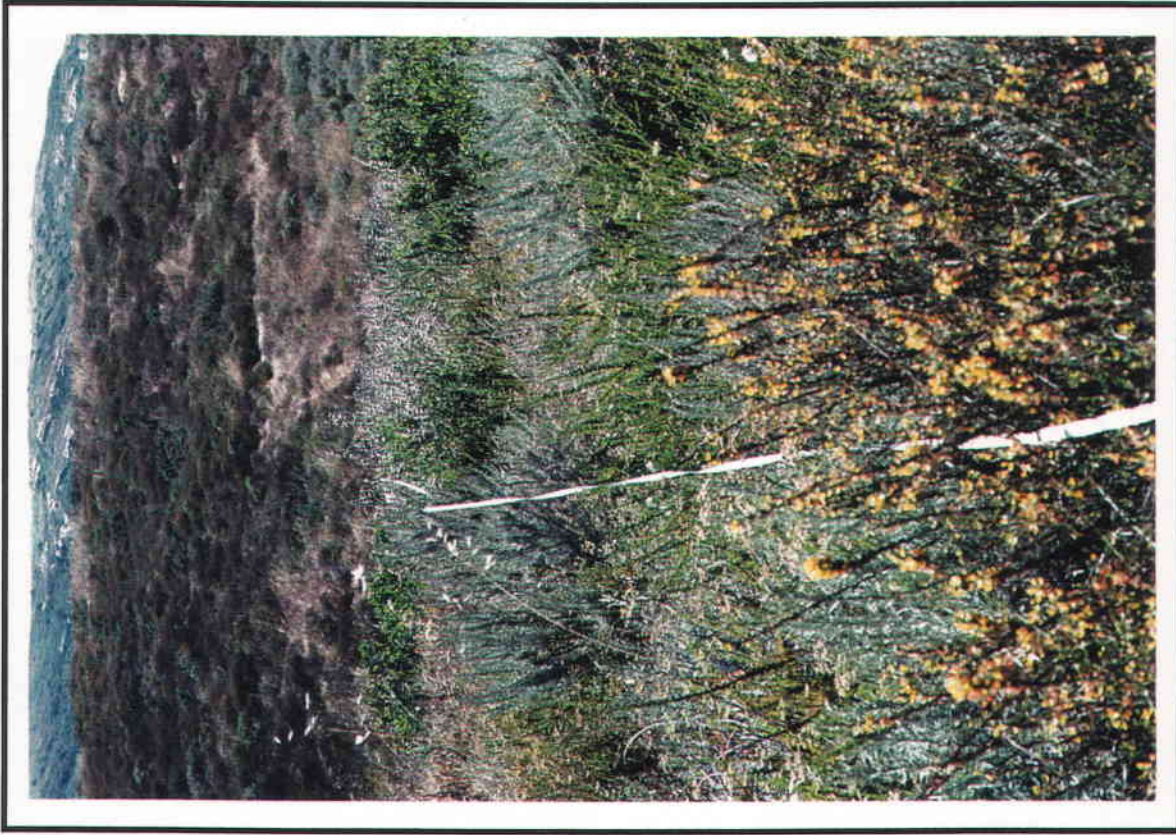


Figure 4: Transects through grids containing good gnatcatcher habitat with breeding pairs of gnatcatchers absent.



Figure 5: Transects through grids containing poor gnatcatcher habitat with breeding pairs of gnatcatchers absent.

2.2 Habitat classification

All potential and suitable gnatcatcher and cactus wren habitat was mapped and quantified in 1996 and 1998. Bi-annual mapping was sufficient to accurately document habitat changes due to the relatively slow rate at which habitat change occurs. At each patch the percentage cover of each of the dominant shrub species was recorded, as was the percentage tree and herb/grass cover. The average canopy height of each of the dominant shrub species was also recorded at each patch. All habitat patches were classified twice, once in relation to gnatcatcher nesting requirements and once in relation to cactus wren nesting requirements (Tables 1 and 2).

Table 1: California gnatcatcher habitat classification categories used for the SJHTC sensitive bird study.

Category	Height	% Cover by CSS Shrubs ¹
G1	> 0.7 m	> 66%
G2	< 0.7 m	> 66%
G3	> 0.7 m	33 - 66%
G4	< 0.7 m	33 - 66%
G5	> 0.7 m	< 33%
G6	< 0.7 m	< 33%

¹ CSS Shrubs used: *Artemisia californica*, *Eriogonum fasciculatum*, *Salvia mellifera*, *Encelia californica*

Table 2: Cactus wren habitat classification categories used for the SJHTC sensitive bird study.

Category	Height	% Cover by Cactus ¹
W1	> 1 m	> 66%
W2	< 1 m	> 66%
W3	> 1 m	33 - 66%
W4	< 1 m	33 - 66%
W5	> 1 m	< 33%
W6	< 1 m	< 33%

¹ Cactus species used: *Opuntia littoralis*, *O. oricola*, *O. prolifera*

2.3 Determination of gnatcatcher and cactus wren distribution and abundance

To determine the distribution and abundance of California gnatcatchers and cactus wrens in the study area, presence/absence surveys were conducted annually at all suitable and potential habitat within the burn area three times between early February and late April. The TCA revegetation areas at Coyote Canyon landfill were also surveyed. The SJHTC cut and fill slopes were surveyed where the vegetation was sufficiently well established to potentially support gnatcatchers or cactus wrens. The methodology used in the surveys followed the guidelines set forth by Mock *et al.* (1990), and by the Southern California Coastal Sage Scrub Scientific Review Panel (Brussard *et al.* 1992). In addition a 7-day interval was maintained between visits to the same area. The surveys were conducted during the morning hours (prior to 12:00 a.m.) and when the temperature exceeded 55°F. No more than 100 acres were surveyed by each biologist per day, and no surveys were conducted during windy (>15 miles per hour), rainy, or extremely hot (>95°F) conditions. Taped vocalizations of gnatcatcher and wren calls were used when necessary (i.e., when pairs could not be located after observing the area for at least 10 minutes) to elicit a response from resident birds, if they were present.

Once birds were located their legs were checked for the presence of bands, when present the unique color combination of the bands were recorded. Biologists followed each bird long enough to determine whether the bird was paired or single. This, and other behavioral information, was recorded at each location. Bird locations were mapped on color aerial photographs and later transferred to 7.5 minute USGS topographic maps.

Harmsworth Associates biologists conducting this study hold current California gnatcatcher survey permits (Permit number PRT-810768).

2.4 Monitoring of gnatcatcher and cactus wren breeding success

Gnatcatcher and cactus wren nest monitoring commenced in mid March and continued until all monitored pairs had completed their nesting cycle (typically late July). During this period each pair was monitored once per week. This monitoring allowed us to collect information on the pairs breeding biology, nesting success, and level of cowbird parasitism. A total of 10 gnatcatcher pairs and 10 cactus wren pairs were monitored in 1998, time constraints prevented us from monitoring all located gnatcatcher and cactus wren pairs. Those that were monitored were selected based on their accessibility and location. An attempt was made to monitor pairs from the different parts of the hills (eg. some coastal, some inland) so that the monitored pairs were representative of the entire population. An additional five pairs at the Coyote Canyon revegetation area were monitored less intensively.

A passive method of surveying the breeding pairs was used, and every effort was made to avoid disturbing the gnatcatchers. Taped vocalizations of the gnatcatcher were only used

when pairs could not be located after observing the area for at least 20 minutes; when taped vocalizations were used, it was only be for a short time period (<5 seconds). During the nest building phase, biologists were extremely careful not to disturb the pairs because this could cause them to abandon their nest. If either bird appeared agitated, the biologists slowly retreated from the pair and returned at a later date. Nests were only checked for eggs if they were easily accessible or could be seen with the use of a mirror. Nests were checked in the afternoon and only when no predators were present and the gnatcatcher's were not agitated. The biologists followed a roundabout path to the nest and checked several decoy bushes before checking the actual nest. A different path leading to and coming from the nest was used, and the creation of a path or scent trail directly to the nest was avoided. All of this prevented the nest location being revealed to predators.

A series of measurements were recorded at each located nest. These measurements were recorded only after the nest was no longer in use, either after successful fledgling of young or after nest failure. Nest height was taken as the distance from the top lip of the nest to bottom of the nest on the outside; inside height as the distance from the top lip of the nest to the bottom of the inside of the nest; nest height above the ground as the distance from the top lip of the nest to the ground directly below; nest width as the distance of the widest part of the nest; distance from nest to nearest open space as the distance from the nest to the nearest area not covered by shrubs, trees or mustard.

2.5 Non target avifauna and other wildlife

During each field survey biologists kept a record of all avian species observed and heard in the study area, and of all other wildlife species encountered.

3.0 RESULTS

3.1 Vegetation results

3.1.1 Floristic diversity

Within the San Joaquin Hills burn area, 209 vascular plant species, representing 50 families, were detected between 1996 and 1998 (Appendix A). This total included species recorded within the transects, as well as casual observations of species detected during the field study. Of the total, 147 species (70.3 percent) were native and the remaining 62 species (28.7 percent) exotic (Table 3). A little under half of the species (100 species, 48.1 percent) belong to five families, namely Asteraceae (42 species: 30 native, 12 exotic), Poaceae (27 species: 12 native, 17 exotic), Fabaceae (17 species: 12 native, 5 exotic), Scrophulariaceae (7 species: 7 native) and Boraginaceae (7 species: 7 native). The percent of native and non-native species are consistent with nearby upland coastal sage scrub and grasslands habitats.

Table 3: Floristic diversity in the San Joaquin Hills burn area and other areas.

Location	Total Number of Species	Natives (%)	Non-Natives (%)	Number of Families
SJH Burn area	209	147 (70.3)	62 (28.7)	50
Chiquita Canyon Conservation Easement ¹	211	155 (73.5)	56 (26.5)	49
Crystal Cove State Park ²	304	210 (69.1)	94 (30.9)	63
UCI Ecological Preserve ³	120	82 (68)	38 (32)	---
Laguna Canyon ⁴	110	87 (79)	23 (21)	---

¹ Harmsworth Associates 1998, ² Unpublished data from Crystal Cove State Park; ^{3,4} Bowler *et al.* (1994)

3.1.2 Sensitive species

Four sensitive species were detected in the San Joaquin Hills burn area between 1996 and 1998 (Figure 6). All four species were observed during the surveys in 1998. Only one of the four, *Calochortus weedii* var. *intermedius*, was observed prior to 1998.

The first sensitive species, Intermediate Mariposa Lily (*Calochortus weedii* var. *intermedius*) is a bulbiferous herb, member of the lily family (Liliaceae). The geophyte is

a federal species of concern (FSC) and CNPS 1B species, indicating that it is rare, threatened or endangered in California and elsewhere. Its distribution is limited to dry rocky open slopes and hills in the coastal ranges and northern Peninsula Ranges in Orange County associated with chaparral, coastal sage scrub, and valley and foothill grassland. In the San Joaquin Hills burn area, approximately 20 individuals were detected on a rocky knoll with *Opuntia littoralis*, *Lotus scoparius* and *Dudleya multicaulis* a ridge east of Upper Shady Canyon along the Irvine Corporation Boundary (Figure 6)

Approximately 50-100 many-stemmed *Dudleya* (*Dudleya multicaulis*), were observed with Intermediate Mariposa Lily. Many-stemmed *Dudleya* is a perennial herb often found on clay soils in chaparral, coastal scrub and valley and foothill grasslands. Populations are known from Los Angeles, Orange, Riverside, San Bernardino and Ventura counties. It is also a federal species of concern (FSC) and CNPS 1B species. The small succulent occurs in thin well-drained soils on slopes and ridge tops in coastal sage scrub, chaparral, and native perennial grasslands. Threats to known populations include development, road construction, grazing and recreation.

The third sensitive species is western dichondra (*Dichondra occidentalis*), a perennial rhizomatous herb that has been found in chaparral, cismontane woodlands, coastal scrub and valley and foothill grasslands. Populations are known from Santa Barbara County south to northern Baja California. It is a CNPS 4 listed species, which means it is on a watch list, and limited in distribution. Within the San Joaquin Hills, approximately seven individuals were located on an east-facing slope in Boat Canyon, in patchy shrubs with *Hemizonia fasciculata*, *Bromus diandrus*, *B. madritensis*, *B. hordeaceus* and *Vulpia myuros* in interspaces in coastal sage scrub. It is often common after fires, in rock outcrops, and under shrubs along coastal bluffs.

Ashy spike moss (*Selaginella cinerascens*), was the fourth sensitive species located in the burn area. Ashy spike-moss is a perennial rhizomatous herb that has been found in chaparral and coastal scrub communities. Populations are known from Orange and San Diego counties, as well as Baja California. This species is not listed by state or federal agencies, but it is recognized by CNPS as a "list 4" species. Approximately 10 large patches of ashy spike moss were detected in a lateral canyon east of Shady Canyon growing on north-facing aspects of large sandstone boulders.

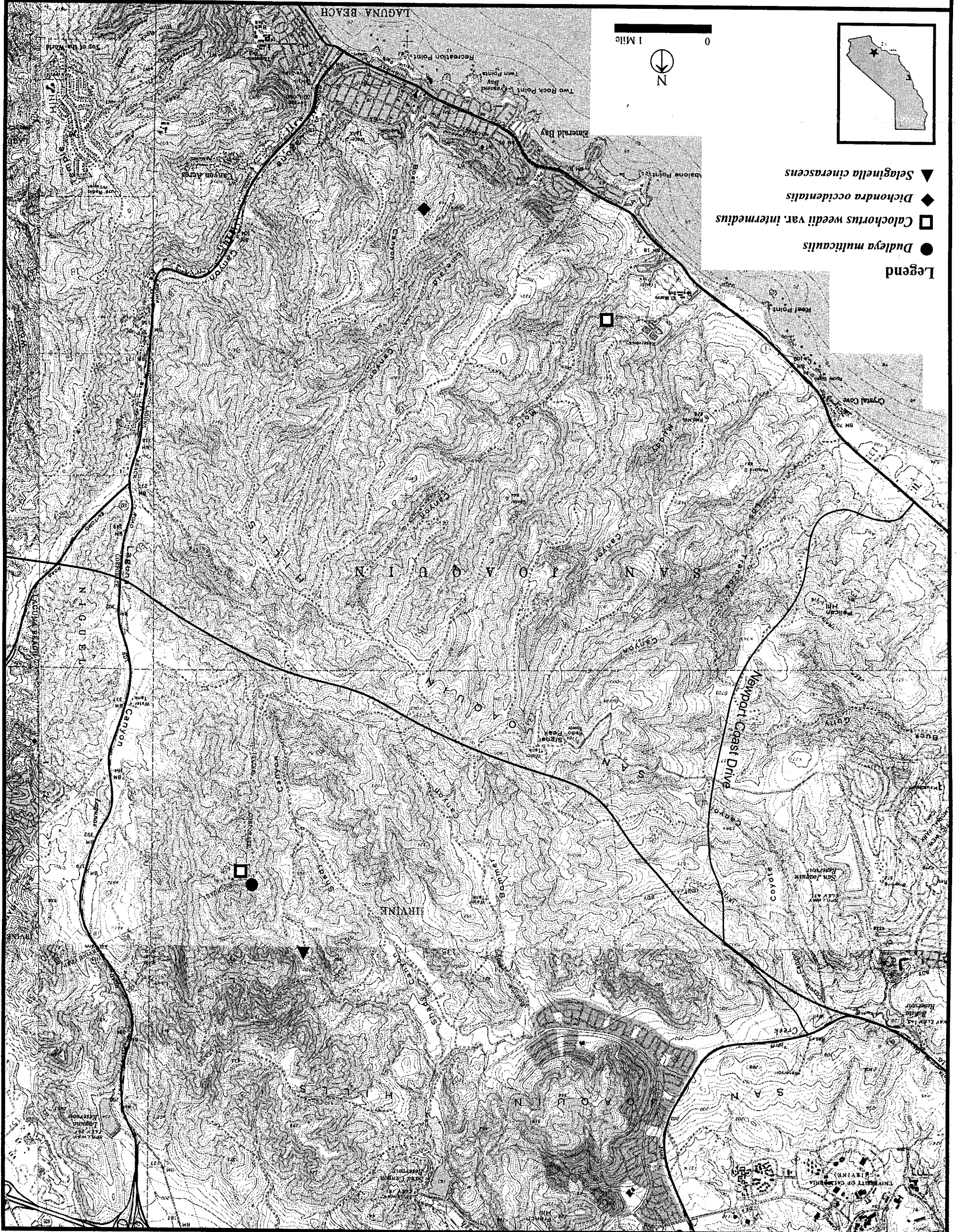


Figure 6
 Locations of sensitive plant species recorded in the San Joaquin Hills burn area, 1996 through 1998.

3.1.3 Total vegetation cover

The total cover of live vegetation increased in each grid type through-out the study period (Figure 7). Differences between years were statistically significant ($F = 16.0, p = 0.05$) but differences between grid types were not significant. The total cover of live vegetation in each grid type in 1998 was similar to other recently burned and climax coastal sage scrub communities (Harmsworth Associates 1998). The majority of cover, in each grid type in each year, was provided by native vegetation (Appendix B, Table B1). The proportion of native vegetation was slightly lower than in other recently burned and climax coastal sage scrub communities (Harmsworth Associates 1998). Number of species recorded per transect increased in each grid type through-out the study period (Appendix B, Table B2).

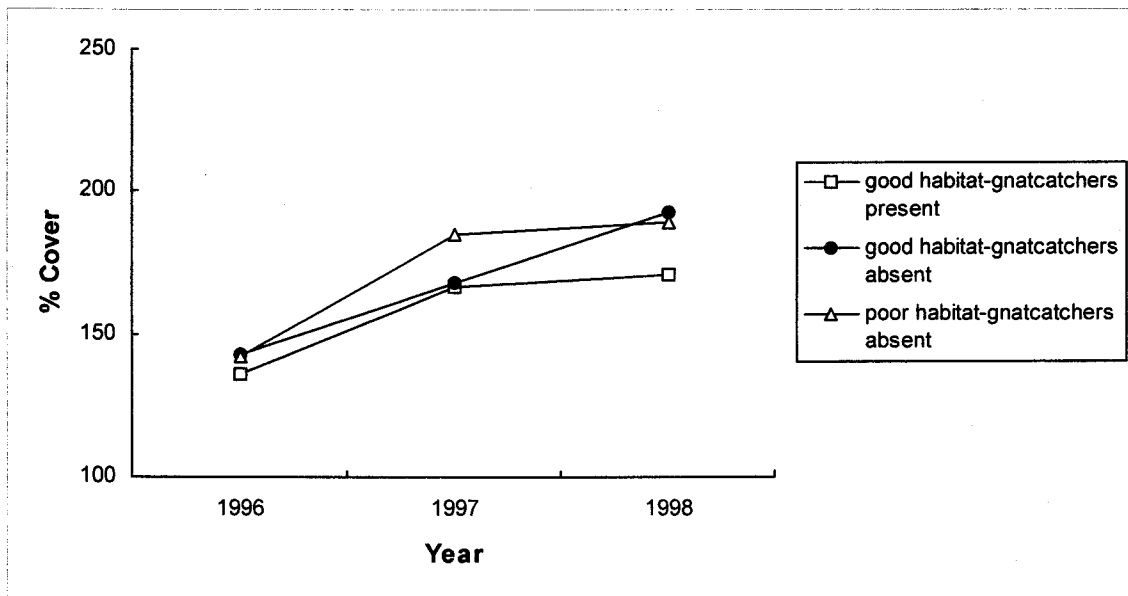


Figure 7: Total cover of live vegetation in each grid type 1996 through 1998. Percent cover exceeds 100 because all vegetation layers are measured and layers frequently overlap.

3.1.4 Dominant species from each grid type

The dominant species, in 1998, were California sagebrush in the good habitat-gnatcatchers present grids and deerweed in the good habitat-gnatcatchers absent and poor habitat-gnatcatchers absent grids (Table 4). These species were also dominant in the same grid types in 1996 and 1997. Non-native grass species were not recorded separately

since they provided the same type of cover: a relatively low (usually < 30 cm), very dense vegetation. Together these non-native annual grasses were the dominant cover type in all grids during each year of the study (Table 4). The non-native annual grasses were primarily composed of red brome (*Bromus madritensis* ssp. *rubens*), Zoro fescue (*Vulpia myuros*), ripgut (*Bromus diandrus*), with occasional occurrences of soft chess (*Bromus hordaceus*), barley (*Hordeum murinum*), false purple brome (*Brachypodium distachyon*) and wild oats (*Avena barbata* and *A. fatua*).

Species providing important cover over the course of the study include, California sagebrush and deerweed in those grids where they were not dominant, California buckwheat (*Eriogonum fasciculatum*) in all grid types, bush monkeyflower (*Mimulus aurantiacus*) and cactus (*Opuntia littoralis*) in the good habitat-gnatcatchers present grids and black sage (*Salvia mellifera*), bush mallow (*Malacothamnus fasciculatus*) and laurel sumac (*Malosma laurina*) in the poor habitat-gnatcatchers absent grids.

These species were also the among the most frequently encountered in each of the grid types (Appendix B, Table B3). Species which occurred frequently in each grid type but which did not provide high percentage cover in 1998 included Nuttall's bedstraw (*Galium nuttalianum*), smooth cat's ear (*Hypochaeris glabrata*) and common catchfly (*Silene gallica*).

Table 4: Percent cover and standard error of dominant and important cover types in each grid type, 1998.

Cover type/ species	good habitat- gnatcatchers present	good habitat- gnatcatchers absent	poor habitat- gnatcatchers absent
> 25% absolute cover	non-native grasses (49.6 ± 11.4) <i>Artemisia californica</i> (32.4 ± 5.7)	non-native grasses (56.4 ± 9.9) <i>Lotus scoparius</i> (29.1 ± 9.5)	non-native grasses (57.4 ± 4.3) <i>Lotus scoparius</i> (34.9 ± 6.3)
≥ 5% absolute cover	<i>Eriogonum fasciculatum</i> (22.2 ± 6.7) <i>Mimulus aurantiacus</i> (7.5 ± 4.5) <i>Hypochaeris glabrata</i> (6.8 ± 3.3) <i>Lotus scoparius</i> (6.2 ± 2.8) <i>Opuntia littoralis</i> (5.9 ± 2.7)	<i>Artemisia californica</i> (24.3 ± 7.2) <i>Eriogonum fasciculatum</i> (14.3 ± 5.1) <i>Nassella pulchra</i> (7.9 ± 3.6) <i>Nassella lepida</i> (5.1 ± 2.7)	<i>Salvia mellifera</i> (19.1 ± 4.6) <i>Eriogonum fasciculatum</i> (14.0 ± 2.7) <i>Malacothamnus fasciculatus</i> (9.7 ± 5.8) <i>Hypochaeris glabrata</i> (8.5 ± 3.6) <i>Malosma laurina</i> (8.8 ± 3.1) <i>Artemisia californica</i> (6.8 ± 3.5) <i>Rhus integrifolia</i> (5.6 ± 1.7)
* dominant species provide >25% cover, important species provide ≥5% cover.			

3.1.5 Vegetation changes 1996 through 1998

Significant vegetation changes have occurred during the course of the study. In 1996, the third year after the fire, climax CSS shrubs formed the dominant cover (all grid types combined), early successional shrubs such as deerweed and bush mallow were also prominent but the fire following species provided low cover (Figure 8). Over the next two years the climax shrubs increased in cover (significant difference between years, $F = 3.25$, $p = 0.05$), deerweed/bush mallow remained stable while the fire followers decreased in cover. By 1998, 5 years after the fire, the pattern of species cover was not dramatically different from climax CSS communities. The fire followers are already past their peak and declining with current cover similar to that found in climax CSS. Deerweed/bush mallow also appear to be past their peak cover and are expected to decline in future years. In fact, deerweed experienced a significant die-back in the winter of 1997 but the senesced plants continued to provide cover during the spring of 1998. Climax shrubs are already the dominant vegetation type and are expected to increase in cover in future years.

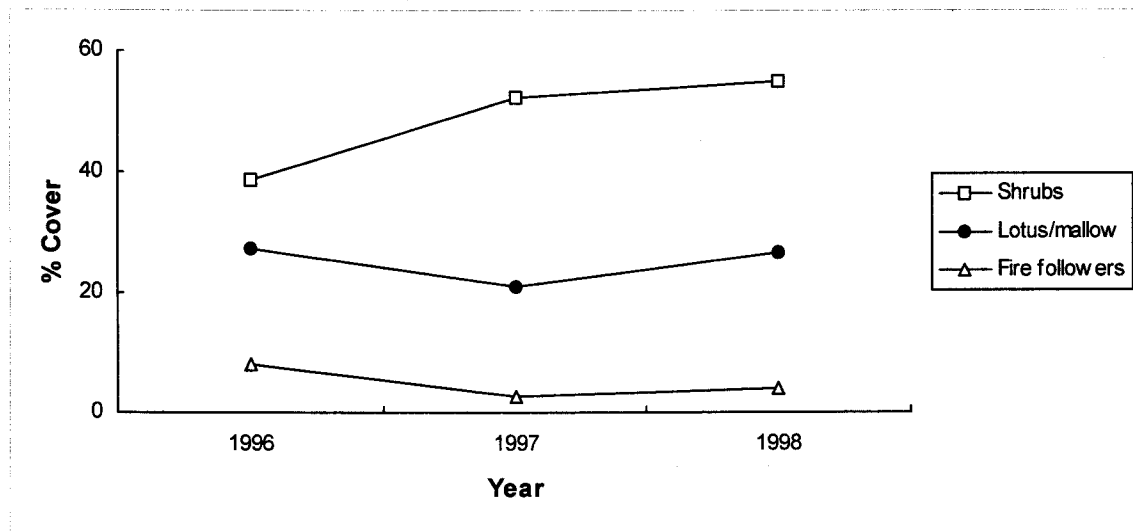


Figure 8: % Cover of typical CSS shrubs, deerweed/bush mallow and typical fire followers in the San Joaquin Hills 1996-1998, data from all grid types combined. See Appendix B, Tables B4 and B5 for species used in each category.

These vegetation changes are also evident within each of the grid types. The cover of the typical CSS shrubs increased in all grid types throughout the study period (Figure 9). The cover of deerweed/bush mallow was unchanged in the two grid types where gnatcatchers were absent (the 1997 dip in cover at good habitat-gnatcatchers absent grids is presumably a sampling artifact) and decreased slightly in the grids with gnatcatchers present (Figure 10).

Differences between grid types were also apparent. The good habitat-gnatcatchers present grids had the highest cover of climax CSS shrubs and the lowest cover of deerweed/bush mallow throughout the study period. The vegetation in these grid types was indistinguishable from climax CSS communities by 1998, 5 years after the fire. Cover of tree-like shrubs (laurel sumac, lemonadeberry, elderberry and toyon) was highest in the poor habitat-gnatcatchers absent grids and lowest in the good habitat-gnatcatchers present grids, throughout the study. Cover of all species from each grid type is presented in Appendix C.

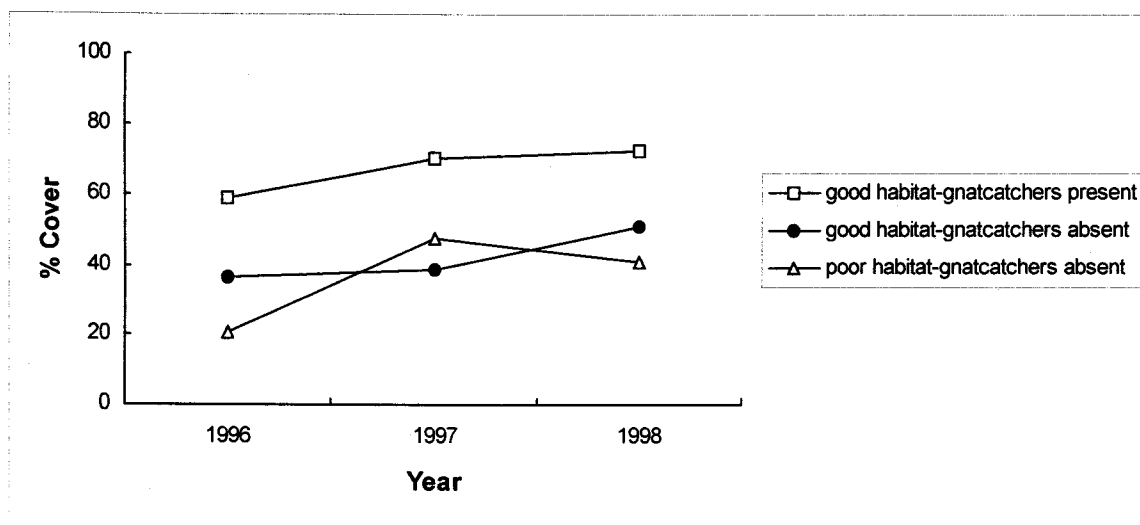


Figure 9: % Cover of typical CSS shrubs from each grid type in the San Joaquin Hills 1996-1998. Species used as follows; California sagebrush, California buckwheat, California sunflower, black sage, white sage, bush monkeyflower and all cactus species.

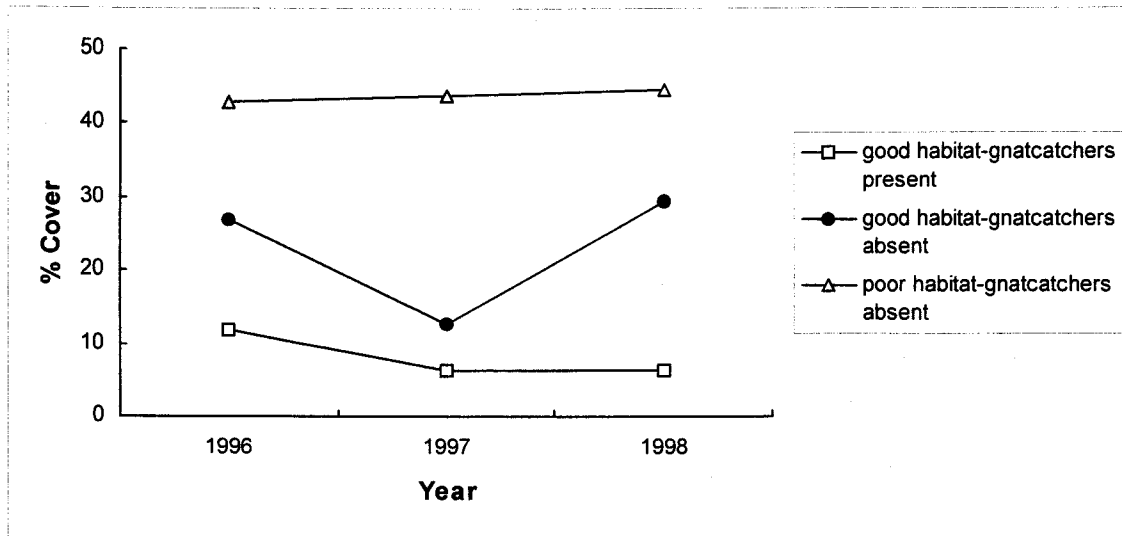


Figure 10: % Cover of deerweed and bush mallow from each grid type in the San Joaquin Hills 1996-1998.

3.1.6 Effects of aspect on vegetation

One environmental factor which has a significant influence the distribution of coastal sage scrub species is aspect. In the coastal ranges of Orange County, south-facing slopes are often dominated by xeric species such as California sagebrush, California buckwheat, California sunflower and cactus. Conversely the north facing aspects, which may also contain some of the representatives from the south-facing slopes, are usually colonized by monkeyflower and several of the more mesic sclerophyllous species such as laura sumac, lemonadeberry and toyon.

Within the San Joaquin Hills burn area, east-facing slopes contained the greatest cover of total vegetation compared to north, south and west exposures, however, the difference was not significant (Table 5). California sagebrush, deerweed, black sage needlegrass were more common on east facing slopes than any other aspects, however, again the differences were not significant. Buckwheat was more common on south facing slopes and cactus did not occur on north-facing slopes, as expected. Sunflower only occurred on north and south facing slopes, however, this may be due to the low number of samples since the species was observed growing on west facing slopes.

Table 5: Absolute percent cover of coastal sage scrub shrubs, native bunchgrasses, non-native grasses and total vegetation in relation to aspect.

Species	Aspect			
	North facing (n = 15)	South facing (n = 9)	West facing (n = 12)	East facing (n = 7)
<i>Artemisia californica</i>	25.8 ± 22.0	14.2 ± 21.2	20.5 ± 24.5	50.8 ± 56.6
<i>Encelia californica</i>	3.5 ± 13.5	3.3 ± 7.0	---	---
<i>Eriogonum fasciculatum</i>	8.7 ± 12.2*	24.1 ± 21.0*	10.2 ± 13.1	17.2 ± 23.6
<i>Lotus scoparius</i>	16.1 ± 24.2	14.8 ± 26.7	27.0 ± 19.8	30.7 ± 31.8
<i>Mimulus aurantiacus</i>	3.9 ± 7.5	1.2 ± 2.1	2.4 ± 5.2	3.0 ± 5.4
<i>Opuntia littoralis</i>	---	2.0 ± 3.8	1.7 ± 5.1	0.8 ± 2.2
<i>Salvia apiana</i>	3.0 ± 10.2	1.5 ± 4.4	0.3 ± 1.2	---
<i>Salvia mellifera</i>	1.7 ± 4.5	9.8 ± 18.1	9.7 ± 23.6	15.9 ± 21.5
<i>Nassella</i> spp.	2.9 ± 9.6	3.4 ± 8.4	3.7 ± 9.4	8.3 ± 18.6
Non-native grasses	78.6 ± 29.0	51.2 ± 40.8	64.3 ± 29.7	65.4 ± 35.4
Total vegetation	196.6 ± 28.2	172.2 ± 39.0	177.6 ± 34.0	211.9 ± 45.3

* difference between north and south facing slopes is significant (F=5, p=0.05)

3.1.7 Vegetation heights

Changes in vegetation height between years were marginal for each grid type and in most cases differences were not statistically significant (Figure 11). In addition, trends were not consistent between years. Vegetation height was lowest for all grid types in 1997. For most years the poor habitat-gnatcatchers absent grids had the highest vegetation. Differences in heights of individual shrub species between grid types were not consistent across years.

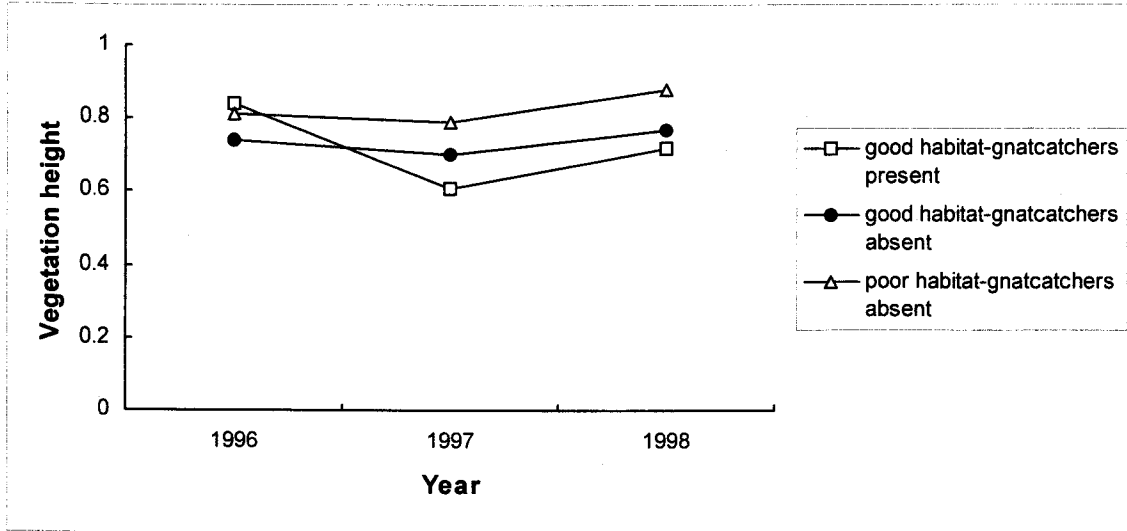


Figure 11: Mean vegetation height (in meters) from each grid type in the San Joaquin Hills 1996-1998.

3.2 Habitat classification

A total of 289 patches of potential or suitable gnatcatcher and/or cactus wren habitat were located within the study area in 1998, almost double the 154 patches recorded in 1996 (Appendix D). These patches had a combined area of 2,810 acres and ranged in size from 0.2 to 149 acres (Tables 6 and 7). This represents an almost 4-fold increase on the 720 acres present in 1996. Patches were frequently clumped together, with most of the good gnatcatcher and cactus wren habitat located in Shady Canyon, Bommer Canyon, Church Canyon, Laidlaw, along Laguna Canyon road, Boat Canyon, Emerald Canyon and Moro Canyon (Figure 12).

The classification of the habitat patches in relation to gnatcatcher nesting requirements revealed that the majority of these patches had greater than 33% cover of the most commonly used nesting substrates for this species (Tables 6). In 1996 the majority of these patches had less than 33% cover, indicating a significant increase in cover for these shrub species over that time. The classification of the habitat patches in relation to cactus wren nesting requirements revealed that the majority of these patches still had low cover from cactus species (Tables 7). This is not unexpected since cactus does not form a dominant cover in coastal sage scrub systems. Cactus occurs frequently in these systems but does not typically cover large areas.

Table 6: Characteristics of habitat patches located in the San Joaquin Hills, 1998, classified in relation to gnatcatcher nesting requirements. Area in acres.

Category*	# of Patches	Total Area	% Area	Mean \pm SD	Range
G1	27	359.3	12.8	13.3 \pm 17.5	0.4-75.3
G2	2	5.7	0.0	2.9 \pm 0.5	2.5-3.2
G3	147	1557.8	55.6	10.7 \pm 15.3	0.4-92.4
G4	7	44.9	1.6	6.4 \pm 7.0	0.5-21.2
G5	89	788.3	28.0	8.9 \pm 19.8	0.2-149.2
G6	14	48.0	1.7	3.4 \pm 3.6	0.6-13.9
TOTAL	285	2810.3	100	9.8 \pm 16.6	0.2-149.2

*Habitat Categories explained in Section 2.2

Figure 12
 Locations of habitat
 patches in the San Joaquin
 Hills study site, 1998.

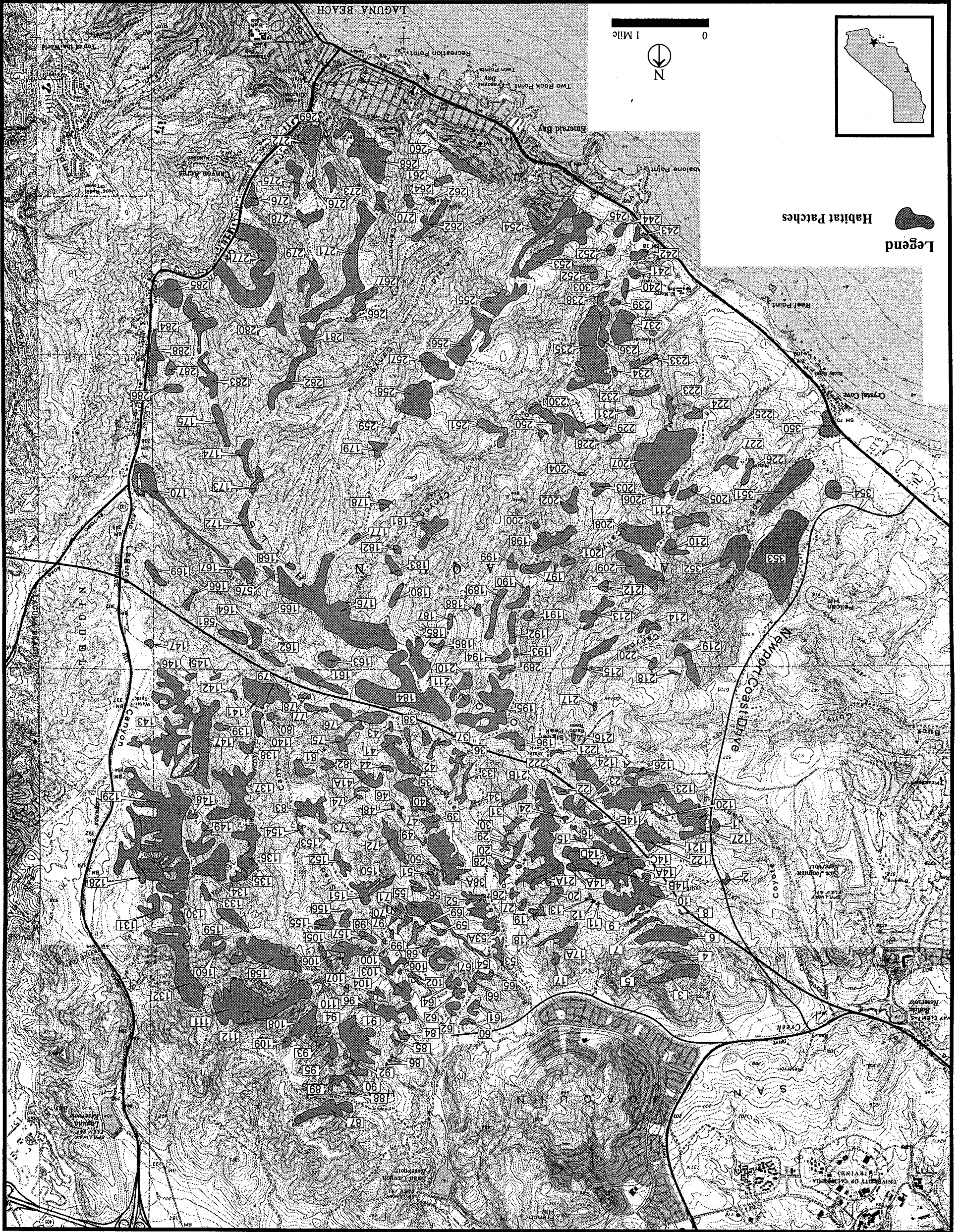


Table 7: Characteristics of habitat patches located in the San Joaquin Hills, 1998, classified in relation to cactus wren nesting requirements. Area in acres.

Category*	# of Patches	Total Area	% Area	Mean ± SD	Range
W1	4	1.3	0.1	0.5 ± 0.2	0.2-0.6±
W2	1	0.1	0.0	0.1	0.1
W3	7	24.5	1.8	3.1 ± 3.1	0.5 ± 7.3
W4	4	12.9	0.9	3.2 ± 3.7	0.9 ± 8.7
W5	98	1117.5	80.3	11.4 ± 16.6	0.4 ± 92.4
W6	35	234.1	16.8	6.7 ± 8.4	0.2 ± 8.6
TOTAL	149	1390.9	100	9.3 ± 14.4	0.2 ± 92.4

*Habitat Categories explained in Section 2.2

3.3 Distribution and abundance of the California gnatcatcher and the cactus wren

California gnatcatchers were recorded at 79 different locations in the burn area in 1998 (Figure 13). Seventy-three of these sightings represented breeding pairs, the remainder were of unpaired adult gnatcatchers. Dispersing juvenile gnatcatchers were recorded at several additional locations. Gnatcatcher breeding pairs were located throughout the hills, with the largest numbers in Shady Canyon, Church Canyon, Moro Canyon and at Laidlaw (Table 8).

The 73 gnatcatcher pairs present in the burn area in 1998 represent a substantial increase on the 27 pairs present in 1997 and continued the increasing trend exhibited since 1995. In fact, the population in the burn area has more than doubled every year since 1995 (Figure 14). These data suggest that the gnatcatcher population in the San Joaquin Hills is recovering rapidly from the effects of the 1993 fire. The current population is still below the pre-fire population but if the current rate of increase is sustained then the population will return to pre-fire levels by the year 2000. However many factors, particularly habitat recovery from the fire, will effect this outcome.

Cactus wrens were recorded at 63 different locations in the burn area in 1998 (Figure 13). Of these sightings, 51 represented breeding pairs, the other twelve sightings were of unpaired adult wrens. Wrens were located throughout the San Joaquin Hills but were most abundant in Shady Canyon, Bommer Canyon and Church Canyon (Table 8).

Cactus wren numbers have also increased annually since 1995 when 39 pairs were present (Figure 15). The cactus wren population appears to be recovering more slowly than the gnatcatcher population, perhaps due to the slower rate of growth of cactus.

Although numbers of wrens has increased consistently since 1995, the current population in the burn area is still less than 25% of the pre-fire population.

Table 8: Location of California gnatcatchers and cactus wrens in the San Joaquin Hills, 1998.

LOCATION	CAGN-PAIR	CAGN-SINGLE	CCWR-PAIR	CCWR-SINGLE
Laidlaw	11	1	0	0
Church Canyon	12	0	10	3
Bommer Canyon	5	1	16	1
Shady Canyon	15	2	14	3
Laguna Canyon	8	1	0	1
Los Trancos Canyon	6*	0	1	2
Muddy Canyon	3*	0	3	1
Moro Canyon	11	1	2	1
Emerald Canyon	1	0	2	0
Boat Canyon	4	0	3	0
TOTAL	76*	6	51	12

* includes 3 birds located in revegetation sites within burn area, 2 in Los Trancos Canyon and 1 in Muddy Canyon.

3.3.1 Banded birds located

A total of 33 banded California gnatcatchers and 7 banded cactus wrens were recorded in the study area between 1996 and 1998 (Appendix E, Table E3). All birds were banded in areas adjacent to the study site, by Dave Bontrager and his assistants. All band combinations were provided to Dave Bontrager to use in his analysis of gnatcatcher movement in the San Joaquin Hills (Atwood *et al.* 1998). The large number of banded gnatcatchers recorded in the study site indicates a high level of movement into the burn area from surrounding mature scrub.

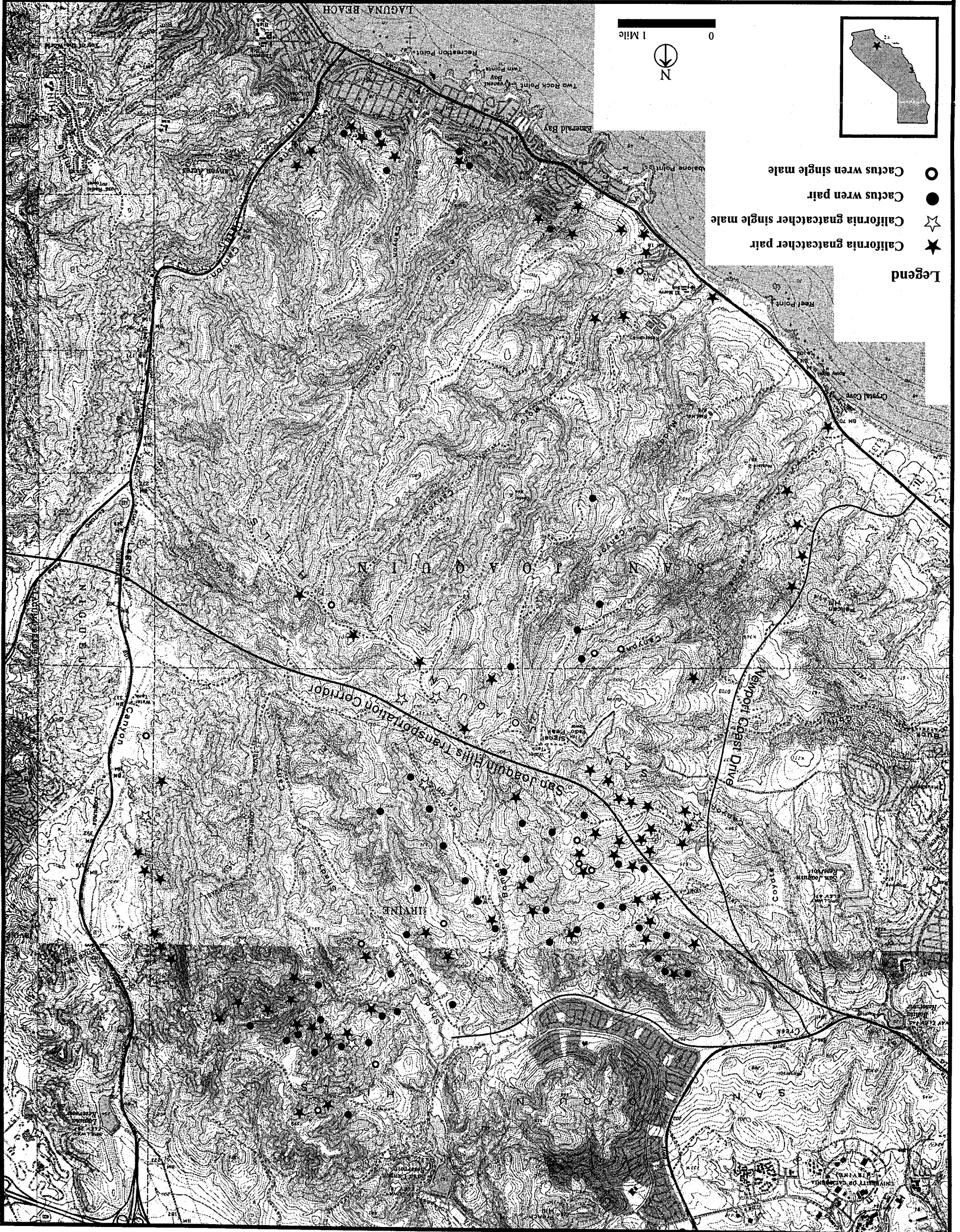


Figure 13
 Locations of California gnatcatchers and cactus wrens in the San Joaquin Hills burn area, 1998.

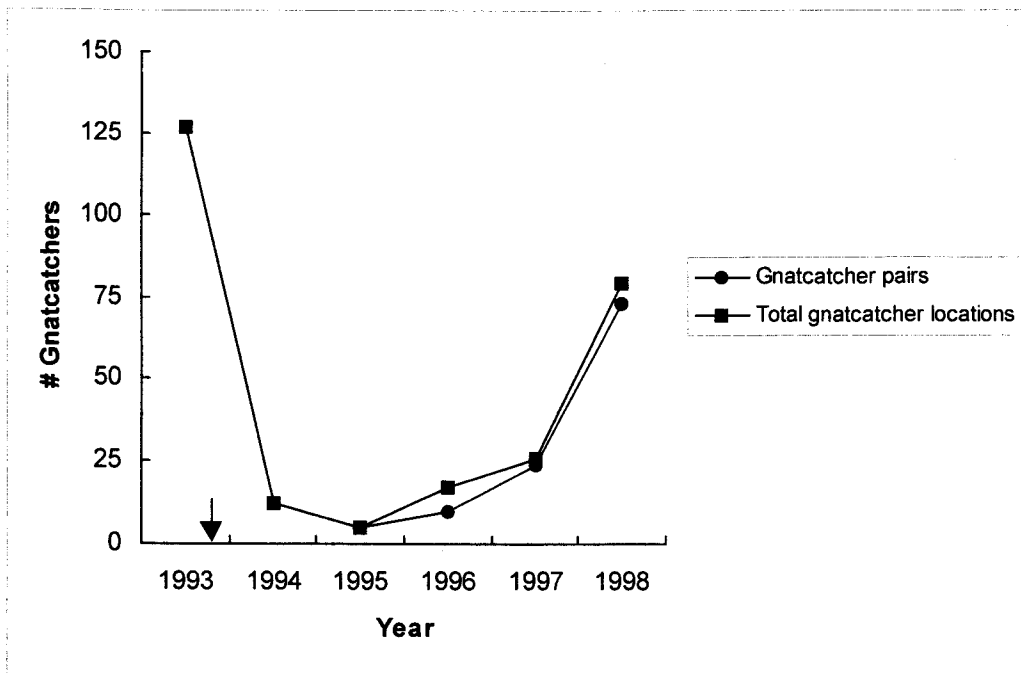


Figure 14: California gnatcatcher population in the San Joaquin Hills burn area since the 1993 Laguna Beach Fire. Gnatcatchers in revegetation sites within burn area not included.

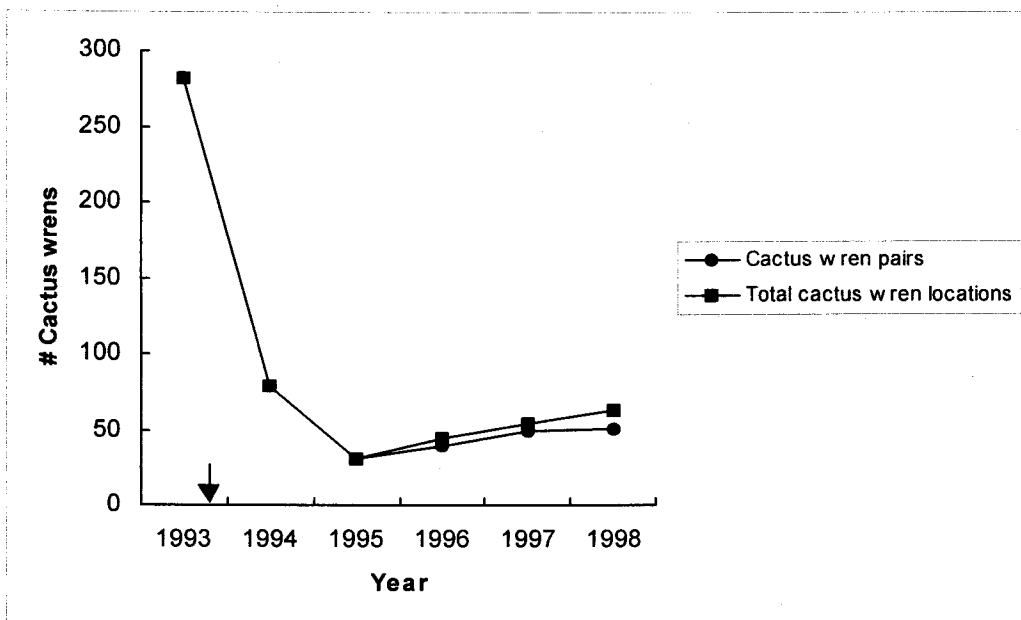


Figure 15: Cactus wren population in the San Joaquin Hills since the 1993 Laguna Beach Fire.

Comparing gnatcatcher distributions with the habitat classification indicates that although gnatcatcher breeding pairs occurred in most habitat categories they showed a strong preference for category G1. A chi-squared test of the gnatcatcher distribution against habitat categories was significant ($\chi^2 = 18.79$, $p < 0.01$), with birds under using categories G5 and G6 (Table 9).

Cactus wren distribution was not correlated with the habitat categories, most of the wrens occurred in the categories containing the majority of habitat (Table 9). The wren distribution was more closely related to the location of individual cactus patches, which the wrens invariably use for nesting. Even those categories with low cover of cactus can provide enough cactus to allow wrens to nest there.

Table 9: Percentage of gnatcatchers and cactus wrens in each habitat category.

Category	% of gnatcatcher habitat	% of gnatcatchers present	% of cactus wren habitat	% of cactus wren present
G1/W1	12.8	25.0	0.1	4.0
G2/W2	0.002	0.0	0.0	0.0
G3/W3	55.6	57.9	1.8	4.0
G4/W4	1.6	1.3	0.9	4.0
G5/W5	28.0	15.8	80.3	80.0
G6/W6	1.7	0.0	16.8	16.0

3.4 California gnatcatcher breeding biology

3.4.1 Gnatcatcher breeding chronology

Between nine and ten gnatcatcher breeding pairs were monitored in the burn area annually. Nest monitoring typically commenced in mid-March, at which time all monitored pairs had commenced nest building. The first chicks typically hatched in March and the first young fledged in April. Nest monitoring was continued until all pairs were finished nesting, typically by late July. This breeding chronology did not differ significantly for gnatcatchers at other study sites (Atwood *et al.* 1995, Bontrager *et al.* 1995b).

3.4.2 Gnatcatcher reproductive success

A total of 71 nests were located for the 30 gnatcatcher pairs which were monitored during the study. Of the 71 nests located, 63 nests (89%) reached incubation, 51 (72%) reached the nestling stage and 42 (59%) fledged at least one young. Rates of nest success (% of nests from which at least one young fledged) decreased from 71% in 1996 to 59% in 1997 and down to 52% in 1998. No incidence of brood parasitism by brown-headed cowbirds on gnatcatchers were observed in the study area in any year of the study. Mean clutch size of the 63 nests reaching the incubation stage was 3.83 ± 0.56 eggs per clutch, (range 3-6) and did not differ significantly between years ($p = 0.05$).

Eighty-three percent of the monitored pairs produced successful broods (at least one young fledged), more than half the pairs produced at least two successful broods (Figure 16). The overall rate of reproductive success ranged from 5.55 ± 2.54 fledglings/pair in 1997 to 4.3 ± 3.37 in 1998. In 1996 the rate was 5.22 ± 3.53 fledglings/pair. Although the differences between years were large, they were not statistically significant ($p = 0.05$) due to the large variation within years.

Two banded female gnatcatchers were present in the same locations (from pairs #1 and #3) all three years of the study. Both birds were banded as nestlings in 1995. The female from pair # 1 has now produced 18 young and the female from pair # 2 has produced 14 young. One banded male (from pair #8) was present in 1997 and 1998 has produced 16 young to date.

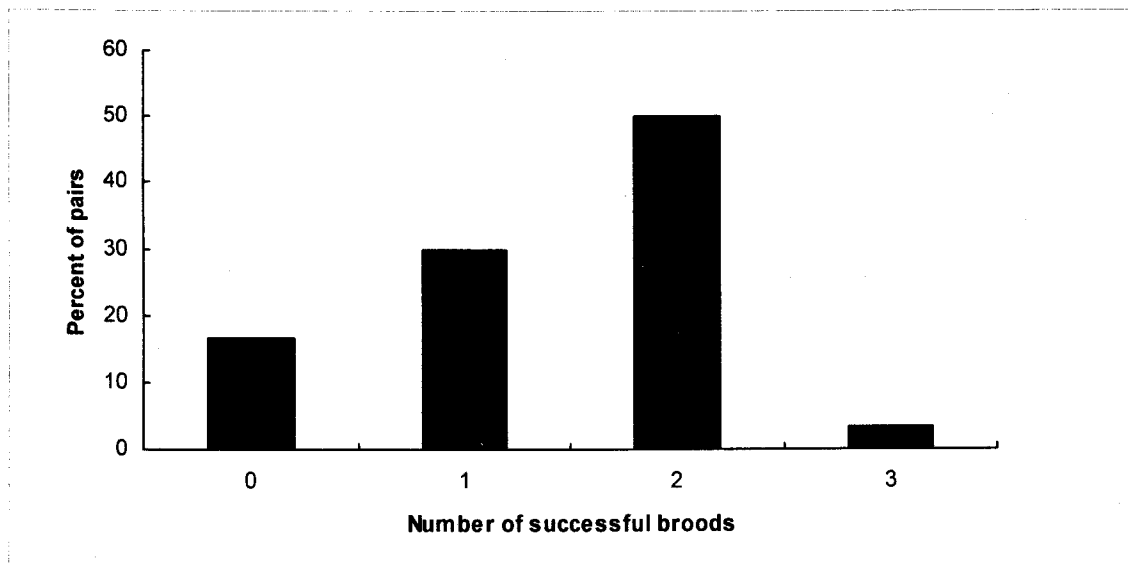


Figure 16: Number of successful broods each breeding season per gnatcatcher pair in the San Joaquin Hills burn area, 1996-1998.

3.4.3 Nest site selection

A total of nine different nesting substrates were used by the monitored gnatcatcher pairs between 1996 and 1998. California sagebrush was the most frequently used nest substrate, accounting for 46.9% of all nesting attempts (Table 10). California sunflower, buckwheat and common phacelia were also commonly used nest substrates. The number of nests located in the four shrub species used in the habitat classification (California sagebrush, California buckwheat, black sage and California sunflower) averaged 81.3% but increased every year from 63% in 1996 to 95% in 1998. In most cases (81% of located nests) the vegetation within a 5m radius of the nest was dominated by these four shrub species, which had an average cover within a 5m radius of all located nests of 55.2%. Cover of these four shrubs within a 5m radius of all nests increased each year, from 50.3% in 1996 to 58.5% in 1998.

Table 10: Nesting substrates used by California gnatcatchers in the San Joaquin Hills burn area, 1996-1998.

Nest substrate	# of successful nests	# of unsuccessful nests	Total # of nests	% of nests
California sagebrush	17	13	30	46.9
California sunflower	9	3	12	18.8
California buckwheat	5	2	7	10.9
Common phacelia	3	3	6	9.4
Black sage	2	1	3	4.7
Bush mallow	1	1	2	3.1
Pine bush	1	1	2	3.1
Artichoke thistle	0	1	1	1.6
Bush monkeyflower	1	0	1	1.6
Total	39	25	64	100

3.4.4 Nest site characteristics

There was no significant difference in any of the nest site characteristics between years. The mean height of shrubs used as nest substrates by gnatcatchers was 1.04 ± 0.19 m (range 0.39-1.57 m), while the mean height of the located nests above ground was 0.67 ± 0.16 m (range 0.23-1.15 m), (1996-1998 data pooled; Table 11). Means, standard deviation, range, and sample size for a variety of nest characteristics (1996-1998 data pooled) are presented in Table 11.

Height of supporting shrub and height of the located nests above ground was greater in successful nests (mean heights = 1.05 ± 0.19 and 0.69 ± 0.14 m respectively) than

unsuccessful nests (mean heights = 1.01 ± 0.19 and 0.64 ± 0.18 m respectively, 1996-1998 data pooled) but the differences were not significant. Other nest site characteristics showed no significant differences between successful and unsuccessful nests.

Table 11: Mean, standard deviation, range, and sample size (N) for a variety of nest characteristics recorded from California gnatcatchers located in the San Joaquin Hills, 1996-1998.

Character	N	Mean \pm S.D. (m)	Range (m)
% Canopy cover within 5m radius of nest	66	80.0 ± 16.9	25-100
Height of nest substrate above ground	64	1.04 ± 0.19	0.39-1.57
Height of nest above ground	59	0.67 ± 0.16	0.23-1.15
Nest height	51	0.069 ± 0.012	0.03-0.09
Inside height of nest	49	0.036 ± 0.008	0.01-0.06
Nest width	48	0.063 ± 0.01	0.03-0.095
Distance from nest to edge of bush	56	0.22 ± 0.13	0.05-0.54
Distance from nest to nearest trail	63	2.12 ± 3.65	0.2-20.0
Distance from nest to nearest open space	58	19.9 ± 25.2	0.75-100
Distance from nest to nearest CSS edge	59	24.1 ± 26.8	0.5-100
Slope of nesting area	65	$6.61^0 \pm 4.84^0$	0^0 - 15^0

3.5 *Cactus wren breeding biology*

3.5.1 Cactus wren breeding chronology

A total of ten cactus wren breeding pairs were monitored during the breeding season in 1997 and 1998. Nest monitoring commenced in mid-March, at which time all monitored pairs had commenced nest building, both years. The first chicks hatched in late March or early April and the first young fledged in late April. All pairs had completed their nesting attempts by the mid August.

3.5.2 Cactus wren reproductive success

A total of 38 nests were located for the monitored cactus wren pairs in 1997 and 1998. Of the 38 nests located, 34 nests (89%) reached incubation, 31 (82%) reached the nestling stage and 30 (79%) fledged at least one young.

Nesting success for the monitored wren pairs was high, all 10 of the monitored pairs (100%) producing fledglings each year. Ten pairs (50%) produced 2 successful broods each and ten pairs (50%) produced 1 successful brood each. Average clutch size of the 20 nests which were accessible was 3.15 ± 1.01 , range 1-5. Nesting success ranged from 4.0 fledglings/pair in 1998 to 4.3 fledglings/pair in 1997. Differences between years were not significant.

3.5.3 Nest site selection and characteristics

A total of 3 different nesting substrates were used by the monitored cactus wren pairs in 1997 and 1998. *Opuntia littoralis* was the most frequently used nest substrate, accounting for 79% of all nesting attempts, perhaps reflecting the fact that this was by far the most abundant cactus species in the burn area. Seven (18%) nests were located in *Opuntia prolifera* and 1 (2.6%) nest was located in California sagebrush. The mean height of the nest substrate was $1.54 \text{ m} \pm 0.38$ (range 0.7–2.6 m), while the mean height of the nest above ground was $1.32 \text{ m} \pm 0.39$ (range 0.6-1.8 m), indicating that the wrens generally built their nest near the top of tall cactus. Only one nest substrate was less than 1 m tall despite the fact that much of the wren habitat was dominated by cactus below this height, indicating a strong preference for the taller cactus as a nesting site. The direction of the opening of the wren nests was random with respect to direction.

3.6 Non target avifauna and other wildlife

A total of 158 wildlife species were detected in the San Joaquin Hills between 1996 and 1998, including six amphibians, 11 reptiles, 127 birds and 14 mammals (Appendix F). A number of sensitive species including western spadefoot toad (*Scaphiopus hammondi*), San Diego horned lizard (*Phrynosoma coronatum blainvillei*), northern red diamond rattlesnake (*Crotalus ruber ruber*), white-tailed kite (*Elanus caeruleus*), northern harrier (*Circus cyaneus*), sharp-shinned hawk (*Accipiter striatus*), Cooper's hawk (*Accipiter cooperii*), bald eagle (*Haliaeetus leucocephalus*), golden eagle (*Aquila chrysaetos*), peregrine falcon (*Falco peregrinus*), willow flycatcher (*Empidonax traillii*), California horned lark (*Eremophila alpestris*), Swainson's thrush (*Catharus ustulatus*), loggerhead shrike (*Lanius ludovicianus*), least Bell's vireo (*Vireo bellii pusillus*), yellow warbler (*Dendroica petechia*), yellow-breasted chat (*Icteria virens*), grasshopper sparrow (*Ammodramus savannarum*), rufous-crowned sparrow (*Aimophila ruficeps*) and black-

tailed jackrabbit (*Lepus californicus*) were located. Unusual species recorded include a sage thrasher (*Oreoscoptes montanus*) in a cactus patch near Laguna Beach in February 1997, 3 cattle egrets (*Bubulcus ibis*) near Bonita Canyon Road in May 1997, an olive-sided flycatcher (*Contopus borealis*) in Bommer Canyon in April 1998 and a vesper sparrow (*Pooecetes gramineus*) in Shady Canyon in February 1998.

3.7 TCA revegetation areas

The number of California gnatcatcher pairs in the Coyote Canyon landfill area increased each year of the project, from one pair in 1996 to seven in 1998. In 1998 two pairs occupied mature coastal sage scrub to the south of the restoration site, three pairs occupied the 18 acre restoration site and two pairs occupied the revegetation site (Figure 17). Ten additional dispersing juveniles were recorded at the revegetation site in July and August 1998.

In the 18 acre restoration site, two pairs successfully raised broods and one pair was unsuccessful, in 1998. Both of the successful pairs used parts of the revegetation site adjacent to the restoration site as part of their home range during the breeding season, particularly when they had fledged young.

In the revegetation site, in 1998, one gnatcatcher pair used the west canyon area and successfully fledged four young from a nest located there. That pair's other nesting attempts were unsuccessful. The successful nest was located in a goldenbush (*Isocoma menzeisii*), the unsuccessful ones in buckwheat. The second pair moved into the revegetation site in early June from an unknown location. They successfully fledged four young in late June. Both these pairs home ranges were exclusively within the revegetation site.

A total of 46 wildlife species were detected in the Coyote Canyon between 1996 and 1998, including 1 reptile, 39 birds and 6 mammals (Appendix G). A number of sensitive species including white-tailed kite, northern harrier, California horned lark and grasshopper sparrow were located. Blacktail jackrabbits and mule deer (*Odocoileus hemionus*) were among the mammals located at Coyote Canyon. The latter were observed utilizing the wildlife crossing under the SJHTC at Laidlaw.

No gnatcatchers or cactus wrens have been recorded at the TCA revegetation areas along the SJHTC cut and fill slopes to date. At Bonita Reservoir, gnatcatchers used portions of the revegetation site adjacent mature scrub and were present year round.

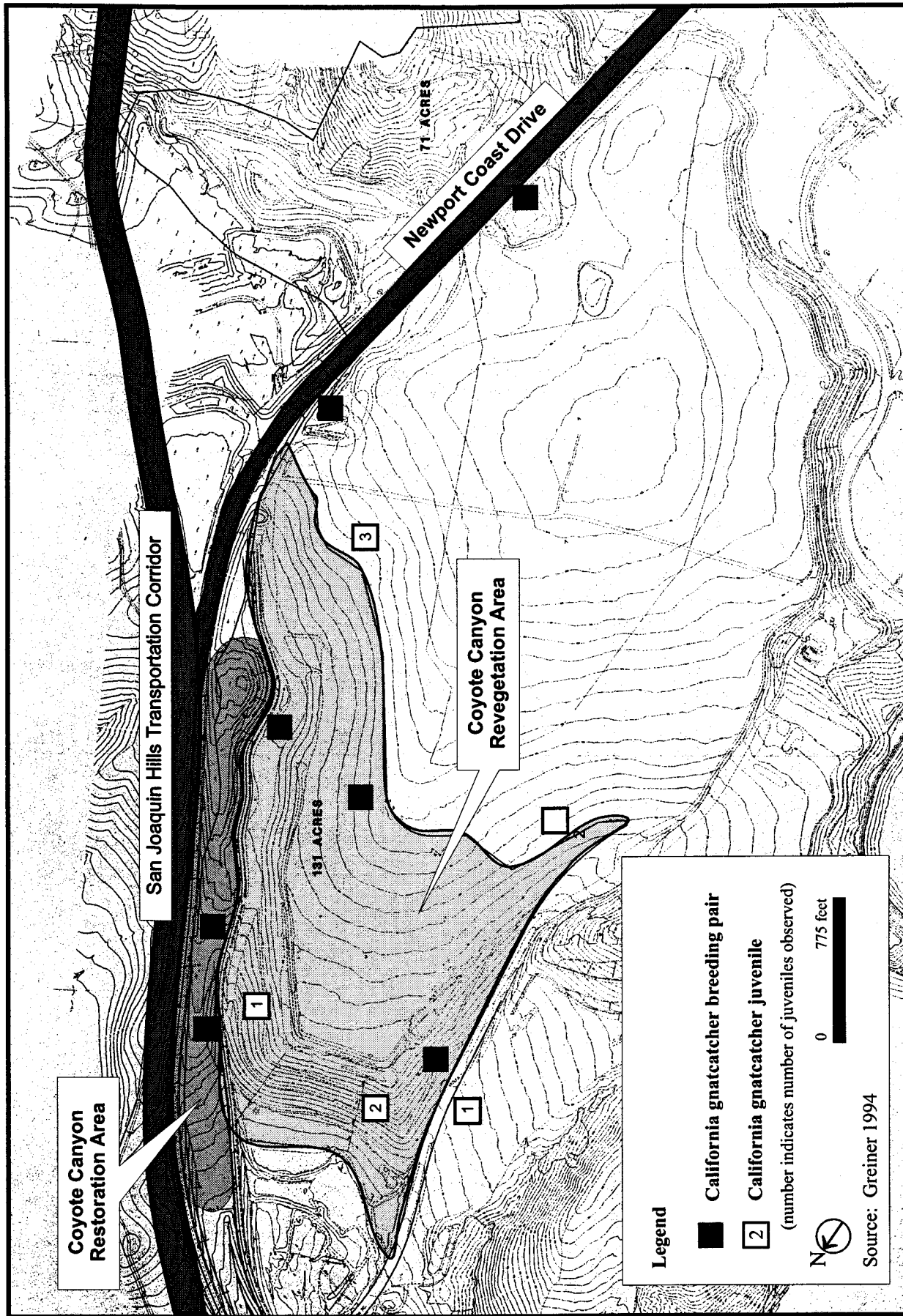


Figure 17: Locations of California gnatcatchers at Coyote Canyon, 1998.

4.0 DISCUSSION

Coastal sage scrub is a very diverse system, forming many sub-associations within the context of the larger community (DeSimone 1995). These sub-associations have different species composition and different species dominants. The sub-associations are correlated with slope, aspect, soils and micro-climate. The intrinsic heterogeneity of the coastal sage scrub community makes comparisons within the burn area and against other burned and unburned sites difficult. This is particularly true when comparisons are made between individual species, as the intrinsic variation in species distributions often result in the error values exceeding the means. As a result, statistically significant differences between sites are difficult to obtain. The situation is less problematic when species are grouped together in natural assemblages, such as “fire followers”, early successional shrubs and climax shrubs. These groupings reduce the variation within sites and make differences between sites easier to detect. This is the approach we have taken and, it has highlighted some interesting patterns, despite the intrinsic heterogeneity of the system.

The most significant finding we made during our three year study is that the response of the coastal sage scrub to the 1993 Laguna Beach fire is following the classic pattern of scrub recovery to fire described by numerous authors (Callaway and Davis 1993; Keeley 1981; Keeley and Keeley 1994; Malanson 1983; Malanson and O’Leary 1982; O’Leary 1990; Westman 1981; White 1995). Over the course of our study “fire following” species decreased in cover, early successional shrubs such as deerweed and bush mallow remained stable but appeared past their peak cover and climax CSS shrubs (see Appendix B) increased in cover (Figure 7). It is evident, only 5 years after the fire, that this area has already returned to a community dominated by climax CSS shrubs.

The burn area is dominated by native species, with California sagebrush, California buckwheat, deerweed, black sage, monkeyflower, laurel sumac and cactus among the dominant species. One group of non-native species which did provide a significant amount of cover were non-native grasses, which often provided an understory to the scrub. This correlates with several studies identifying the coastal sage scrub as supporting an understory of grasses and forbs (DeSimone and Burk 1992, Paysen *et al.* 1980). The cover of non-native grasses increased throughout the study, which is a concern, since conversion of shrubland to grassland has been documented in fire studies of coastal sage scrub (White 1995, O’Leary 1995, Callaway and Davis 1993). However, this trend may also be weather related: 1996 was a normal rain year, 1997 had greater than normal early rainfall and 1998 was an El Nino event, with much higher than normal rainfall through an extended rainy season. The ideal growing conditions for these non-native grasses over the past three years might be the reason for the increased cover of these species. Since the cover of native shrub and herb species have also increased each year, we believe that the type conversion is not taking place and that the cover of non-native grasses will decline during the next drought period.

Differences between grid types were apparent each year of the study (Figures 8 and 9). The good habitat-gnatcatchers present grids had the highest cover of climax CSS shrubs and the lowest cover of early successional shrubs throughout the study period. The vegetation in these grid types was indistinguishable from climax CSS communities by 1998, 5 years after the fire.

Shrub cover in the burn area was similar to other post fire sites (Keeley 1996, Malanson 1983). Westman (1981) found that shrubs typically reached 60% total cover within ten years after fires at a variety of sites in southern California. However, there is tremendous variation between individual sites depending on factors such as age of site, time of occurrence of the fire, weather conditions, aspect, soils and fire intensity. In fact fire intensity has been identified as one of the primary factors determining scrub response to fires, with recovery slower after more intense fires (Keeley 1998). Fire intensity is often correlated with fuel loads and length of time since a fire occurrence. None of these factors were analyzed during the current study.

Mean cover of both shrubs and herbs in the burn area was similar to that recorded in climax scrub communities in Orange County (Table 12), despite the fact that the burn area had only five years to attain this cover (Westman 1983, Martha Blane Associates and Sycamore Associates 1993). Cover of non-native species was higher in the burn area than in the climax communities.

Table 12: Comparison of mean percent cover in the San Joaquin Hills burn area, 1996-98 with other published studies.

Study	Shrubs	Herbs	Native	Non-native
Chiquita Canyon (1998)	87	70	126.9	33.1
Westman (1983)	85	24	105	12
Laguna Laurel (1993)	68	24	76	16
Present Study 1996				
Good habitat – gnatcatchers present	81.1	49.8	96.8	38.6
Good habitat – gnatcatchers absent	73	68.7	83.9	57.5
Poor habitat – gnatcatchers absent	84	57.7	94.4	48.1
Present Study 1997				
Good habitat – gnatcatchers present	84.64	65.63	92.97	57.45
Good habitat – gnatcatchers absent	73.5	78.35	80.57	71.28
Poor habitat – gnatcatchers absent	106.76	59.82	115.5	51.08
Present Study 1998				
Good habitat – gnatcatchers present	86.78	83.92	106.45	64.25
Good habitat – gnatcatchers absent	79.75	110.16	117.35	72.55
Poor habitat – gnatcatchers absent	103.09	85.90	117.22	71.78

In addition to the increase in cover of climax CSS shrubs, there has been a dramatic increase in the area dominated by these shrubs. Potential gnatcatcher habitat (areas dominated by climax CSS shrubs) increased 4-fold between 1996 and 1998. The 2,810 acres present in 1998 represents 41% of the gnatcatcher habitat present prior to the fire in 1993. The gnatcatcher population has also increased dramatically (Figure 14), with the current estimate of 73 pairs representing 57% of the pre-fire total (Bontrager *et al.* 1995b). The new birds appear to be a combination of offspring from resident breeding pairs and immigration from surrounding populations (banding returns indicate birds have come from the Bonita Reservoir, Turtle Rock, Laguna Laurel, Sand Canyon Reservoir, Sycamore Hills and Crystal Cove). The high fledgling rate of the resident birds is contributing significantly to the population growth. This increase is expected as new habitat becomes available in the burn area as a result of shrub recovery from the fire. The high fledgling rate in 1998 suggest that the population will increase again by 1999. In fact, if current rates of increase continue the population will exceed the pre-fire total by the year 2000. However, population growth could be checked by saturation of existing habitat and/or poor weather conditions over the winter.

Gnatcatcher breeding success (expressed as fledglings/pair) has been consistently high in the burn area, ranging from 4.3 to 5.55 fledglings/pair. This is significantly higher than that reported from other studies, 1.93 fledglings/pair at Riverside (Braden *et al.* 1995), 2.29-3.89 fledglings/pair at Palos Verdes (Atwood *et al.* 1998), 2.29-2.66 fledglings/pair at the Superpark Project (Atwood *et al.* 1998) and 3.2 fledglings/pair at Siphon Reservoir (Galvin 1998). The following factors may be contributing to the high reproductive success in the burn area:

- the relatively low number of gnatcatchers present in the burn probably select only the highest quality habitat in the area, therefore increasing their likelihood of successful nesting. This does however assume that the habitat in the burn, just 5 years after the fire, is of high quality, see Harmsworth Associates (1997) for further discussion.
- populations of both intra- and inter-specific competitors are presumably below pre-fire levels, thus the gnatcatchers which are present may be faced with lower than normal levels of competition for important resources, see Harmsworth Associates (1997) for further discussion.
- predator populations are presumably lower in the burn area than prior to the fire and if so, they may be having less of an impact on gnatcatcher nesting success than in “normal” situations. There is some evidence to suggest that this is indeed the case. In the burn area 41% of nesting attempts failed (1996-1998 data combined). This compares with 72% at the Superpark Project (1995 and 1996) and 71% at the Palos Verdes project (Atwood *et al.* 1995). Rates of nest failure are almost twice as high at these other sites compared with the burn area. This may be attributable directly to lower predator populations in the burn area. In addition, nest failure rates have increased each year of the project in the burn area, from 29% in 1996 to 48% in 1998. This is exactly what we would expect if predator populations were depressed after the fire and gradually returned to “normal” as the habitat recovered. We believe that this is the most likely reason for the high rates of nest success for gnatcatchers in the burn

area. However, we have no quantitative data on predator populations in either the burn area or the other two study sites to support this theory.

The gnatcatchers in the burn area appeared to be utilizing the best available habitat. Cover of climax CSS shrubs was significantly higher and, cover of deerweed significantly lower, in the gnatcatcher present vegetation grids than in the gnatcatcher absent grids (Figures 8 and 9). This was true all years of the study, with mean cover of climax shrubs in the gnatcatchers grids ranging from 59 to 72.5%. The chi-squared analysis of gnatcatcher distribution against the habitat classification indicated a strong preference for the habitat with most cover of the four important shrub species (Table 9). Even within their home range areas, gnatcatchers showed a strong preference for nesting in and adjacent to the four important shrub species used in the habitat classification (California sagebrush, California buckwheat, black sage and California sunflower). These shrubs accounted for 81% of all nest locations.

How much cover of climax CSS shrubs are needed for gnatcatchers to return to a post burn area? The lowest mean cover of climax CSS shrubs in the gnatcatcher present grids was 59% (in 1996), while the highest mean cover of climax CSS shrubs in the gnatcatcher absent grids was 51% (in 1998). In general it would seem that gnatcatchers start utilizing post burn areas when the cover of climax shrubs reaches 50-60%, at least for this project. However, there were some exceptions to this generality. Several pairs of gnatcatchers occupied areas with very low cover of climax shrubs. For example one of the monitored pairs fledged young every year from an area where the combined coverage of the seven climax shrubs was only 26%. On the other hand several large areas with cover of climax CSS shrubs in excess of 70% were unoccupied by gnatcatchers. The fact that these areas were unoccupied while gnatcatchers were successfully fledging young from areas with significantly lower cover of apparently important shrubs, indicates that our understanding of gnatcatcher habitat requirements are rudimentary at best.

The population of cactus wrens in the burn area has also increased over the course of this study, however, the rate of increase was much slower than for the gnatcatcher (Figure 15). Cactus wrens exclusively used areas with cactus patches and the slow recovery of these plants from the fire may be limiting the population recovery of the wrens. The current wren population is about 22% of the pre-fire total for the burn area. The wren populations increase results from a combination of immigration into the burn area from adjacent populations and high nesting success of resident pairs. Nesting success for the monitored wren pairs was high, with the mean fledglings/pair ranging from 4.0 to 4.30. This was higher than the only study we have for comparison, at the Palos Verdes where fledgling success/pair was 3.42 (Atwood *et al.* 1995).

Cactus wrens only occurred with the presence of cactus patches. Large areas of cactus were not necessary if some of the patches consisted of tall cactus. The habitat classification system used was not able to detect the amounts of cactus necessary in a patch for wrens to occur. Most of the habitat patches had less than 33% cover from cactus species and most of the wrens occurred in these areas. In order to determine the

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minimum amount of cactus necessary for wrens to occur we would need an approach more focused on the cactus patches and less on the general gnatcatcher/cactus wren habitat characteristics. Regarding the height of the cactus, it was apparent that cactus wrens used areas dominated by low growing cactus, if some tall cactus was present for nest location. All wren nests were located in tall cactus (mean nest substrate height was 1.54 m) even in areas dominated by low growing cactus.

The California gnatcatchers use of the TCA restoration and revegetation sites at Coyote Canyon have increased every year of this project. This year, gnatcatchers bred successfully in the revegetation site for the first time. The site was planted just five years ago. Two pairs occupied the revegetation area exclusively and produced a total of eight fledglings between them. Three additional pairs used the restoration site, successfully fledging young there. These birds also used the revegetation site adjacent their territories in the restoration site.

All the objectives of this year's surveys outlined in the introduction were successfully completed:

- quantitative vegetation surveys were conducted within the burn area,
- the distribution and abundance of the California gnatcatcher and the cactus wren in the burn area of the San Joaquin Hills and in the TCA revegetation areas at Coyote Canyon landfill, the SJHTC cut and fill slopes, Bonita Creek channel and at Bonita Reservoir were determined,
- gnatcatcher breeding biology was monitored and nesting success was determined, and;
- cactus wren breeding biology was monitored and nesting success was determined.

5.0 RECOMMENDATIONS

It should be noted that this is the last year the TCA will conduct gnatcatcher/cactus wren studies under the terms and conditions of Biological Opinion 1-6-93-F-98R. With the cooperation of the USFWS and CDFG, this obligation is being transferred to The Nature Reserve of Orange County (NROC). Future gnatcatcher/cactus wren studies in the San Joaquin Hills burn area will be incorporated into the NROC management program. The TCA is providing an endowment to NROC for this purpose.

Should the NROC decide to continue this specific study in 1999 the monitoring program should follow the same general format that was conducted successfully between 1996 and 1998. The following recommendations should be implemented in 1999:

- A quantitative vegetation survey should be conducted in the burn area, similar in nature and scope to the one conducted in 1996-1998.
- The distribution and abundance of California gnatcatchers and cactus wrens in the burn area of the San Joaquin Hills should be mapped. In order to conduct this mapping, all suitable and potential habitat for the two target species in the burn area should be surveyed 3 times, beginning in early February, 1999. A total of 2,800 acres of suitable habitat was present in 1998 and this is expected to increase by 1999.
- The nests of 10 pairs of California gnatcatchers and 10 pairs of cactus wrens (in the burn area) should be monitored during the breeding season, to assess the nesting success for these species in the burn area. Nest monitoring should commence in mid March and continue until all monitored pairs have completed their nesting cycle (usually by the end of July).

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8.0 APPENDICES

8.1 Appendix A: Floral inventory of plant species located in the San Joaquin Hills, 1996-1998.

SCIENTIFIC NAME	COMMON NAME
PTERIDOPHYTES - FERNS AND ALLIES	
SELAGINELLACEAE	SPIKE-MOSS FAMILY
<i>Selaginella bigelovii</i>	Spike-moss
<i>Selaginella cinerascens</i> ⁺	Mesa spike-moss
POLYPODIACEAE	POLYPODY FAMILY
<i>Polypodium californicum</i>	California Polypody
GYMNOPERMS	
PINACEAE	PINE FAMILY
<i>Pinus</i> sp.*	Pine (ornamental)
ANGIOSPERMS - DICOTS	
AIZOACEAE	CARPET-WEED FAMILY
<i>Carpobrotus edulis</i> *	Hottentot Fig
ANACARDIACEAE	SUMAC OR CASHEW FAMILY
<i>Malosma laurina</i>	Laurel Sumac
<i>Rhus integrifolia</i>	Lemonadeberry
<i>Toxicodendron diversilobum</i>	Poison Oak
APIACEAE	CARROT FAMILY
<i>Apiastrum angustifolium</i>	Wild Celery
<i>Conium maculatum</i> *	Poison Hemlock
<i>Daucus pusillus</i> *	American Carrot
<i>Foeniculum vulgare</i> *	Sweet Fennel
<i>Sanicula arguta</i>	Sharp-toothed Sanicle
<i>Sanicula crassicaulis</i>	Pacific Sanicle
ASTERACEAE	SUNFLOWER FAMILY
<i>Acourtia microcephala</i>	Sacapellote
<i>Ambrosia psilostachya</i>	Western Ragweed
<i>Artemisia californica</i>	Coastal Sagebrush
<i>Artemisia douglasiana</i>	Mugwort
<i>Asteraceae</i> sp.	Unidentified sunflower
<i>Baccharis pilularis</i>	Coyote Brush
<i>Baccharis salicifolia</i>	Mulefat
<i>Brickellia californica</i>	California Bricklebush
<i>Centaurea melitensis</i> *	Tocalote
<i>Cirsium occidentale</i>	Cobwebby Thistle

SCIENTIFIC NAME	COMMON NAME
<i>Cirsium</i> sp.*	Thistle
<i>Conyza canadensis</i>	Horseweed/Mare's Tail
<i>Conyza</i> sp. *	Horseweed/Mare's Tail
<i>Cotula coronopifolia</i> *	Brass Buttons
<i>Cynara cardunculus</i> *	Artichoke Thistle
<i>Encelia californica</i>	California Encelia
<i>Ericameria pinifolius</i>	Pine bush
<i>Erigeron foliosus</i>	Leaf Daisy
<i>Eriophyllum confertiflorum</i>	Golden Yarrow
<i>Filago californica</i>	California Fluffweed
<i>Gazania</i> sp.*	Gazania
<i>Gnaphalium californicum</i>	California Everlasting
<i>Gnaphalium canescens</i> ssp. <i>beneolens</i>	Everlasting
<i>Gnaphalium palustre</i>	Lowland cudweed
<i>Hazardia squarrosa</i>	Common Hazardia
<i>Hemizonia fasciculata</i>	Fascicled Tarweed
<i>Hypochoeris glabra</i> *	Smooth cat's ear
<i>Hypochoeris radicata</i> *	Hairy cat's ear
<i>Isocoma menziesii</i> var. <i>vernonioides</i>	Coast Goldenbush
<i>Lactuca serriola</i> *	Prickly lettuce
<i>Lessingia filaginifolia</i>	California Aster
<i>Malacothrix saxatilis</i>	Cliff Malacothrix
<i>Osmadenia tenella</i>	Southern Rosinweed
<i>Pentachaeta aurea</i>	Golden Daisy
<i>Rafinesquia californica</i>	California Chicory
<i>Silybum marianum</i> *	Milk Thistle
<i>Sonchus asper</i> *	Prickly Sow Thistle
<i>Sonchus oleraceus</i> *	Common Sow-thistle
<i>Stephanomeria exigua</i>	Small Wreath Plant
<i>Stephanomeria virgata</i>	Tall Wreath Plant
<i>Uropappus lindleyi</i>	Silver Puffs
<i>Xanthium strumarium</i> var. <i>canadense</i>	Cocklebur
BORAGINACEAE	BORAGE FAMILY
<i>Amsinckia menziesii</i> ssp. <i>intermedia</i>	Fiddleneck
<i>Cryptantha intermedia</i>	Common cryptantha
<i>Cryptantha</i> sp.	Unidentified Popcornflower
<i>Pectocarya linearis</i> ssp. <i>ferocula</i>	Pectocarya
<i>Plagiobothrys canescens</i>	Valley Popcornflower
<i>Plagiobothrys nothofulvus</i>	Rusty Popcornflower
<i>Plagiobothrys</i> sp.	Popcornflower
BRASSICACEAE	MUSTARD FAMILY

SCIENTIFIC NAME	COMMON NAME
<i>Brassica nigra</i> *	Black Mustard
<i>Brassica</i> sp.*	Unidentified Mustard
<i>Hirschfeldia incana</i> *	Shortpod Mustard
CACTACEAE	CACTUS FAMILY
<i>Opuntia ficus-indica</i> *	Indian-fig
<i>Opuntia littoralis</i> var. <i>littoralis</i>	Coast Prickly Pear
<i>Opuntia prolifera</i>	Coast Cholla
CAPPARACEAE	CAPER FAMILY
<i>Isomeris arborea</i>	Bladderpod
CAPRIFOLIACEAE	HONEYSUCKLE FAMILY
<i>Sambucus mexicana</i>	Blue Elderberry
CARYOPHYLLACEAE	PINK FAMILY
<i>Cardionema ramosissimum</i>	Sand Mat
<i>Cerastium glomeratum</i> *	Sticky Mouse Ear Chickweed
<i>Silene gallica</i> *	Windmill Pink
<i>Silene laciniata</i> ssp. <i>major</i>	Indian Pinks
<i>Spergularia arvensis</i> *	Stickwort/ Starwort
<i>Stellaria media</i> *	Common Chickweed
CHENOPODIACEAE	GOOSEFOOT FAMILY
<i>Atriplex semibaccata</i> *	Australian Saltbush
<i>Salsola tragus</i> *	Russian Thistle
CONVOLVUACEAE	MORNING-GLORY FAMILY
<i>Calystegia macrostegia</i>	Morning-glory
<i>Convolvulus arvensis</i> *	Bindweed
<i>Dichondra occidentalis</i> ⁺	Western dichondra
CRASSULACEAE	STONECROP FAMILY
<i>Crassula connata</i>	Pygmy-weed
<i>Dudleya lanceolata</i>	Lance-leaved Dudleya
<i>Dudleya pulverulenta</i>	Chalk Dudleya
CUCURBITACEAE	GOURD FAMILY
<i>Cucurbita foetidissima</i>	Calabazilla
<i>Marah macrocarpus</i>	Wild Cucumber
CUSCUTACEAE	DODDER FAMILY
<i>Cuscuta californica</i>	California Dodder
EUPHORBIACEAE	SPURGE FAMILY
<i>Chamaesyce albomarginata</i>	Rattlesnake Spurge
<i>Chamaesyce</i> sp.	Prostrate Spurge
<i>Eremocarpus setigerus</i>	Dove Weed
FABACEAE	LEGUME FAMILY
<i>Lotus hamatus</i>	San Diego Lotus
<i>Lotus purshianus</i>	Lotus

SCIENTIFIC NAME	COMMON NAME
<i>Lotus salsuginosus</i>	Alkali Lotus
<i>Lotus scoparius</i>	Deer Weed
<i>Lotus strigosus</i>	Lotus
<i>Lupinus bicolor</i>	Miniature Lupine
<i>Lupinus hirsutissimus</i>	Stinging Lupine
<i>Lupinus sparsiflorus</i>	Coulter's Lupine
<i>Lupinus succulentus</i>	Succulent Lupine
<i>Lupinus truncatus</i>	Lupine
<i>Lupinus sp.</i>	Lupine
<i>Medicago polymorpha</i> *	Bur-clover
<i>Melilotus alba</i> *	White Sweetclover
<i>Melilotus indica</i> *	Yellow Sweetclover
<i>Trifolium willdenovii</i>	Valley Clover
<i>Trifolium sp.</i> *	Clover
<i>Vicia villosa</i> *	Winter Vetch
FAGACEAE	BEECH FAMILY
<i>Quercus agrifolia</i>	Coast Live Oak
GERANIACEAE	GERANIUM FAMILY
<i>Erodium botrys</i> *	Long-beaked Filaree
<i>Erodium cicutarium</i> *	Red-stemmed Filaree
<i>Erodium moschatum</i> *	White-stemmed Filaree
<i>Geranium carolinianum</i>	Carolina geranium
GROSSULARIACEAE	GOOSEBERRY FAMILY
<i>Ribes speciosum</i>	Fuchsia-flowered Gooseberry
HYDROPHYLLACEAE	WATERLEAF FAMILY
<i>Emmenanthe pendulifera</i>	Whispering Bells
<i>Eucrypta chrysanthemifolia</i>	Common Eucrypta
<i>Phacelia cicutaria</i>	Caterpillar Phacelia
<i>Phacelia distans</i>	Common Phacelia
<i>Phacelia ramosissima</i>	Phacelia
<i>Phacelia sp.</i>	Phacelia
LAMIACEAE	MINT FAMILY
<i>Lamium amplexicaule</i> *	Dead Nettle
<i>Marrubium vulgare</i> *	Horehound
<i>Monardella lanceolata</i>	Mustang Mint
<i>Salvia apiana</i>	White Sage
<i>Salvia mellifera</i>	Black Sage
<i>Stachys rigida</i>	Hedge Nettle
LYTHRACEAE	LOOSESTRIFE FAMILY
<i>Lythrum hyssopifolia</i> *	Grass poly
MALVACEAE	MALLOW FAMILY

SCIENTIFIC NAME	COMMON NAME
<i>Malacothamnus fasciculatus</i>	Lax-flowered Bushmallow
<i>Malva parviflora</i> *	Cheeseweed
MYRTACEAE	MYRTLE FAMILY
<i>Eucalyptus</i> sp.*	Gum Tree
NYCTAGINACEAE	FOUR O'CLOCK FAMILY
<i>Mirabilis californica</i>	California Wishbone Bush
ONAGRACEAE	EVENING PRIMROSE FAMILY
<i>Camissonia bistorta</i>	Southern Sun Cup
<i>Camissonia</i> sp.	Sun Cup
<i>Epilobium canum</i>	California Fuchsia
PAPAVERACEAE	POPPY FAMILY
<i>Eschscholzia californica</i>	California Poppy
PLATANACEAE	SYCAMORE FAMILY
<i>Platanus racemosa</i>	Western Sycamore
PLUMBAGINACEAE	LEADWORT FAMILY
<i>Limonium perezii</i> *	Sea Lavender
POLEMONIACEAE	PHLOX FAMILY
<i>Eriastrum sapphirinum</i>	Sapphire Woolly-star
<i>Gilia australis</i>	Southern Gilia
POLYGONACEAE	BUCKWHEAT FAMILY
<i>Chorizanthe staticoides</i> ssp. <i>chrysacantha</i>	Orange County Turkish Rugging
<i>Eriogonum cinereum</i>	Coastal Buckwheat
<i>Eriogonum elongatum</i>	Long-stemmed Buckwheat
<i>Eriogonum fasciculatum</i>	California Buckwheat
<i>Pterostegia drymarioides</i>	Pterostegia
<i>Rumex crispus</i> *	Curly dock
PORTULACACEAE	PURSLANE FAMILY
<i>Claytonia perfoliata</i>	Common Miner's Lettuce
PRIMULACEAE	PRIMROSE FAMILY
<i>Anagallis arvensis</i> *	Scarlet pimpernel
RANUNCULACEAE	CROWFOOT FAMILY
<i>Ranunculus californica</i>	California Buttercup
RHAMNACEAE	BUCKTHORN FAMILY
<i>Rhamnus crocea</i>	Spiny Redberry
<i>Rhamnus ilicifolia</i>	Holly-leaved coffeeberry
ROSACEAE	ROSE FAMILY
<i>Heteromeles arbutifolia</i>	Toyon
RUBIACEAE	MADDER FAMILY
<i>Galium angustifolium</i>	Bedstraw
<i>Galium aparine</i>	Goose Grass
<i>Galium nuttallii</i>	Nuttall's Bedstraw

SCIENTIFIC NAME	COMMON NAME
<i>Rubiaceae</i> sp.	Unidentified Madder
SCROPHULARIACEAE	FIGWORT FAMILY
<i>Antirrhinum coulterianum</i>	White Snapdragon
<i>Antirrhinum nuttalianum</i>	Snapdragon
<i>Castilleja exserta</i>	Purple Owl's Clover
<i>Cordylanthus filifolius</i>	Bird's Beak
<i>Linaria canadensis</i> var. <i>texana</i>	Larger Blue Toadflax
<i>Mimulus aurantiacus</i>	Monkey Flower
<i>Scrophularia californica</i>	California Figwort
SOLANACEAE	NIGHTSHADE FAMILY
<i>Nicotiana glauca</i> *	Tree Tobacco
<i>Nicotiana quadrivalvis</i>	Indian Tobacco
<i>Solanum douglasii</i>	Douglas' Nightshade
<i>Solanum xanti</i>	Chaparral Nightshade
<i>Solanum</i> sp.	Nightshade
URTICACEAE	NETTLE FAMILY
<i>Hesperocnide tenella</i>	Western Nettle
<i>Urtica dioica</i>	Stinging Nettle
VERBENACEAE	VERVAIN FAMILY
<i>Verbena lasiostachys</i>	Blue vervain
VIOLACEAE	VIOLET FAMILY
<i>Viola pedunculata</i>	Johnny Jump-ups
ANGIOSPERMS - MONOCOTS	
IRIDACEAE	IRIS FAMILY
<i>Sisyrinchium bellum</i>	Blue-eyed Grass
JUNCACEAE	RUSH FAMILY
<i>Juncus balticus</i>	Wire Rush
<i>Juncus bufonius</i>	Common Toad Rush
<i>Juncus rugulosus</i>	Wrinkled Rush
LILIACEAE	LILY FAMILY
<i>Bloomeria crocea</i>	Golden Stars
<i>Calochortus splendens</i>	Splendid Mariposa Lily
<i>Calochortus weedii</i> var. <i>intermedius</i> +	Intermediate Mariposa Lily
<i>Calochortus</i> sp.	Mariposa Lily
<i>Chlorogalum pomeridianum</i>	Amole
<i>Dichelostemma pulchellum</i>	Blue Dicks
POACEAE	GRASS FAMILY
<i>Agrostis diegoensis</i>	San Diego bentgrass
<i>Aristida purpurea</i>	Purple three-awn
<i>Avena barbata</i> *	Slender Wild Oat
<i>Avena fatua</i> *	Wild Oat

SCIENTIFIC NAME	COMMON NAME
<i>Brachypodium distachyon</i> *	False Purple Brome
<i>Bromus carinatus</i>	California Brome
<i>Bromus diandrus</i> *	Ripgut Grass
<i>Bromus hordeaceus</i> *	Soft Chess
<i>Bromus madritensis</i> ssp. <i>rubens</i> *	Red Brome/ Foxtail Chess
<i>Bromus tectorum</i> *	Cheat Grass
<i>Ehrharta calycina</i> *	Veldtgrass
<i>Gastridium ventricosum</i> *	Nitgrass
<i>Hordeum murinum</i> ssp. <i>leporinum</i> *	Hare Barley
<i>Lamarckia aurea</i> *	Goldentop
<i>Leymus condensatus</i>	Giant Wild Rye
<i>Lolium perenne</i> *	English Ryegrass
<i>Lolium temulentum</i> *	Darnel
<i>Melica imperfecta</i>	Coast Range Melic
<i>Muhlenbergia microsperma</i>	Small-flowered Melic
<i>Nassella lepida</i>	Foothill Needlegrass
<i>Nassella pulchra</i>	Purple Needlegrass
<i>Nassella</i> sp.	Unidentified Nassella
<i>Poa secunda</i>	One-sided Bluegrass
<i>Poaceae</i> sp.*	Unidentified Grass
<i>Polypogon monspeliensis</i> *	Rabbitfoot Grass
<i>Schismus barbatus</i> *	Mediterranean Grass
<i>Vulpia myuros</i> var. <i>hirsuta</i> *	Foxtail Fescue
<p>Asterix (*) indicates non-native species; + indicates rare species</p> <p>Floristics summary:</p> <p>50 FAMILIES; 209 taxa; 147 native (70%); 62 non-native (30%)</p> <p>5 largest FAMILIES:</p> <p>ASTERACEAE - 42 spp., 30 native, 12 non-native; POACEAE - 27 spp., 10 native, 17 non-native; FABACEAE - 17 spp., 12 native, 5 non-native; BORAGINACEAE - 7 spp., 7 native; and SCROPHULARIACEAE - 7 spp., 7 native.</p>	

8.2 Appendix B: Vegetation details in the San Joaquin Hills burn area, 1996-1998.

Table B1: Absolute cover provide by native and non-native plant species, litter, and bare ground/rock by grid type in the San Joaquin Hills burn area, 1996-1998.

Year/grid type	native vegetation	non-native vegetation	litter	bare ground /rock
1996				
Good habitat - gnatcatchers present	96.8 ± 8.6	38.6 ± 7.1	8.8 ± 3.6	3.7 ± 1.3
Good habitat - gnatcatchers absent	83.9 ± 5.9	57.5 ± 7.2	2.8 ± 0.9	4.6 ± 2.1
Poor habitat - gnatcatchers absent	94.4 ± 12.5	48.1 ± 11.5	0.7 ± 0.3	5.0 ± 1.7
1997				
Good habitat - gnatcatchers present	92.97 ± 8.4	57.45 ± 4.43	9.48 ± 1.79	6.48 ± 1.94
Good habitat - gnatcatchers absent	80.57 ± 6.67	71.28 ± 7.99	10.66 ± 3.16	5.22 ± 2.19
Poor habitat - gnatcatchers absent	115.50 ± 9.55	51.08 ± 8.73	15.84 ± 5.31	2.31 ± 0.62
1998				
Good habitat - gnatcatchers present	106.45 ± 10.75	64.25 ± 13.43	3.05 ± 1.13	3.15 ± 1.23
Good habitat - gnatcatchers absent	117.35 ± 7.06	72.55 ± 12.74	1.47 ± 0.75	1.00 ± 0.66
Poor habitat - gnatcatchers absent	117.22 ± 5.22	71.78 ± 6.36	0.72 ± 0.28	1.44 ± 0.48

Table B2: Mean number and standard error of different cover types by grid type in the San Joaquin Hills burn area, 1996-1998.

Year/grid type	mean number of cover types	range
1996		
Good habitat - gnatcatchers present	17.9 ± 0.4	12 - 26
Good habitat - gnatcatchers absent	17.0 ± 0.4	12 - 25
Poor habitat - gnatcatchers absent	19.5 ± 0.2	15 - 27
1997		
Good habitat - gnatcatchers present	19.8 ± 1.5	13 - 28
Good habitat - gnatcatchers absent	24.2 ± 0.9	20 - 28
Poor habitat - gnatcatchers absent	21.3 ± 1.4	15 - 29
1998		
Good habitat - gnatcatchers present	23.4 ± 1.5	17 - 32
Good habitat - gnatcatchers absent	28.1 ± 2.1	21 - 38
Poor habitat - gnatcatchers absent	30.8 ± 2.7	20 - 45

Table B3: Cover types that occurred in at least one grid type, in \square 50% of the transects in the San Joaquin Hills burn area, 1998.

Cover types/ species	good habitat - gnatcatchers present (frequency in %)	good habitat - gnatcatchers absent (frequency in %)	poor habitat - gnatcatchers absent (frequency in %)
<i>Anagallis arvensis</i> *	44.4	77.8	55.6
<i>Artemisia californica</i>	100.0	77.8	88.9
<i>Brassica nigra</i> *	44.4	55.6	33.3
<i>Calystegia macrostegia</i>	11.1	--	55.6
<i>Daucus pusillus</i> *	44.4	55.6	66.7
<i>Eriogonum fasciculatum</i>	77.8	77.8	88.9
<i>Eucrypta chrysanthemifolia</i>	22.2	22.2	55.6
<i>Filago californica</i>	22.2	66.7	66.7
<i>Galium nuttallianum</i>	55.6	55.6	55.6
<i>Gnaphalium californicum</i>	44.4	100.0	55.6
<i>Hemizonia fasciculata</i>	44.4	77.8	77.8
<i>Hypochaeris glabra</i> *	66.7	66.7	88.9
<i>Lotus scoparius</i>	55.6	77.8	100.0
<i>Malacothamnus fasciculatus</i>	11.1	--	66.7
<i>Malosma laurina</i>	44.4	33.3	77.8
<i>Malacothrix saxitalis</i>	22.2	33.3	66.7
<i>Mimulus aurantiacus</i>	66.7	55.6	33.3
<i>Nassella pulchra</i>	55.6	77.8	44.4
<i>Nassella lepida</i>	33.3	77.8	55.6
Non Native Grasses*	100.0	100.0	100.0
<i>Rafinesquia californica</i>	--	--	55.6
<i>Rhus integrifolia</i>	33.3	44.4	77.8
<i>Salvia mellifera</i>	33.3	33.3	88.9
<i>Silene gallica</i> *	55.6	66.7	66.7
<i>Sonchus asper</i> *	--	66.7	55.6
<i>Sonchus oleraceus</i> *	22.2	88.9	77.8
<i>Stephanomeria virgata</i>	--	88.9	88.9
Bare ground	77.8	33.3	77.8
Litter	77.8	44.4	55.6

* indicates non-native species.
Bold face indicates that the species occurred in that grid type in over 50 % of the transects.
Underline indicates that the species occurred in all grid types and in over 50% of the transects.

Table B4: Fire following species used in analysis, species absent from project site not included.

SCIENTIFIC NAME	COMMON NAME
ASTERACEAE	SUNFLOWER FAMILY
<i>Filago californica</i>	California Fluffweed
<i>Gnaphalium californicum</i>	California Everlasting
<i>Hemizonia fasciculata</i>	Fascicled Tarweed
<i>Rafinesquia californica</i>	California Chicory
BORAGINACEAE	BORAGE FAMILY
<i>Amsinckia menziesii</i> ssp. <i>intermedia</i>	Common Fiddleneck
<i>Cryptantha intermedia</i>	Popcorn Flower
<i>Cryptantha</i> spp.	Popcorn-Flower
<i>Plagiobothrys</i> spp.	Popcorn-Flower
CONVOLVUACEAE	MORNING-GLORY FAMILY
<i>Calystegia macrostegia</i>	Morning-glory
CUCURBITACEAE	GOURD FAMILY
<i>Marah macrocarpus</i>	Wild Cucumber
FABACEAE	LEGUME FAMILY
<i>Lotus hamatus</i>	San Diego Lotus
<i>Lotus purshianus</i>	Spanish Lotus
<i>Lotus strigosus</i>	Strigose Lotus
<i>Lupinus bicolor</i>	Miniature Lupine
<i>Lupinus hirsutissimus</i>	Stinging Lupine
<i>Lupinus sparsiflorus</i>	Coulter's Lupine
<i>Lupinus truncatus</i>	Collar Lupine
<i>Trifolium gracilentum</i> var. <i>gracilentum</i>	Pin-Point Clover
<i>Trifolium willdenovii</i>	Tomcat Clover
HYDROPHYLLACEAE	WATERLEAF FAMILY
<i>Eucrypta chrysanthemifolia</i>	Common Eucrypta
<i>Phacelia distans</i>	Common Phacelia
<i>Phacelia parryi</i>	Parry's Phacelia
ONAGRACEAE	EVENING PRIMROSE FAMILY
<i>Camissonia</i> spp.	Primrose
PORTULACAEAE	PURSLANE FAMILY
<i>Calandrinia ciliata</i>	Red Maids
RUBIACEAE	MADDER FAMILY
<i>Galium aparine</i>	Goose Grass
SCROPHULARIACEAE	FIGWORT FAMILY
<i>Linaria canadensis</i>	Blue Toad Flax

Table B5: Climax CSS shrubs used in analysis. Shrubs selected were those which are dominant in climax CSS communities and which provide important habitat for the California gnatcatcher.

SCIENTIFIC NAME	COMMON NAME
ASTERACEAE	SUNFLOWER FAMILY
<i>Artemisia californica</i>	California Sagebrush
<i>Encelia californica</i>	California Encelia
CACTACEAE	CACTUS FAMILY
<i>Opuntia littoralis</i> var. <i>littoralis</i>	Coast Prickly Pear
<i>Opuntia prolifera</i>	Coast Cholla
LAMIACEAE	MINT FAMILY
<i>Salvia apiana</i>	White Sage
<i>Salvia mellifera</i>	Black Sage
POLYGONACEAE	BUCKWHEAT FAMILY
<i>Eriogonum fasciculatum</i>	California Buckwheat
SCROPHULARIACEAE	FIGWORT FAMILY
<i>Mimulus aurantiacus</i>	Monkey Flower

8.3 Appendix C: Total Cover and % absolute cover for each plant species encountered in each plot, in the San Joaquin Hills, 1998.

Scientific Name	Good Habitat - Gnatcatchers Present				Good Habitat - Gnatcatchers Absent				Poor Habitat - Gnatcatchers Absent				
	Cover (meters)	± SE	% Abs. Cov.	± SE Freq.	Cover in meters	± SE	% Abs. Cov.	± SE Freq.	Cover in meters	± SE	% Abs. Cov.	± SE Freq.	
<i>Agrostis diegoensis</i>	--	--	--	--	0.14	0.14	0.19	0.19	11.11	0.02	0.02	0.02	11.11
<i>Ambrosia psilostachys</i>	0.01	0.01	0.01	11.11	--	--	--	--	--	--	--	--	--
<i>Anagallis arvensis*</i>	2.63	2.14	3.50	44.44	3.18	1.55	4.24	2.06	77.78	0.30	0.26	0.40	55.56
<i>Antirrhinum nuttalianum</i>	--	--	--	--	--	--	--	--	--	--	--	--	--
<i>Apiastrum angustifolium</i>	--	--	--	--	--	--	--	--	--	0.02	0.01	0.03	33.33
<i>Aristida purpurea</i>	1.02	1.02	1.35	11.11	--	--	--	--	--	0.18	0.15	0.24	22.22
<i>Artemisia californica</i>	24.30	4.30	32.40	100	18.25	5.37	24.33	7.16	77.78	5.06	2.59	6.75	88.89
<i>Artemisia douglasiana</i>	0.02	0.02	0.03	11.11	--	--	--	--	--	--	--	--	--
<i>Baccharis pilularis</i>	0.06	0.06	0.08	11.11	0.76	0.66	1.01	0.87	22.22	0.01	0.01	0.01	11.11
<i>Bloomeria crocea</i>	--	--	--	--	0.03	0.02	0.04	0.03	22.22	0.19	0.19	0.25	11.11
<i>Brassica nigra*</i>	0.80	0.48	1.07	44.44	0.73	0.38	0.98	0.51	55.56	0.09	0.06	0.12	33.33
<i>Calochortus splendens</i>	--	--	--	--	0.01	0.01	0.01	0.01	11.11	0.02	0.02	0.02	22.22
<i>Calochortus sp.</i>	--	--	--	--	--	--	--	--	--	0.01	0.01	0.01	11.11
<i>Calystegia macrostegia</i>	0.06	0.06	0.08	11.11	--	--	--	--	--	0.34	0.23	0.45	55.56
<i>Cardionema ramosissimum</i>	0.07	0.07	0.10	11.11	--	--	--	--	--	--	--	--	--
<i>Castilleja exserta</i>	--	--	--	--	0.00	0.00	0.00	0.00	11.11	--	--	--	--
<i>Centaurea melitensis*</i>	1.06	0.76	1.41	33.33	1.82	1.13	2.43	1.51	44.44	2.92	1.90	3.90	33.33
<i>Chaemosyce albomarginata</i>	0.07	0.07	0.10	11.11	0.01	0.01	0.01	0.01	11.11	--	--	--	--
<i>Chlorogalum pomeridianum</i>	--	--	--	--	--	--	--	--	--	0.04	0.04	0.05	22.22
<i>Cirrium occidentale</i>	--	--	--	--	0.01	0.01	0.02	0.02	11.11	--	--	--	--
<i>Claytonia perfoliata</i>	--	--	--	--	--	--	--	--	--	0.00	0.00	0.01	22.22
<i>Convolvulus arvensis*</i>	--	--	--	--	--	--	--	--	--	0.00	0.00	0.00	11.11
<i>Coryza canadensis</i>	0.02	0.02	0.03	22.22	0.05	0.03	0.07	0.03	44.44	0.02	0.02	0.03	33.33
<i>Coryza sp.</i>	--	--	--	--	0.00	0.00	0.00	0.00	11.11	0.13	0.09	0.18	33.33
<i>Crassula connata</i>	0.00	0.00	0.00	11.11	0.01	0.01	0.01	0.01	11.11	0.15	0.10	0.21	22.22
<i>Cryptantha intermedia</i>	0.10	0.10	0.14	22.22	0.03	0.03	0.03	0.03	11.11	0.05	0.04	0.06	22.22

Scientific Name	Good Habitat - Gnatcatchers Present				Good Habitat - Gnatcatchers Absent				Poor Habitat - Gnatcatchers Absent						
	Cover (meters)	± SE	% Abs. Cov.	± SE	Freq.	Cover in meters	± SE	% Abs. Cov.	± SE	Freq.	Cover in meters	± SE	% Abs. Cov.	± SE	Freq.
<i>Cryptantha</i> sp.	--	--	--	--	--	--	--	--	--	--	0.02	0.01	0.02	0.02	22.22
<i>Cucurbita foetidissima</i>	0.01	0.01	0.01	0.01	11.11	--	--	--	--	--	--	--	--	--	--
<i>Cuscuta californica</i>	--	--	--	--	--	--	--	--	--	--	0.19	0.19	0.25	0.25	11.11
<i>Cynara cardunculus</i> *	--	--	--	--	--	0.21	0.15	0.28	0.20	33.33	--	--	--	--	--
<i>Daucus pusillus</i> *	0.07	0.04	0.10	0.05	44.44	0.80	0.37	1.06	0.49	55.56	0.07	0.03	0.10	0.04	66.67
<i>Dichelostemma pulchellum</i>	0.01	0.01	0.02	0.01	22.22	0.02	0.02	0.03	0.03	22.22	0.01	0.00	0.01	0.01	33.33
<i>Dichondra occidentalis</i>	--	--	--	--	--	0.10	0.10	0.13	0.13	11.00	--	--	--	--	--
<i>Emmenanthe penulifera</i>	--	--	--	--	--	0.00	0.00	0.00	0.00	11.11	--	--	--	--	--
<i>Encelia californica</i>	1.73	1.16	2.30	1.54	22.22	3.24	2.28	4.33	3.04	33.33	0.26	0.26	0.35	0.35	11.11
<i>Eremocarpus setiger</i>	0.57	0.41	0.76	0.55	44.44	0.00	0.00	0.00	0.00	11.11	--	--	--	--	--
<i>Eriophyllum confertiflorum</i>	--	--	--	--	--	--	--	--	--	--	0.10	0.07	0.14	0.09	22.22
<i>Eriogonum fasciculatum</i>	16.52	5.05	22.02	6.74	77.78	10.72	3.84	14.30	5.12	77.78	10.50	2.00	14.00	2.67	88.89
<i>Ericameria pinifolia</i>	0.51	0.42	0.68	0.56	33.33	--	--	--	--	--	--	--	--	--	--
<i>Erodium botrys</i> *	0.30	0.26	0.40	0.35	22.22	0.39	0.21	0.51	0.29	33.33	0.06	0.04	0.08	0.05	22.22
<i>Erodium cicutarium</i> *	0.50	0.49	0.67	0.66	33.33	--	--	--	--	--	0.01	0.01	0.01	0.01	22.22
<i>Erodium moschatum</i> *	--	--	--	--	--	0.01	0.01	0.01	0.01	11.11	--	--	--	--	--
<i>Eucrypta chrysanthemifolia</i>	0.24	0.18	0.32	0.24	22.22	0.29	0.19	0.39	0.26	22.22	0.64	0.27	0.86	0.36	55.56
<i>Filago californica</i>	0.01	0.01	0.01	0.01	22.22	0.18	0.09	0.24	0.12	66.67	0.52	0.25	0.69	0.33	66.67
<i>Galium angustifolium</i>	0.43	0.37	0.58	0.49	33.33	0.63	0.36	0.84	0.48	44.44	0.80	0.43	1.07	0.57	33.33
<i>Galium nuttallii</i>	1.50	0.79	2.00	1.05	55.56	2.35	1.20	3.14	1.59	55.56	0.98	0.71	1.31	0.94	55.56
<i>Geranium carolinianum</i>	--	--	--	--	--	0.04	0.04	0.06	0.06	11.11	--	--	--	--	--
<i>Gilia australis</i>	--	--	--	--	--	0.06	0.06	0.08	0.08	11.11	--	--	--	--	--
<i>Gnaphalium californicum</i>	0.76	0.47	1.01	0.63	44.44	0.21	0.07	0.28	0.10	###	0.43	0.22	0.57	0.29	55.56
<i>Gnaphalium palustre</i>	0.03	0.03	0.04	0.04	11.11	0.10	0.07	0.14	0.09	33.33	0.27	0.23	0.36	0.31	22.22
<i>Gnaphalium</i> sp.	--	--	--	--	--	--	--	--	--	--	0.03	0.03	0.04	0.04	22.22
<i>Hazardia squarrosa</i>	--	--	--	--	--	0.06	0.06	0.08	0.08	11.11	0.75	0.50	1.00	0.67	22.22
<i>Hemizonia fasciculata</i>	0.49	0.32	0.65	0.43	44.44	0.87	0.37	1.16	0.50	77.78	0.87	0.47	1.17	0.63	77.78
<i>Hesperocnide tenella</i>	--	--	--	--	--	0.01	0.01	0.02	0.02	11.11	--	--	--	--	--
<i>Heteromeles arbutifolia</i>	--	--	--	--	--	0.36	0.36	0.48	0.48	11.11	--	--	--	--	--

Scientific Name	Good Habitat - Gnatcatchers Present				Good Habitat - Gnatcatchers Absent				Poor Habitat - Gnatcatchers Absent						
	Cover (meters)	± SE	% Abs. Cov.	± SE	Freq.	Cover in meters	± SE	% Abs. Cov.	± SE	Freq.	Cover in meters	± SE	% Abs. Cov.	± SE	Freq.
<i>Hirschfeldia incana</i> *	0.24	0.20	0.32	0.27	22.22	0.03	0.03	0.04	0.04	11.11	0.08	0.08	0.10	0.10	11.11
<i>Hypochoeris glabra</i> *	5.07	2.50	6.76	3.34	66.67	3.62	1.36	4.82	1.81	66.67	6.39	2.70	8.51	3.60	88.89
<i>Hypochoeris radicata</i> *	0.20	0.11	0.26	0.15	44.44	0.07	0.06	0.10	0.07	22.22	0.01	0.01	0.01	0.01	11.11
<i>Isomeris arboreus</i>	0.05	0.05	0.07	0.07	11.11	--	--	--	--	--	--	--	--	--	--
<i>Isocoma menziesii</i>	0.60	0.56	0.80	0.74	22.22	0.68	0.44	0.90	0.58	33.33	0.17	0.17	0.23	0.23	11.11
<i>Juncun bufonius</i>	--	--	--	--	--	0.13	0.13	0.17	0.17	11.11	0.07	0.07	0.09	0.09	11.11
<i>Lactuca scariola</i> *	0.01	0.01	0.02	0.02	11.11	0.01	0.01	0.01	0.01	11.11	0.01	0.01	0.01	0.01	11.11
<i>Lessingia filaginifolia</i>	0.66	0.52	0.88	0.69	33.33	0.91	0.59	1.22	0.79	33.33	0.52	0.52	0.70	0.70	11.11
<i>Leymus condensatus</i>	2.37	1.21	3.16	1.61	44.44	0.24	0.16	0.33	0.22	22.22	--	--	--	--	--
<i>Linaria canadensis var. texana</i>	0.00	0.00	0.00	0.00	11.11	--	--	--	--	--	0.01	0.01	0.01	0.01	11.11
Lichen	--	--	--	--	--	0.01	0.01	0.02	0.02	11.11	--	--	--	--	--
<i>Lotus hamatus</i>	--	--	--	--	--	0.01	0.01	0.01	0.01	11.11	0.02	0.02	0.03	0.03	22.22
<i>Lotus salsuginosus</i>	0.00	0.00	0.00	0.00	11.11	0.19	0.14	0.25	0.19	33.33	0.01	0.01	0.01	0.01	11.11
<i>Lotus scoparius</i>	4.63	2.07	6.17	2.75	55.56	21.82	7.09	29.10	9.45	77.78	26.18	4.73	34.91	6.30	100
<i>Lotus strigosus</i>	--	--	--	--	--	0.15	0.12	0.20	0.16	22.22	0.04	0.04	0.05	0.05	11.11
<i>Lupinus bicolor</i>	0.26	0.20	0.35	0.27	33.33	0.54	0.29	0.72	0.38	44.44	0.35	0.22	0.47	0.29	44.44
<i>Lupinus succulentus</i>	--	--	--	--	--	0.18	0.18	0.24	0.24	11.11	0.01	0.01	0.01	0.01	11.11
<i>Lupinus sparsiflorus</i>	--	--	--	--	--	--	--	--	--	--	0.08	0.08	0.11	0.11	11.11
<i>Lupinus truncatus</i>	0.06	0.06	0.08	0.08	22.22	0.78	0.52	1.05	0.69	22.22	0.16	0.16	0.21	0.21	11.11
<i>Lupinus sp.</i>	--	--	--	--	--	--	--	--	--	--	0.03	0.02	0.03	0.02	22.22
<i>Malacothamnus fasciculatus</i>	0.06	0.06	0.08	0.08	11.11	0.30	0.30	0.40	0.40	11.11	7.26	4.33	9.68	5.77	66.67
<i>Malosma laurina</i>	0.74	0.55	0.99	0.74	44.44	2.35	1.56	3.13	2.08	33.33	6.06	2.35	8.08	3.13	77.78
<i>Malacothrix saxitalis</i>	0.04	0.04	0.06	0.05	22.22	0.09	0.06	0.12	0.08	33.33	0.26	0.12	0.35	0.16	66.67
<i>Marah macrocarpus</i>	--	--	--	--	--	--	--	--	--	--	0.08	0.08	0.11	0.11	11.11
<i>Medicago polymorpha</i> *	--	--	--	--	--	0.60	0.59	0.80	0.79	22.22	0.06	0.05	0.08	0.07	22.22
<i>Melica imperfecta</i>	0.19	0.10	0.25	0.14	33.33	0.09	0.09	0.12	0.12	11.11	--	--	--	--	--
<i>Melilotus indicus</i> *	--	--	--	--	--	0.01	0.01	0.02	0.02	11.11	--	--	--	--	--
<i>Mimulus aurantiacus</i>	5.60	3.39	7.47	4.52	66.67	2.17	1.06	2.89	1.41	55.56	0.16	0.12	0.22	0.15	33.33
<i>Mirabilis californica</i>	0.08	0.06	0.10	0.07	22.22	--	--	--	--	--	--	--	--	--	--

Scientific Name	Good Habitat - Gnatcatchers Present				Good Habitat - Gnatcatchers Absent				Poor Habitat - Gnatcatchers Absent						
	Cover (meters)	± SE	% Abs. Cov.	± SE	Freq.	Cover in meters	± SE	% Abs. Cov.	± SE	Freq.	Cover in meters	± SE	% Abs. Cov.	± SE	Freq.
Moss	0.00	0.00	0.00	0.00	11.11	0.02	0.01	0.02	0.02	22.22	0.00	0.00	0.00	0.00	11.11
<i>Muhlenbergia microsperma</i>	0.18	0.18	0.24	0.24	11.11	--	--	--	--	--	--	--	--	--	--
<i>Nassella lepida</i>	1.20	1.16	1.60	1.55	33.33	3.79	2.03	5.06	2.70	77.78	2.15	1.24	2.86	1.65	55.56
<i>Nassella pulchra</i>	3.71	2.83	4.95	3.77	55.56	5.91	2.68	7.88	3.57	77.78	0.88	0.53	1.17	0.71	44.44
<i>Nicotiana glauca</i> *	0.07	0.05	0.09	0.07	22.22	--	--	--	--	--	--	--	--	--	--
Non-native Grasses*	37.18	8.56	49.58	11.42	100.00	42.27	7.41	56.35	9.88	100.00	43.03	3.23	57.37	4.31	100.00
<i>Opuntia littoralis</i>	4.39	1.98	5.86	2.65	44.44	0.49	0.45	0.65	0.60	22.22	0.31	0.17	0.41	0.23	33.33
<i>Opuntia prolifera</i>	0.01	0.01	0.02	0.02	11.11	--	--	--	--	--	--	--	--	--	--
<i>Osmodenia tenella</i>	--	--	--	--	--	--	--	--	--	--	0.06	0.06	0.08	0.08	11.11
<i>Phacelia cicutaria</i>	--	--	--	--	--	--	--	--	--	--	0.26	0.22	0.34	0.29	33.33
<i>Phacelia distans</i>	0.55	0.43	0.74	0.58	22.22	--	--	--	--	--	--	--	--	--	--
<i>Phacelia sp.</i>	0.61	0.61	0.81	0.81	11.11	--	--	--	--	--	--	--	--	--	--
<i>Plagiobothrys canescens</i>	--	--	--	--	--	--	--	--	--	--	0.00	0.00	0.00	0.00	11.11
<i>Poa secunda</i>	0.20	0.20	0.27	0.27	11.11	--	--	--	--	--	--	--	--	--	--
<i>Polypogon monospermiunum</i> *	--	--	--	--	--	--	--	--	--	--	0.00	0.00	0.00	0.00	11.11
<i>Pterostegia drymaroides</i>	--	--	--	--	--	--	--	--	--	--	0.35	0.35	0.47	0.47	11.11
<i>Ranunculus californica</i>	--	--	--	--	--	0.51	0.51	0.68	0.68	11.11	--	--	--	--	--
<i>Rafinesquia californica</i>	--	--	--	--	--	--	--	--	--	--	0.33	0.21	0.44	0.28	55.56
<i>Rhamnus crocea</i>	--	--	--	--	--	0.18	0.18	0.23	0.23	11.11	--	--	--	--	--
<i>Rhamnus ilicifolia</i>	--	--	--	--	--	--	--	--	--	--	0.04	0.04	0.06	0.06	11.11
<i>Rhus integrifolia</i>	1.22	0.71	1.63	0.95	33.33	2.60	1.93	3.47	2.57	44.44	4.18	1.28	5.57	1.71	77.78
<i>Salvia apiana</i>	1.73	1.28	2.31	1.71	22.22	--	--	--	--	--	--	--	--	--	--
<i>Salvia mellifera</i>	0.04	0.02	0.06	0.03	33.33	3.33	2.38	4.44	3.18	33.33	14.34	3.48	19.11	4.64	88.89
<i>Sambucus mexicanus</i>	0.63	0.46	0.83	0.62	22.22	0.07	0.07	0.09	0.09	11.11	--	--	--	--	--
<i>Sanicula crassicaulis</i>	0.08	0.08	0.11	0.11	11.11	0.59	0.39	0.78	0.51	44.44	0.03	0.03	0.04	0.03	22.22
<i>Sanicula arguta</i>	0.06	0.06	0.08	0.08	11.11	--	--	--	--	--	--	--	--	--	--
<i>Scrophularia californica</i>	0.36	0.35	0.48	0.46	22.22	0.38	0.25	0.51	0.34	22.22	0.00	0.00	0.00	0.00	11.11
<i>Silene gallica</i> *	0.14	0.07	0.19	0.09	55.56	0.16	0.06	0.21	0.08	66.67	0.12	0.05	0.16	0.07	66.67

Scientific Name	Good Habitat - Gnatcatchers Present			Good Habitat - Gnatcatchers Absent			Poor Habitat - Gnatcatchers Absent				
	Cover (meters)	± SE	% Abs. Cov.	± SE	Cover in meters	% Abs Cov	± SE	Cover in meters	% Abs Cov	± SE	Freq.
<i>Solanum douglasii</i>	0.17	0.11	0.23	0.15	33.33	0.01	0.01	0.01	0.01	11.11	11.11
<i>Solanum xanthii</i>	--	--	--	--	0.18	0.18	0.23	0.23	0.23	11.11	11.11
<i>Solanum</i> sp.	--	--	--	--	--	--	--	--	--	--	--
<i>Sonchus asper*</i>	--	--	--	--	0.25	0.12	0.33	0.17	0.17	66.67	66.67
<i>Sonchus oleraceus*</i>	0.01	0.01	0.02	0.02	0.26	0.10	0.35	0.13	0.13	88.89	88.89
<i>Spergularia arvensis*</i>	--	--	--	--	0.01	0.01	0.02	0.02	0.02	11.11	11.11
<i>Stachys albens</i>	0.03	0.03	0.04	0.04	0.16	0.11	0.21	0.15	0.15	33.33	33.33
<i>Stephanomeria exigua</i>	0.01	0.01	0.02	0.02	--	--	--	--	--	--	--
<i>Stephanomeria virgata</i>	--	--	--	--	0.34	0.17	0.45	0.23	0.23	88.89	88.89
<i>Sisyrinchium bellum</i>	0.07	0.07	0.09	0.09	0.22	0.15	0.30	0.20	0.20	22.22	22.22
<i>Trifolium</i> sp.	--	--	--	--	--	--	--	--	--	--	--
<i>Trifolium willdenovii</i>	--	--	--	--	--	--	--	--	--	--	--
Unknown	--	--	--	--	0.01	0.01	0.01	0.01	0.01	11.11	11.11
<i>Uropappus lindleyi</i>	--	--	--	--	--	--	--	--	--	--	--
<i>Verbena lasiostachys</i>	--	--	--	--	0.00	0.00	0.00	0.00	0.00	11.11	11.11
<i>Vicia villosa*</i>	--	--	--	--	--	--	--	--	--	--	--
<i>Viola pedunculata</i>	0.66	0.44	0.88	0.59	22.22	0.04	0.05	0.05	0.05	11.11	11.11
Other											
Bare Ground	1.61	0.56	2.15	0.75	77.78	0.59	0.43	0.78	0.57	33.33	33.33
Litter	2.29	0.84	3.05	1.13	77.78	1.10	0.56	1.47	0.75	44.44	44.44
Rock	0.75	0.57	1.00	0.75	44.44	0.16	0.16	0.22	0.22	11.11	11.11
Total Cover	132.77	9.58	177.03	12.78	144.31	7.65	192.41	10.20	143.38	3.21	191.17
											4.28

8.4 Appendix D: Characteristics of habitat patches in the San Joaquin Hills burn area, 1998.

PATCH #	LOCATION	ACRES	CANOPY HEIGHT	% CSS SPECIES	CAGN CATEGORY	CACTUS HEIGHT	% CACTUS	CCWR CATEGORY
1	CHURCH CYN	3.4	1.3	80	G1	1.1	5	W5
2	CHURCH CYN	1.2	1.3	95	G1			
3	CHURCH CYN	17	0.7	57	G3	1.3	19	W5
4	CHURCH CYN	6.3	0.6	32	G6	1	2	W5
5	CHURCH CYN	0.5	1	10	G5	1.2	70	W1
6	CHURCH CYN	30.2	1	66	G1	1.2	15	W5
7	CHURCH CYN	5.7	0.9	58	G3	1	15	W5
8	CHURCH CYN	0.4	1	85	G1			
9	CHURCH CYN	2.3	0.8	45	G3	0.8	20	W6
10	CHURCH CYN	30.9	1	60	G3	1.1	10	W5
11	CHURCH CYN	0.2	1	5	G5	1	85	W1
12	CHURCH CYN	0.7	1.2	60	G3	1.1	17	W5
13	CHURCH CYN	0.5	1.1	55	G3	1.1	35	W3
14	CHURCH CYN	71.1	1	49	G3	1.2	21	W5
15	CHURCH CYN	1.3	1.1	65	G3	1	6	W5
16	CHURCH CYN	0.7	0.9	45	G3	1.2	35	W3
17	BOMMER CYN	1.3	1	2	G6	0.8	20	W6
18	BOMMER CYN	0.9	1	30	G5	0.9	15	W6
19	BOMMER CYN	3.6	0.8	17	G5	1.1	20	W5
20	BOMMER CYN	6.3	1.1	90	G1	1	2	W5
21	BOMMER CYN	67.8	1.1	55	G3	1	5	W5
22	CHURCH CYN	3.1	0.8	40	G3	0.7	15	W6
23	CHURCH CYN	17.1	0.9	53	G3	0.8	5	W6
24	CHURCH CYN	1.1	0.8	30	G5			
25	BOMMER CYN	0.6	1	5	G5	1.2	75	W1

PATCH #	LOCATION	ACRES	CANOPY HEIGHT	% CSS SPECIES	CAGN CATEGORY	CACTUS HEIGHT	% CACTUS	CCWR CATEGORY
26	BOMMER CYN	1.8	1.1	75	G1	1	5	W5
27	BOMMER CYN	3.1	0.9	35	G3			
28	BOMMER CYN	4.3	1.2	65	G3	1.5	12	W5
29	BOMMER CYN	7.9	0.8	25	G5	0.8	15	W6
30	BOMMER CYN	2.6	1.1	40	G3			
31	BOMMER CYN	4.1	0.8	50	G3	1	6	W5
32	BOMMER CYN	4.9	1.1	50	G3	1	5	W5
33	BOMMER CYN	6.5	0.6	45	G4	0.8	2	W6
34	BOMMER CYN	1.6	0.6	20	G6	0.7	5	W6
35	BOMMER CYN	0.9	0	0	G6	0.7	50	W4
36	BOMMER CYN	7.9	0.8	30	G5	1.5	4	W5
37	BOMMER CYN	2.5	0.7	40	G3	0.9	10	W6
38	BOMMER CYN	2.3	1	52	G3			
39	BOMMER CYN	4.9	0.8	33	G3			
40	BOMMER CYN	23.8	0.8	52	G3	0.9	5	W6
41	BOMMER CYN	16.2	0.9	35	G3	1.3	6	W5
42	BOMMER CYN	4.5	0.9	30	G5			
43	BOMMER CYN	0.9	0.7	15	G5	0.8	10	W6
44	BOMMER CYN	0.6	1.1	10	G5	1.2	70	W1
46	BOMMER CYN	0.1				0.8	100	W2
47	BOMMER CYN	0.8	0.9	50	G3	1	5	W5
48	BOMMER CYN	0.7	1	60	G3	1	5	W5
49	BOMMER CYN	0.8	1	5	G5	1	60	W3
50	BOMMER CYN	0.7	0.6	30	G6			
51	BOMMER CYN	2.6	9	5	G6	0.8	20	W6
52	BOMMER CYN	4.9	0.7	14	G5	1.4	17	W5

PATCH #	LOCATION	ACRES	CANOPY HEIGHT	% CSS SPECIES	CAGN CATEGORY	CACTUS HEIGHT	% CACTUS	CCWR CATEGORY
53	BOMMER CYN	3.6	0.9	5	G5	1	10	W5
54	BOMMER CYN	4.5	1	60	G3	1.3	17	W5
55	BOMMER CYN	7	0.9	10	G5	1	35	W3
56	BOMMER CYN	3.3	0.8	15	G5	1.2	13	W5
59	BOMMER CYN	0.8	1.1	20	G5	1.1	30	W5
60	SHADY CYN	0.6	1.1	35	G3	1.3	15	W5
61	SHADY CYN	0.8	0.8	50	G3			
62	SHADY CYN	1.1	0.8	25	G5	1	15	W5
63	SHADY CYN	1	0.7	30	G5	1	10	W5
64	SHADY CYN	2.5	0.6	45	G4	1.2	10	W5
65	SHADY CYN	1.9	0.6	5	G6	1.2	10	W5
66	SHADY CYN	0.7	0.7	30	G5			
67	SHADY CYN	6.5	0.8	60	G3	1.2	7	W5
68	SHADY CYN	4.1	1	35	G3	1.4	5	W5
69	SHADY CYN	3.2	1.1	50	G3	1.3	3	W5
70	SHADY CYN	2.8	1.1	40	G3	1.2	5	W5
71	SHADY CYN	1.7	1.1	30	G5	1.4	3	W5
72	BOMMER CYN	12	1.1	58	G3			
73	SHADY CYN	1.6	1.2	37	G3			
74	SHADY CYN	3.5	1	25	G5	1	5	W5
75	SHADY CYN	6.3	0.8	40	G3	1	10	W5
76	SHADY CYN	14.3	1	45	G3	1	5	W5
77	SHADY CYN	4	0.8	55	G3			
78	SHADY CYN	0.8	0.9	25	G5	1	5	W5
79	SHADY CYN	8.1	1	30	G5			
80	SHADY CYN	1.4	1.3	45	G3			

PATCH #	LOCATION	ACRES	CANOPY HEIGHT	% CSS SPECIES	CAGN CATEGORY	CACTUS HEIGHT	% CACTUS	CCWR CATEGORY
81	SHADY CYN	5.3	1.3	50	G3			
82	SHADY CYN	2.3	1	45	G3	1	5	W5
83	SHADY CYN	12.9	1	35	G3	1	5	W5
84	SHADY CYN	3.32	1	20	G5	1	5	W5
85	SHADY CYN	0.8	0.7	35	G3	0.8	7	W6
86	SHADY CYN	0.6	0.8	45	G3	1.2	2	W5
87	SHADY CYN	17	1	75	G1	1.3	7	W5
88	SHADY CYN	0.8	1.2	40	G3			
89	SHADY CYN	5.3	0.7	27	G5			
90	SHADY CYN	1	0.6	25	G6			
91	SHADY CYN	26.4	1	35	G3	1.3	25	W5
92	SHADY CYN	1.7	0.9	30	G5	1.4	15	W5
93	SHADY CYN	7.1	1.2	70	G1	1	5	W5
94	SHADY CYN	3.4	1.2	80	G1			
95	SHADY CYN	3.2	0.6	85	G2	0.8	5	W6
96	SHADY CYN	16.9	1.1	40	G3	1.1	20	W5
97	SHADY CYN	0.5	1.2	10	G5	1.8	30	W5
98	SHADY CYN	0.4	0.9	70	G1	1	2	W5
99	SHADY CYN	0.2	0.8	30	G5	0.8	5	W6
100	SHADY CYN	6.1	1	15	G5	1.7	20	W5
101	SHADY CYN	0.6	1.2	30	G5	1.5	10	W5
102	SHADY CYN	1.7	0.6	45	G4	0.8	5	W6
103	SHADY CYN	6	0.9	35	G3	0.8	2	W6
104	SHADY CYN	4.1	0.9	30	G5			
105	SHADY CYN	14.4	1.2	70	G1	1.3	10	W5
106	SHADY CYN	6.5	1.2	35	G3			

PATCH #	LOCATION	ACRES	CANOPY HEIGHT	% CSS SPECIES	CAGN CATEGORY	CACTUS HEIGHT	% CACTUS	CCWR CATEGORY
107	SHADY CYN	0.9	1.1	25	G5			
108	SHADY CYN	11.6	1	55	G3	1	15	W5
109	SHADY CYN	1.7	1.2	65	G3	1.4	15	W5
110	SHADY CYN	5.3	1	20	G5	1.2	20	W5
111	SHADY CYN	55	1	57	G3	1	3	W5
112	SHADY CYN	3.5	1.2	25	G5	1.5	30	W5
120	LAIDLAW	3.8	1.1	60	G3	0.8	2	W6
121	LAIDLAW	8.5	1.1	55	G3	1	2	W5
122	LAIDLAW	7.9	1	15	G5			
123	LAIDLAW	37	1.1	48	G3	1	2	W5
124	LAIDLAW	22	1.1	15	G5			
126	LAIDLAW	7.7	1	20	G5			
127	LAIDLAW	10.1	1.2	67	G1	1	2	W5
128	LAGUNA CYN RD	23.2	1.1	60	G3			
129	LAGUNA CYN RD	104.7	1	27	G5			
130	LAGUNA CYN RD	15.3	1	55	G3			
131	LAGUNA CYN RD	4.7	0.6	40	G4			
132	LAGUNA CYN RD	33.7	1.1	30	G5			
133	LAGUNA CYN RD	2.3	1.1	30	G5			
134	LAGUNA CYN RD	16	0.8	27	G5			
135	LAGUNA CYN RD	2.9	1	15	G5	1.2	20	W5
136	LAGUNA CYN RD	17.8	1.2	30	G5			
137	LAGUNA CYN RD	29.2	1.2	27	G5			
138	LAGUNA CYN RD	5.2	0.9	50	G3			
139	LAGUNA CYN RD	3.3	1.2	35	G3			
140	LAGUNA CYN RD	7.9	1.1	25	G5			

PATCH #	LOCATION	ACRES	CANOPY HEIGHT	% CSS SPECIES	CAGN CATEGORY	CACTUS HEIGHT	% CACTUS	CCWR CATEGORY
141	LAGUNA CYN RD	16.1	1.2	40	G3			
142	LAGUNA CYN RD	1.6	1.2	40	G3			
143	LAGUNA CYN RD	92.4	0.9	40	G3	1	2	W5
144	LAGUNA CYN RD	22.9	1.3	25	G5			
145	LAGUNA CYN RD	1.1	1.2	50	G3			
146	LAGUNA CYN RD	2.5	1.2	40	G3			
147	LAGUNA CYN RD	1.6	1.2	25	G5			
148	LAGUNA CYN RD	1.6	1.2	30	G5			
149	LAGUNA CYN RD	11.5	1	43	G3			
150	SHADY CYN	3.1	1	25	G5	1	5	W5
151	SHADY CYN	8.7	1.1	20	G5			
152	SHADY CYN	5.5	0.6	25	G6			
153	SHADY CYN	1.5	1	35	G3			
154	SHADY CYN	0.4	1.1	40	G3			
155	SHADY CYN	6	0.6	10	G6	1	15	W5
156	SHADY CYN	4	0.6	10	G6	1.1	10	W5
157	SHADY CYN	3	1	20	G5			
158	SHADY CYN	31.8	1	49	G3			
159	SHADY CYN	5.7	1.1	35	G3			
160	SHADY CYN	7	0.8	25	G5	1.1	5	W5
161	LAGUNA CYN RD	11.9	1	25	G5			
162	LAGUNA CYN RD	5	1	20	G5	1	5	W5
163	LAGUNA CYN RD	4.7	1.2	40	G3			
164	LAGUNA CYN RD	4.9	0.9	15	G5	1	10	W5
165	LAGUNA CYN RD	0.6	1.1	45	G3			
166	LAGUNA CYN RD	3.9	0.7	60	G3			

PATCH #	LOCATION	ACRES	CANOPY HEIGHT	% CSS SPECIES	CAGN CATEGORY	CACTUS HEIGHT	% CACTUS	CCWR CATEGORY
167	LAGUNA CYN RD	11.4	1.1	30	G5	1.2	10	W5
168	LAGUNA CYN RD	1.6	1	25	G5	1	5	W5
169	LAGUNA CYN RD	5.6	0.8	60	G3			
170	LAGUNA CYN RD	22.6	0.7	55	G3			
171	LAGUNA CYN RD	0.9	1.1	25	G5			
172	LAGUNA CYN RD	10	0.9	55	G3			
173	LAGUNA CYN RD	5.4	0.9	35	G3			
174	LAGUNA CYN RD	9.1	0.9	60	G3			
175	LAGUNA CYN RD	11.7	0.8	55	G3			
176	EL MORO CYN	75.3	0.8	70	G1			
177	EL MORO CYN	2	0.9	45	G3	0.8	5	W6
178	EL MORO CYN	2.1	1.3	35	G3			
179	EL MORO CYN	1.6	0.9	66	G1			
180	EL MORO CYN	3	1.1	40	G3			
181	EL MORO CYN	11.3	1	35	G3			
182	EL MORO CYN	2.4	1	30	G5			
183	EL MORO CYN	5.3	1	30	G5			
184	EL MORO CYN	71	1	45	G3	1	20	W5
185	EL MORO CYN	21	0.9	35	G3	0.9	10	W6
186	EL MORO CYN	2.5	1.1	20	G5	1.1	15	W5
187	EL MORO CYN	1.7	0.9	60	G3			
188	EL MORO CYN	1	1.1	60	G3			
189	EL MORO CYN	7	0.8	30	G5	0.9	15	W6
190	EL MORO CYN	7.8	1	60	G3			
191	EL MORO CYN	2				1	25	W5
192	EL MORO CYN	4.5	0.7	40	G3	0.9	20	W6
193	EL MORO CYN	0.4	0.7	65	G3			
194	EL MORO CYN	4.2	1.1	25	G5			
195	EL MORO CYN	38.6	0.8	20	G5	0.8	10	W6

PATCH #	LOCATION	ACRES	CANOPY HEIGHT	% CSS SPECIES	CAGN CATEGORY	CACTUS HEIGHT	% CACTUS	CCWR CATEGORY
196	MUDDY CYN	10.2	1	40	G3	1.1	5	W5
197	EL MORO CYN	8.4	0.9	40	G3			
198	EL MORO CYN	13.1	1	30	G5	0.8	20	W6
199	EL MORO CYN	4	1	65	G3			
200	EL MORO CYN	0.7	0.8	85	G1			
201	MUDDY CYN	3.4	0.9	65	G1			
202	EL MORO CYN	7.7	1	45	G3	1	10	W5
203	MUDDY CYN	5.1	1	15	G5	1.1	45	W3
204	EL MORO CYN	0.4				1.3	15	W5
205	MUDDY CYN	3.8				0.9	5	W6
206	MUDDY CYN	1.8	0.9	50	G3	0.9	10	W6
207	MUDDY CYN	27.2	0.7	75	G1			
208	MUDDY CYN	21.2	0.6	40	G4	0.9	5	W6
209	MUDDY CYN	15.2	1	65	G3			
210	LOS TRANCOS	7.5	0.9	45	G3			
211	LOS TRANCOS	12.6	0.9	50	G3			
212	MUDDY CYN	2.4	0.9	10	G5	0.8	50	W4
213	MUDDY CYN	8.7	0.7	10	G5	0.7	50	W4
214	LOS TRANCOS	7.3	1	20	G5	1.2	10	W5
215	LOS TRANCOS	12.5	1.1	30	G5	1	13	W5
216	LOS TRANCOS	0.6	0.6	30	G6			
217	LOS TRANCOS	0.5	0.6	35	G4			
218	LOS TRANCOS	1	1.2	60	G3			
219	LOS TRANCOS	12	1.1	30	G5			
220	LOS TRANCOS	2.8	0.7	20	G5			
221	LAIDLAW	1.3	0.7	55	G3			
222	LAIDLAW	0.5	1.2	45	G3			
223	MUDDY CYN	2.5	0.6	70	G2			
224	MUDDY CYN	2.8	1	20	G5			
225	LOS TRANCOS	1.7	0.6	25	G6			
226	LOS TRANCOS	2.3	0.8	15	G5			

PATCH #	LOCATION	ACRES	CANOPY HEIGHT	% CSS SPECIES	CAGN CATEGORY	CACTUS HEIGHT	% CACTUS	CCWR CATEGORY
227	LOS TRANCOS	4.8	1	20	G5			
228	MUDDY CYN	2.3	1.2	20	G5			
229	MUDDY CYN	4.1	0.8	80	G1	1.3	5	W5
230	MUDDY CYN	7.6	0.8	95	G1			
231	MUDDY CYN	1.6	0.9	40	G3			
232	MUDDY CYN	2.1	0.7	45	G3			
233	MUDDY CYN	5	0.7	50	G3	0.7	5	W5
234	MUDDY CYN	1.2	0.7	20	G5			
235	MUDDY CYN	51.2	1	75	G1			
236	MUDDY CYN	7.8	0.6	35	G4			
237	MUDDY CYN	11.5	0.8	60	G3			
238	MUDDY CYN	2.1	0.7	55	G3			
239	MUDDY CYN	1.1	1.1	35	G3	1.2	10	W5
240	MUDDY CYN	1.5	1.1	30	G5			
241	BOAT CYN	2.8	1.1	65	G3	1	10	W5
242	EL MORO CYN	3.3	1	55	G3			
243	EL MORO CYN	2.3	0.8	70	G1	0.6	5	W6
244	EL MORO CYN	4.5	1.1	35	G3			
245	EL MORO CYN	0.9	1	15	G5	0.9	55	W4
250	EL MORO CYN	10.1	1	60	G3			
251	EL MORO CYN	6.7	1.1	20	G5			
252	EL MORO CYN	2.4	0.9	30	G5			
253	EL MORO CYN	32.7	0.7	65	G3			
254	EL MORO CYN	19.2	0.7	40	G3	1.2	10	W5
255	EL MORO CYN	19.2	0.7	35	G3			
256	EL MORO CYN	23.7	1	50	G3	1	10	W5
257	EL MORO CYN	13.8	1	65	G3	0.8	5	W6
258	EL MORO CYN	16.1	0.8	40	G3	1	5	W5
259	EL MORO CYN	0.9	1.2	40	G3			
260	MUDDY CYN	1.9	0.8	75	G1	0.8	10	W6
261	MUDDY CYN	1.7	1	30	G5			

PATCH #	LOCATION	ACRES	CANOPY HEIGHT	% CSS SPECIES	CAGN CATEGORY	CACTUS HEIGHT	% CACTUS	CCWR CATEGORY
262	BOAT CYN	14.8	0.7	35	G3	1	5	W5
263	BOAT CYN	1.1	1	60	G3			
264	BOAT CYN	1.8			G3			
265	BOAT CYN	13.4	1	45	G3	1.1	5	W5
266	BOAT CYN	6.6	0.9	40	G3			
267	BOAT CYN	1.2	1.1	60	G3			
268	BOAT CYN	33.2	0.9	80	G1	1.1	10	W5
269	BOAT CYN	2.7	0.9	50	G3	0.9	3	W6
270	BOAT CYN	6.4	0.8	40	G3			
271	BOAT CYN	35.1	0.7	40	G3	1	5	W5
272	LAGUNA CYN RD	16.2	1	60	G3			
273	BOAT CYN	5	1	45	G3			
274	LAGUNA CYN RD	1.8	0.8	25	G5	0.8	5	W6
275	LAGUNA CYN RD	8.2	0.8	55	G3			
276	LAGUNA CYN RD	3.9			G3			
277	LAGUNA CYN RD	67.8	1	60	G3			
278	LAGUNA CYN RD	10.5	1	30	G5			
279	LAGUNA CYN RD	16	1	50	G3			
280	LAGUNA CYN RD	9.1	1	35	G3	1	5	W5
281	BOAT CYN	7.6	1	55	G3			
282	LAGUNA CYN RD	14.5	0.8	60	G3			
283	LAGUNA CYN RD	10.4	0.9	70	G1	1.1	10	W5
284	LAGUNA CYN RD	17.1	1.1	70	G1			
285	LAGUNA CYN RD	12.4	1.1	60	G3			
286	LAGUNA CYN RD	3.7	0.8	45	G3	1	20	W5
287	LAGUNA CYN RD	2.4	1	45	G3	0.9	10	W6
288	LAGUNA CYN RD	5.8	1.2	65	G1			
289	EL MORO CYN	3	1.1	40	G3	1.2	35	W3
290	EL MORO CYN	7.1	0.9	45	G3	0.8	10	W6
291	EL MORO CYN	2.9	1.1	35	G3	0.8	5	W6
298	EL MORO CYN	3			G3			

PATCH #	LOCATION	ACRES	CANOPY HEIGHT	% CSS SPECIES	CAGN CATEGORY	CACTUS HEIGHT	% CACTUS	CCWR CATEGORY
303	EL MORO CYN	0.5	0.9	50	G3			
350	LOS TRANCOS	18.4	0.8	65	G3	1.2	5	W5
351	LOS TRANCOS	49.2	0.8	65	G3			
352	LOS TRANCOS	21.8	1	70	G1			
353	LOS TRANCOS	149.2	0.9	20	G5			
354	LOS TRANCOS	13.9	0.6	30	G6			
576	LAGUNA CYN RD	1.9	0.8	40	G3			
581	LAGUNA CYN RD	4.5	0.8	20	G5	1.1	5	W5
17A	BOMMER CYN	11.1	1	52	G3	1.2	20	W5
38A	BOMMER CYN	31.3	0.7	30	G5	1	3	W5
41A	SHADY CYN	7.3	0.7	5	G5	1.3	35	W3
53A	BOMMER CYN	13.3	1.1	45	G3	1.2	14	W5

8.5 Appendix E: Wildlife details in the San Joaquin Hills burn area, 1998.

Table E1: Breeding success of individual California gnatcatcher pairs located in the San Joaquin Hills, 1998.

Pair #	Pair location	# of nests attempted	# of eggs laid	# of young hatched	# of young fledged	Comments
1	Laidlaw	2	10	6	3	both nests in sagebrush
2	Laidlaw	4	11	7	4	successful nests in buckwheat, unsuccessful nests in sagebrush
3	Laidlaw	4	11	4	0	nests in phacelia and sagebrush, male from #10 moved in, in July, other male disappeared
4	Laidlaw	2	8	8	8	both nests in sagebrush
5	Shady Canyon	2	9	7	3	both nests in sagebrush
6	Boat Canyon	3	7	3	0	nests in buckwheat, pair disappeared in june
7	Shady Canyon	1	4	4	4	nest in sagebrush, pair disappeared in may
8	Boat Canyon	2	8	8	8	nests in sunflower
9	Boat Canyon	3	10	10	10	nests in sunflower
10	Laidlaw	2	8	3	3	both nests in sagebrush, male moved to pair #3 in july
Total		25	86	60	43	

Table E2: Breeding success of individual cactus wren pairs located in the San Joaquin Hills, 1998.

Pair #	Pair location	# of nests attempted	# of eggs laid ¹	# of young hatched ¹	# of young fledged	Comments
1	Shady Canyon	2	4+	6	6	both nests in opuntia
2	Shady Canyon	2	5+	5	5	one nest in opuntia, one in cholla
3	Shady Canyon	2	7	7	6	both nests in opuntia
4	Shady Canyon	1	?	?	2	nest in opuntia
5	Shady Canyon	1	4	3	3	nest in opuntia
6	Boat Canyon	2	3	3	3	both nests in opuntia
7	Emerald Canyon	2	3	3	3	both nests in opuntia
8	Bommer Canyon	3	10	9	5	two nests in opuntia, one in cholla
9	Bommer Canyon	2	5	5	5	both nests in opuntia
10	El Moro Canyon	1	?	?	2	both nests in opuntia
Total		18	41+	41+	40	

¹ total # of eggs laid and chicks hatched not always possible to determine due to nest location and shape, 4+ indicates that 4 were known to occur but more were suspected or known but could not be quantified.

Table E3: Banded birds recorded in the San Joaquin Hills, 1998.

SPECIES	DATE OBSERVED	LOCATION	SEX	BAND	MATE
CCWR	numerous times	BOMMER CYN		UK	UB
CCWR	2/7/98	CHURCH CANYON		UK	UP
CCWR	2/16/98	LOS TRANCOS		O-M	UB
CCWR	2/17/1998, 3/3/98	SHADY CANYON		LGM-YY	UB
CAGN	numerous times	BOAT CANYON	M	ODB-M	UB
CAGN	3/10/98	BOMMER CANYON	M	LG-YM	UB
CAGN	2/10/98	BOMMER CANYON	M	M-WBL	UB
CAGN	5/25/98	CHURCH CANYON	F	M-PY/LG	UB
CAGN	3/19/1998, 5/15/98	CHURCH CANYON	M	PDG-M	B
CAGN	2/5/1998, 2/7/98	CHURCH CANYON	M	MDG-W/Y	UB
CAGN	4/20/98	COYOTE CYN	M	Y/LGY/LG-M	UB
CAGN	2/23/1998, 5/10/98, 5/24/98	LAGUNA CNY RD	M	YDB-M	B
CAGN	5/10/98	LAGUNA CYN RD	F	M-WRY	B
CAGN	3/31/98	LAGUNA CYN RD	M	LG/YDB-M	UB
CAGN	numerous times	LAIDLAW	F	LG-W/M	UB
CAGN	numerous times	LAIDLAW	F	OLG-M	UB
CAGN	numerous times	LAIDLAW	M	PM-W/R	UB
CAGN	2/13/98	LOS TRANCOS	F	MR/W-R	UB
CAGN	5/10/98	MORRO CYN	M	Y/LG-BM	UK
CAGN	5/10/98	MORRO CYN	M	YM-B	UK
CAGN	4/26/98	MORRO CYN	M	R/WM-LG	UB
CAGN	4/2/98, 4/26/98	MORRO CYN	M	R/W-M	UB
CAGN	numerous times	SHADY CANYON	M	R/W-OM	UB
CAGN	2/13/98	SHADY CANYON	M	DG-MLG	UB
CAGN	2/16/1998, 2/27/98	SHADY CANYON	M	O-BLM	UB
CAGN	6/4/98, 6/8/98	SHADY CANYON	M	R/W-RM	UP
CAGN	3/3/98	SHADY CANYON	M	M-OY	UB
CAGN	7/7/98	COYOTE CYN	HY	W-MW/R	
CAGN	7/7/98	COYOTE CYN	HY	P-MW/R	

* right leg first, M = USFWS metal band, O = orange, W = white, Y = yellow, LB = light blue, DB = dark blue, LG = light green, DG = dark green, Bl = black, R/W = red over white split band, Y/LG yellow over light green split band, P = mauve.

8.6 Appendix F: Fauna recorded in the San Joaquin Hills, 1996-1998.

FAMILY/SPECIES NAME	COMMON NAME
AMPHIBIA	AMPHIBIANS
PLETHODONTIDAE	LUNGLESS SALAMANDERS
<i>Batrachoseps pacificus</i>	Pacific slender salamander
PELOBATIDAE	SPADEFoot TOADS
<i>Scaphiopus hammondi</i>	western spadefoot toad
BUFONIDAE	TRUE TOADS
<i>Bufo boreas</i>	western toad
HYLIDAE	TREEFROGS
<i>Hyla cadaverina</i>	California treefrog
<i>Hyla regilla</i>	Pacific treefrog
RANIDAE	TRUE FROGS
<i>Rana catesbeiana</i>	bullfrog
REPTILIA	REPTILES
IGUANIDAE	IGUANIDS
<i>Sceloporus occidentalis</i>	western fence lizard
<i>Uta stansburiana</i>	side-blotched lizard
<i>Phrynosoma coronatum blainvillei</i>	San Diego horned lizard
TEIIDAE	WHIPTAILS
<i>Cnemidophorus tigris multiscutatus</i>	coastal western whiptail
ANGUIDAE	ALLIGATOR LIZARDS
<i>Gerrhonotus multicarinatus</i>	southern alligator lizard
COLUBRIDAE	COLUBRIDS
<i>Masticophis lateralis</i>	striped racer
<i>Pituophis melanoleucus</i>	gopher snake
<i>Lampropeltis getulus</i>	common kingsnake
VIPERIDAE	VIPERS
<i>Crotalus atrox</i>	western diamondback rattlesnake
<i>Crotalus ruber ruber</i>	northern red diamond rattlesnake
<i>Crotalus viridis helleri</i>	southern pacific rattlesnake
AVES	BIRDS
ARDEIDAE	HERONS & BITTERNS
<i>Ardea herodias</i>	great blue heron
<i>Casmerodius albus</i>	great egret
<i>Bubulcus ibis</i>	cattle egret
<i>Egretta thula</i>	snowy egret
ANATIDAE	SWANS, GEESE & DUCKS
<i>Branta canadensis</i>	Canada goose
<i>Anas platyrhynchos</i>	mallard
<i>Anas americana</i>	American wigeon
<i>Anas crecca</i>	green-winged teal

FAMILY/SPECIES NAME	COMMON NAME
<i>Anas discors</i>	blue-winged teal
<i>Anas cyanoptera</i>	cinnamon teal
CATHARTIDAE	AMERICAN VULTURES
<i>Cathartes aura</i>	turkey vulture
ACCIPITRIDAE	KITES, HAWKS, EAGLES & VULTURES
<i>Elanus caeruleus</i>	white-tailed kite
<i>Circus cyaneus</i>	northern harrier
<i>Accipiter striatus</i>	sharp-shinned hawk
<i>Accipiter cooperii</i>	Cooper's hawk
<i>Buteo jamaicensis</i>	red-tailed hawk
<i>Buteo lineatus</i>	red-shouldered hawk
<i>Buteo regalis</i>	ferruginous hawk
<i>Haliaeetus leucocephalus</i>	bald eagle
<i>Aquila chrysaetos</i>	golden eagle
FALCONIDAE	FALCONS
<i>Falco sparverius</i>	American kestrel
<i>Falco peregrinus</i>	peregrine falcon
PHASIANIDAE	PHEASANTS, PARTRIDGES & QUAIL
<i>Callipepla californica</i>	California quail
RALLIDAE	RAILS & COOTS
<i>Fulica americana</i>	American coot
<i>Gallinula chloropus</i>	common moorhen
CHARADRIIDAE	PLOVERS
<i>Charadrius vociferus</i>	killdeer
LARIDAE	SKUAS, GULLS & TERNS
<i>Sterna hirundo</i>	common tern
COLUMBIDAE	PIGEONS & DOVES
<i>Zenaida macroura</i>	mourning dove
<i>Columbina passerina</i>	common-ground dove
<i>Columba livia</i>	rock dove
CUCULIDAE	CUCKOOS & ROADRUNNERS
<i>Geococcyx californianus</i>	greater roadrunner
CAPRIMULGIDAE	NIGHTJARS
<i>Chordeiles acutipennis</i>	lesser nighthawk
<i>Phalaenoptilus nuttallii</i>	common poorwill
TYTONIDAE	BARN OWLS
<i>Tyto alba</i>	barn owl
STRIGIDAE	TYPICAL OWLS
<i>Bubo virginianus</i>	great horned owl
APODIDAE	SWIFTS

FAMILY/SPECIES NAME	COMMON NAME
<i>Aeronautes saxatalis</i>	white-throated swift
TROCHILIDAE	HUMMINGBIRDS
<i>Calypte anna</i>	Anna's hummingbird
<i>Selasphorus sasin</i>	Allen's hummingbird
<i>Calypte costae</i>	Costa's hummingbird
<i>Archilochus alexandri</i>	black-chinned hummingbird
PICIDAE	WOODPECKERS
<i>Melanerpes formicivorus</i>	acorn woodpecker
<i>Colaptes auratus</i>	northern flicker
<i>Picoides nuttallii</i>	Nuttall's woodpecker
TYRANNIDAE	TYRANT FLYCATCHERS
<i>Tyrannus verticalis</i>	western kingbird
<i>Tyrannus vociferans</i>	Cassin's kingbird
<i>Myiarchus cinerascens</i>	ash-throated flycatcher
<i>Contopus sordidulus</i>	western wood-pewee
<i>Contopus borealis</i>	olive-sided flycatcher
<i>Sayornis nigricans</i>	black phoebe
<i>Sayornis saya</i>	Say's Phoebe
<i>Empidonax traillii</i>	willow flycatcher
<i>Empidonax difficilis</i>	pacific-slope flycatcher
ALAUDIDAE	LARKS
<i>Eremophila alpestris</i>	horned lark
MOTACILLIDAE	PIPITS
<i>Anthus rubescens</i>	American pipit
HIRUNDINIDAE	SWALLOWS
<i>Tachycineta bicolor</i>	tree swallow
<i>Tachycineta thalassina</i>	violet-green swallow
<i>Hirundo rustica</i>	barn swallow
<i>Hirundo pyrrhonota</i>	cliff swallow
<i>Stelgidopteryx serripennis</i>	northern rough-winged swallow
CORVIDAE	CROWS, JAYS
<i>Corvus brachyrhynchos</i>	American crow
<i>Corvus corax</i>	common raven
<i>Aphelocoma coerulescens</i>	western scrub jay
PARIDAE	TITMICE
<i>Baeolophus inornatus</i>	oak titmouse
AEGITHALIDAE	BUSHTIT
<i>Psaltriparus minimus</i>	common bushtit
TROGLODYTIDAE	WRENS
<i>Troglodytes aedon</i>	house wren
<i>Thryomanes bewickii</i>	Bewick's wren
<i>Cistothorus palustris</i>	marsh wren

FAMILY/SPECIES NAME	COMMON NAME
<i>Catherpes mexicanus</i>	canyon wren
<i>Campylorhynchus brunneicapillus</i>	cactus wren
<i>Salpinctes obsoletus</i>	rock wren
MUSCICAPIDAE	THRUSHES, OLD WORLD WARBLERS
<i>Turdus migratorius</i>	American robin
<i>Catharus guttatus</i>	hermit thrush
<i>Catharus ustulatus</i>	Swainson's thrush
<i>Sialia mexicana</i>	western bluebird
<i>Sialia currucoides</i>	mountain bluebird
<i>Regulus calendula</i>	ruby-crowned kinglet
<i>Polioptila caerulea</i>	blue-gray gnatcatcher
<i>Polioptila californica</i>	California gnatcatcher
<i>Chamaea fasciata</i>	wren tit
MIMIDAE	MOCKINGBIRDS & THRASHERS
<i>Mimus polyglottos</i>	northern mockingbird
<i>Toxostoma crissale</i>	California thrasher
<i>Oreoscoptes montanus</i>	sage thrasher
BOMBYCILLIDAE	WAXWINGS
<i>Bombycilla cedrorum</i>	ceder waxwing
PTILOGONATIDAE	SILKY-FLYCATCHERS
<i>Phainopepla nitens</i>	phainopepla
LANIIDAE	SHRIKES
<i>Lanius ludovicianus</i>	loggerhead shrike
STURNIDAE	STARLINGS
<i>Sturnus vulgaris</i>	European starling
VIREONIDAE	VIREOS
<i>Vireo huttoni</i>	Hutton's vireo
<i>Vireo bellii pusillus</i>	least Bell's vireo
<i>Vireo gilvus</i>	warbling vireo
EMBERIZIDAE	WOOD WARBLERS, SPARROWS, NEW WORLD FINCHES & BLACKBIRDS
<i>Dendroica coronata</i>	yellow-rumped warbler
<i>Dendroica townsendi</i>	Townsend's warbler
<i>Vermivora ruficapilla</i>	nashville warbler
<i>Oporornis tolmiei</i>	Macgillivray's warbler
<i>Dendroica petechia</i>	yellow warbler
<i>Vermivora celata</i>	orange-crowned warbler
<i>Icteria virens</i>	yellow-breasted chat
<i>Geothlypis trichas</i>	common yellowthroat
<i>Wilsonia pusilla</i>	Wilson's warbler

FAMILY/SPECIES NAME	COMMON NAME
<i>Pheucticus melanocephalus</i>	black-headed grosbeak
<i>Guiraca caerulea</i>	blue grosebeak
<i>Passerina ciris</i>	lazuli bunting
<i>Zonotricha leucophrys</i>	white-crowned sparrow
<i>Zonotrichia atricapilla</i>	golden-crowned sparrow
<i>Chondestes grammacus</i>	lark sparrow
<i>Pooecetes gramineus</i>	vesper sparrow
<i>Spizella atrogularis</i>	black-chinned sparrow
<i>Melospiza lincolni</i>	Lincoln's sparrow
<i>Spizella passerina</i>	chipping sparrow
<i>Aimophila ruficeps</i>	rufous-crowned sparrow
<i>Ammodramus savannarum</i>	grasshopper sparrow
<i>Melospiza melodia</i>	song sparrow
<i>Passerella iliaca</i>	fox sparrow
<i>Passerculus sandwichensis</i>	savannah sparrow
<i>Pipilo erythrophthalmus</i>	spotted towhee
<i>Pipilo crissalis</i>	California towhee
<i>Junco hyemalis</i>	dark-eyed junco
<i>Euphagus cyanocephalus</i>	Brewer's blackbird
<i>Agelaius phoeniceus</i>	red-winged blackbird
<i>Sturnella neglecta</i>	western meadowlark
<i>Molothrus ater</i>	brown headed cowbird
<i>Piranga ludoviciana</i>	western tanager
<i>Icterus bullocki</i>	Bullock's oriole
<i>Icterus cucullatus</i>	hooded oriole
FRINGILLIDAE	OLD WORLD FINCHES
<i>Carpodacus mexicanus</i>	house finch
<i>Carduelis psaltria</i>	lesser goldfinch
<i>Carduelis tristis</i>	American goldfinch
<i>Carduelis lawrencei</i>	Lawrence's Goldfinch
MAMMALIA	MAMMALS
PROCYONIDAE	RACOONS & COATIS
<i>Procyon lotor</i>	raccoon
CANIDAE	DOGS, WOLVES, FOXES
<i>Canis latrans</i>	coyote
<i>Urocyon cinereoargenteus</i>	gray fox
FELIDAE	CATS
<i>Lynx rufus</i>	bobcat
SCIURIDAE	SQUIRRELS
<i>Citellus beecheyi</i>	California ground squirrel
CRICETIDAE	MICE, RATS, LEMMINGS, VOLES
<i>Peromyscus californicus</i>	California mouse

FAMILY/SPECIES NAME	COMMON NAME
<i>Peromyscus maniculatus</i>	deer mouse
<i>Peromyscus boylei</i>	brush mouse
<i>Neotoma lepida</i>	desert woodrat
<i>Microtus californicus</i>	California vole
LEPORIDAE	HARES, RABBITS
<i>Lepus californicus</i>	blacktailed jackrabbit
<i>Sylvilagus auduboni</i>	desert cottontail
<i>Sylvilagus bachmani</i>	brush rabbit
CERVIDAE	DEER
<i>Odocoileus hemionus</i>	mule deer

8.7 Appendix G: Fauna recorded at Coyote Canyon, 1996-1998.

FAMILY/SPECIES NAME	COMMON NAME
REPTILIA	REPTILES
IGUANIDAE	IGUANIDS
<i>Sceloporus occidentalis</i>	western fence lizard
AVES	BIRDS
CATHARTIDAE	AMERICAN VULTURES
<i>Cathartes aura</i>	turkey vulture
ACCIPITRIDAE	KITES, HAWKS, EAGLES & VULTURES
<i>Elanus caeruleus</i>	white-tailed kite
<i>Circus cyaneus</i>	northern harrier
<i>Buteo jamaicensis</i>	red-tailed hawk
FALCONIDAE	FALCONS
<i>Falco sparverius</i>	American kestrel
PHASIANIDAE	PHEASANTS, PARTRIDGES & QUAIL
<i>Callipepla californica</i>	California quail
CHARADRIIDAE	PLOVERS
<i>Charadrius vociferus</i>	killdeer
COLUMBIDAE	PIGEONS & DOVES
<i>Zenaida macroura</i>	mourning dove
CUCULIDAE	CUCKOOS & ROADRUNNERS
<i>Geococcyx californianus</i>	greater roadrunner
TYTONIDAE	BARN OWLS
<i>Tyto alba</i>	barn owl
APODIDAE	SWIFTS
<i>Aeronautes saxatalis</i>	white-throated swift
TROCHILIDAE	HUMMINGBIRDS
<i>Calypte anna</i>	Anna's hummingbird
TYRANNIDAE	TYRANT FLYCATCHERS
<i>Myiarchus cinerascens</i>	ash-throated flycatcher
<i>Sayornis nigricans</i>	black phoebe
<i>Sayornis saya</i>	Say's Phoebe
ALAUDIDAE	LARKS
<i>Eremophila alpestris</i>	horned lark
MOTACILLIDAE	PIPITS
<i>Anthus rubescens</i>	American pipit
HIRUNDINIDAE	SWALLOWS
<i>Hirundo pyrrhonota</i>	cliff swallow
<i>Stelgidopteryx serripennis</i>	northern rough-winged swallow
CORVIDAE	CROWS, JAYS

FAMILY/SPECIES NAME	COMMON NAME
<i>Corvus corax</i>	common raven
<i>Aphelocoma coerulescens</i>	western scrub jay
AEGITHALIDAE	BUSHTIT
<i>Psaltriparus minimus</i>	common bushtit
TROGLODYTIDAE	WRENS
<i>Troglodytes aedon</i>	house wren
MUSCICAPIDAE	THRUSHES, OLD WORLD WARBLERS
<i>Poliopitila californica</i>	California gnatcatcher
MIMIDAE	MOCKINGBIRDS & THRASHERS
<i>Mimus polyglottos</i>	northern mockingbird
LANIIDAE	SHRIKES
<i>Lanius ludovicianus</i>	loggerhead shrike
STURNIDAE	STARLINGS
<i>Sturnus vulgaris</i>	European starling
EMBERIZIDAE	WOOD WARBLERS, SPARROWS, NEW WORLD FINCHES & BLACKBIRDS
<i>Guiraca caerulea</i>	blue grosebeak
<i>Passerina ciris</i>	lazuli bunting
<i>Zonotricha leucophrys</i>	white-crowned sparrow
<i>Chondestes grammacus</i>	lark sparrow
<i>Spizella passerina</i>	chipping sparrow
<i>Ammodramus savannarum</i>	grasshopper sparrow
<i>Passerculus sandwichensis</i>	savannah sparrow
<i>Pipilo crissalis</i>	California towhee
<i>Agelaius phoeniceus</i>	red-winged blackbird
<i>Sturnella neglecta</i>	western meadowlark
FRINGILLIDAE	OLD WORLD FINCHES
<i>Carpodacus mexicanus</i>	house finch
<i>Carduelis psaltria</i>	lesser goldfinch
MAMMALIA	MAMMALS
PROCYONIDAE	RACOONS & COATIS
<i>Procyon lotor</i>	raccoon
CANIDAE	DOGS, WOLVES, FOXES
<i>Canis latrans</i>	coyote
LEPORIDAE	HARES, RABBITS
<i>Lepus californicus</i>	blacktailed jackrabbit
<i>Sylvilagus auduboni</i>	desert cottontail
<i>Sylvilagus bachmani</i>	brush rabbit
CERVIDAE	DEER
<i>Odocoileus hemionus</i>	mule deer