SECOND ANNUAL REPORT

1994 CALIFORNIA GNATCATCHER AND CACTUS WREN STUDIES IN THE SAN JOAQUIN HILLS

February 27, 1995

Prepared for:

California Corridor Constructors
2 Venture, Suite 260
Irvine, CA 92718

Prepared by:

LSA Associates, Inc.
1 Park Plaza, Suite 500
Irvine, California 92714
(714) 553-0666
LSA Project #CRN401

TABLE OF CONTENTS

TABLE OF CONTENTS - CONTINUED

APPENDICES

LIST OF FIGURES

PAGE

LIST OF TABLES

INTRODUCTION

This is the second annual report on studies conducted in accordance with the terms and conditions of the U.S. Fish & Wildlife Service's Biological Opinion (USFWS 1994) concerning effects of the San Joaquin Hills Transportation Corridor (SJHTC) on coastal California gnatcatchers (*Polioptila californica californica*[1]) and coastal cactus wrens (coastal Southern California populations of *Campylorhynchus brunneicapillus*[2]).[3] Considerable background material relevant to these studies was presented by LSA (1994).

A flexible approach to these studies has been necessary for two reasons: 1) existing conditions in the San Joaquin Hills study area have continued to change following the October, 1993, Laguna fire; and 2) the relationship of the SJHTC Conservation Committee and the Fish & Wildlife Service (Service) as directors of these studies is not yet fully developed.

Study activities in 1994 were in five major areas:

- Spring gnatcatcher and wren surveys, coupled with gross vegetation mapping, in the entire area burned in the Laguna fire;

---

1 Hereinafter referred to as gnatcatchers, or California gnatcatchers

2 Hereinafter referred to as wrens, or cactus wrens

3 Terms and Conditions item number 11 states: "The Federal Highway Administration or its agents shall perform a series of monitoring studies to provide additional information on gnatcatcher and coastal cactus wren habitat utilization. The purposes of these studies may include, but are not limited to:

a. The study of the recovery of the gnatcatchers, coastal cactus wrens and their habitat from the fire,

b. An examination of the success of the revegetation efforts in providing nesting opportunities for the gnatcatcher and coastal cactus wren, with consideration of predation, nest parasitism and other factors.

Maximum funding for studies will be $60,000 annually for a total of ten years, beginning with the 1993 studies. Although the specific focus and methodology for the studies will be recommended each year by the SJHTC Conservation Committee, the studies shall be at the direction of the Service. The Service shall fully consider the recommendations of the Committee and shall actively seek the input of the Department of Fish and Game. Reports detailing study finding [sic] and recommendations shall be due each calendar year for the life of the study period.

- Color-banding of gnatcatchers and wrens, and gathering of nesting data, in the burned area;
- Preparation of a publishable paper summarizing the initial effects of the Laguna fire on gnatcatchers and wrens;
- Wildlife surveys at vegetation study plots established by The Nature Conservancy within the area burned in the Laguna fire;
- Design of future studies for the San Joaquin Hills.

This volume should not be considered a stand-alone scientific report, but rather a summary of the year's activities and a compilation of relevant documents prepared during the year. Therefore, only limited analysis of data is provided here; a more thorough discussion would be premature.

STUDY AREA

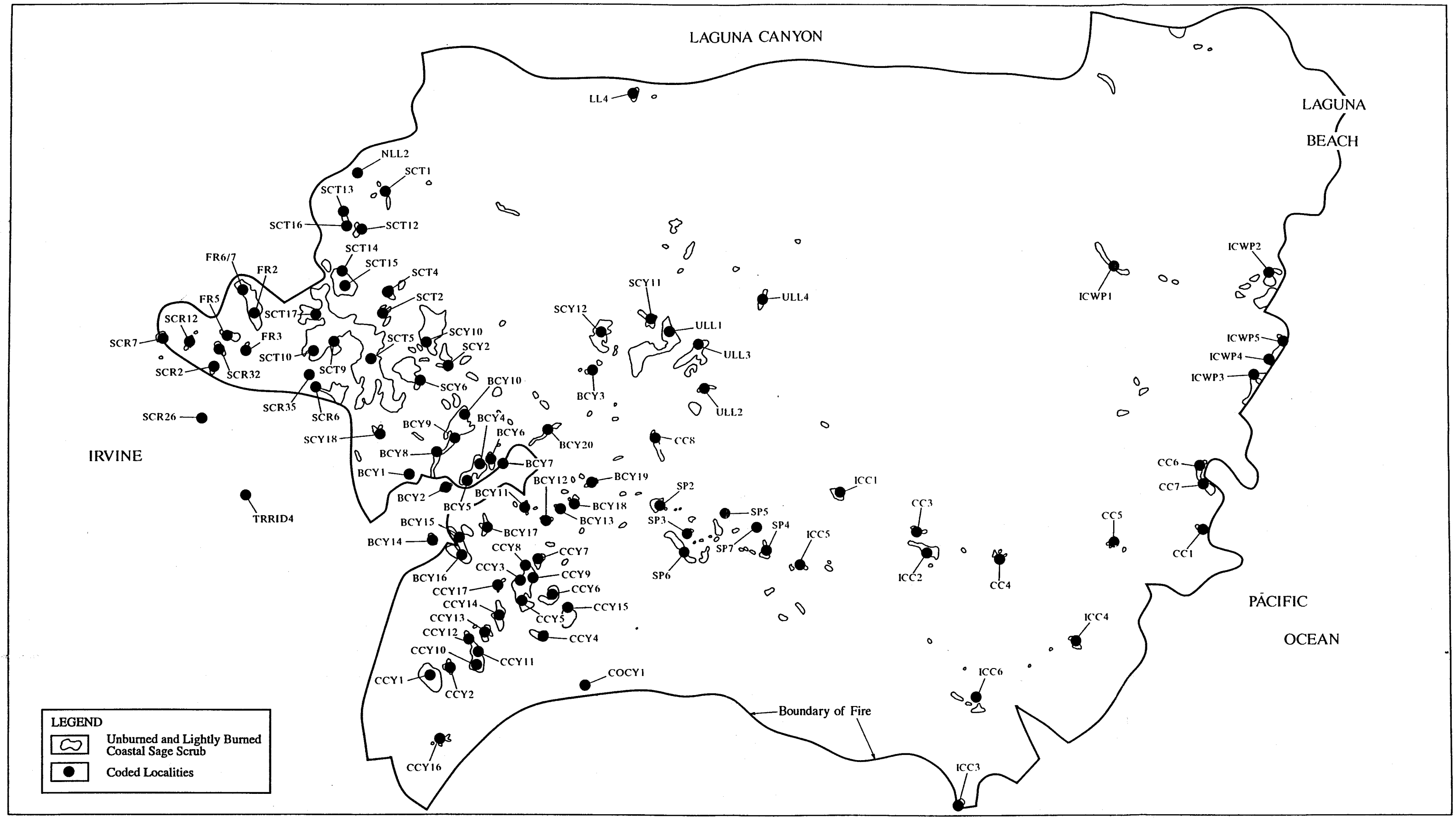
A general consensus was reached among interested parties that the Laguna fire presented a rare opportunity for study. Accordingly, the 1994 study effort was limited to the approximately 13,000 acres of natural vegetation burned in the fire, much of which was coastal sage scrub. Pre-fire vegetation in the San Joaquin Hills was mapped by Jones and Stokes Associates (1993). Portions of that information were presented by LSA (1994). Post-fire vegetation in the hills is under investigation by The Nature Conservancy, Jon E. Keeley of Occidental College, and probably others.

An alphanumeric code system for designating specific sites in the San Joaquin Hills, employed by David R. Bontrager in ongoing studies of wrens and gnatcatchers, is followed here (Figure 1). With few exceptions, each identified location is intended to represent a traditional "territory" for either of these species.

METHODS

SPRING SURVEYS AND VEGETATION MAPPING

LSA biologists mapped unburned and lightly burned patches of coastal sage scrub (using aerial photographs and ground truthing), and surveyed the entire burned area from March 22 to April 23, 1994. Patches of potentially suitable habitat were visited once; taped vocalizations aided in searching for gnatcatchers and wrens. Nearly all of the occupied areas identified were visited again by LSA subconsultant David Bontrager in May and June, with follow-up visits to many areas during the period July 13 to August 2.



12/16/94(CRN401)

N

LSA

Approximate Scale in Feet

0 2700

Figure 1

Area Burned in the Laguna Fire Showing Remnant Coastal Sage Scrub and Specific Coded Localities

COLOR-BANDING AND NEST MONITORING

Based primarily upon locational information from the spring surveys, nest monitoring and color-banding of gnatcatchers and wrens was conducted by David Bontrager during the periods of April 28 to June 17 and July 13 to August 2. Mr. Bontrager's efforts helped to substantiate the number of breeding birds in the burned area, provided specific information on the birds' nesting activities, and resulted in the color-marking of many individuals. Emphasis was given to obtaining general data on reproductive success of all birds, rather than more precise data on fewer pairs.

Most birds were banded as nestlings; the remainder were caught in nylon mist-nets. All birds were fitted with a U.S. Fish & Wildlife Service aluminum band and plastic color bands on their tarsi. In conjunction with ongoing studies in the San Joaquin Hills, Mr. Bontrager used the following nine colors, along with a numbered USFWS aluminum band, to create unique color combinations for each individual bird:

W	white	**LG**	light green
R	red	**DG**	dark green
P	purple (mauve)	**DB**	dark blue
O	orange	**LB**	light blue
Y	yellow	**M**	metal USFWS band

Abbreviated codes for color-banded birds show the bands on the bird's right leg first (top to bottom), followed by a dash, followed by the bands on the bird's left leg. Thus, "LBLG-MR" would describe a bird with a light blue plastic color-band above a light green plastic color-band on its right tarsus and a USFWS metal band above a red plastic color-band on its left tarsus.

Color codes were noted in the field whenever banded birds were encountered. Most resightings were obtained during Mr. Bontrager's work in the study area, but additional resightings were obtained in the course of other work conducted by LSA biologists in the San Joaquin Hills.

PAPER PREPARATION

In consultation with the USFWS, it was agreed that the publication of information obtained during these studies is a worthy and justifiable goal.

The annual meeting of the Southern California Academy of Sciences at the University of California, Irvine, in May, 1994, included a symposium entitled "Brushfires in California Wildlands: Ecology and Resource Management." This represented an appropriate forum for sharing some of the initial findings of these studies. LSA biologists worked with David Bontrager, pooling most data relevant to the fire, to prepare a poster presentation. After receiving a positive response at the meeting, an updated document was finalized for the symposium proceedings, to be edited by Jon E. Keeley and

Thomas A. Scott and published by the Academy. This process resulted in further consultation with Dr. Keeley concerning an overall statement of findings from the symposium.

WILDLIFE SURVEYS AT THE NATURE CONSERVANCY VEGETATION STUDY PLOTS

At the request of The Nature Conservancy, and following consultation with the USFWS, LSA conducted a series of wildlife surveys at 12 vegetation monitoring areas established by The Nature Conservancy in preserved open space areas burned in the Laguna fire. The purpose of these surveys was to provide baseline information on wildlife use of the study plots and surrounding areas, with the general intent of monitoring long-term biotic changes as post-fire regeneration proceeds.

LSA biologists conducted surveys at each of the approximately one acre study plots from June 17 to June 29. Surveys were conducted between dawn and 9:05 a.m. and lasted 20 minutes, during which time all butterflies, herpetiles, birds and mammals (and their sign) were recorded on and around the plots. Complete details on the survey methods are provided in Appendix D.

DESIGN OF FUTURE STUDIES

Michael A. Patten, a graduate student of John T. Rotenberry's at the University of California, Riverside, and an employee of Tierra Madre Consultants, was retained to help prepare the study design for future years. Dr. Rotenberry is a highly regarded avian ecologist who has served as an advisor to the State's Natural Communities Conservation Planning program. Mr. Patten is currently engaged in studies incorporating the latest ecological and statistical concepts; his involvement will ensure that statistically valid and publishable quantitative data are gathered.

RESULTS

SPRING SURVEYS AND VEGETATION MAPPING

Vegetation

Unburned and lightly burned patches of coastal sage scrub are shown on Figure 1. Many cactus (*Opuntia* spp.) patches burned completely, but those of sufficient size tended to dampen the intensity of the fire, allowing some vegetation within these patches to survive the event intact. Cactus in grassland tended to burn less severely than cactus in coastal sage scrub and chaparral where much higher fuel loads had accumulated. In general geographic terms, Laguna Canyon and other coastal canyons burned hotter and more completely than areas on the north and west flanks of the fire, and consequently experienced greater loss of vegetation. Approximately 470 acres of

coastal sage scrub within the area of the Laguna fire were unburned or burned only lightly. Most of this scrub contains 20 percent or greater relative cover of cactus and would, therefore, be classified as "southern cactus scrub" under the County of Orange GIS Habitat Classification System (Jones and Stokes 1993).

Bird Surveys

Twelve pairs of California gnatcatchers and 79 pairs of cactus wrens were located during spring and summer surveys of the entire burned area (Figures 2 and 4 in Appendix C). For analysis here, it is assumed that all observations of "single" birds actually represented pairs. In our experience, it is more likely that only one of a pair was observed in such situations, rather than singles truly representing unmated birds.

Most birds were located in northern, less severely burned, areas and appeared to be occupying established pre-fire territories (Bontrager pers. obs.; County of Orange GIS).

COLOR-BANDING AND NEST MONITORING

Color-banding

As detailed in Appendices A and B, 254 birds were color-banded within the study area; for another project, 117 gnatcatchers and 76 wrens were banded by Bontrager and Gorospe (1995) in unburned areas in the vicinity. Of the 228 cactus wrens banded in the study area, 164 were nestlings, 25 were fledglings, and 39 were adults (23 males and 16 females). Twenty-six California gnatcatchers were banded, 15 as nestlings, two as fledglings, and nine as adults (six males and three females).

Dispersal data were obtained for four color-banded gnatcatchers and eight wrens (Tables A and B and Figures 2 and 3). The average dispersal distance recorded for these birds was 1.4 km for gnatcatchers and 1.2 km for wrens.

Nest Monitoring

Results of the 1994 nest monitoring are shown in Tables C and D and Appendices A-C. In summary, attempted nesting was documented for nine of the 12 pairs of gnatcatchers in the study area (75 percent). A combined total of 11 documented nesting attempts by these birds resulted in five successful efforts (45 percent; defined as the rearing of young to fledgling stage), each

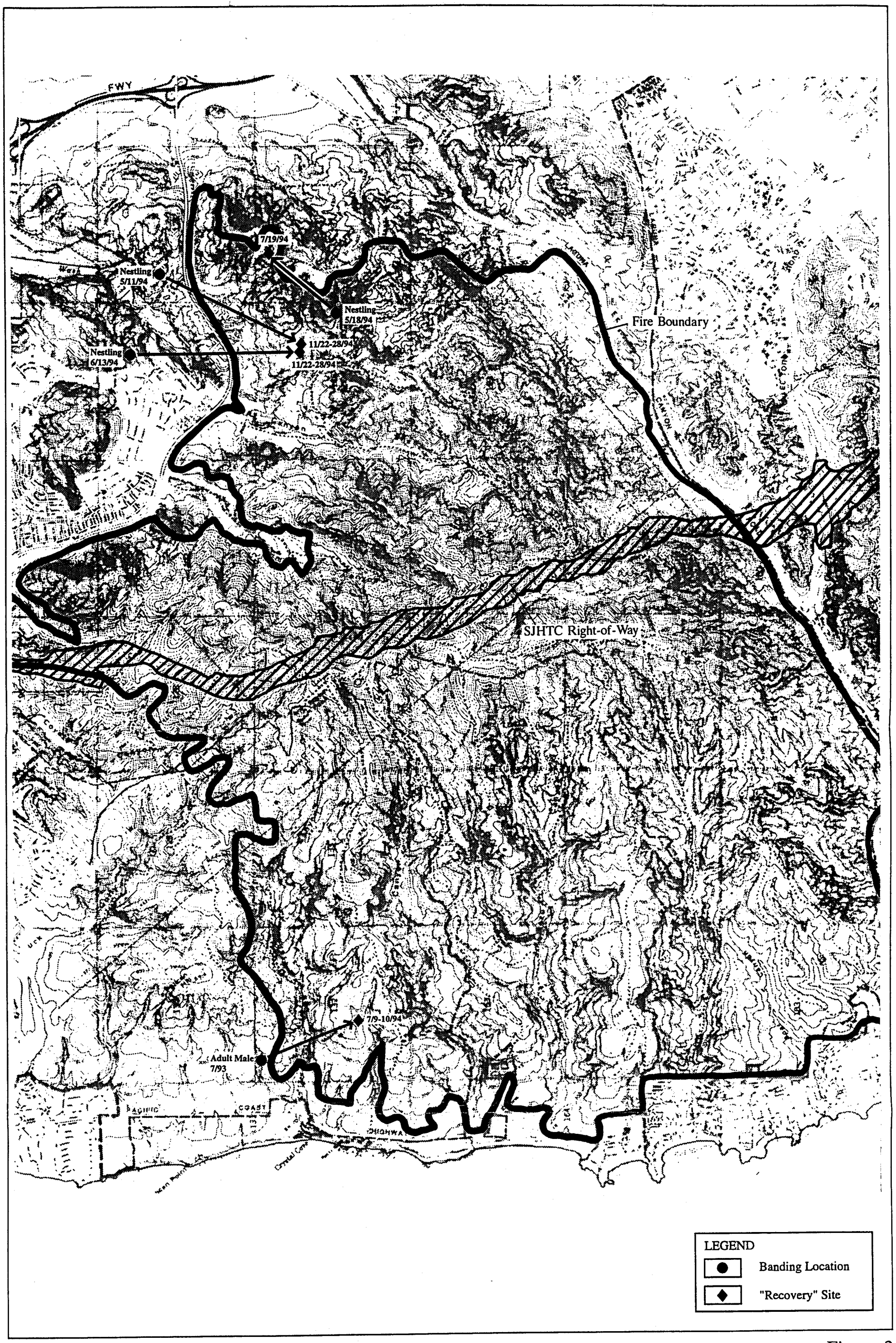
Table A - "Recoveries" of Four Color-Banded California Gnatcatchers in the San Joaquin Hills

USFWS No. and Color Code	Date	Age/Sex	Location	Minimum Dispersal Distance
#unknown RM-R/B[1]				
banded	late July 1993	adult male	ICC3	1.1 km
"recovered"	July 9-10, 1994	adult male	ICC 6	
#196041981 MO-DB				
banded	May 11, 1994	nestling	SCR26	1.6 km
"recovered"	Nov. 22-28, 1994	immature female	near SCT9	
#196041993 MLB-DB				
banded	May 18, 1994	nestling	SCT15	1.0 km
"recovered"	July 19, 1994	immature	FR6/7	
#196042032 M-YDG				
banded	June 13, 1994	nestling	TRRID4	1.8 km
"recovered"	Nov. 22-28, 1994	immature male	near SCT9	
			Average Dispersal Distance	**1.4 km**

[1] This was a single split-color band, red over blue.

Table B - "Recoveries" of Eight Color-Banded Cactus Wrens in the San Joaquin Hills

USFWS No. and Color Code	Date	Age/Sex	Location	Minimum Dispersal Distance
#806187882 M-DBR				
banded	July 23, 1993	nestling	SCR32	.2 km
"recovered"	July 18, 1994	adult male	FR5	
#807177621 W-DGM				
banded	July 31, 1993	adult male	SCT9	.4 km
"recovered"	Nov. 28, 1994	adult male	SCT10	
#807177667 LB-DGM				
banded	May 1, 1994	nestling	SCY18	2.1 km
"recovered"	July 22, 1994	immature	CCY14	
#807177694 Y-MDB				
banded	May 6, 1994	nestling	SCT2	1.9 km
"recovered"	July 15, 1994	immature	BCY20	
"recovered"	July 29, 1994	immature	BCY7	
#807177700 W-MLG				
banded	May 7, 1994	fledgling	ULL2	2.4 km
"recovered"	July 22, 1994	immature	BCY10	
#807177721 LG-MO				
banded	May 15, 1994	nestling	SCT12	.2 km
"recovered"	July 28, 1994	immature	SCT13	
#807177747 OY-M				
banded	May 20, 1994	nestling	SCR35	1.4 km
"recovered"	July 14, 1994	immature	SCR35	
"recovered"	July 20, 1994	immature	SCT14	
#804102063 MY-LGLG				
banded	July 27, 1994	fledgling	SP7	.8 km
"recovered"	Nov. 13, 1994	immature	SP2	
			Average Dispersal Distance	**1.2 km**



12/16/94(CRN401)

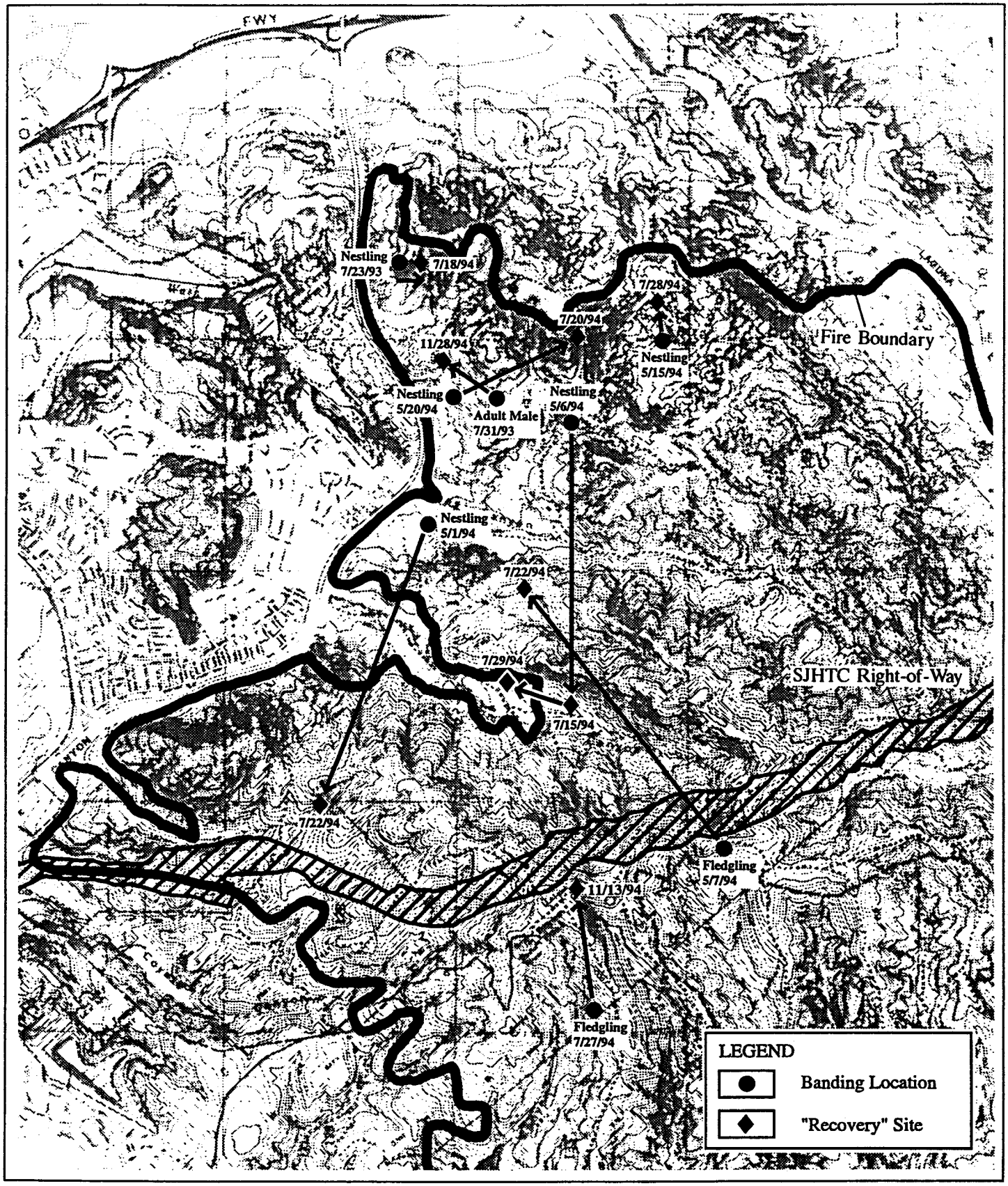
Figure 2

N

LSA

Scale in Feet
0 1500 3000

"Recoveries" of Four Color-Banded
California Gnatcatchers in the San Joaquin Hills



12/16/94(CRN401)

Figure 3

LSA

Scale in Feet
0 1500 3000

"Recoveries" of Eight Color-Banded Cactus Wrens in the San Joaquin Hills

Table C - Breeding Phenology of California Gnatcatchers in the San Joaquin Hills, 1994

Nesting Pair	Nest Building	Egg Phase[1]	Nestling Phase[1]	Fledgling Phase[1]
BCY14				
first attempt[2]				May 26 (2+)
second attempt			July 31 (3)	
CCY1			May 27-31 (3)	–
CCY10			May 25-27 (3)	
COCY1				June 7 (4)
FR2			June 7-12 (2)	July 19 (2)
ICC3 (just outside the burn)				
first attempt				+
second attempt	June 7	–		
ICWP2				
first attempt		May 21 (2)	–	
second attempt		May 30 (2)	–	
SCR32				May 3 (3)
SCT9		May 29-June 5 (3)	June 17 (3)	
SCT15			May 11-18 (4)	+
Date Ranges[3]				
Overall	June 7	May 21-June 5	May 11-July 31	May 3-June 7
First Nesting Attempt		May 21-June 5	May 11-June 17	May 3-June 7
Second Nesting Attempt	June 7	May 30	July 31	
Average Clutch Size ±S.D.	2.9 ± 0.7			

1 Numbers in parentheses represent the number of eggs, nestlings, or fledglings observed; dashes represent known failed nestings; plus signs indicate known successful attempts where fledgling dates are unknown.

2 In reality, most pairs probably attempted multiple nestings, only some of which were detected in this study.

3 Date ranges are incomplete and suggestive only.

Table D - Breeding Phenology of Cactus Wrens in the San Joaquin Hills, 1994

Nesting Pair	Nest Building	Egg Phase[1]	Nestling Phase[1]	Fledgling Phase[1]
BCY1				
abandoned nest found April 30				
BCY4				
first attempt[2]		May 28 (4)	–	
second attempt			July 14 (2)	
BCY5				
first attempt		May 9 (2)		–
second attempt		May 21 (4)	June 4 (4)	+
BCY6				
first attempt		May 25 (4)	–	
second attempt				July 14 (2+)
BCY7				
first attempt			May 9-15 (3)	–
second attempt				July 29 (2+)
BCY9			May 9 (3)	+
BCY10	May 12?			
BCY11				
first attempt		May 15 (4)	May 25 (4)	
second attempt		July 30 (3/4)	July 30 (1/4)	
BCY12			May 15 (1)	
BCY13		May 15 (2/4)	May 15-25 (4)	
BCY15		May 26 (1)		
BCY16				
first attempt				+
second attempt	May 26?			July 31 (3+)
BCY17			May 26 (2)	
BCY19				
first attempt				May 30 (3+)
second attempt			July 30 (3)	
BCY20				July 17 (3+)

Table D - Continued

Nesting Pair	Nest Building	Egg Phase[1]	Nestling Phase[1]	Fledgling Phase[1]
CC3		May 16-25 (5)	June 6 (4)	
CC5	May 25?			July 21 (1)
CC6				
first attempt				May 26 (2+)
second attempt				July 21 (1+)
CC7				May 26 (2+)
CCY1			April 30 (4)	
CCY2		April 30 (1/3)	April 30 (2/3)	—
CCY3		May 12 (4)	June 6 (3/5)	
CCY4		May 12 (4)	June 2 (2/3)	
CCY5			May 12 (5)	
CCY6		May 23-June 2 (4)		
CCY8				May 23 (1+)
CCY9		May 23 (4)	June 8 (3/4)	
CCY11		May 23-June 2 (3)		
CCY13				
first attempt			May 27 (4)	
second attempt				July 20 (?)
CCY14	May 12?			July 19-22 (2+)
CCY17				
first attempt				June 6 (1+)
second attempt		June 6 (3)		
FR2				
first attempt			May 5 (?)	—
second attempt		June 3 (4)	June 12 (2/4)	July 16 (2)
FR3				
first attempt		May 3 (2)	—	
second attempt		May 28?		July 25 (1+)
third attempt			July 25 (2/4)	

Table D - Continued

Nesting Pair	Nest Building	Egg Phase[1]	Nestling Phase[1]	Fledgling Phase[1]
FR5				
first attempt			May 5 (2/3)	+
second attempt				July 18 (3)
ICC 2				July 21 (4)
ICC5			June 5 (2)	
ICWP1				
first attempt				May 20-22 (2+)
second attempt				July 26 (2+)
ICWP2		May 30-June 6 (4)	June 6-14 (2)	
ICWP3				
first attempt				May 21 (3+)
second attempt				July 26 (2+)
ICWP4				May 21 (4+)
ICWP5			May 21 (3/4)	
LL4				
first attempt			May 1-4 (4)	+
second attempt			July 16-29 (4)	
NLL2			May 3 (4)	May 4 (3)
SCR2				
first attempt		April 27 (4)	May 6 (4)	—
second attempt		June 3 (4)	June 3-12 (4)	July 13 (2+)
SCR6				
first attempt			April 27-May 3 (5)	May 18 (2+)
second attempt			July 13-20 (4)	
SCR7				
first attempt	April 30	May 4 (3)	May 30 (5)	+ (3)
second attempt		July 13 (4)	—	
SCR12				
first attempt		April 30 (5)	—	
second attempt			—	
third attempt				July 13-23 (2+)
SCR32			May 3 (4)	

Table D - Continued

Nesting Pair	Nest Building	Egg Phase[1]	Nestling Phase[1]	Fledgling Phase[1]
SCR35		May 2 (4)	May 12-20 (4)	+ (4)
SCT1			June 6-8 (5)	+(2)
SCT2			April 29-May 6 (4)	+
SCT4			April 29 (2+)	+
SCT5				
first attempt		April 29 (4)	May 9-18 (4)	
second attempt			July 14 (4)	
SCT9				
first attempt		May 12 (2)	May 12-21 (3)	
second attempt			July 20 (2)	
SCT10		May 12 (3)	May 24 (3)	+ (3)
SCT12		May 3 (4)	May 15(3/4)	+
SCT13			May 3 (3)	
SCT14	May 11?			
SCT15				
first attempt		May 11 (3)	—	
second attempt		June 4 (4)	—	
SCT16		May 3 (4)	—	
SCT17				
first attempt			May 12 (3)	+ (2+)
second attempt			July 14 (3/4)	
SCY2		April 29 (4)	May 18 (4)	June 5 (2+)
SCY6				
first attempt				June 1 (3+)
second attempt		July 13 (4)	July 30 (3)	
SCY10				
first attempt		May 1 (5)	—	
second attempt				July 18 (3+)
SCY11	May 2		June 6 (4/5)	
SCY12		June 7 (4)		July 23 (1+)

Table D - Continued

Nesting Pair	Nest Building	Egg Phase[1]	Nestling Phase[1]	Fledgling Phase[1]
SCY18				
first attempt			May 1 (4)	+ (2+)
second attempt		June 8 (1/4)	June 8 (3/4)	—
third attempt			July 13-20 (3/4)	
SP2			May 7 (?)	May 30 (3)
SP3				May 22 (2+)
SP4			July 22-29 (4)	
SP6				July 21 (2)
ULL1				
first attempt			May 2 (4)	—
second attempt		June 8 (4)	—	
ULL2				
first attempt				May 7 (3)
second attempt			July 16 (4)	
Date Ranges[3]				
Overall	April 30-May 2 (-26?)	April 27-July 30	April 27-July 30	May 4-August 1
First Nesting Attempt		April 27-June 3 (-6?)	April 27-June 14	May 4-June 6
Second Nesting Attempt		May 21-July 30	June 3-July 30	July 13-August 1
Third Nesting Attempt			July 25	July 13-23
Average Clutch Size ± S.D.[4]	3.56 ± 1.10.9			

1 Numbers in parentheses represent the number of eggs, nestlings, or fledglings observed; dashes represent known failed nestings; plus signs indicate known successful attempts where fledgling dates are unknown.

2 In reality, most pairs probably attempted multiple nestings, only some of which were detected in this study.

3 Date ranges are incomplete and suggestive only.

4 Note caveat in text.

by a different pair (i.e., five pairs successfully nested within the burned area, 42 percent of the pairs present). Bontrager et al. (in press) showed as unknown the outcome of what ultimately was successful nesting at BCY 14, resulting in an erroneously low success rate (per pair) of 33 percent. The average clutch size of 2.9 $\pm$ 0.7 S.D. is based on the maximum number of eggs, nestlings, or fledglings observed.

Nesting cactus wrens in the study area fared better than gnatcatchers. Of the 79 pairs present, attempted nesting was confirmed for 71 (90 percent). Forty-three pairs (54 percent of the total present) were documented as successful breeders. Based on the total of 48 successful attempts, out of the combined total of 103 nesting attempts by all birds present, the 47 percent success rate per attempt is almost identical to that for gnatcatchers. An average clutch size of 3.3 $\pm$ 1.1 S.D. is based on all of the information in Table D, and should be considered a minimum estimate. Nest visits prior to completion of laying, predation of partial clutches/broods, and unobserved juveniles among family groups all probably contributed to a reduced average.

PAPER PREPARATION

Appendix C is the paper prepared by David Bontrager and LSA for inclusion in the proceedings entitled *Brushfires in California Wildlands: Ecology and Resource Management*. The proceedings, to be published by the Southern California Academy of Sciences in early 1995, will make much of the data gathered to date available to a considerable audience.

WILDLIFE SURVEYS AT THE NATURE CONSERVANCY VEGETATION STUDY PLOTS

The following text is taken from the Conclusions section of Appendix D, the final report prepared for The Nature Conservancy.

- Due to the relatively small size of the LSA study sites, far more birds were detected in adjacent areas (most detected by voice). Notably, however, similar numbers of bird species were detected within the cactus scrub sites (Nos. 10, 11, 12) as in adjacent areas; cactus scrub areas also appeared to be used more by western fence lizards, Audubon cottontails, coyote and mule deer. These observations relate to the greater propensity for cactus scrub to withstand fire compared with other scrub habitats, which were typically decimated by the fire (cf. Bontrager et al. in press).

- The greatest number and variety of butterflies were detected at Site Nos. 1, 3, 4 and 7, where fire-following plants such as deer weed (*Lotus scoparius*) and blue dicks (*Dichelostemma capitatum*) were relatively abundant. The cactus scrub sites were among those supporting relatively few butterflies.

- Among the reptiles, only eight western fence lizards were detected, a very low abundance and species diversity.

- The surveys indicated that several local bird populations were reduced below their usual abundance (e.g., California gnatcatcher was not detected), while others obviously thrived in the post-burn landscape (e.g., lazuli bunting was detected at 10 of 12 sites). The study was too limited to support a more detailed analysis of this issue.

- Pacific kangaroo rat sign (holes and/or tracks) was detected at Sites Nos. 1, 2, 4, and 5. The sparsity of shrubs and herbs facilitated detection of this nocturnal heteromyid.

Complete details are presented in Appendix D.

DESIGN OF FUTURE STUDIES

The general study plan for use in 1995 and thereafter is included as Appendix E. This will serve as a guideline while consulting with the SJHTC Conservation Committee/USFWS concerning subsequent studies, but will not necessarily be adhered to precisely. The ultimate use of future SJHTC study funds may depend, in part, on the dispensation of additional study funds from other sources.

DISCUSSION

SURVEYS

The broad surveys reported here were effective in establishing early post-fire populations of California gnatcatchers and cactus wrens, and their relative reproductive status (Bontrager et al. in press; Appendix C). The numbers of these birds remaining within burned areas were two to three times greater than had been unofficially predicted by LSA staff and others prior to the surveys. Along with post-fire data previously presented by LSA (1994) and Bontrager et al. (in press), this argues strongly against such unfounded claims as Small's (1994, p. 191) that "extensive brush fires of October 1993, in addition to destroying about 25,000 acres of prime habitat, probably killed about 160 pairs" of California gnatcatchers.

BREEDING BIOLOGY

The collection of precise nesting data on gnatcatchers and wrens was not a priority this year; thus, any conclusions drawn from these data should be considered tentative. Because only partial coverage was possible, many nesting attempts were probably completely unrecorded, clutch size data are

incomplete (many incomplete and partially predated clutches were likely recorded), and nesting success is underestimated.

Assuming that resources are more limited following the fire, one might intuitively suspect that those birds attempting nesting within the study area would be less productive than their counterparts in unburned scrub. Two lines of evidence suggest this may have been the case, especially for gnatcatchers: 1) timing of nesting, and 2) reduced clutch size. These are known reactions among some birds to periods of limited resources (e.g., Welty and Baptista 1988, pp. 321-329).

California gnatcatcher nesting activities within the study area may have been later in 1994 than 1993, which were considered late compared with other (low elevation) sites in Orange County (cf. LSA 1994, pp. 13-18). More time may have been required to allow sufficient plant growth for cover and/or insect build-up for food. Comparable data on cactus wren phenology in the San Joaquin Hills is not available to LSA at this time, but Woods (1948) and Unitt (1984) reported earlier nesting elsewhere in Southern California. The possible effect of weather and other variables on our findings is unknown.

The average clutch size of gnatcatchers reported here (2.9) is well below the average of 3.84 for the species reported by Atwood (1988) or the average of 3.82 reported in the San Joaquin Hills in 1993 (LSA 1994, p.19). Information on cactus wren clutch size in Southern California is unavailable to LSA at this time, but the average of 3.4 in an Arizona study (Anderson and Anderson 1973) is comparable to the minimum of 3.3 reported here.

DISPERSAL

There are not enough data for a detailed discussion of this issue at this time. As expected, however, gnatcatchers raised outside the burned area in 1994 were already detected within the burn in the fall (Figure 2). It is tempting to suggest that the relative void in gnatcatchers within the study area, in comparison to wrens, resulted in the observation of incoming gnatcatchers but not wrens. Only time will tell if this initial pattern is maintained.

The movement demonstrated by resightings of two wrens and one gnatcatcher color-banded as adults before the Laguna fire (Figures 2 and 3) suggest the obvious displacement potential of a catastrophic event such as fire. These species rarely vacate an established territory, so it is unlikely these birds would have moved from their 1993 territories without the fire.

A preliminary report on this subject, involving some of the birds included in this study, has been prepared by Bontrager and Gorospe (1995).

RECOMMENDATIONS

There are a number of ongoing or planned studies of gnatcatchers, wrens, and their habitat in the vicinity of the San Joaquin Hills, and more funding for these efforts is expected. This emphasizes the need for careful oversight of these studies to avoid duplication of effort, maximize cooperation/compatibility, and establish consistency in data collection when necessary. This should be the role of the SJHTC Conservation Committee and the USFWS, or their designees. To the extent possible, it would be advisable to extend such oversight to all of Southern California, as well.

The broad surveys employed this year were well suited for the early post-fire landscape, but will be increasingly difficult to accomplish as vegetation recovery continues. Current plans call for a shift to point counts and vegetation samples at 130 locations within the burned area. If additional funding becomes available from other sources, however, a repeat of the overall surveys described here may be warranted in 1995.

Additional funding could also be used for the careful collection of nesting information within the burned area, allowing for a more rigorous consideration of the reduced breeding potential alluded to above. Similarly, there are apparently no plans for color-banding within the burned area in 1995, another good use of any additional funds.

ACKNOWLEDGMENTS

Field studies in 1994 were conducted by LSA biologists Richard Erickson and Robert Hamilton and LSA subconsultant David Bontrager. They also prepared the paper summarizing the Laguna fire's impact on gnatcatchers and wrens for publication by the Southern California Academy of Sciences. Michael Patten of Tierra Madre Consultants and U.C. Riverside assisted in preparation of future study plans. Other primary contacts included Loren Hays of the USFWS, Steve Letterly and Laura Coley Eisenberg of the San Joaquin Hills Transportation Corridor Agency and Connan Pinkston of California Corridor Constructors. This document was written primarily by Richard Erickson, with graphics prepared by Gary Dow.

LITERATURE CITED

Anderson, A.H. and A. Anderson. 1973. The Cactus Wren. University of Arizona Press, Tucson.

Atwood, J.L. 1988. Speciation and geographic variation in black-tailed gnatcatchers. Ornithological Monographs No. 42.

Bontrager, D.R., R.A. Erickson, and R.A. Hamilton. in press. Impacts of the October 1993 Laguna fire on California gnatcatchers and cactus wrens. *In* Brushfires in California Wildlands: Ecology and Resource Management (J.E. Keeley and T.A. Scott editors). Southern California Academy of Sciences, Los Angeles.

Bontrager, D.R. and A.L. Gorospe. 1995. Movement and dispersal of California gnatcatchers and cactus wrens in the San Joaquin Hills, Orange County, California. unpublished report prepared for Ed Almanza & Associates, Laguna Beach, California.

Jones and Stokes Associates, Inc. 1993. Methods used to survey the vegetation of Orange County parks and open space areas and the Irvine Company property. Unpublished report prepared for the County of Orange Environmental Management Agency. Santa Ana, California.

LSA Associates, Inc. 1994. 1993 California gnatcatcher and cactus wren studies in the San Joaquin Hills. Report dated September 1, 1994, prepared for California Corridor Constructors, Irvine, California.

Small, A. 1994. California Birds: Their Status and Distribution. Ibis Publishing Company, Vista, California.

Unitt, P. 1984. The birds of San Diego County. San Diego Society of Natural History Memoir 13.

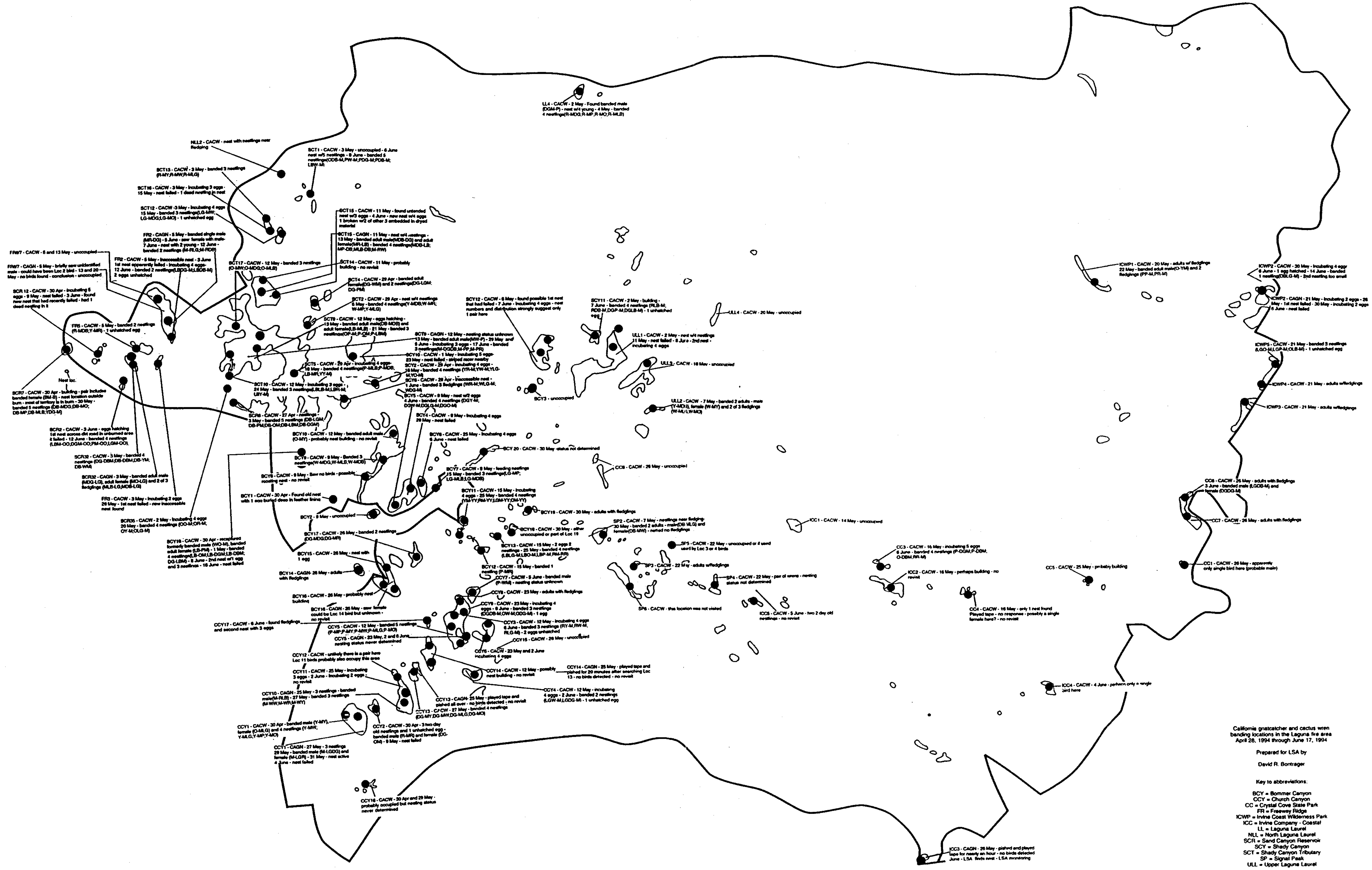
U.S. Fish & Wildlife Service. 1994. Revised biological opinion on the effects of the San Joaquin Hills Transportation Corridor on the coastal california gnatcatcher and coastal cactus wren; Orange County, California (1-6-93-F-98R). Letter report dated January 28, 1994, addressed to Mr. James Bednar of the U.S. Department of Transportation and signed by Gail C. Kobetich, Supervisor, Carlsbad Field Office.

Welty, J.C. and L. Baptista. 1988. The Life of Birds, Fourth Edition. Saunders College Publishing, New York.

Woods, R.S. 1948. *Heleodytes brunneicapillus couesi* (Sharpe), Northern Cactus Wren. *In* A.C. Bent. Life histories of North American nuthatches, wrens, thrashers, and their allies. U.S. National Museum Bulletin 195.

APPENDIX A

California Gnatcatcher and Cactus Wren Banding Locations in the Laguna Fire Area April 28, 1994 through June 17, 1994. by David R. Bontrager.



California gnatcatcher and cactus wren
banding locations in the Laguna fire area
April 28, 1994 through June 17, 1994

Prepared for LSA by

David R. Bontrager

Key to abbreviations:

BCY = Bommer Canyon
CCY = Church Canyon
CC = Crystal Cove State Park
FR = Freeway Ridge
ICWP = Irvine Coast Wilderness Park
ICC = Irvine Company - Coastal
LL = Laguna Laurel
NLL = North Laguna Laurel
SCR = Sand Canyon Reservoir
SCY = Shady Canyon
SCT = Shady Canyon Tributary
SP = Signal Peak
ULL = Upper Laguna Laurel

Notes Accompanying the Map Titled
"California gnatcatcher and cactus wren banding locations
in the Laguna fire area April 28, 1994 through June 17, 1994"

Prepared for LSA by

David R. Bontrager

The following notes expand on the information contained on the map. This is to assist in arriving at a better estimate of the numbers of gnatcatchers and wrens in the study area. For the time being, I believe locations with single birds should be treated as pairs until more thorough searches are completed. Because my primary goal was to band birds, not estimate numbers, some of the visits may have been shorter than others and in all instances when only one bird was located no followup visit was made. We should note that a very small number of our territories may have been holding a single bird during the period.

I have added a few new pairs of birds not detected during the LSA surveys as well as several locations without birds but which were searched. These latter areas are labeled as unoccupied. I have also added a couple of locations just outside of the burn for future reference.

Each map label is related/connected to a specific area by a line. I have attempted to place the terminal end of each line as close as possible to the nest or netting site. In many instances this site lies beneath the black circle and I could not be as precise.

<u>Bommer Canyon</u>

BCY1 - I added this location. In the past I have found wrens here.

BCY 2 - I added this because it also was formerly occupied by wrens.

BCY 3 - I added this location because I checked it for wrens - none found.

BCY7 - I added this location. The nest was in a small cactus patch on the fence row.

BCY 8/9 - I added the dot for Loc 9. There could be 2 wren territories in here but at this time, bird observations, nest numbers and nest locations suggest only 1.

BCY 11 - Arrow shows the flight line of the adult wrens between 2 spots, indicating the 2 locations are in the same territory, i.e., 1 not 2 territories.

BCY 12 - The arrow on the map shows the flight line of the adult wrens down slope from the nest area, thus placing the 2 locations in their territory.

BCY 13 - I added this dot for a pair of wrens nesting at the upper end of the massive rock outcropping.

BCY 14 - I added this spot outside the burn where LSA previously found gnatcatchers. A family group was present.

BCY 14/16 - Count 1 pair of gnatcatchers for the burn area. There could be 2 territories between these 2 locations but regardless I did see a bird in loc 16, i.e., in the burn.

BCY16 - Birds and nests suggest only 1 pair of wrens in the habitat above loc 15.

BCY 18/19 - Birds and nests suggest there is only 1 wren territory between these two spots.

Church Canyon

CCY 4/5 - LSA had 3 pairs of wrens between these two areas. Nests strongly suggest only 2 pairs, the ones labeled on the map.

CCY 6 - 1 pair of wrens in the area holding 2 dots.

CCY 11/12 - Birds and nests suggest 1 pair of wrens.

CCY 13/14 - I surveyed loc 13 once and loc 14 twice without finding gnatcatchers. If they are present it seems most likely they would be in loc 14. I will look again in July.

CCY 16 - Although I never saw a bird here nests suggest we should continue to count it as a territory.

Freeway Ridge

FR3 - My addition. This is another spot which wrens have occupied in the past.

FR6/7 - No gnatcatchers present on 2nd and 3rd very thorough searches.

North Laguna Laurel

NLL2 - My addition. Most of these wrens' territory is outside of the burn but the nest was in an isolated cactus patch in the burn, a place they have nested in the past. (see SCT1 comments).

Sand Canyon Reservoir

SCR 2 - This is my addition. Their first nest attempt (it failed) and most of their territory was outside the burn but the second nest was east of the dirt road in the burn.

SCR 7 - This is my addition. Although the nest was outside of the burn I know these birds quite well and most of the territory is in the burn.

SCR35 - My addition. Birds nested in 1 of several small cactus patches in grassland/rock outcrop area.

Shady Canyon

SCY12 - Birds and nests suggest 1 territory in this habitat patch.

SCY18 - This location is off a little. I think I covered the original dot with the BCY9 label. I stuck this dot on the map. Check the mylar sheet for the precise location.

Shady Canyon Tributary

SCT1 - My addition. Dave and LSA looked at this patch in late April. There were no active nests at the time. There is a possibility that the NLL2 birds moved down to this spot. Amy Gorospe is working on this. For the time being I am considering it 2 territories.

SCT10 - My addition - Wrens nested in 1 of several small cactus patches in grassland/rock outcrop area. Possibly these birds are the ones seen by LSA at the nearby spot connected by arrows on the map. Because I did not find birds at that spot I am counting these as 1 territory.

Signal Peak

SP6 - CACW - Dick, we discussed this location. In hindsite I see that I did not visit it. Until resurveyed we should assume the wrens are still present.

Upper Laguna Laurel

ULL1 - Birds and nests suggest only 1 pair in this area. LSA had 2.

Summary (suggested changes to survey totals).

Add 9 new CACW territories - BCY1, BCY7, BCY13, FR3, NLL2, SCR2, SCR7, SCR35, SCT1.

Subtract 10 CACW territories - BCY11(subtract 1, 1 not 2 territories here), BCY16 (subtract 1, 1 not 2 territories), BCY18/19 (subtract 1, 1 not 2 territories here), CCY4/5 (subtract 1, 2 not 3 territories here), CCY6 (subtract 1, 1 not 2 territories here), CCY11/12 (subtract 1, 1 not 2 territories here), SCY12 (subtract 1, 1 not 2 territories here), SP5 (subtract 1, no birds or active nests found), ULL1 (subtract 1, 1 not 2 territories here), ULL3 (subtract 1, no birds or active nests found).

Net change to CACW total = minus 1 territory

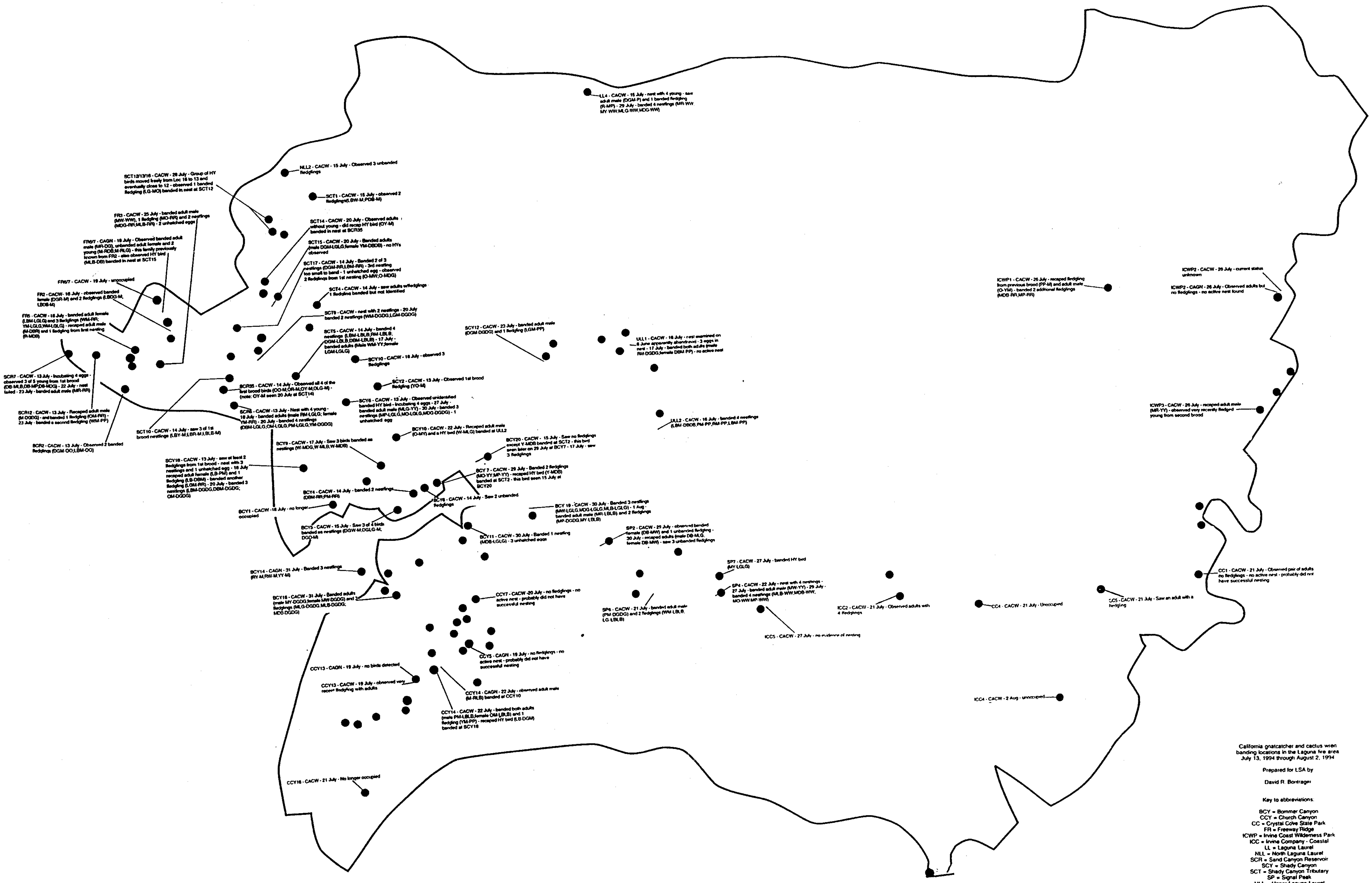
Add 1 new CAGN territory - BCY16.

Subtract 2 CAGN territories - CCY14 (birds not found), FR6/7 (birds not found) - if LSA has time to conduct 1 more extensive search of these 2 locations for CAGNs it would be good.

Net change to CAGN total = minus 1 territory

APPENDIX B

California Gnatcatcher and Cactus Wren Banding Locations in the Laguna Fire Area July 13, 1994 through August 2, 1994. by David R. Bontrager.



California gnatcatcher and cactus wren banding locations in the Laguna fire area July 13, 1994 through August 2, 1994

Prepared for LSA by

David R. Bontrager

Key to abbreviations:

BCY = Bommer Canyon
CCY = Church Canyon
CC = Crystal Cove State Park
FR = Freeway Ridge
ICWP = Irvine Coast Wilderness Park
ICC = Irvine Company - Coastal
LL = Laguna Laurel
NLL = North Laguna Laurel
SCR = Sand Canyon Reservoir
SCY = Shady Canyon
SCT = Shady Canyon Tributary
SP = Signal Peak
ULL = Upper Laguna Laurel

Notes Accompanying the Map Titled
"California gnatcatcher and cactus wren banding locations
in the Laguna fire area July 13, 1994 through August 2, 1994"

Prepared for LSA by

David R. Bontrager

The following notes expand on observations noted on the map including, in particular, information concerning reproductive success of gnatcatchers and wrens at specific localities/territories. A final short section summarizes banding totals for each species during the entire field period, April 28, 1994 through August 2, 1994. Two tables present lists of all birds banded.

Bommer Canyon

BCY1 - Found no active wren nests. No new nests have been added since previous visit and the old nests are in disrepair and obviously no longer in use. I concluded this location is no longer occupied. No successful nestings were recorded from this territory.

BCY5 - Observed three HY wrens banded previously in the nest thus confirming successful nesting.

BCY6 - Observed 2 unbanded HY wrens confirming successful nesting.

BCY7 - Did not locate any of the first brood of wrens banded as nestlings but did band two fledglings thus confirming successful nesting. An interesting recapture was HY wren Y-MDB banded on 6 May in the nest at SCT2. It was also seen on 15 July on the adjacent territory SCT20.

BCY9 - Observed three HY wrens banded previously in the nest thus confirming successful nesting.

BCY10 - Combining observations in May, a current check of potentially active nests and netting results I concluded these wrens most likely were not successful nesters.

BCY11 - Did not locate any of the first brood of wrens banded as nestlings.

BCY14/16 - Observed the female adult gnatcatcher make several trips between locs 14 and 16. She was collecting food in loc 16 and taking it to nestlings in a nest down slope in loc 14. This is a second brood the first one being successful. These trips took her across a wide expanse of open grassland. This answers the question of whether there is one or two gnatcatcher territories in these two patches.

BCY16 - Saw at least 8 HY wrens on this territory thus confirming successful nesting and apparently two broods. Banded three of these fledglings and the adults.

BCY19 - Confirmed successful wren nesting by netting and banding two fledglings. Also banded a second brood of three nestlings.

BCY20 - Saw three unbanded wren fledglings thus confirming successful nesting.

Church Canyon

CCY5 - Followed the male gnatcatcher for 60 minutes. Although he exchanged calls with the female several times they did not join up. The male did not go to a nest nor was he seen with fledglings. I concluded that these birds did not have an active nest and that they had not previously nested successfully.

CCY7 - Found no active wren nests and no fledglings. Concluded this pair was not successful in nesting.

CCY13 - Did not locate any of the first brood of wrens banded as nestlings but did see a very recently fledged bird with the adults thus confirming a successful nesting.

CCY13 - Once again found no gnatcatchers.

CCY14 - Observed male adult gnatcatcher M-RLB with an unbanded female. This bird nested over on CCY10 in May. This pair either has an incredibly large home range (which may be possible after the fire) or their home range has shifted. At this time it seems likely that CCY13 is a part of their home range.

CCY14 - Banded one fledgling wren thus confirming a successful nesting. An interesting recapture was the HY wren LB-DGM banded in the nest on 1 May at SCY18.

CCY16 - Examined all cactus for wren nests. No new nests were found and all nests from previous visits were in disrepair and not in use. I concluded that this territory is no longer occupied.

Crystal Cove State Park

CC1 - I had only seen one wren on my June visit to this territory. There are now two birds. I checked all nests and found none active. No fledglings were located. I concluded that if these birds attempted nesting it was not successful.

CC4 - I played the wren tape on and off for 30 minutes obtaining no response. The only nest I found was one seen on 16 May. At that time it may have been active as a roost nest but it is now in disarray and obviously not usable. I concluded that this location is not occupied.

CC5 - Successful wren nesting was confirmed when I saw a fledgling with an adult.

Freeway Ridge

FR2 - Observed two wren fledglings from previous nesting thus confirming successful nesting.

FR3 - Banded one fledgling wren confirming successful nesting.

FR5 - Confirmed two successful wren nestings by recaping one banded fledgling from first nesting and banding three others from a second brood. The recaped adult male was banded as a nestling on 072393 at SCR32.

FR6/7 - Determined that the gnatcatchers from FR2 include FR6/7 in their home range. Observing 2 fledglings banded in the nest at FR2 confirms successful nesting. The "outsider" HY bird (MLB-DB) banded in the nest at SCT15 was chased three times but not driven out of the area. Throughout most of the period it remained no further than 10-20 meters from the family group.

Irvine Coast Wilderness Park

ICWP1 - Recaped previously banded fledgling wren and banded two more. All three appeared to be the same age thus indicating one successful nesting.

ICWP2 - Saw no adult or fledgling wrens but did not play tape. Observed numerous new, active appearing roost nests. Best guess would be that nesting was successful but it was not confirmed.

ICWP2 - Followed the gnatcatcher pair for 20 minutes. Saw no fledglings or indication of nesting. Habitat here was highly disturbed or removed by grazing goats brought into the area after my previous visits in early June. With 200 goats crammed into such a small area it is easy to conceive why these gnatcatchers were not successful nesters.

ICWP3 - The observation of a recently fledged wren indicates two successful nestings here.

Irvine Company Coastal

ICC2 - Observed adult wren with 4 fledglings confirming a successful nesting.

ICC4 - Had no response to the wren tape. Found no new nests and nests from earlier in the season were in disrepair. Concluded that this territory is no longer occupied.

ICC5 - Found no active wren nest or fledglings. There are indications the first nest failed: (1) there are only two active appearing roost nests, (2) the natal nest is in disrepair and obviously not in use as a roost by young birds and (3) because there is no new natal nest active at this time it seems less likely that all of the first brood fledglings would have left the territory by now.

Laguna Laurel

LL4 - Saw one fledgling wren from first brood confirming successful nesting. Second brood in nestling stage.

North Laguna Laurel

NLL2 - Observed three unbanded wren fledglings confirming successful nesting. Also, combined with other observations I determined that the NLL2 and SCT1 birds are not the same.

Sand Canyon Reservoir

SCR2 - Observed two banded wren fledglings confirming successful nesting.

SCR6 - Banded wren nestlings of second brood. Failed to note in previous report observing two first brood fledglings (DB-OM;LG-OM) on 18 May thus confirming a successful nesting.

SCR7 - Observed three of five wren fledglings from first nesting confirming successful nesting.

SCR12 - Banded 2 wren fledglings confirming successful nesting.

SCR35 - On 14 July observed all four wren fledglings from first brood confirming successful nesting. Six days later on 20 July one of these birds (OY-M) was seen at SCT14.

Shady Canyon

SCY2 - Saw one of the first brood wren fledglings confirming successful nesting.

SCY6 - Saw an unidentified but banded wren fledgling with an adult confirming successful nesting. Second brood nestlings also banded.

SCY10 - Observed three wren fledglings confirming successful nesting.

SCY12 - Banded one fledgling wren confirming successful nesting.

SCY18 - Saw banded wren fledglings from first brood (all banded in the nest) confirming successful nesting. Banded another fledgling indicating possible second successful nesting (there is the possibility this bird came in from another territory). Banded nestlings meaning there is a possibility of three broods and the chance of three successful nestings.

Shady Canyon Tributary

SCT1 - Observed two banded wren fledglings confirming successful nesting. Combined with other observations determined that the SCT1 and NLL2 birds are not the same.

SCT2 - Observed SCT2 wren fledgling (Y-MDB) at BCY20 on 15 July and BCY7 on 29 July confirming successful nesting.

SCT4 - Saw young wrens with adults including one banded but unidentified fledgling confirming successful nesting.

SCT5 - Failed to locate any wren fledglings from first nesting (last seen in the nest). Did band four nestlings in second nesting.

SCT9 - Failed to locate any wren fledglings from first nesting (last seen in the nest). Did band two nestlings in second nesting.

SCT12/13/16 - Observed banded SCT12 wren fledgling (LG-MO) in SCT13 and 16 confirming successful nesting at SCT12. An undetermined number of HY wrens moved more or less together throughout 13 and 16. These observations strongly suggest there are now only two territories in here but it would take a more careful examination to be sure.

SCT14 - Found no wren fledglings or active nest. Appears this pair was not successful.

SCT15 - Found no wren fledglings or active nest. Appears this pair was not successful.

SCT15 - Observed gnatcatcher banded in nest at SCT15 (MLB-DB) "with" another gnatcatcher family at FR6/7 on 19 July confirming successful nesting at SCT15.

SCT17 - Observed two banded wren fledglings from first brood while banding second brood nestlings. Successful nesting confirmed.

Signal Peak

SP2 - Observed at least three unbanded wren fledglings with adults confirming successful nesting.

SP4 - Did not see any wren fledglings from first nesting. Successful nesting not confirmed.

SP6 - Banded two wren fledglings confirming successful nesting.

SP7 - This is a new location added this field period. Found two HY wrens (banded one) here but no adults. Adults were not found here earlier in the season. I believe these were dispersing birds and did not represent an additional territory. Or it is possible they could be young from an earlier nesting on SP4, i.e., this is part of the SP4 wrens' territory. This will remain unknown.

Upper Laguna Laurel

ULL1 - The nest I located in early June was apparently abandoned. Only three of the original four eggs were in it. Perhaps a predator took one egg and in the process caused the abandonment. No other active nests were found. It seems likely this pair did not have a successful nesting.

Banding Summary

Banding of California gnatcatchers and cactus wrens was conducted during the periods April 28, 1994 through June 17, 1994 and July 13, 1994 through August 2, 1994. Tables 1 and 2 provide a complete banding record for each individual including USFWS band number, color code, banding date, banding location, age and sex.

A total of 254 birds were banded including 228 cactus wrens and 26 California gnatcatchers. Of the wrens, 39 were banded as adults (23 males;16 females), 164 as nestlings and 25 as fledglings. Of the gnatcatchers 9 were banded as adults (6 males;3 females), 15 as nestlings and 2 as fledglings.

TABLE 1

CACTUS WREN BANDING
IN THE LAGUNA FIRE STUDY AREA
APRIL-AUGUST 1994
DAVID R. BONTRAGER

Band No.	Age	Sex	Date	Location	Color Code
807177654	A	F	04/29/94	SCT 04	DG-WM
807177655	N	U	04/29/94	SCT 04	DG-LGM
807177656	N	U	04/29/94	SCT 04	DG-PM
807177657	A	F	04/30/94	CCY 02	DG-OM
807177658	A	M	04/30/94	CCY 02	R-MR
807177659	A	M	04/30/94	CCY 01	Y-MY
807177660	A	F	04/30/94	CCY 01	O-MLG
807177661	N	U	04/30/94	CCY 01	Y-MW
807177662	N	U	04/30/94	CCY 01	Y-MLG
807177663	N	U	04/30/94	CCY 01	Y-MP
807177664	N	U	04/30/94	CCY 01	Y-MO
807177665	A	F	04/30/94	SCY 18	LB-PM
807177666	N	U	05/01/94	SCY 18	LB-OM
807177667	N	U	05/01/94	SCY 18	LB-DGM
807177668	N	U	05/01/94	SCY 18	LB-DBM
807177669	N	U	05/01/94	SCY 18	DG-LBM
807177670	N	U	05/03/94	SCR 32	DG-DBM
807177671	N	U	05/03/94	SCR 32	DB-DBM
807177672	N	U	05/03/94	SCR 32	DB-YM
807177673	N	U	05/03/94	SCR 32	DB-WM
807177674	N	U	05/03/94	SCR 06	DB-LGM
807177675	N	U	05/03/94	SCR 06	DB-PM
807177676	N	U	05/03/94	SCR 06	DB-OM
807177677	N	U	05/03/94	SCR 06	DB-LBM
807177678	N	U	05/03/94	SCR 06	DB-DGM
807177679	N	U	05/03/94	SCT 13	R-MY
807177680	N	U	05/03/94	SCT 13	R-MW
807177681	N	U	05/03/94	SCT 13	R-MLG
807177682	N	U	05/04/94	LL 04	R-MDG
807177683	N	U	05/04/94	LL 04	R-MP
807177684	N	U	05/04/94	LL 04	R-MO
807177685	N	U	05/04/94	LL 04	R-MLB
807177687	N	U	05/05/94	FR 05	R-MDB
807177688	N	U	05/05/94	FR 05	Y-MR
807177694	N	U	05/06/94	SCT 02	Y-MDB
807177695	N	U	05/06/94	SCT 02	W-MR
807177696	N	U	05/06/94	SCT 02	W-MP

CACTUS WREN BANDING (con't.)

Band No.	Age	Sex	Date	Location	Color Code
807177697	N	U	05/06/94	SCT 02	Y-MLG
807177698	A	M	05/07/94	ULL 02	Y-MDG
807177699	A	F	05/07/94	ULL 02	W-MY
807177700	F	U	05/07/94	ULL 02	W-MLG
807177701	F	U	05/07/94	ULL 02	W-MO
807177702	N	U	05/09/94	BCY 09	W-MDG
807177703	N	U	05/09/94	BCY 09	W-MLB
807177704	N	U	05/09/94	BCY 09	W-MDB
807177705	A	M	05/12/94	BCY 10	O-MY
807177706	N	U	05/12/94	SCT 17	O-MW
807177707	N	U	05/12/94	SCT 17	O-MDG
807177708	N	U	05/12/94	SCT 17	O-MLB
807177709	N	U	05/12/94	CCY 05	P-MP
807177710	N	U	05/12/94	CCY 05	P-MY
807177711	N	U	05/12/94	CCY 05	P-MW
807177712	N	U	05/12/94	CCY 05	P-MLG
807177713	N	U	05/12/94	CCY 05	P-MO
807177714	A	F	05/13/94	SCT 09	LB-MLB
807177715	A	M	05/13/94	SCT 09	DB-MDB
807177719	N	U	05/15/94	SCT 12	LG-MW
807177720	N	U	05/15/94	SCT 12	LG-MDG
807177721	N	U	05/15/94	SCT 12	LG-MO
807177722	N	U	05/15/94	BCY 07	LG-MP
807177723	N	U	05/15/94	BCY 07	LG-MLB
807177724	N	U	05/15/94	BCY 07	LG-MDB
807177725	N	U	05/15/94	BCY 12	P-MR
807177732	N	U	05/18/94	SCT 05	P-MLB
807177733	N	U	05/18/94	SCT 05	P-MDB
807177734	N	U	05/18/94	SCT 05	LB-MR
807177735	N	U	05/18/94	SCT 05	YY-M
807177736	N	U	05/18/94	SCY 02	YR-M
807177737	N	U	05/18/94	SCY 02	YW-M
807177738	N	U	05/18/94	SCY 02	YLG-M
807177739	N	U	05/18/94	SCY 02	YO-M
807177745	N	U	05/20/94	SCR 35	OO-M
807177746	N	U	05/20/94	SCR 35	OR-M
807177747	N	U	05/20/94	SCR 35	OY-M
807177748	N	U	05/20/94	SCR 35	OLG-M
807177749	N	U	05/21/94	ICWP 05	LGO-M
807177750	N	U	05/21/94	ICWP 05	LGP-M
807177751	N	U	05/21/94	ICWP 05	OLB-M
807177752	N	U	05/21/94	SCT 09	OP-M
807177753	N	U	05/21/94	SCT 09	P-OM

CACTUS WREN BANDING (con't.)

Band No.	Age	Sex	Date	Location	Color Code
807177754	N	U	05/21/94	SCT 09	P-LBM
807177755	A	M	05/22/94	ICWP 01	O-YM
807177756	N	U	05/22/94	ICWP 01	PP-M
807177757	N	U	05/22/94	ICWP 01	PR-M
807177762	N	U	05/24/94	SCT 10	LBLB-M
807177763	N	U	05/24/94	SCT 10	LBR-M
807177764	N	U	05/24/94	SCT 10	LBY-M
807177765	N	U	05/25/94	BCY 13	LBLG-M
807177766	N	U	05/25/94	BCY 13	LBO-M
807177767	N	U	05/25/94	BCY 13	LBP-M
807177768	N	U	05/25/94	BCY 13	RM-RR
807177769	N	U	05/25/94	BCY 11	YM-YY
807177770	N	U	05/25/94	BCY 11	RM-YY
807177771	N	U	05/25/94	BCY 11	LGM-YY
807177772	N	U	05/25/94	BCY 11	OM-YY
807177773	N	U	05/26/94	BCY 17	DG-MDG
807177774	N	U	05/26/94	BCY 17	DG-MR
807177775	N	U	05/27/94	CCY 13	DG-MY
807177776	N	U	05/27/94	CCY 13	DG-MW
807177777	N	U	05/27/94	CCY 13	DG-MLG
807177778	N	U	05/27/94	CCY 13	DG-MO
807177787	A	F	05/30/94	SP 02	DB-MW
807177788	A	M	05/30/94	SP 02	DB-MLG
807177789	N	U	05/30/94	SCR 07	DB-MDG
807177790	N	U	05/30/94	SCR 07	DB-MO
807177791	N	U	05/30/94	SCR 07	DB-MP
807177792	N	U	05/30/94	SCR 07	DB-MLB
807177793	N	U	05/30/94	SCR 07	YDG-M
807177796	F	U	06/01/94	SCY 06	WR-M
807177797	F	U	06/01/94	SCY 06	WLG-M
807177798	F	U	06/01/94	SCY 06	WDG-M
804102102	N	U	06/02/94	CCY 04	LGW-M
804102103	N	U	06/02/94	CCY 04	LGDG-M
804102104	A	M	06/03/94	CC 06	LGDB-M
804102105	A	F	06/03/94	CC 06	DGDG-M
804102106	A	F	06/03/94	FR 02	DGR-M
804102107	N	U	06/04/94	BCY 05	DGY-M
804102108	N	U	06/04/94	BCY 05	DGW-M
804102109	N	U	06/04/94	BCY 05	DGLG-M
804102109	N	U	06/04/94	BCY 05	DGLG-M
804102110	N	U	06/04/94	BCY 05	DGO-M
804102111	A	M	06/05/94	CCY 07	P-WM
804102112	N	U	06/06/94	CC 03	P-DGM

CACTUS WREN BANDING (con't.)

Band No.	Age	Sex	Date	Location	Color Code
804102113	N	U	06/06/94	CC 03	P-DBM
804102114	N	U	06/06/94	CC 03	O-DBM
804102115	N	U	06/06/94	CC 03	RR-M
804102116	N	U	06/06/94	CCY 03	RY-M
804102117	N	U	06/06/94	CCY 03	RW-M
804102118	N	U	06/06/94	CCY 03	RLG-M
804102122	N	U	06/07/94	SCY 11	RLB-M
804102123	N	U	06/07/94	SCY 11	RDB-M
804102124	N	U	06/07/94	SCY 11	DGP-M
804102125	N	U	06/07/94	SCY 11	DGLB-M
804102126	N	U	06/08/94	CCY 09	DGDB-M
804102127	N	U	06/08/94	CCY 09	OW-M
804102128	N	U	06/08/94	CCY 09	ODG-M
804102129	N	U	06/08/94	SCT 01	ODB-M
804102130	N	U	06/08/94	SCT 01	PW-M
804102131	N	U	06/08/94	SCT 01	PDG-M
804102132	N	U	06/08/94	SCT 01	PDB-M
804102133	N	U	06/08/94	SCT 01	LBW-M
804102134	N	U	06/12/94	FR 02	LBDG-M
804102135	N	U	06/12/94	FR 02	LBDB-M
804102140	N	U	06/12/94	SCR 02	LBM-OO
804102141	N	U	06/12/94	SCR 02	DGM-OO
804102142	N	U	06/12/94	SCR 02	RM-OO
804102143	N	U	06/12/94	SCR 02	LGM-OO
804102148	N	U	06/14/94	ICWP 02	DBLG-M
804102001	F	U	07/13/94	SCR 12	OM-RR
804102002	N	U	07/14/94	SCR 17	DGM-RR
804102003	N	U	07/14/94	SCT 17	LBM-RR
804102004	N	U	07/14/94	SCT 05	LBM-LBLB
804102005	N	U	07/14/94	SCT 05	RM-LBLB
804102006	N	U	07/14/94	SCT 05	DGM-LBLB
804102007	N	U	07/14/94	SCT 05	DBM-LBLB
804102008	N	U	07/14/94	BCY 04	DBM-RR
804102009	N	U	07/14/94	BCY 04	PM-RR
804102010	N	U	07/16/94	ULL 02	LBM-DBDB
804102011	N	U	07/16/94	ULL 02	PM-PP
804102012	N	U	07/16/94	ULL 02	RM-PP
804102013	N	U	07/16/94	ULL 02	LBM-PP
804102014	A	M	07/17/94	ULL 01	RM-DGDG
804102015	A	F	07/17/94	ULL 01	DBM-PP
804102016	A	M	07/17/94	SCT 05	WM-YY
804102017	A	F	07/17/94	SCT 05	LGM-LGLG
804102018	A	F	07/18/94	SCR 06	YM-RR

CACTUS WREN BANDING (con't.)

Band No.	Age	Sex	Date	Location	Color Code
804102019	A	M	07/18/94	SCR 06	RM-LGLG
804102020	N	U	07/18/94	SCY 18	LGM-RR
804102021	F	U	07/18/94	FR 05	WM-RR
804102022	F	U	07/18/94	FR 05	YM-LGLG
804102023	F	U	07/18/94	FR 05	WM-LGLG
804102024	A	F	07/18/94	FR 05	LBM-LGLG
804102025	A	M	07/20/94	SCT 15	DGM-LGLG
804102026	A	F	07/20/94	SCT 15	YM-LBLB
804102027	N	U	07/20/94	SCR 06	DBM-LGLG
804102028	N	U	07/20/94	SCR 06	OM-LGLG
804102029	N	U	07/20/94	SCR 06	PM-LGLG
804102030	N	U	07/20/94	SCR 06	YM-DGDG
804102031	N	U	07/20/94	SCT 09	WM-DGDG
804102032	N	U	07/20/94	SCT 09	LGM-DGDG
804102033	N	U	07/20/94	SCY 18	LBM-DGDG
804102034	N	U	07/20/94	SCY 18	DBM-DGDG
804102035	N	U	07/20/94	SCY 18	OM-DGDG
804102036	A	M	07/21/94	SP 06	PM-DGDG
804102037	F	U	07/21/94	SP 06	WM-LBLB
804102038	F	U	07/21/94	SP 06	LG-LBLB
804102039	A	F	07/22/94	CCY 14	OM-LBLB
804102040	A	M	07/22/94	CCY 14	PM-LBLB
804102041	F	U	07/22/94	CCY 14	YM-PP
804102042	A	M	07/23/94	SCR 07	MR-RR
804102043	F	U	07/23/94	SCR 12	WM-PP
804102044	A	M	07/23/94	SCY 12	DGM-DGDG
804102045	F	U	07/23/94	SCY 12	LGM-PP
804102055	N	U	07/25/94	FR 03	MDG-RR
804102056	N	U	07/25/94	FR 03	MLB-RR
804102057	A	M	07/25/94	FR 03	MW-WW
804102058	F	U	07/25/94	FR 03	MO-RR
804102059	F	U	07/26/94	ICWP 01	MDB-RR
804102060	F	U	07/26/94	ICWP 01	MP-RR
804102061	A	M	07/26/94	ICWP 03	MR-YY
804102062	A	M	07/27/94	SP 04	MW-YY
804102063	F	U	07/27/94	SP 07	MY-LGLG
804102064	A	M	07/27/94	SCY 06	MLG-YY
804102068	F	U	07/29/94	BCY 07	MO-YY
804102069	F	U	07/29/94	BCY 07	MP-YY
804102070	N	U	07/29/94	LL 04	MR-WW
804102071	N	U	07/29/94	LL 04	MY-WW
804102072	N	U	07/29/94	LL 04	MLG-WW
804102073	N	U	07/29/94	LL 04	MDG-WW

CACTUS WREN BANDING (con't.)

Band No.	Age	Sex	Date	Location	Color Code
804102074	N	U	07/29/94	SP 04	MLB-WW
804102075	N	U	07/29/94	SP 04	MDB-WW
804102076	N	U	07/29/94	SP 04	MO-WW
804102077	N	U	07/29/94	SP 04	MP-WW
804102078	N	U	07/30/94	BCY 19	MW-LGLG
804102079	N	U	07/30/94	BCY 19	MDG-LGLG
804102080	N	U	07/30/94	BCY 19	MLB-LGLG
804102081	N	U	07/30/94	BCY 11	MDB-LGLG
804102082	N	U	07/30/94	SCY 06	MO-LGLG
804102083	N	U	07/30/94	SCY 06	MP-LGLG
804102084	N	U	07/30/94	SCY 06	MDG-DGDG
804102086	A	M	07/31/94	BCY 16	MY-DGDG
804102087	A	F	07/31/94	BCY 16	MW-DGDG
804102088	F	U	07/31/94	BCY 16	MLG-DGDG
804102089	F	U	07/31/94	BCY 16	MLB-DGDG
804102090	F	U	07/31/94	BCY 16	MDB-DGDG
804102092	F	U	08/01/94	BCY 19	MP-DGDG
804102093	A	M	08/01/94	BCY 19	MR-LBLB
804102094	F	U	08/01/94	BCY 19	MY-LBLB

TABLE 2

CALIFORNIA GNATCATCHER BANDING
IN THE LAGUNA FIRE STUDY AREA
MAY-JULY 1994
DAVID R. BONTRAGER

Band No.	Age	Sex	Date	Location	Color Code
196041966	A	M	05/03/94	SCR 32	MDG-LG
196041967	A	F	05/03/94	SCR 32	MO-LG
196041968	F	U	05/03/94	SCR 32	MLB-LG
196041969	F	U	05/03/94	SCR 32	MDB-LG
196041972	A	M	05/05/94	FR 02	MR-DG
196041982	A	M	05/13/94	SCT 15	MDB-DG
196041983	A	F	05/13/94	SCT 15	MR-LB
196041984	A	M	05/13/94	SCT 09	MW-P
196041991	N	U	05/18/94	SCT 15	MDB-LB
196041992	N	U	05/18/94	SCT 15	MP-DB
196041993	N	U	05/18/94	SCT 15	MLB-DB
196041994	N	U	05/18/94	SCT 15	M-RW
196042006	A	M	05/25/94	CCY 10	M-RLB
196042007	N	U	05/27/94	CCY 10	M-WW
196042008	N	U	05/27/94	CCY 10	M-WR
196042009	N	U	05/27/94	CCY 10	M-WY
196042021	A	M	05/29/94	CCY 01	M-LGDG
196042022	A	F	05/29/94	CCY 01	M-LGR
196042030	N	U	06/11/94	FR 02	M-RLG
196042031	N	U	06/11/94	FR 02	M-RDB
196042042	N	U	06/17/94	SCT 09	M-DGDB
196042043	N	U	06/17/94	SCT 09	M-PP
196042044	N	U	06/17/94	SCT 09	M-PR
205012105	N	U	07/31/94	BCY 14	RY-M
205012106	N	U	07/31/94	BCY 14	RW-M
205012107	N	U	07/31/94	BCY 14	YY-M

APPENDIX C

Impacts of the October 1993 Laguna Fire on California Gnatcatchers and Cactus Wrens. by David R. Bontrager, Richard A. Erickson, and Robert A. Hamilton.

IMPACTS OF THE OCTOBER 1993 LAGUNA FIRE ON CALIFORNIA GNATCATCHERS AND CACTUS WRENS

David R. Bontrager,[1] Richard A. Erickson,[2] and Robert A. Hamilton[2]

[1] 80645 Lost Creek Road, Dexter, Oregon 97431
(Ed Almanza & Associates, 422 Glenneyre, Laguna Beach, California 92651)

[2] LSA Associates, One Park Plaza, Suite 500, Irvine, California 92714

Abstract. The Laguna fire burned approximately 13,000 acres of natural vegetation in the San Joaquin Hills in late October 1993, much of which was classified as coastal sage scrub. Previously mapped localities for approximately 50% (over 200 individuals) of the gnatcatchers in these hills were impacted by the fire, along with localities for approximately 75% (over 500 individuals) of the wrens. Contrasting with press reports, but in accordance with most findings concerning bird mortality in fire, surveys of burned areas in the first days following the fire suggested that few gnatcatchers, wrens, or other birds perished in the fire. Post-fire conditions were insufficient to support pre-fire bird numbers, however, so bird densities diminished rapidly. Behavioral observations and survey data suggest that unburned areas on the periphery of the fire absorbed many displaced gnatcatchers, but few wrens. Compared to the 1993 breeding season, gnatcatcher numbers increased at four of five carefully monitored study sites outside the fire limits, for an overall increase of 28-35%; the role of 1993 reproductive success on these results is unknown. Decreases in numbers of cactus wrens were noted at three of the study sites, for an overall decrease of 2.7% since summer 1993. More wrens were able to remain within burned areas because the fire-dampening effect of dense cactus patches allowed a disproportionate amount of that vegetation to remain intact.

Prospects for post-fire recolonization of the San Joaquin Hills by gnatcatchers and wrens are enhanced by the presence of habitat refugia within the fire perimeter. Pockets of unburned and lightly burned scrub, especially associated with dense stands of cactus, supported wrens and gnatcatchers through the winter. Spring 1994 surveys revealed 79 pairs of wrens and 12 pairs of gnatcatchers within the perimeter of the burn. These represent 28% and 9%, respectively, of 1992 survey results for the same area. As of 2 August 1994, nesting confirmation was obtained for 90% of the wrens and 75% of the gnatcatchers; successful nesting was confirmed for 54% and 33%, respectively. Five unburned areas around the periphery of the fire (Sand Canyon Reservoir, north Laguna Laurel, Sycamore Hills, coastal Crystal Cove State Park, and the Bonita Reservoir area) support wren and/or gnatcatcher concentrations that will also serve as important sources of birds to recolonize the hills. Studies are underway to monitor the recovery of the native scrub community and these important bird populations within the burned area.

Introduction

The biota of the San Joaquin Hills, Orange County, California was dramatically impacted by the Laguna fire in October 1993. The fire started in Laguna Canyon on 27 October and quickly spread throughout much of the San Joaquin Hills. When extinguished several days later, the fire had burned approximately 13,000 acres of natural vegetation, primarily coastal sage scrub, chaparral and grassland (County of Orange GIS). The habitat of a large number of California gnatcatchers (*Polioptila californica californica*) and cactus wrens (*Campylorhynchus brunneicapillus*) was consumed. Presented here are the results of 1) surveys we conducted for gnatcatchers and wrens at selected sites within and adjacent to burned areas in spring/summer 1993 and in the days and weeks following the fire, and 2) surveys of the entire burned area in spring 1994. Baseline information on vegetation and bird locations from a 1992 survey is used for comparison, and future prospects for recolonization of the hills are discussed.

Methods

1993 Nesting Study

Figure 1 shows the locations of five unburned sites studied in detail during the 1993 breeding season (Bontrager 1994a,b). Several hundred hours were spent searching for nests and plotting gnatcatcher and wren locations. Eventually the number of pairs was determined by combining the location of simultaneously nesting birds and cumulative bird locations. The process was enhanced by the presence of color-banded birds.

Post-fire Surveys

Immediately following the fire, LSA Associates, Inc. (LSA) initiated surveys in portions of the San Joaquin Hills under investigation by LSA and others since at least 1988 (LSA 1994). Burned portions of the Corridor were surveyed from 30 October to 3 November, with sporadic visits thereafter. Surveys during the period 3-13 November were in unburned areas on the northern and eastern periphery of the fire. In the latter surveys, special attention was given to detecting color-banded birds that may have been displaced by the fire. Most areas were visited only once, and taped vocalizations of gnatcatchers and wrens were not used.

More detailed surveys by Bontrager on his unburned study sites began on 5 November. These areas were methodically searched on foot, using binoculars and a spotting scope. Combinations of "spishing" and taped playback of gnatcatcher and cactus wren vocalizations were used to elicit responses. Primary tasks were to determine the number of pairs of gnatcatchers and wrens at each site, identify and count unpaired birds, and determine the color code of previously banded birds.

During the periods 16-24 and 27-29 December, intensive mist netting and color-banding of California gnatcatchers was done by Bontrager in the vicinity of Sand Canyon Reservoir. Forty gnatcatchers were color-banded. Combined with visual surveys, the large number of banded birds made it possible to reach what was believed to be an accurate estimate of the number of gnatcatchers in the Sand Canyon and Sand Canyon Wash study sites.

Because of the need to obtain a relatively quick snapshot of post-fire conditions, the standard Scientific Review Panel 3-visit protocol was not used by Bontrager. The exceptions were the Sand Canyon Reservoir and Sand Canyon Wash study sites, where banding activity resulted in three or more visits to most territories. Portions of Sycamore Hills and North Laguna Laurel were visited twice; all other sites received one thorough visit.

Spring 1994 Surveys

LSA mapped unburned and lightly burned patches of scrub and surveyed the entire burned area from 22 March to 23 April 1994. Patches of potentially suitable habitat were visited only once; taped vocalizations aided in searching for gnatcatchers and wrens. Nearly all of the occupied areas identified were visited again in May and June, with follow-up visits to many areas during the period 13 July - 2 August. A good sense of nesting status was obtained by more lengthy observation and focused cactus wren nest searches during the May - August field effort.

Results

Vegetation

Not all areas burned with equal intensity. This mosaic pattern is the result of at least four factors: 1) terrain; 2) position of the vegetation relative to wind direction at the time of burning; 3) the use of controlled "backlighting" of the fire in certain areas; and 4) the makeup of the vegetation at any given site. Post-fire conditions varied from simple ash and charred stumps in some intensively burned areas formerly heavily vegetated to lightly burned areas where grasses and forbs burned beneath shrubs that were only singed; elsewhere there were pockets of completely untouched vegetation. Many cactus (*Opuntia* spp.) patches burned completely, but those of sufficient size tended to dampen the intensity of the fire, allowing some vegetation within these patches to survive the event intact. Cactus in grassland tended to burn less severely than cactus in coastal sage scrub and chaparral where fuel loads had accumulated. In general geographic terms, Laguna Canyon and other coastal canyons burned hotter and more completely than areas on the north and west flanks of the fire, and consequently experienced greater loss of vegetation. Based on our spring 1994 mapping effort, approximately 470 acres of coastal sage scrub within the area of the Laguna fire were unburned or burned only lightly. Most of this scrub contains 20 percent or greater relative cover of cactus and would, therefore, be classified as "southern cactus scrub" under the County of Orange GIS Habitat Classification System (Jones and Stokes 1993).

Immediate Bird Impacts

Twenty-seven gnatcatchers (8 pairs, 11 singles) and 19 wrens (5 pairs, 9 singles) were found during surveys of the general vicinity of the San Joaquin Hills Transportation Corridor right-of-way in the first week following the fire. The results of these surveys suggest that few birds perished in the blaze, at least in those areas visited. Birds were widespread and common within the fire perimeter, primarily in remnant patches of scrub and cactus where some cover remained, but also in more devastated areas. All of the expected species of birds were represented, including those whose terrestrial or skulking nature might be expected to put them at greater risk in such a situation. The latter group included California quail (*Callipepla californica*), Bewick's wren (*Thryomanes bewickii*), hermit thrush (*Catharus guttatus*), wrentit (*Chamaea fasciata*), California thrasher (*Toxostoma redivivum*), and rufous-sided towhee (*Pipilo erythrophthalmus*), as well as California gnatcatcher and cactus wren. The numbers of gnatcatchers and several other species observed along the San Joaquin Hills Transportation Corridor route on October 30 and 31 were actually greater than recorded on previous single-visit surveys. These surveys did not pro-

duce numbers of cactus wrens as impressive as those of gnatcatchers and other species.

Short-Term Bird Impacts

By the end of the first week following the fire, bird numbers had dropped substantially in the burned areas that were surveyed days earlier. Refugia of unburned and lightly burned scrub were still occupied by a small number of gnatcatchers, cactus wrens, and other species at year's end, however.

Results of LSA's surveys of unburned areas north and east of the fire are considered superseded by Bontrager's more thorough surveys of the same areas (Figure 1), discussed in the following paragraph. Likewise, LSA's (1994) documented observations of color-banded birds in these areas will ultimately be incorporated in an additional analysis of dispersal in these species.

Bontrager's post-fire surveys and color-banding revealed an increase in the number of gnatcatchers since the previous breeding season (Figure 1). Some of these individuals were probably hatching year birds from unburned habitat. There are, however, reasons to believe that many of these "extra" birds were fire-dispersed. Many unpaired birds behaved abnormally, being especially restive and moving over great distances (behaviors also observed during LSA's surveys of the same areas). In contrast to gnatcatchers, post-fire surveys revealed almost no sign of fire-dispersed cactus wrens (Figure 1).

Spring 1994 Bird Surveys

Figures 2 and 4 show the locations of 12 pairs of California gnatcatchers and 79 pairs of cactus wrens located during spring surveys of the entire burned area; for analysis here, we have assumed that all observations of "single" birds actually represent pairs. In our experience, it is more likely that only one of a pair was observed in such situations, rather than singles truly representing unmated birds. Most birds were located in northern, less severely burned, areas and appeared to be occupying established pre-fire territories (Bontrager pers. obs.; County of Orange GIS). Also shown are preliminary findings (through 2 August) concerning nesting status and success.

Discussion

Bird Mortality

It is probable that the high numbers of gnatcatchers and several other species recorded immediately following the fire were primarily the result of: 1) increased conspicuousness of the birds due to lack of cover, and 2) the ease of surveying large areas quickly. Cactus wrens were presumably less conspicuous and more difficult to detect.

Our observations of many birds surviving the fire are consistent with most of the previous literature on the subject. The indirect influence of fire (primarily the temporary loss of habitat) has long been recognized as being far more important than direct impacts (Leopold 1933). The observation of Chew et al. (1959) is the exception; they found 43 dead mammals and two dead birds in 1.7 acres following a Malibu, California chaparral fire and suggested that the fire's toll on wildlife was enormous. Howard et al. (1959), Stoddard (1963), Komarek (1969), and Biswell (1989) especially downplay the loss of life due to fire, based largely on their experiences with controlled burns, which typically burn less intensely than wildfires. Leopold (1933), Lawrence (1966), Catling et al. (1982), Chandler et al. (1983), and Pyne (1984) took more moderate positions, suggesting that few birds and mammals die in wildfires, but acknowledging that under certain conditions (usually intensely burning fire) many animals may die.

Additional evidence of extensive gnatcatcher survival was obtained at Crystal Cove State Park in spring 1994. On the unburned coastal terrace there (Figure 1), 45 pairs of gnatcatchers represented a 125% increase over the 20 pairs in 1993 (K.L. Pluff in. litt.). Inland portions of the park burned, but the fire did not cross Pacific Coast Highway along most of this stretch.

Post-fire Bird Distribution

Based on surveys conducted by Jones & Stokes Associates and Ed Almanza & Associates in 1992, locations for over 400 California gnatcatchers in the San Joaquin Hills and vicinity have been entered in the County GIS. Although these surveys were extensive, they were not complete; areas such as the U.C. Irvine Preserve and Turtle Rock area of Irvine were not included. Moreover, vagaries in the GIS output do not allow complete confidence in precise figures available at this time. The mapped localities for approximately 50% of these birds burned in the Laguna fire. In the same area, locations for roughly 700 cactus wrens have been entered; the mapped localities for approximately75% of which are within the perimeter of the fire.

For comparison with our survey results, we have adjusted the 1992 survey data within the burn to 127 gnatcatcher pairs (Figure 3) and 282 cactus wren pairs (Figure 5) by considering all singles (as explained previously under Results), and multiples in excess of two (most likely represent family groups), as pairs. Note that we would apply the same reinterpretation of bird data from unburned areas, and thus do not question the relative number of birds in the local populations that were impacted by the fire. By this convention, the 79 pairs of cactus wrens still on territory within the burn represent 28% of the 1992 total for the same area. The short-term impact on gnatcatchers is greater: the 12 pairs found on our surveys represent only 9% of the 1992 total. The

fire's impact on habitat is a ready explanation, as extant scrub in the post-fire landscape is disproportionately represented by cactus.

The post-fire distribution of both species was fairly predictable based on a visual analysis of remaining habitat. Gnatcatchers were quite particular, requiring a fair amount of relictual scrub, usually with a well-developed herbaceous component. Gnatcatchers were not present at any of several badly burned sites that appeared to have sufficient new growth of California encelia (*Encelia californica*) by spring 1994. The distribution of wrens was dependent upon the presence of cactus, with the quantity of tall (>1 m) cactus closely correlated to the number of wrens. Anomalous situations observed include: 1) seemingly suitable patches of cactus with no wrens, 2) apparently underutilized large patches of cactus, and 3) wrens occupying areas that appear too devastated to support them.

One gnatcatcher known to be present within the burn as late as 24 January was not found there during the spring survey. We believe there was some rearrangement of bird distribution at the initiation of the breeding season as birds became more territorial and some searched for mates. It is possible there was some movement back into burned areas at this time, as appeared to be the case with several similarly sedentary bird species (e.g., wrentit). Further evidence of prenesting adjustment was obtained on the unburned coastal terrace at Crystal Cove State Park where the 125% increase in gnatcatcher pairs was only detected well into spring; March 1994 surveys had suggested a mere 40% increase (K.L. Pluff in litt.).

Future Prospects

Most of the birds that left burned habitat will probably never again occupy their former territories. An increased mortality rate is expected among displaced birds as they are forced to search for food and shelter in poor and marginal habitat or suffer excessive competition in better habitat. Reduced reproductive potential in the first nesting seasons following the fire is even more significant. Due to these combined effects, a short-term decline is probably underway in the California gnatcatcher population of the San Joaquin Hills. Within a year or two, the population is expected to increase again in response to recovering scrub habitat. It is possible the gnatcatcher population will eventually exceed pre-fire levels. Regenerating coastal sage scrub will be more open, and potentially more suitable for gnatcatchers, and may temporarily expand into areas that will ultimately return to chaparral. This would, in turn, be followed by a gradual population decline to more closely match pre-fire levels as some areas of coastal sage scrub reach senescence and chaparral recovery continues, reducing habitat suitability for gnatcatchers. Shortened fire cycles are known to turn some areas to grassland (Zedler et al. 1983, Westman and O'Leary 1986), however. At Camp Pendleton, Tutton et al. (1991) found that 80 percent of known California gnatcatcher locations were in areas that had not burned in at least 16 years.

The optimistic scenario offered in the previous paragraph is possible only because significant gnatcatcher strongholds around the periphery of the San Joaquin Hills were essentially unaffected by the fire. In addition to these birds, the small number of gnatcatchers occupying scrub refugia within the burn perimeter are expected to contribute to recolonization of burned portions of the San Joaquin Hills.

Cactus wrens may follow a different course in recolonizing the San Joaquin Hills. The fact that wrens presently outnumber gnatcatchers by approximately seven to one within the burn perimeter should not be taken as an indication that the wren population is closer to full recovery. Cactus wrens generally require cactus scrub that is at least one meter tall, a height that is not quickly attained by these relatively slow-growing plants. Rea and Weaver (1990) emphasized that Benson (1969) considered fire to be the chief limiting factor in the distribution of cactus in southern California. During our 1993 and 1994 surveys, we have observed a great range of response from burned cactus patches, with many badly burned patches showing only weak signs of recovery even several months after the fire. In addition, two major scrub habitat areas around the burn periphery (Bonita Reservoir area and coastal Crystal Cove State Park) lack significant numbers of wrens to contribute toward recovery of the population. These factors lead us to believe that recovery to pre-fire levels may take longer for cactus wrens than for California gnatcatchers.

Acknowledgements. These studies were funded in part by Southern California Edison, LSA Associates, and Ed Almanza and Associates. Access to survey lands was provided by The Irvine Company, California Park Service, County of Orange, and the cities of Irvine and Laguna Beach. Field work was conducted by the authors, Amy Gorospe, Robert Meade and James E. Pike. Loren R. Hays, Jeff M. Newman, and Michael A. Patten offered helpful comments on the manuscript.

Literature Cited

Benson, L. 1969. The Native Cacti of California. Stanford University Press, Stanford, California.

Biswell, H.H. 1989. Prescribed Burning in California Wildlands Vegetation Management. University of California Press, Berkeley.

Bontrager, D.R. 1994a. First annual progress report, 1993 California gnatcatcher research activity in the superpark area of Orange County, California. Unpublished report prepared for the Office of Management Authority, U.S. Fish & Wildlife Service, Arlington, Virginia.

Bontrager, D.R. 1994b. A preliminary assessment of the effects of the October 1993 Laguna Beach fire on California gnatcatcher and cactus wren populations in the Orange County Superpark. Unpublished report prepared for Ed Almanza & Associates, Laguna Beach, California.

Catling, P.C., A.E. Newsome, and G. Dudzinski. 1982. Small mammals, habitat components, and fire in southeastern Australia. Pages 199-206 *in* C.E. Conrad and W.C. Oechel (technical coordinators). Proceedings of the Symposium on Dynamics and Management of Mediterranean-type Ecosystems. Pacific Southwest Forest and Range Experiment Station General Technical Report PSW-58. Berkeley, California.

Chandler, C., P. Cheney, P. Thomas, L. Trabaud, and D. Williams. 1983. Fire in Forestry, volume 1, Forest Fire Behavior and Effects. John Wiley & Sons, New York.

Chew, R.M. B.B. Butterworth, and R. Grechman. 1959. The effects of fire on the small mammal population of chaparral. Journal of Mammalogy 40:253.

Howard, W.E., R.L. Fenner, and H.E. Childs, Jr. 1959. Wildlife survival in brush burns. Journal of Range Management 12:230-234.

Jones and Stokes Associates, Inc. 1993. Methods used to survey the vegetation of Orange County parks and open space areas and the Irvine Company property. unpublished report prepared for the County of Orange Environmental Management Agency. Santa Ana, California.

Komarek, E.V. 1969. Fire and animal behavior. Proceedings of the Tall Timbers Fire Ecology Conference 9:161-207.

Lawrence, G.E. 1966. Ecology of vertebrate animals in relation to chaparral fire in the Sierra Nevada foothills. Ecology 47:278-291.

Leopold, A. 1933. Game Management. Scribner, New York.

LSA Associates, Inc. 1994. 1993 California gnatcatcher and cactus wren studies in the San Joaquin Hills. Unpublished report prepared for California Corridor Constructors, Irvine, California.

Pyne, S.J. 1984. Introduction to Wildland Fire. J. Wiley and Sons, New York.

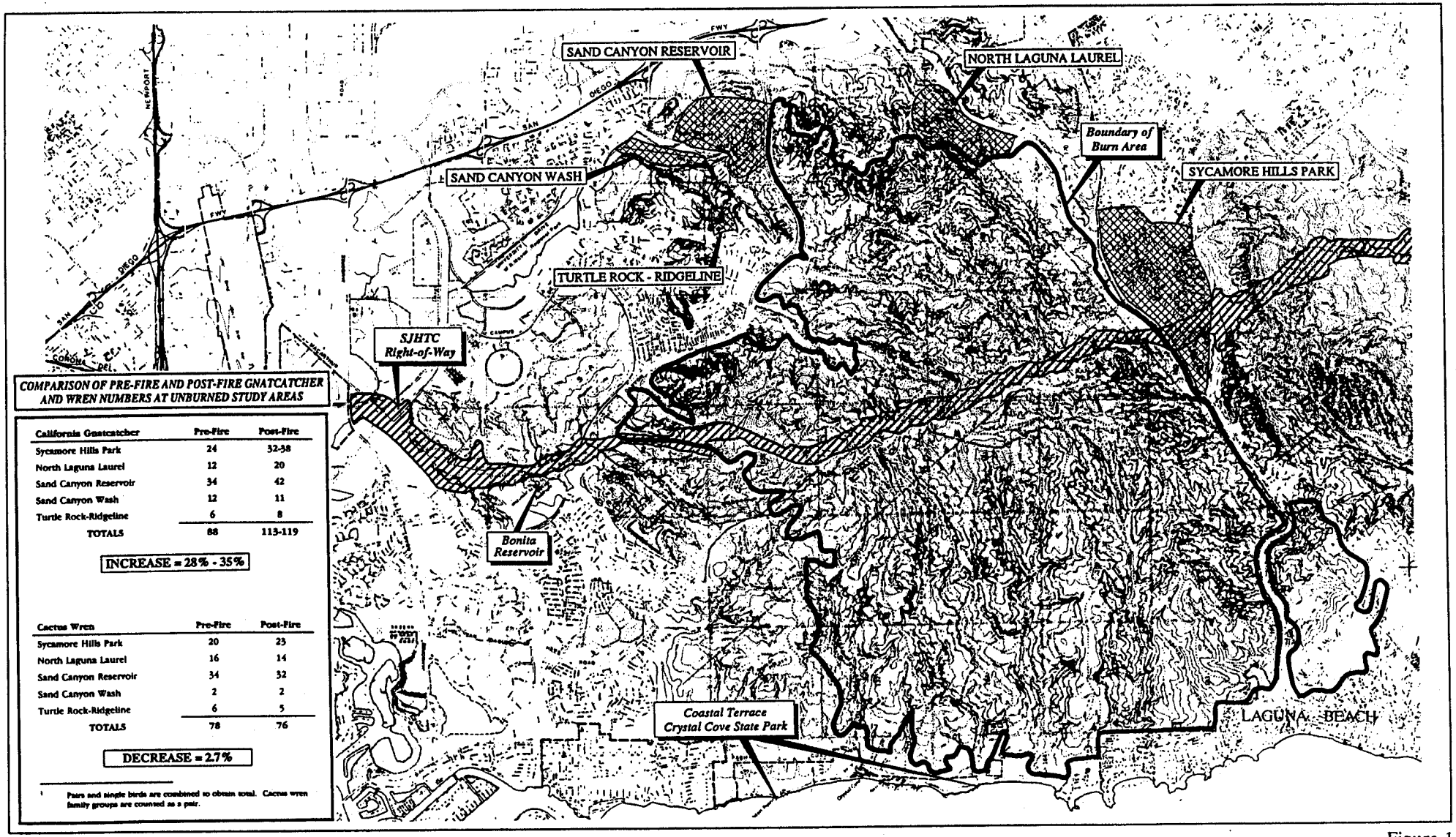
Rea, A.M. and K.L. Weaver. 1990. The taxonomy, distribution, and status of coastal California cactus wrens. Western Birds 21:81-126.

Stoddard, H.L. 1963. Bird habitat and fire. Proceedings of the Tall Timbers Fire Ecology Conference 2:163-175.

Tutton, J., B. Harper, and R. Zembal. 1991. A survey of the California gnatcatcher and cactus wren on Camp Pendleton, San Diego County, California (final). Unpublished report prepared for the U.S. Marine Corps Environmental and Natural Resources Management Office, Camp Pendleton, California.

Westman, W.E. and J.F. O'Leary. 1986. Measures of resilience: the response of coastal sage scrub to fire. Vegetatio 65:179-189.

Zedler, P.H., C.R. Gautier, and G.S. McMaster. 1983. Vegetation change in response to extreme events: the effect of a short interval between fires in California chaparral and coastal sage scrub. Ecology 84:809-818.



COMPARISON OF PRE-FIRE AND POST-FIRE GNATCATCHER AND WREN NUMBERS AT UNBURNED STUDY AREAS

California Gnatcatcher	Pre-Fire	Post-Fire
Sycamore Hills Park	24	32-38
North Laguna Laurel	12	20
Sand Canyon Reservoir	34	42
Sand Canyon Wash	12	11
Turtle Rock-Ridgeline	6	8
TOTALS	88	113-119

INCREASE = 28% - 35%

Cactus Wren	Pre-Fire	Post-Fire
Sycamore Hills Park	20	23
North Laguna Laurel	16	14
Sand Canyon Reservoir	34	32
Sand Canyon Wash	2	2
Turtle Rock-Ridgeline	6	5
TOTALS	78	76

DECREASE = 2.7%

[1] Pairs and single birds are combined to obtain total. Cactus wren family groups are counted as a pair.

7/13/94(CRN401C)

LEGEND

Unburned Study Areas

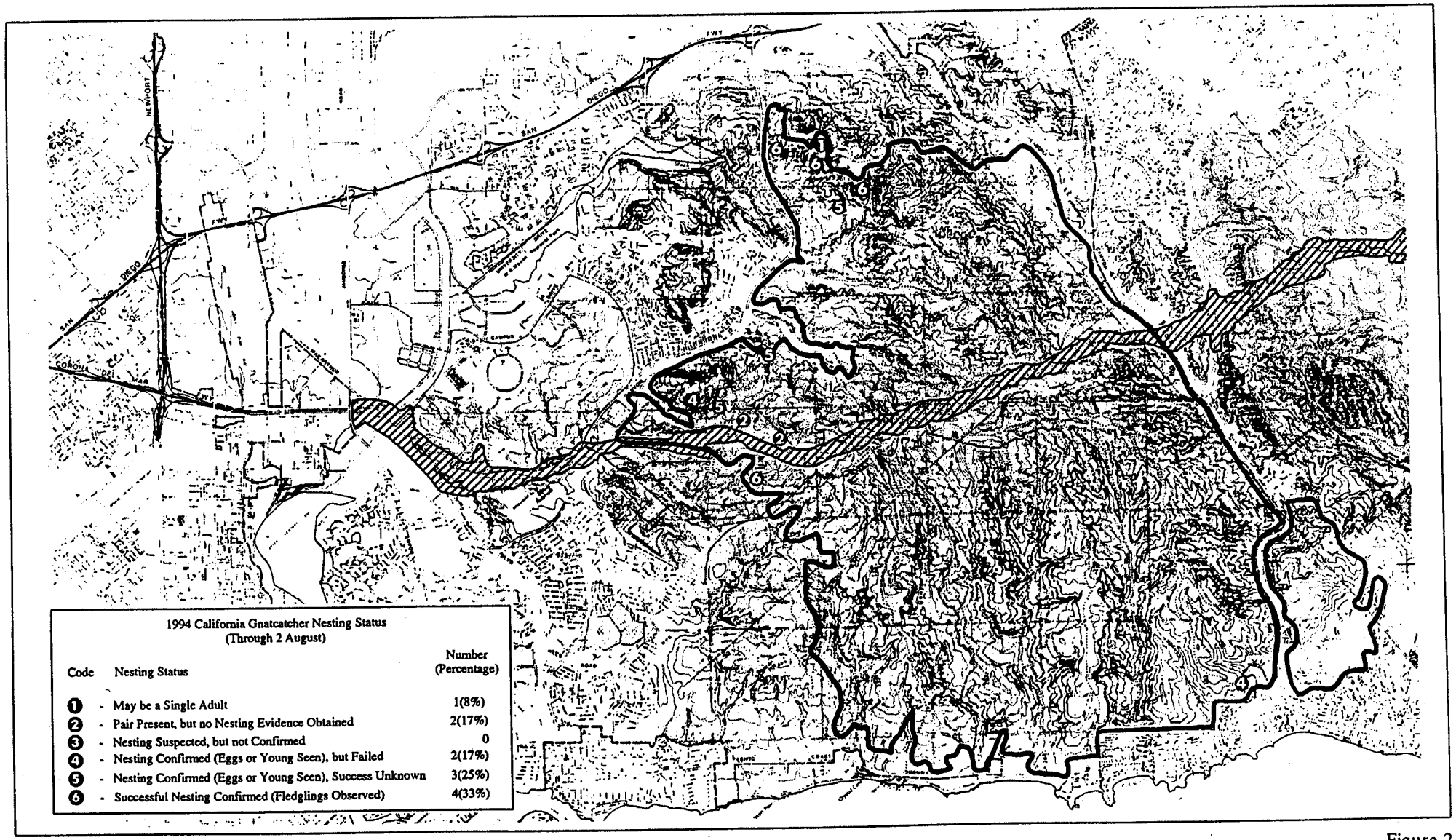
LSA

Scale in Feet

0 2250 4500

Figure 1

Study Area and Vicinity



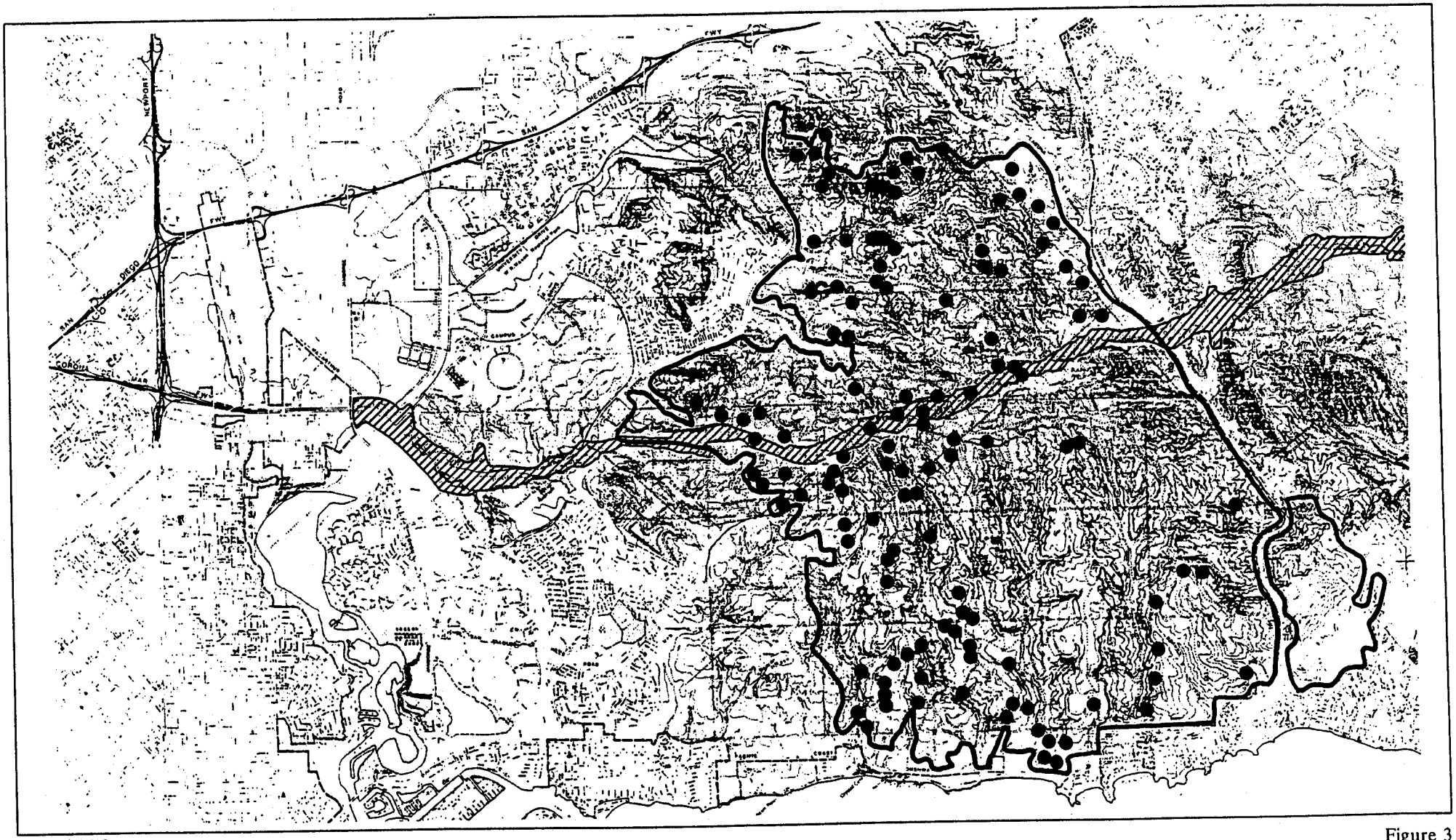
7/13/94(CRN401C)

Figure 2

LSA

Scale in Feet
0 2250 4500

1994 California Gnatcatcher Locations and Nesting Status



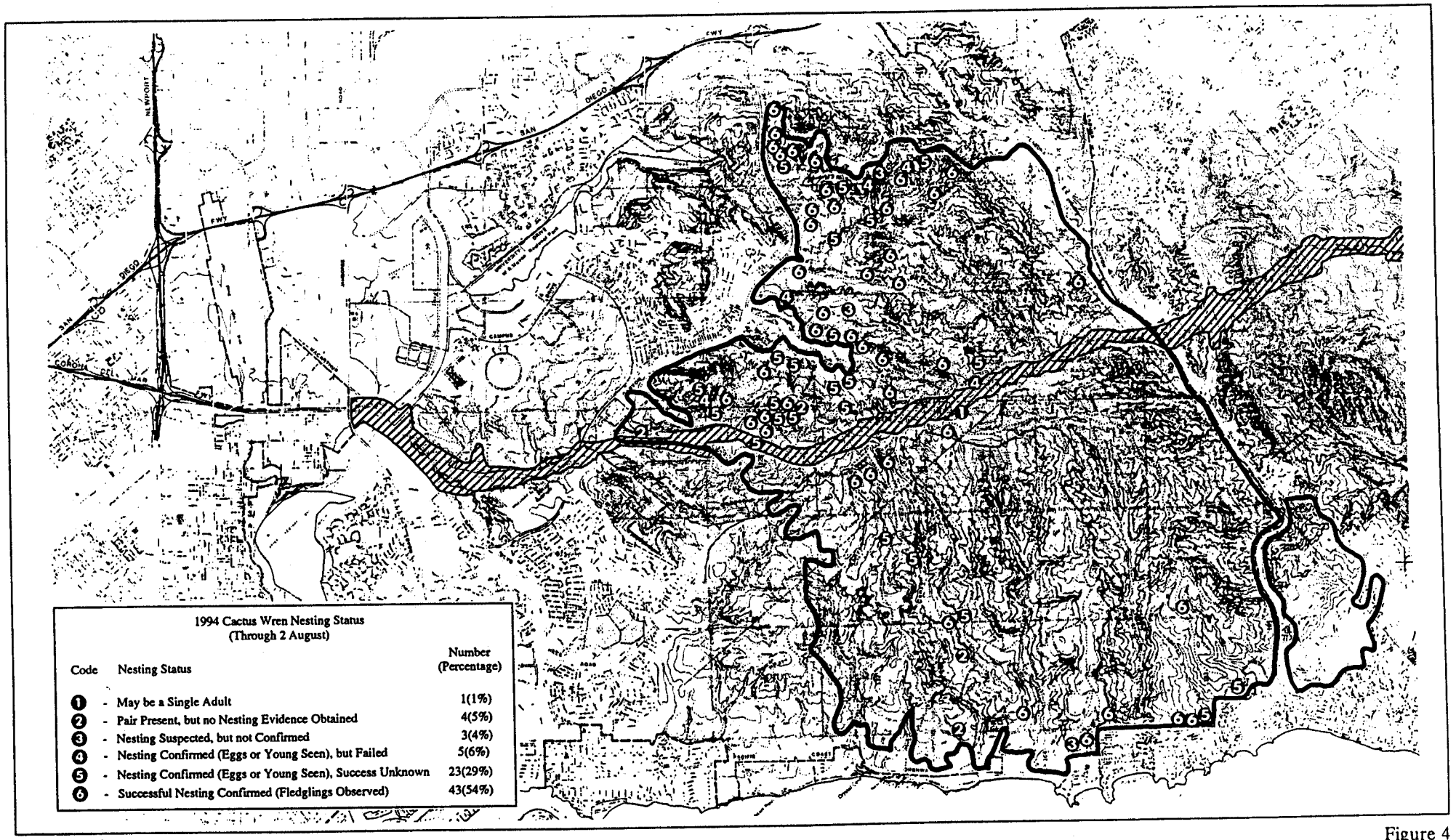
7/13/94(CRN401C)

Figure 3

LSA

Scale in Feet
0 2250 4500

1992 Califonia Gnatcatcher Locations



7/13/94(CRN401C)

Figure 4

LSA

Scale in Feet
0 2250 4500

1994 Cactus Wren Locations and Nesting Status

APPENDIX D

1994 Wildlife Study, TNC Vegetation Plots, San Joaquin Hills. by LSA Associates, Inc.

1994 WILDLIFE STUDY
TNC VEGETATION PLOTS
SAN JOAQUIN HILLS

November 21, 1994

Prepared for:

California Corridor Constructors
2 Venture, Suite 260
Irvine, California 92718

Prepared by:

LSA Associates, Inc.
1 Park Plaza, Suite 500
Irvine, California 92714
(714) 553-0666
LSA Project #CRN401

TABLE OF CONTENTS

APPENDIX

LIST OF FIGURES

PAGE

INTRODUCTION

Under a contract with California Corridor Constructors, LSA Associates, Inc. (LSA) has investigated various biological effects of the October, 1993, Laguna fire in the San Joaquin Hills. As part of these investigations, LSA conducted a series of wildlife surveys at 12 vegetation monitoring plots established by The Nature Conservancy (TNC) in preserved open space areas in the San Joaquin Hills. The purpose of these surveys was to provide baseline information on wildlife use of the study plots and surrounding areas, with the general intent of monitoring long-term biotic changes as post-fire regeneration proceeds.

METHODS

LSA biologists Robert A. Hamilton and Richard A. Erickson conducted surveys at 12 TNC study plots from June 17 to June 29, 1994. Each LSA site covered approximately one acre, as sketched in the field on a USGS topographic base map, scale 1" = 2,000' (the sites were not staked in the field). Figure 1 shows the locations of each LSA site in relation to the TNC sites. LSA's site numbers are the same as TNC's vegetation plot numbers. Habitat conditions were typically not recorded, with the understanding that TNC gathered detailed vegetation information at each study plot throughout the season.

Each site was surveyed for 20 minutes between dawn and 9:05 a.m. We recorded all butterflies, herpetiles, birds and mammals detected on and around the sites (i.e., animals seen, heard, or identified by the presence of tracks, scat or other signs). Individuals were noted as being detected a) on the LSA site (includes butterflies in flight), b) outside of the site (seen or heard from within the site), or c) in flight over the site (birds only).

RESULTS

Species tallies are provided for each LSA site. Scientific names are provided in the master species list at the end of this report. Some individuals could not be identified to species.

Source: USGS Topographic Quadrangle, "Laguna Beach, Calif."

11/23/94(CRN401)

Figure 1

N

LSA

Scale in Feet

0 1000 2000

LSA Wildlife Study Site Locations

LSA Site No. 1

Date: June 17, 1994
Time: 0750 - 0810
Conditions: clear, calm, approx. 72°f
Observers: Hamilton, Erickson

Species Detected On Site		*Species Detected Off Site*	
Anise swallowtail	1	Red-tailed hawk	1
Common white	1	Anna's hummingbird	1
Sulphur sp.	1	Scrub jay	1
Painted lady	9	Common raven	1
West coast lady	7	Wrentit	1
Buckeye	1	California thrasher	1
Marina blue	1	Orange-crowned warbler	1
Acmon blue	9	Blue grosbeak	1
Duskywing sp.	1	Lazuli bunting	5
		Rufous-sided towhee	2
Western fence lizard	2	California towhee	2
		Black-chinned sparrow	1
California towhee	2	Lark sparrow	1
		Lawrence's goldfinch	3
Botta pocket gopher	sign		
Pacific kangaroo rat	sign		

Birds Observed Flying Over Site

Anna's hummingbird	1
Common raven	2
House finch	5

LSA Site No. 2

Date: June 29, 1994
Time: 0610 - 0630
Conditions: fog breaking (40% cover), approx. 62°f, calm
Observer: Erickson

Species Detected On Site	
Marina blue	2
Acmon blue	1
Anna's hummingbird	1
Bewick's wren	1
Lazuli bunting	1
House finch	1
Botta pocket gopher	sign
Pacific kangaroo rat	sign

Birds Observed Flying Over Site	
Cliff swallow	10
House finch	4

Species Detected Off Site	
Red-shouldered hawk	1
Mourning dove	1
Costa's hummingbird	1
Ash-throated flycatcher	1
Wrentit	1
Northern mockingbird	1
Blue grosbeak	1
Lazuli bunting	3
Rufous-sided towhee	3
California towhee	2
Rufous-crowned sparrow	2
Black-chinned sparrow	2
Lark sparrow	1
House finch	4

LSA Site No. 3

Date: June 17, 1994
Time: 0705 - 0725
Conditions: clear, calm, approx. 70°f
Observers: Hamilton, Erickson

Species Detected On Site		*Species Detected Off Site*	
West coast lady	2	California quail	1
Lady sp.	1	Mourning dove	2
Marina blue	4	Anna's hummingbird	1
Duskywing sp.	3	Northern mockingbird	2
		Loggerhead shrike	1
Anna's hummingbird	1	Lazuli bunting	1
Ash-throated flycatcher	2	Rufous-sided towhee	1
California towhee	2	Rufous-crowned sparrow	2
		Black-chinned sparrow	2
Botta pocket gopher	sign		

Birds Observed Flying Over Site

House finch	1

LSA Site No. 4

Date: June 17, 1994
Time: 0825 - 0845
Conditions: clear, calm, approx. 70°f
Observers: Hamilton, Erickson

Species Detected On Site

White sp.	1
West coast lady	9
Painted lady	3
Marina blue	3
Acmon blue	1
Duskywing sp.	7
Lazuli bunting	2
House finch	1
Botta pocket gopher	sign
Pacific kangaroo rat	sign
Mule deer	sign

Species Detected Off Site

Mourning dove	3
Ash-throated flycatcher	1
Scrub jay	3
Common raven	2
Wrentit	1
Orange-crowned warbler	1
Blue grosbeak	1
Lazuli bunting	6
Rufous-sided towhee	2
Black-chinned sparrow	2
House finch	5

Birds Observed Flying Over Site

Common raven	7
Lawrence's goldfinch	1

LSA Site No. 5

Date: June 29, 1994
Time: 0645 - 0705
Conditions: 90% overcast (fog breaking), wind 5-10 mph, approx. 62°f
Observer: Erickson

Species Detected On Site		*Species Detected Off Site*	
Marina blue	1	Mourning dove	3
Western checkered skipper	1	Greater roadrunner	1
		Ash-throated flycatcher	2
Bewick's wren	1	Cliff swallow	2
		Bewick's wren	1
Botta pocket gopher	sign	Wrentit	1
Pacific kangaroo rat	sign	Black-headed grosbeak	1
		Blue grosbeak	1
		Lazuli bunting	1
Birds Observed Flying Over Site		Rufous-sided towhee	2
		California towhee	2
American kestrel	1	Rufous-crowned sparrow	1
Anna's hummingbird	1	Grasshopper sparrow	1
Lazuli bunting	1	House finch	4

LSA Site No. 6

Date: June 29, 1994
Time: 0735 - 0755
Conditions: 95% overcast, wind 5-8 mph, approx. 64°f
Observer: Erickson

Species Detected On Site	
Sulphur sp.	2
Marina blue	1
Acmon blue	1
Duskywing sp.	1
Mourning dove	1
Botta pocket gopher	sign

Birds Observed Flying Over Site	
Cliff swallow	4
Hummingbird sp.	1
House finch	2

Species Detected Off Site	
Red-tailed hawk	1
California quail	1
Northern flicker	1
Black phoebe	1
Say's phoebe	1
Ash-throated flycatcher	1
Common raven	2
Northern mockingbird	2
Blue grosbeak	1
Lazuli bunting	3
Rufous-sided towhee	1
California towhee	1

LSA Site No. 7

Date: June 29, 1994
Time: 0840 - 0900
Conditions: 90% overcast clearing to 30%, wind 0-5 mph, approx. 65°f
Observers: Hamilton, Erickson

Species Detected On Site

Common white	4
Cabbage white	2
Sulphur sp.	6
Buckeye	1
Marina blue	8
Acmon blue	18
Duskywing sp.	4

Birds Observed Flying Over Site

White-throated swift	1
Cliff swallow	2
Nuttall's woodpecker	1
Lark sparrow	2
House finch	2

Species Detected Off Site

Canyon wren	1
Wrentit	1
Northern mockingbird	2
Blue grosbeak	1
Lazuli bunting	2
Rufous-sided towhee	1
California towhee	1
Rufous-crowned sparrow	2
House finch	3
Lawrence's goldfinch	1

LSA Site No. 8

Date: June 29, 1994
Time: 0751 - 0811
Conditions: overcast, wind 3-10 mph, approx. 64°f
Observer: Hamilton

Calochortus weedii var. *intermedius* observed on site, near marker "8A LL"

Species Detected On Site		*Species Detected Off Site*	
Sulphur sp.	1	Canyon wren	1
Marina blue	2	Northern mockingbird	1
Acmon blue	3	Blue grosbeak	1
Common hairstreak	1	Rufous-sided towhee	3
		California towhee	2
Blue grosbeak	1		
House finch	2		

Birds Observed Flying Over Site

Mourning dove	1
Common raven	2
California towhee	2
House finch	3
Lesser goldfinch	1

LSA Site No. 9

Date: June 29, 1994
Time: 0725 - 0745
Conditions: overcast, wind 5-10 mph, approx. 63°f
Observer: Hamilton

Site rather barren. A few *Calochortus weedii* var. *intermedius* nearby.

Species Detected On Site		*Species Detected Off Site*	
West coast lady	1	Red-tailed hawk	1
		Scrub jay	1
Mourning dove	1	Canyon wren	2
		Northern mockingbird	1
Mule deer	sign	Rufous-sided towhee	2

Birds Observed Flying Over Site

White-throated swift	1
Cliff swallow	1
Common raven	7

LSA Site No. 10

Date: June 27, 1994
Time: 0810 - 0830
Conditions: clear, wind 2-10 mph, approx. 74°f
Observer: Hamilton

Partially burned and burned cactus scrub. Cactus wren observed here was unbanded.

Species Detected On Site		*Species Detected Off Site*	
Common white	1	Common raven	20
Skipper sp.	2	Cliff swallow	2
		Cactus wren	1
Western fence lizard	1	Northern mockingbird	2
		Lazuli bunting	1
Mourning dove	1	California towhee	2
Anna's hummingbird	2	Grasshopper sparrow	1
Cactus wren	1		
Bewick's wren	1	Audubon cottontail	1
House wren	1		
Northern mockingbird	1		
Rufous-sided towhee	2		
California towhee	4		
Audubon cottontail	sign		
Mule deer	sign		

Birds Observed Flying Over Site

Cliff swallow	8
Common raven	5
Lark sparrow	2

LSA Site No. 11

Date: June 27, 1994
Time: 0845 - 0905
Conditions: clear, wind 2-5 mph, approx. 75°f
Observer: Hamilton

Partially burned and burned cactus scrub. Bewick's wrens observed here included a family group of five.

Species Detected On Site	
Sulphur sp.	1
West coast lady	1
Western fence lizard	2
Mourning dove	1
Anna's hummingbird	1
Costa's hummingbird	1
Cactus wren	1
Bewick's wren	8
Scrub jay	1
Lazuli bunting	1
Rufous-sided towhee	2
California towhee	2
Audubon cottontail	sign
Coyote	sign
Mule deer	sign

Species Detected Off Site	
Common raven	3
Cactus wren	1
Northern mockingbird	1
Blue grosbeak	1
Grasshopper sparrow	1

Birds Observed Flying Over Site

Turkey vulture	2
Cliff swallow	2
Common raven	12
House finch	3
Lawrence's goldfinch	2

LSA Site No. 12

Date: June 27, 1994
Time: 0714 - 0734
Conditions: clear, wind 3-8 mph, approx. 72°f
Observer: Hamilton

Partially burned and burned cactus scrub (TNC sites 12B/C/D). Two unbanded adult cactus wrens observed off-site, at TNC site 12A.

Species Detected On Site		*Species Detected Off Site*	
Cabbage white	1	Mourning dove	2
Sulphur sp.	1	Costa's hummingbird	1
Duskywing sp.	1	Nuttall's woodpecker	1
		Scrub jay	1
Western fence lizard	3	Common raven	1
		Cactus wren	1
Mourning dove	4	Northern mockingbird	2
Anna's hummingbird	3	Lazuli bunting	4
Bewick's wren	1	Rufous-sided towhee	1
Northern mockingbird	1	California towhee	3
Lazuli bunting	1	Grasshopper sparrow	1
Rufous-crowned sparrow	1	Northern oriole	1
California towhee	2	House finch	2
House finch	4		
		Mule deer	1
Botta pocket gopher	sign		
Mule deer	sign		

Birds Observed Flying Over Site

Cliff swallow	1

CONCLUSIONS

The purpose of LSA's surveys was to provide some measure of wildlife habitat use at TNC's vegetation study plots during the first year after the Laguna fire. The conclusions that may be drawn from the 1994 surveys are obviously limited by a number of factors, including 1) the short duration of the surveys, 2) the lack of repeat visits, 3) the fact that surveys were conducted by differing numbers of observers, and 4) the varying weather conditions under which the surveys were conducted. Predictably, surveys conducted in the early morning hours detected relatively few butterflies or reptiles. Nevertheless, LSA's 1994 surveys provide specific information regarding the occurrence of wildlife at the TNC study plots, and these data may be useful for comparison with future surveys. We offer the following general interpretations of data gathered during the surveys.

- Due to the relatively small size of the LSA study sites, far more birds were detected in adjacent areas (most detected by voice). Notably, however, similar numbers of bird species were detected within the cactus scrub sites (Nos. 10, 11, 12) as in adjacent areas; cactus scrub areas also appeared to be used more by western fence lizards, Audubon cottontails, coyote and mule deer. These observations relate to the greater propensity for cactus scrub to withstand fire compared with other scrub habitats, which were typically decimated by the fire (cf. Bontrager et al. in review).

- The greatest number and variety of butterflies were detected at Site Nos. 1, 3, 4 and 7, where fire-following plants such as deer weed (*Lotus scoparius*) and blue dicks (*Dichelostemma capitatum*) were relatively abundant. The cactus scrub sites were among those supporting relatively few butterflies.

- Among the reptiles, only eight western fence lizards were detected, a very low abundance and species diversity.

- The surveys indicated that several local bird populations were reduced below their usual abundance (e.g., California gnatcatcher was not detected), while others obviously thrived in the post-burn landscape (e.g., lazuli bunting was detected at 10 of 12 sites). The study was too limited to support a more detailed analysis of this issue.

- Pacific kangaroo rat sign (holes and/or tracks) was detected at Sites Nos. 1, 2, 4, and 5. The sparsity of shrubs and herbs facilitated detection of this nocturnal heteromyid.

REFERENCES

American Ornithologists' Union. 1983. Check-list of North American Birds, sixth edition. Washington, D.C. (plus supplements).

Bontrager, D.R., R.A. Erickson, and R.A. Hamilton. in review. *Impacts of the October 1993 Laguna Fire on California Gnatcatchers and Cactus Wrens*. in: J.E. Keeley and T.A. Scott (editors). *Brushfires in California Wildlands: Ecology and Resource Management*. Southern California Academy of Sciences.

Hickman, J.C. 1993. *The Jepson Manual: Higher Plants of California*. Univ. of Cal. Press. Berkeley and Los Angeles, Cal.

Ingles, L.G. 1965. *Mammals of the Pacific States*. Stanford University Press, Stanford, CA.

Mattoni, R. 1990. *Butterflies of Greater Los Angeles*. Identification poster published for the Los Angeles Co. Mus. of Nat. Hist. by the Ctr. for the Conservation of Biodiversity/Lepidoptera Rsrch. Fdn., Beverly Hills, CA.

Roberts, F.M. Jr. 1989. *A Checklist of the Vascular Plants of Orange County, California*. Museum of Systematic Biology Special Publication No. 6, Univ. of California, Irvine.

Stebbins, R.C. 1966. *A Field Guide to Western Reptiles and Amphibians*. Houghton Mifflin: Boston.

APPENDIX A
ANIMAL SPECIES OBSERVED

This is a list of the butterflies, reptiles, birds and mammals noted during LSA's surveys. Presence may be noted if a species is seen or heard, or identified by the presence of tracks, scat or other signs.

* Introduced species

LEPIDOPTERA	**BUTTERFLIES**
Papilionidae	**Swallowtails**
Papilio zelicaon zelicaon	Anise swallowtail
Pieridae	**Whites, Orangetips and Sulphurs**
* *Pieris rapae*	Cabbage butterfly
Pieris sisymbrii sisymbrii	Common white
Nymphalidae	**Brush-footed Butterflies**
Vanessa cardui	Painted lady
Vanessa carye anabella	West coast lady
Precis coenia	Buckeye
Lycaenidae	**Metalmarks, Hairstreaks, Coppers and Blues**
Strymon melinus pudica	Common hairstreak
Leptotes marina	Marina blue
Plebejus acmon acmon	Acmon blue
Hesperiidae	**True Skippers**
Pyrgus communis albescens	Western checkered skipper
REPTILIA	**REPTILES**
Iguanidae	**Iguanid Lizards**
Sceloporus occidentalis	Western fence lizard
AVES	**BIRDS**
Cathartidae	**New World Vultures**
Cathartes aura	Turkey vulture
Accipitridae	**Kites, Hawks, Eagles and Ospreys**
Buteo lineatus	Red-shouldered hawk
Buteo jamaicensis	Red-tailed hawk

Falconidae	**Falcons**
Falco sparverius	American kestrel
Phasianidae	**Partridges and Allies**
Callipepla californica	California quail
Columbidae	**Pigeons and Doves**
Zenaida macroura	Mourning dove
Cuculidae	**Cuckoos, Roadrunners**
Geococcyx californianus	Greater roadrunner
Apodidae	**Swifts**
Aeronautes saxatilis	White-throated swift
Trochilidae	**Hummingbirds**
Calypte anna	Anna's hummingbird
Calypte costae	Costa's hummingbird
Picidae	**Woodpeckers**
Picoides nuttallii	Nuttall's woodpecker
Colaptes auratus	Northern flicker
Tyrannidae	**Tyrant Flycatchers**
Sayornis nigricans	Black phoebe
Sayornis saya	Say's phoebe
Myiarchus cinerascens	Ash-throated flycatcher
Hirundinidae	**Swallows**
Hirundo pyrrhonota	Cliff swallow
Corvidae	**Jays, Magpies and Crows**
Aphelocoma coerulescens	Scrub jay
Corvus corax	Common raven
Troglodytidae	**Wrens**
Campylorhynchus brunneicapillus	Cactus wren
Catherpes mexicanus	Canyon wren
Thryomanes bewickii	Bewick's wren
Troglodytes aedon	House wren
Muscicapidae	**Muscicapids**
Chamaea fasciata	Wrentit
Mimidae	**Mimic Thrushes**
Mimus polyglottos	Northern mockingbird
Toxostoma redivivum	California thrasher

Laniidae	**Shrikes**
Lanius ludovicianus	Loggerhead shrike
Emberizidae	**Emberizids**
Vermivora celata	Orange-crowned warbler
Pheucticus melanocephalus	Black-headed grosbeak
Guiraca caerulea	Blue grosbeak
Passerina amoena	Lazuli bunting
Pipilo erythrophthalmus	Rufous-sided towhee
Pipilo crissalis	California towhee
Aimophila ruficeps canescens	Southern California rufous-crowned sparrow
Spizella atrogularis	Black-chinned sparrow
Chondestes grammacus	Lark sparrow
Ammodramus savannarum	Grasshopper sparrow
Icterus galbula	Northern oriole
Fringillidae	**Finches**
Carpodacus mexicanus	House finch
Carduelis psaltria	Lesser goldfinch
Carduelis lawrencei	Lawrence's goldfinch
MAMMALIA	**MAMMALS**
Leporidae	**Rabbits and Hares**
Sylvilagus audubonii	Audubon cottontail
Geomyidae	**Pocket Gophers**
Thomomys botta	Botta pocket gopher
Heteromyidae	**Pocket Mice and Kangaroo Rats**
Dipodomys agilis	Pacific kangaroo rat
Canidae	**Foxes, Wolves and Allies**
Canis latrans	Coyote
Cervidae	**Deer, Elk and Allies**
Odocoileus hemionus	Mule deer

Taxonomy and nomenclature follows Mattoni (1990), Stebbins (1966), American Ornithologists' Union (1983) and supplements, and Ingles (1965).

Study Proposal

Response of California Gnatcatcher (*Polioptila californica californica*) and San Diego Cactus Wren (*Campylorhynchus brunneicapillus sandiegensis*) to the San Joaquin Hills fire

Prepared for:

California Corridor Constructors

Prepared by:

LSA Associates, Inc.
and
Tierra Madre Consultants, Inc.

Introduction

The nominate subspecies of California Gnatcatcher (*Polioptila c. californica*) was recently listed as Threatened by the U. S. Fish and Wildlife Service (Salata 1993). In southern California, this species occurs from Orange County and cismontane Riverside County south to the Mexican border; there is also an isolated population on the Palos Verdes Peninsula in Los Angeles County. The subspecies formerly ranged northward through Ventura and cismontane San Bernardino counties, but it has been extirpated in the former and is near extirpation in the latter. Recent work by Mellink and Rea (1994) described California Gnatcatchers of northwestern Baja California as a distinct subspecies (*P. c. atwoodi*), so the range of nominate *californica* is even smaller than what was thought at the time of its listing.

The California Gnatcatcher is a coastal sage scrub obligate (Atwood 1990) that generally occurs in habitats where California Sagebrush (*Artemisia californica*), California Buckwheat (*Eriogonum fasciculatum*), sage (*Salvia* spp.), and encelia (*Encelia* spp.) are the dominant plant species. The San Diego Cactus Wren (*Campylorhynchus brunneicapillus sandiegensis*) is also a coastal sage scrub species, but occurs only where there is a sufficient amount of prickly pear or cholla (*Opuntia* spp.) present. Based on Rea (1986), the San Joaquin Hills are within the range of San Diego Cactus Wren, but Rea and Weaver (1990) revised its range to include only those populations in cismontane northwestern Baja California, San Diego County, and extreme southern Orange County. Until the taxonomy of this subspecies is more settled, the taxonomic status of Cactus Wrens in the San Joaquin Hills is unclear. Perhaps because of taxonomic uncertainty, the U. S. Fish and Wildlife Service designated the "coastal population" of Cactus Wrens as a Category 2 candidate for federal listing.

California Gnatcatcher and San Diego Cactus Wren have declined dramatically in southern California during this century (Atwood 1990, Rea and Weaver 1990). Management efforts to protect their habitat are currently being implemented (e.g., the Natural Community Conservation Plan), but much of the basic biology of each species remains to be learned. In particular, as fire plays a dominant role in coastal sage scrub habitat (Keeley and Keeley 1984), learning these species' response to fire is critical to their management. Whereas the effects of fires and fire history have been relatively well-studied for coastal sage scrub and its regeneration (e.g., Westman 1978, Malanson and O'Leary 1982, Zedler et al. 1983, Malanson 1984, Westman and O'Leary 1986), little is known of the response of vertebrates, particularly birds, to fire in this habitat. Specifically, whereas there is a thorough study on rodent community response to fire (Price and Waser 1984), similar studies on birds (e.g. Moriarty et al. 1985) have relied on more generalized information not allowing for rigorous statistical comparison.

Furthermore, most studies of vegetation response and vertebrate population response to fire suffer from problems inherent to short-term projects, which can be misleading (Wiens and Rotenberry 1985). In their case, they were unable to predict the change in abundance of the species they studied, and while they noted an immediate change in vegetation, bird numbers were not altered as much as would be expected. Similar results have been noted in the San Joaquin Hills following the large October 1993 fire there (Bontrager et al. in press). Nevertheless, to better quantify the responses of California Gnatcatcher and San Diego Cactus Wren to the San Joaquin Hills fire, an intensive long-term study needs to be conducted. This proposal describes such a study.

Methods

The San Joaquin Hills study site includes approximately 13,000 acres of habitat, approximately half of which was coastal sage scrub prior to the October 1993 fire (LSA Associates 1994). Studies of California Gnatcatcher and San Diego Cactus Wren, including color-banding in recent years, have been conducted within this study site annually beginning in 1988. Therefore, a substantial amount of baseline data is available for comparison of burned habitat. The study described in this proposal will last at least five years.

To study the response of gnatcatchers and Cactus Wrens to the fire, we propose to conduct presence/absence point counts throughout the San Joaquin Hills study area. These counts will be conducted for 15-minute intervals and will record all species noted within a 200 meter radius (roughly 31 acres). One point count will be designated per 100 acres of the site, for a total of 130 points. These points will be distributed evenly throughout the site in a grid and will be established regardless of access to the maximum extent feasible. With this procedure, a variety of topography should be sampled; thus, points will not be specifically chosen to sample differing topography. Five visits will be made to each point before a determination of absence is reached. Point counts will be conducted in both the spring and the fall/early winter (a maximum of five each season). A point will not be surveyed five times if presence of both species is established beforehand.

To avoid and/or reduce errors common to transect surveys (see Bibby et al. 1992), the same points will be used each year, the same observers will be used to the maximum extent possible, and counts will be conducted under similar conditions (e.g., similar weather conditions). Time-of-day can greatly affect bird detectibility. To minimize the effects of this variable, each point will be surveyed in a "round-robin" fashion. That is, a point surveyed first one visit will be surveyed last the next visit, with the one surveyed second one visit surveyed first the next visit, and so on. Surveying the site in this manner will allow monitoring of fluctations in the overall population size and a clear picture of the recolonization pattern used by each species on a yearly basis.

Focused nest searches will be conducted throughout the site and adjacent areas in burned, lightly burned, and unburned areas until thirty nests of both California Gnatcatcher and San Diego Cactus Wren are located throughout the breeding season of each species. These nests should be distributed equally among each of the "burn types" listed above. Each nest will be monitored long enough to determine its success (i.e., whether or not young successfully fledged) and number of young. Nesting success between burned, lightly burned, and unburned areas will be compared using one-way ANOVAs or similar methods. Each nest will count as a statisitically separate event, regardless if the same pair is involved.

All predation, Brown-headed Cowbird (*Molothrus ater*) parasitism events, or other reasons for nest failure will be recorded. Annual variations in weather can have a significant effect on bird density in an area, whether through increased predation pressure or other factors (Lima 1987, Rotenberry and Wiens 1989). Predation has a significant negative effect on California Gnatcatcher nesting success (G. Braden pers. comm., P. J. Mock pers. comm.). Predation rates will be compared (using a two-tailed Fisher exact test, or similar method) between burned, lightly burned, and unburned areas using nesting information gathered during this study. Demographic stochasticity, which can seriously threaten small populations (Pimm

et al. 1988), will be monitored using nesting information such that local extinctions (a disappearance of birds in a 1000-acre or less area) within the recovering burned area can be compared to overall population fluctuations in the San Joaquin Hills.

With continuing banding efforts, survivorship, carrying capacity, dispersal capabilities, and other factors that significantly effect population viability (see Stacey and Taper 1992) will be monitored by conducting transect surveys through the study site and recording locations and habitat (using the ocular-estimate plots described below) of banded individuals. Also, patterns of biogeography will be examined. For example, it can be determined whether colonizing birds are coming from unburned "islands" within the fire area or from unburned "mainland" areas east of Laguna Canyon Road. Further, whether birds colonize randomly, from the edge inward, or with some other pattern will be examined and analyzed using logistic regression.

Vegetation structure and composition around each point count site will be quantified using a simple ocular-estimate survey (see Attachment). Habitat within the overall study area also will be measured using the transect technique described by Wiens and Rotenberry (1981), or a similar method that allows for comparison of bird occurrence and density with habitat structure. Much of this data will be gathered by Jon Keeley et al. independent of this study and presumably will be available for use. Vegetation information will be important in monitoring avian usage of the burned area as coastal sage scrub reestablishes itself. Habitat correlates with gnatcatcher and Cactus Wren occurrence will be examined using logistic regression. Distance to habitat edge, continuity, and other landscape features will be retrieved from the Orange County Geographic Information System (GIS) for use in comparative aspects of this project.

The primary benefit arising from this study will be formulation of a predicitive model for California Gnatcatcher and San Diego Cactus Wren recolonization of a disturbed site. Whether using as a base a "standard" density-dependent model, a metapopulation model, or a theory similar to MacArthur's (1970) for predicting community structure, this study will provide insight into the recolonization of recovering habitats by rare or endangered species following a major disturbance.

Literature Cited

Atwood, J. L. 1990. Status review of the California Gnatcatcher (*Polioptila californica*). Unpubl. tech. rep., Manomet Bird Observatory, Manomet, Mass.

Bibby, C. J., N. D. Burgess, and D. A. Hill. 1992. Bird Census Techniques. Academic Press, San Diego.

Bontrager, D. R., R. A. Erickson, and R. A. Hamilton. In press. Impacts of the October 1993 Laguna fire on California Gnatcatchers and Cactus Wrens, *in* Brushfires in California Wildlands: Ecology and Resource Management (J. E. Keeley and T. A. Scott, eds.). So. Calif. Acad. Sci., Los Angeles.

Keeley, J. E. and S. C. Keeley. 1984. Postfire recovery of California coastal sage scrub. Am. Midl. Nat. 111:105-117.

Lima, S. L. 1987. Clutch size in birds: A predation perspective. Ecol. 68:1062-1070.

LSA Associates. 1994. 1993 California Gnatcatcher and Cactus Wren studies in the San Joaquin Hills. Unpubl. report prepared for Calif. Corridor Constructors, Irvine, Calif.

Malanson, G. P. 1984. Fire history and patterns of Venturan subassociation of Californian coastal sage scrub. Vegetatio 57:121-128.

Malanson, G. P. and J. F. O'Leary. 1982. Post-fire regeneration strategies of Californian coastal sage scrubs. Oecologia 53:355-358.

Malanson, G. P. and W. E. Westman. 1985. Postfire sucession in Californian coastal sage scrub: The role of continual basal sprouting. Am. Midl. Nat. 113:309-318.

MacArthur, R. H. 1970. Species packing and competitive equilibrium for many species. Theoretical Pop. Biol. 1:1-11.

Mellink, E. and A. M. Rea. 1994. Taxonomic status of the California Gnatcatchers of northwestern Baja California, Mexico. W. Birds 25:50-62.

Moriarty, D. J., R. E. Farris, D. K. Noda, and P. A. Stanton. 1985. Effects of fire on a coastal sage scrub bird community. Southwest. Nat. 30:152-153.

Pimm, S. L., H. L Jones, and J. Diamond. 1988. On the risk of extinction. Am. Nat. 132:757-785.

Price, M. V. and N. M. Waser. 1984. On the relative abundance of species: Postfire changes in a coastal sage scrub rodent community. Ecol. 65:1161-1169.

Rea, A. M. 1986. Geographic variation [of *Campylorhynchus brunneicapillum*]: (1) NW, peninsular, and insular races, *in* The Known Birds of North and Middle America, Part I (A. R. Phillips, ed.), pp. 118-119. Allan R. Phillips, Denver.

Rea, A. M., and K. L. Weaver. 1990. The taxonomy, distribution, and status of coastal California Cactus Wrens. W. Birds 21:81-126.

Rotenberry, J. T. and J. A. Wiens. 1989. Reproductive biology of shrubsteppe passerine birds: Geographical and temporal variation in clutch size, brood size, and fledgling success. Condor 91:1-14.

Salata, L. 1993. Endangered and Threatened wildlife and plants; determination of Threatened status of the Coastal California Gnatcatcher. Fed. Register 58:16742-16757.

Stacey, P. B. and M. Taper. 1992. Environmental variation and the persistence of small populations. Ecol. Appl. 2:18-29.

Westman, W. E. 1978. A potential role of coastal sage scrub understories in the recovery of

chaparral after fire. Madroño 26:64-68.
Westman, W. E. and J. F. O'Leary. 1986. Measures of resilience: The response of coastal sage scrub to fire. Vegetatio 65:179-189.
Wiens, J. A. and J. T. Rotenberry. 1981. Habitat associations and community structure of birds in shrubsteppe environments. Ecol. Monogr. 51:21-41.
Wiens, J. A. and J. T. Rotenberry. 1985. Response of breeding passerine birds to rangeland alteration in a North American shrubsteppe locality. J. Applied Ecol. 22:655-668.
Zedler, P. H., C. R. Gautier, and G. S. McMaster. 1983. Vegetation change in response to extreme events: The effect of a short interval between fires in California chaparral and coastal scrub. Ecol. 64: 809-818.

APPENDIX E

Study Proposal: Response of California Gnatcatcher (*Polioptila californica californica*) and San Diego Cactus Wren (*Campylorhynchus brunneicapillus sandiegensis*) to the San Joaquin Hills Fire. by LSA Associates, Inc. and Tierra Madre Consultants, Inc.