

## Impacts of the October 1993 Laguna Canyon Fire on California Gnatcatchers and Cactus Wrens

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**Abstract.** The Laguna Canyon Fire burned approximately 5,260 ha 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 California gnatcatchers in these hills were impacted by the fire, along with localities for approximately 75% (over 500 individuals) of the cactus 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 increases 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.

**Keywords:** Cactus wrens; California gnatcatchers; recolonization; wildfires.

### Introduction

The biota of the San Joaquin Hills, Orange County, California was dramatically impacted by the Laguna Canyon 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 5,260 ha 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

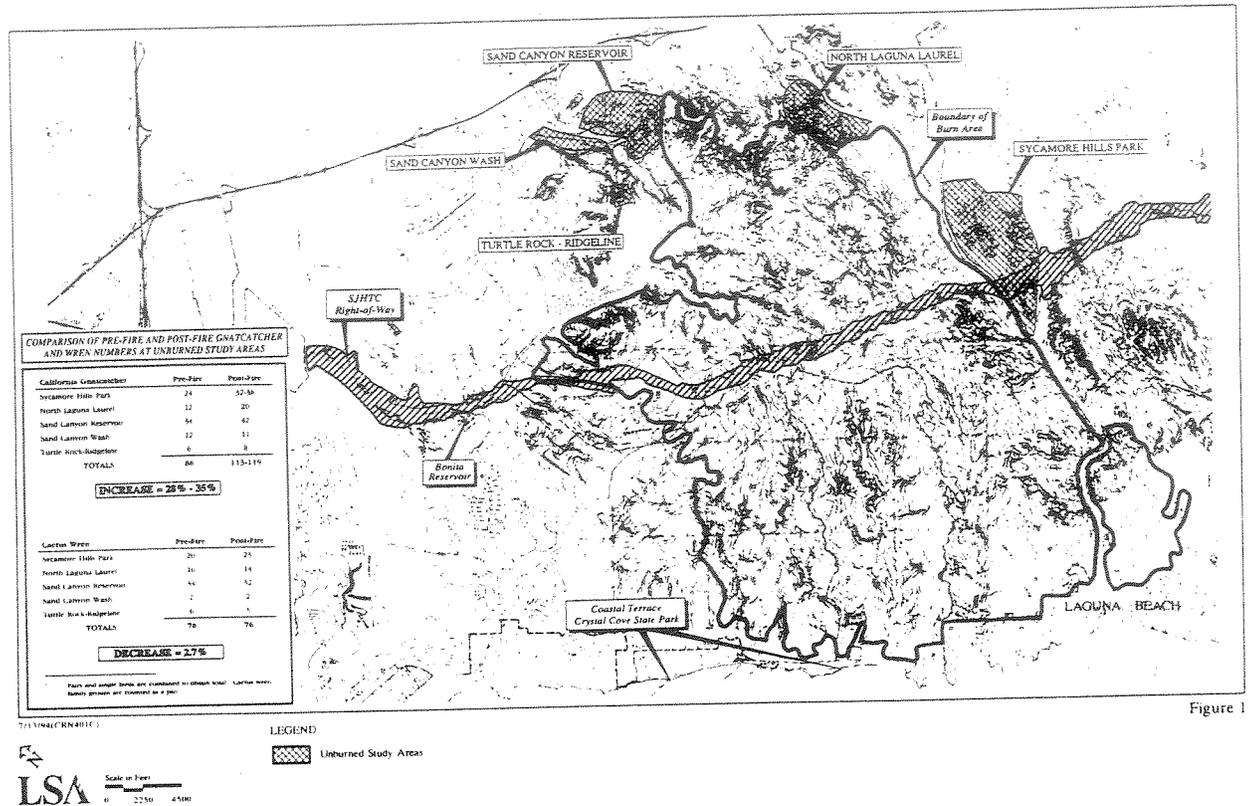


Figure 1

Figure 1. Laguna study area and vicinity for Bontrager (1994 a,b).

(Bontrager 1994 a,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 play back 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 produce 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. However, 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.

Results of LSA's surveys of unburned areas north and east of the fire are considered superseded by Bontrager's (1994 a,b) more thorough surveys of the same areas (Fig. 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 (1994 a,b) post-fire surveys and color-banding revealed an increase in the number of gnatcatchers since the previous breeding season (Fig. 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 (Fig. 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 personal observation; 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 0.7 ha following a Malibu, California chaparral fire and suggested that the fire's toll on wildlife was

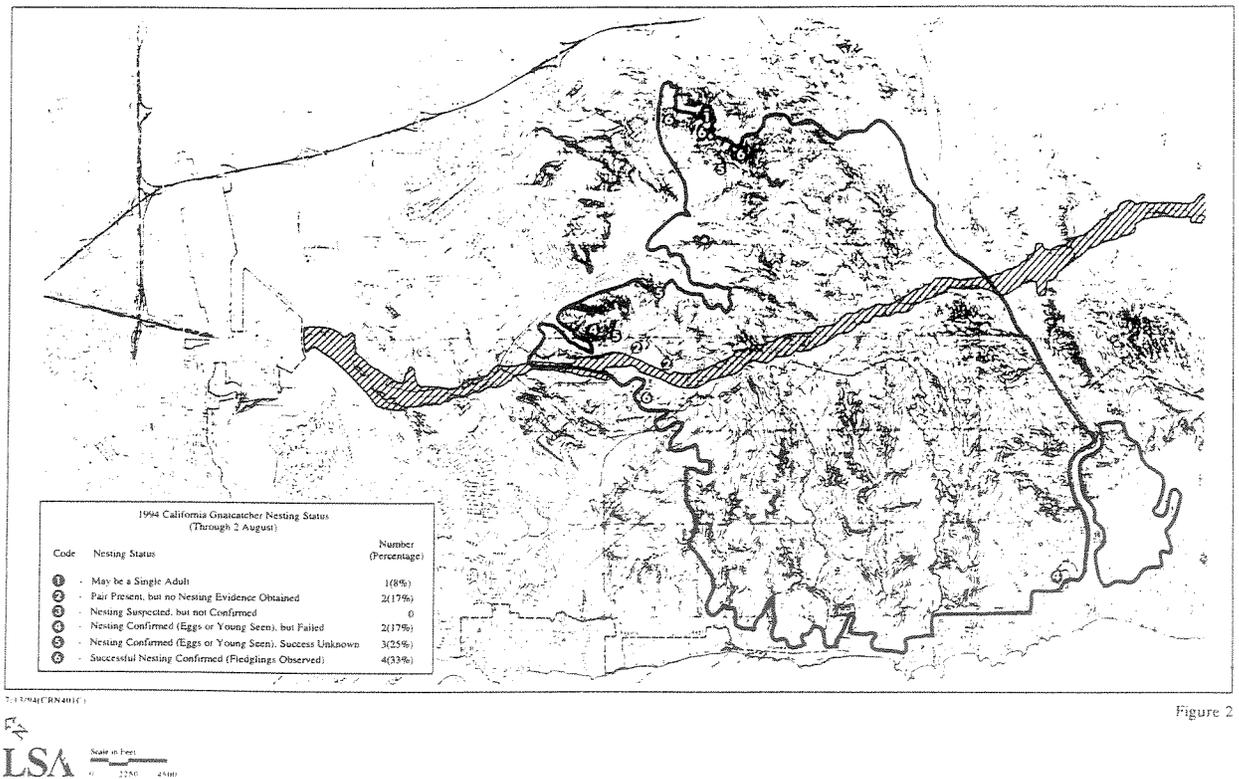


Figure 2

Figure 2. 1994 California gnatcatcher locations and nesting status within the Laguna study area.

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 (Fig. 1), 45 pairs of gnatcatchers represented a 125% increase over the 20 pairs in 1993 (K.L. Pluff personal communication). 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 Orange 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 Canyon Fire. In the same area, locations for roughly 700 cactus wrens have been entered; the mapped localities for approximately 75% 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

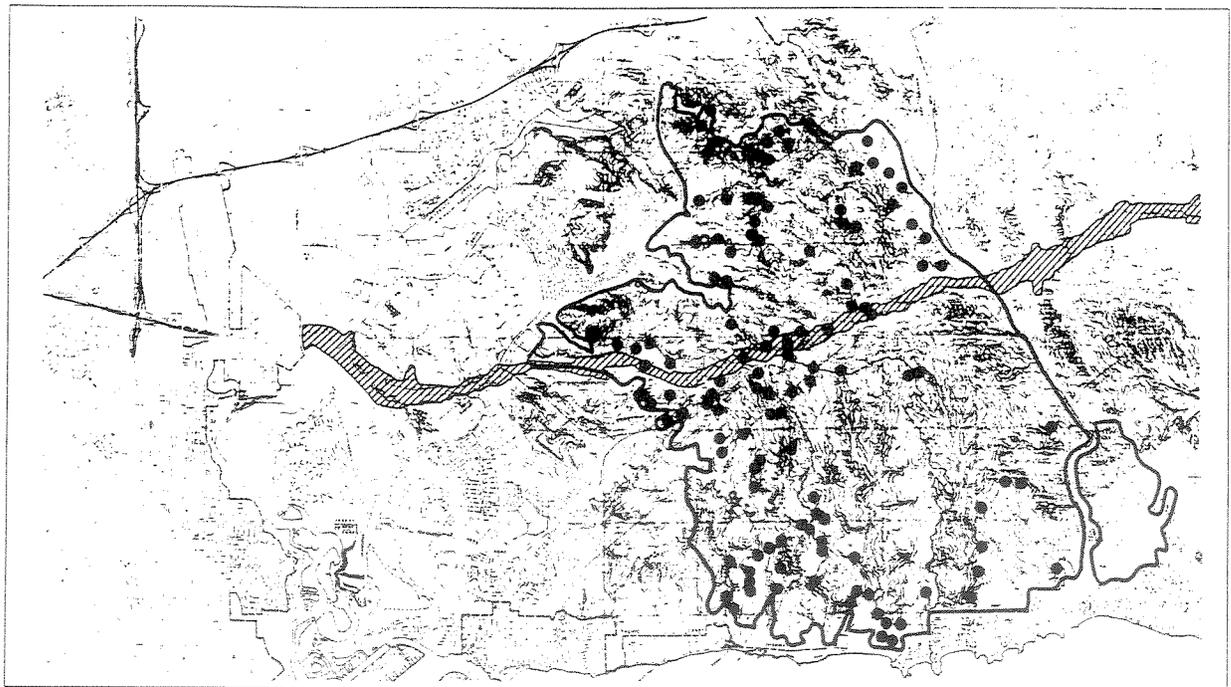


Figure 3

Figure 3. 1992 California gnatcatcher locations within the Laguna study area.

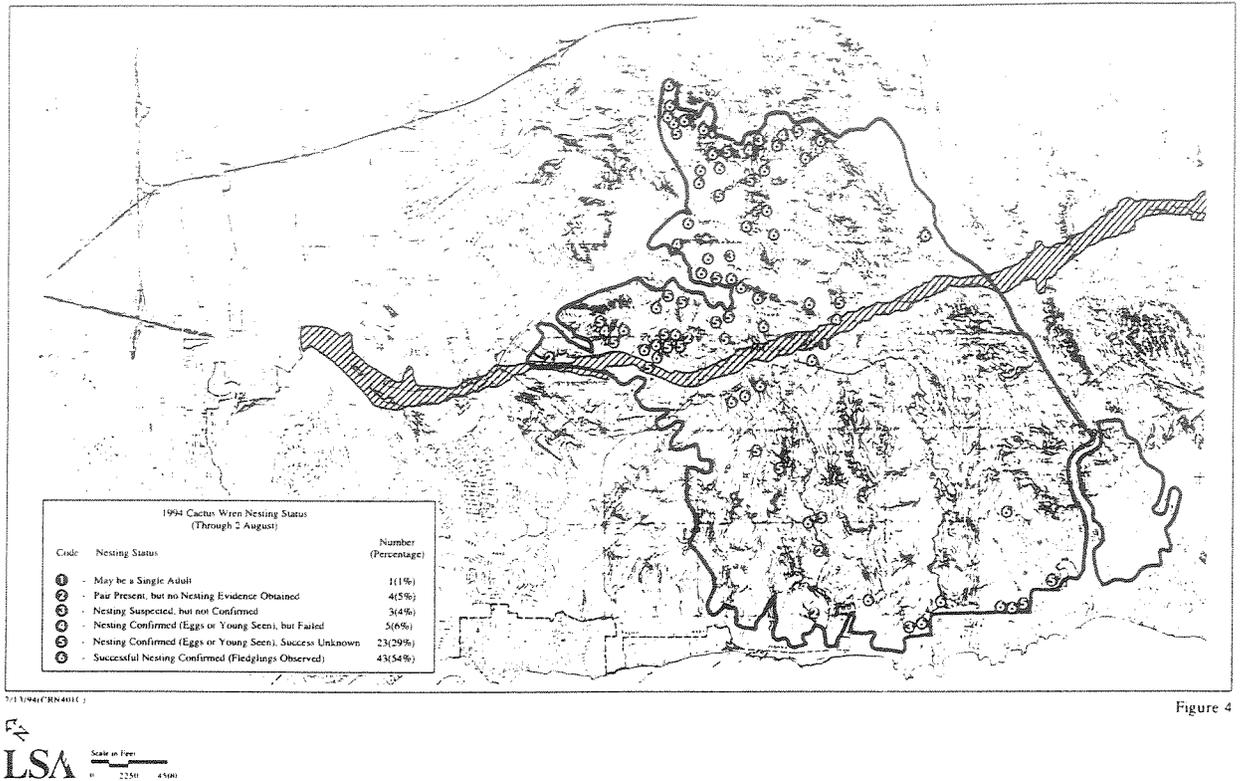


Figure 4

Figure 4. 1994 Cactus wren locations and nesting status within the Laguna study area.

gnatcatcher pairs (Fig. 3) and 282 cactus wren pairs (Fig. 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 relic 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., wrenit). 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 personal communication).

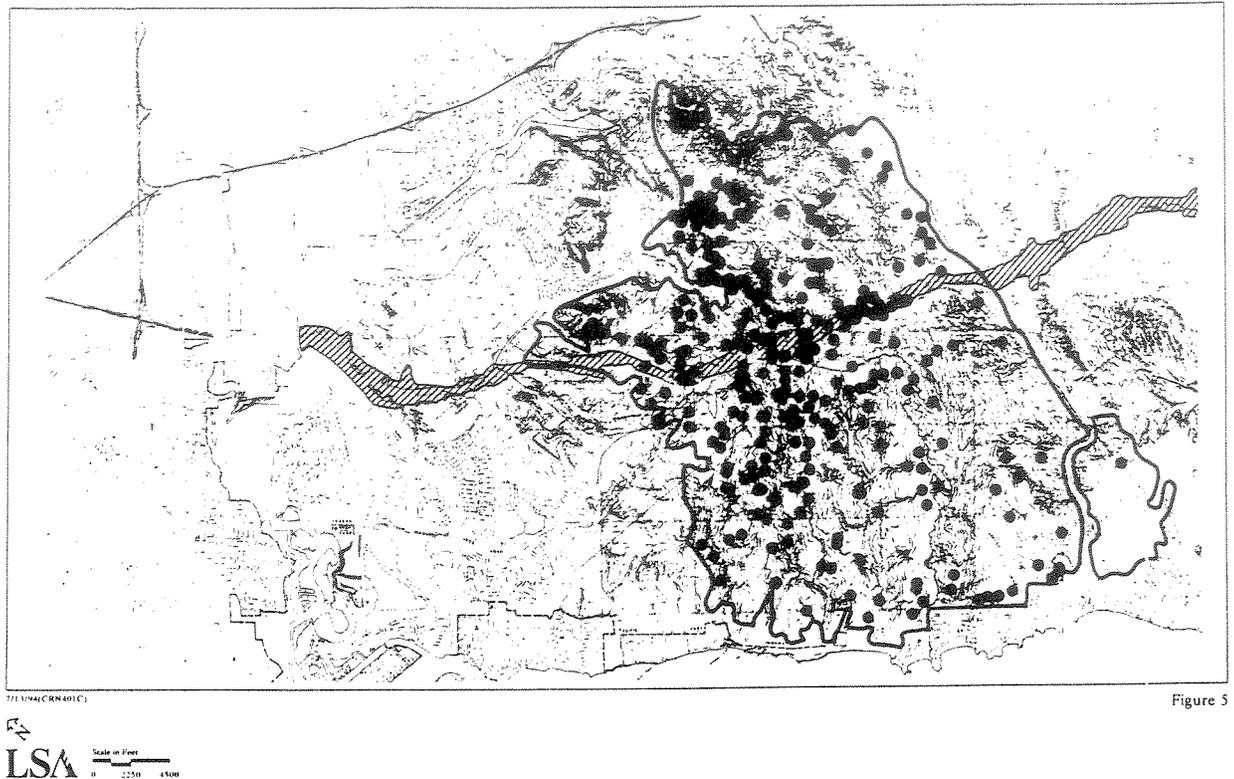


Figure 5

Figure 5. 1992 Cactus wren locations.

### *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. However, shortened fire cycles are known to turn some areas to grassland (Zedler et al. 1983, Westman and O'Leary 1986). 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.

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#### 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. U.S. Fish & Wildlife Service, Office of Management authority, Unpublished report.
- 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. Ed Almanza & Associates, Laguna Beach, California, Unpublished report.
- Catling, P.C., A.E. Newsome, and G. Dudzinski. 1982. Small mammals, habitat components, and fire in southeastern Australia, pp. 199-206. In C.E. Conrad and W.C. Oechel (eds), Proceedings of the symposium on dynamics and management of Mediterranean-type ecosystems. USDA Forest Service, Pacific Southwest Forest and Range Experiment Station, General Technical Report PSW-58.
- 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. County of Orange, Environmental Management Agency, Santa Ana, California Unpublished report.
- 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. California Corridor Constructors, Irvine, California, Unpublished report.
- Pyne, S.J. 1984. Introduction to wildland fire. John Wiley & 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). U.S. Marine Corps Environmental and Natural Resources Management Office, Camp Pendleton, California, Unpublished report.
- 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.