

**Western Riverside County  
Multiple Species Habitat Conservation Plan (MSHCP)  
Biological Monitoring Program**

**Burrowing Owl and Grassland Bird Survey Report 2007**



**19 MARCH 2008**

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NOTE TO READER:

This report is an account of survey activities undertaken by the Biological Monitoring Program for the Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP). The MSHCP was permitted in June 2004. The Biological Monitoring Program monitors the distribution and status of the 146 Covered Species within the Conservation Area to provide information to Permittees, land managers, the public, and the Wildlife Agencies (i.e., the California Department of Fish and Game and the U.S. Fish and Wildlife Service). Monitoring Program activities are guided by the MSHCP species objectives for each Covered Species, the information needs identified in MSHCP Section 5.3 or elsewhere in the document, and the information needs of the Permittees.

While we have made every effort to accurately represent our data and results, it should be recognized that our database is still under development. Any reader wishing to make further use of the information or data provided in this report should contact the Monitoring Program to ensure that they have access to the best available or most current data.

The primary preparer of this report was the 2007 Avian Program Lead, Matt Talluto. If there are any questions about the information provided in this report, please contact the Monitoring Program Administrator. If you have questions about the MSHCP, please contact the Executive Director of the Western Riverside County Regional Conservation Authority (RCA). For further information on the MSHCP and the RCA, go to [www.wrc-rca.org](http://www.wrc-rca.org).

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## INTRODUCTION

The burrowing owl (*Athene cunicularia*; “BUOW”) is a California species of special concern with specific habitat requirements and a relatively large home range. Although suitable habitat occurs throughout much of the Plan Area, burrowing owls are restricted to relatively few locations and are known from even fewer locations within the Conservation Area. The MSHCP identifies the following 5 areas as Core Areas for BUOW: 1) Lake Skinner/Diamond Valley Lake; 2) Playa west of Hemet; 3) San Jacinto Wildlife Area, Mystic Lake, and Lake Perris; 4) Lake Matthews, and 5) The Santa Ana River. The MSHCP species objectives for BUOW specify that 5 Core Areas should support a combined total of 120 breeding owls with no fewer than 5 pairs in any 1 Core Area (Dudek & Associates 2003).

In 2007, the Monitoring Program continued a study begun in 2006 to assess the distribution and abundance of breeding BUOW in the Conservation Area. Three new aims of the 2007 survey season were to increase BUOW survey effort relative to the 2006 survey, use a vegetation assessment to improve the random selection of survey points, and incorporate concomitant surveys of other Covered bird species that occupy habitat similar to BUOW, including grasshopper sparrow (*Ammodrammus savannarum*; “GRSP”), horned lark (*Eremophila alpestris*; “HOLA”), loggerhead shrike (*Lanius ludovicianus*; “LOSH”), and northern harrier (*Circus cyaneus*; “NOHA”).

Several conservation goals must be met in order for grasshopper sparrows to become a Covered Species Adequately Conserved (see Dudek & Associates 2003, volume 1, part 1 for definition). These goals include occupancy, density, and reproductive objectives. The occupancy requirement is 100% of 3 large (greater than 2000 acres suitable habitat) and 75% of 4 small (at least 500 acres suitable habitat) Core Areas. For density, 5 Core Areas must support at least 20 breeding pairs. For reproduction, 5 Core Areas must support at least 1 successful nest. All of these objectives must be demonstrated within a single year during the first five years of permit issuance.

The MSHCP identifies Core Areas for horned larks, but specifies no quantitative species objectives. When no specific objectives are given, section 5.0 of the MSHCP defines a default objective of 75% occupancy of Core Areas demonstrated at least every 8 years. The species objectives for northern harrier and loggerhead shrike require demonstration of both use and successful reproduction in 75% of Core Areas every 5 (NOHA) or 8 (LOSH) years.

Therefore, the following were the overall survey goals in 2007:

### Survey Goals:

- A) Determine the distribution, density, and occupancy rate of BUOW within the Conservation Area.
- B) Determine density, distribution, and occupancy for Covered Species co-occurring with BUOW, including GRSP, HOLA, LOSH, and NOHA.
- C) Provide more complete coverage of the Conservation Area by including as many conserved lands as possible within the study design, and select points in a manner that permits inference to the largest possible area.
- D) Assess progress towards achieving the conservation goals in the species objectives for all 5 target species. Specifically, evaluate occupancy, density, and reproductive

objectives for BUOW, and occupancy objectives for GRSP, HOLA, LOSH, and NOHA.

## **METHODS**

### **Protocol Development**

We conducted multiple visits to point-transect stations using methods outlined in Conway and Simon (2003) and Pagel (2005). We chose a study design that was sufficiently flexible to allow us to compute densities of target species using distance sampling (Buckland et al. 2001) as well as calculate occupancy as described in Mackenzie et al. (2006). To provide a more representative sample of the grassland habitats within the Conservation Area, we designed a vegetation sampling scheme to be completed prior to the survey. We then used the data collected during this survey to stratify our selection of point-transect locations.

### **Personnel and Training**

All field personnel were trained in identification of all 5 target species and other regionally common grassland bird species, and demonstrated proficiency at both visual and aural identification of target species. Supplemental training was provided by Ms. Ginny Short, a graduate student at the University of California at Riverside working on BUOW dispersal. All personnel demonstrated competence with survey techniques before field surveys commenced. Personnel conducting BUOW surveys in 2007 included:

- Matt Talluto, Avian Program Lead (Regional Conservation Authority)
- Dan Williams, BUOW Project Lead (Regional Conservation Authority)
- Andrew Boyce (Regional Conservation Authority)
- Amanda Breon (Regional Conservation Authority)
- Angela Coates (Regional Conservation Authority)
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- Leslie Hanson (Regional Conservation Authority)
- Angela Hyder (Regional Conservation Authority)
- Bill Kronland (Regional Conservation Authority)
- Ariana Malone (Regional Conservation Authority)
- Robert Packard (Regional Conservation Authority)
- Lee Ripma (Regional Conservation Authority)
- Kim Skahan (Regional Conservation Authority)
- Carol Thompson (Regional Conservation Authority)
- Joe Veverka (Regional Conservation Authority)
- Laura Weisel (Regional Conservation Authority)
- Nick Peterson (California Department of Fish and Game)
- Paige Portillo (California Department of Fish and Game)

### **Study Site Selection**

Potential transect locations were placed on a grid with points spaced 400 m apart within potential suitable habitat in the Conservation Area. Suitable habitat was defined as grassland and agriculture mapping units identified in the most current GIS-based vegetation map available

(CDFG et al. 2005). The grid area included a total of 1170 points covering approximately 16,500 ha of potential habitat. Of the 1170 initial points, 427 were later excluded from sampling because we did not have permission to access the land (e.g., Prado Basin, North Hills area of Diamond Valley Lake) or because GIS errors located them outside of the Conservation Area.

We sampled within 4 BUOW Core Areas in 2007 (Santa Ana River, San Jacinto Wildlife Area, Lake Mathews, and Lake Skinner/Diamond Valley Lake), as well as other areas with suitable BUOW habitat not identified as Core Areas (Figure 1). The portion of the Lake Skinner/Diamond Valley Lake Core Area on the north shore of Diamond Valley Lake was not surveyed by the Biological Monitoring Program in 2007 because we could not obtain permission to access the area. Surveys were not conducted in burrowing owl habitat in the Playa West of Hemet Core Area because land has not yet been conserved there.

An initial vegetation and habitat survey was conducted within a 250-m-radius circle surrounding all 743 remaining points. During these surveys, observers recorded the presence or absence of factors thought to be important BUOW indicators, including burrows > 5-cm diameter, perches and rock piles, and banks. Observers also recorded the percent cover of shrubs, tall (> 50 cm) and short (< 50 cm) grass, and bare ground. We used these data to define three strata (primary, secondary, and tertiary BUOW habitat) for our survey. We considered any habitat with burrows, at least 1 other habitat indicator (perches, banks, etc.), and > 50% combined cover of short grass and bare ground to be primary habitat. Secondary habitat was defined as having no habitat indicators but at least 50% cover of short grass and bare ground, or 25-50% cover of short grass and bare ground combined with burrows and 1 other habitat indicator. All other points were considered tertiary habitat. We selected a total of 510 survey points, consisting of all points in primary habitat (n = 344), a random selection of 50% of points in secondary habitat (n = 121), and a random 25% of points in tertiary habitat (n = 45).

## **Survey Methods**

Survey methods used in 2007 are detailed in the *Western Riverside County MSHCP Surveying Protocol for the Burrowing Owl (*Athene cunicularia*) in Western Riverside County, California* (Appendix A).

Surveys were divided into 2 phases. The first phase (distribution and occupancy) allowed us to quickly cover suitable habitat within the Conservation Area and identify locations where BUOW and other target species occurred. It consisted of 3 replicate point-transect surveys. During the second phase (breeding pair counts), we attempted to count all BUOW present at locations where they had already been observed during the first phase. These breeding pair counts occurred immediately after BUOW detections on point transects. Additionally, any BUOW observed in the Conservation Area while traveling between survey points were recorded with a GPS location. These incidental locations were also visited during the second phase of the survey.

Both point-transect surveys and breeding pair counts were conducted 3 times during the breeding season and were timed to correspond with the incubation, nestling growth, and fledging phases of the BUOW nesting cycle. The 2007 survey periods were from 9 April to 11 May, 15 May to 22 June, and 25 June to 27 July. Surveys were conducted from 0.5 h before dawn through 4 h after dawn. Surveys were terminated when the temperature rose above 32 C, when wind speeds rose above 20 km/h, or if it began to rain.

Point-transect surveys lasted for 8 min. During the first 4 min, observers silently scanned the surrounding area for target species. To attempt to improve BUOW detectability, a recorded BUOW call was then played for 30 s, followed by silent observation for 30 s. The 1-min playback and observation period was repeated once in each cardinal direction. Azimuth and distance from the point count location were recorded for all BUOW observed during the 8-min survey. When discernable, age class (adult or juvenile) and sex of observed individuals were also recorded.

When BUOW were detected during point transects or between points, observers returned to the site of the detection and conducted a breeding pair count. These counts occurred the day following the original BUOW detection whenever possible, and no later than 3 days following the initial observation. Three observers approached known BUOW locations while minimizing noise and visibility to prevent flushing BUOW from the site before the inventory was complete. The observers were situated surrounding the site at a minimum of 50 m away from the original detection location. Once in place, all 3 observers waited silently for 20 min to allow BUOW to settle after the disturbance of the approach. All observers began the count at the same time and recorded and mapped all BUOW detected during a 30-min period. The observers also kept notes about BUOW age, sex, and movements during the survey period. Immediately after the count, observers compared notes to determine the total number of unique BUOW detected at the site as well as which observers detected each individual bird.

### **Data Analysis**

Density and estimated population sizes were analyzed using program DISTANCE (Thomas et al. 2006). This method estimates detection probability based on distance sampling data and uses this information to provide a corrected density estimate. We estimated density of Covered Species stratified by Core Area. Because distance sampling requires relatively high sample sizes (40-60 detections per stratum for a simple model with no covariates), we could not calculate separate detection probabilities for individual Core Areas. Species with too few detections to fit a reliable global detection function were not analyzed using this method.

We evaluated multiple detection functions for each species analyzed using both half-normal and hazard-rate key functions with either cosine or polynomial adjustment terms. The model that minimized the Akaike Information Criterion (AIC) was selected and used for all further analysis. When model fit was poor (determined visually and using  $\chi^2$  goodness of fit tests), models were truncated and pooled by hand.

We used program PRESENCE (Hines 2006) to calculate the proportion of area occupied (PAO) for both fall and spring surveys. This analysis determines detection probabilities based on multiple visits to the same locations and then estimates the proportion of the survey area occupied by the target species during the initial visit. This method cannot determine population size nor can it detect trends in population size, but it can provide information about whether the overall range of a species is expanding or contracting when observations from multiple years are compared. An advantage of PAO analysis is that it is more robust than distance sampling at lower sample sizes (Mackenzie et al. 2006).

To improve occupancy estimates for BUOW, we included covariates from the vegetation assessment in occupancy models. These covariates included each site's identity as primary, secondary, or tertiary habitat, the percent cover of short grasses (less than 0.5 m), and the

presence of burrows at the site. All models were compared to models containing no stratification or covariates. The best fitting model was chosen using AIC, and we have reported the results of these models here.

## RESULTS

### General Distribution of Target Species

We surveyed all 4 conserved BUOW Core Areas in 2007 and observed BUOW in 2 Cores: Lake Skinner/Diamond Valley Lake and Lake Perris/San Jacinto Wildlife Area (Figure 2). Both of these areas supported colonies of nesting BUOW. We also observed BUOW as single individuals in each of the following areas: Sycamore Canyon, Quail Valley, Railroad Canyon, and the Santa Rosa Plateau. Including incidental observations, we observed BUOW in 40% of the Core Areas in 2007 (Table 1). One Core Area, the Playa West of Hemet, had no habitat in conservation at the time surveys were initiated.

**Table 1.** Number of observations of target species within Core Areas during 2007 surveys. Core Areas for particular species are represented by shaded cells. A value of P indicates that the species was observed incidentally in 2007 but not during surveys.

Core Areas Surveyed	BUOW	GRSP*	HOLA	LOSH	NOHA
Badlands and Potrero	0	2	44	8	P
Box Springs Mountain	0	0	0	0	P
Garner Valley	0	0	4	0	0
Kabian Park/Quail Valley	1	0	P	0	P
Lake Mathews/Estelle Mountain	0	12	27	7	4
Lake Skinner/Diamond Valley Lake	7	25	51	4	6
Murrieta Hot Springs	0	P	2	0	2
San Jacinto Wildlife Area	14	1	84	23	9
Santa Ana River (Including Prado Basin)	0	0	1	0	1
Santa Rosa Plateau	1	92	35	0	1
Steele Peak	0	P	0	1	0
Sycamore Canyon	1	0	3	0	0
Vail Lake/Wilson Valley	0	2	1	4	P
Wasson Canyon and Railroad Canyon	1	0	3	0	P
<b>Core Areas Not Surveyed</b>					
Temecula Creek			P		
Lake Elsinore/Collier Marsh					
Playa West of Hemet					
Chino Hills					

\*Note that Core Areas for GRSP have not been finalized as of the writing of this report.

We surveyed all of the 11 potential GRSP Core Areas described in the MSHCP. GRSP were observed in 5 of these Cores and in 1 additional area. We also observed GRSP incidentally in 1 potential Core and 1 additional area (Table 1). Although 11 potential Cores are described in the MSHCP, the Plan calls for the eventual establishment of 7 Cores, including 3 large (greater

than 2000 acres suitable habitat) and 4 small (at least 500 acres suitable habitat) Cores. Based on these guidelines, we observed GRSP in 6 of 7 Core Areas (100% of large and 75% of small) in 2007, with the large Cores represented by Lake Mathews/Estelle Mountain, Lake Skinner/Diamond Valley Lake (including Johnson Ranch), and the Santa Rosa Plateau, and the small Cores represented by the Badlands and Potrero, San Jacinto Wildlife Area, Steele Peak, and 1 additional, currently unidentified Core.

We observed HOLA in 4 of 4 Core Areas (100%) and 7 additional areas. HOLA were observed incidentally in 2 additional areas (Table 1).

We performed surveys in 6 of 7 LOSH Core Areas in 2007, and we observed them in 3 of these Cores (43%). LOSH were also observed in 3 non-core areas during surveys (Table 1). The 7<sup>th</sup> Core Area, Temecula Creek, was not surveyed due to a lack of grassland habitat.

We surveyed 5 of 7 NOHA Core Areas in 2007. The 2 areas not surveyed, Chino Hills and the Playa West of Hemet, were not surveyed due to a lack of grassland habitat within conserved lands in the Plan Area. We observed NOHA in 3 of the 5 Cores surveyed, as well as in 3 additional areas. NOHA were also observed incidentally in 1 Core and 4 additional areas. Combining survey and incidental results, NOHA were observed in 4 of 7 (57%) Core Areas in 2007 (Table 1).

### **Density Estimates**

We calculated a total density of GRSP for the entire Conservation Area of 0.0136 individuals/ha (95% confidence interval: 0.00700 - 0.259 individuals/ha) for a total population size of 228 GRSP (95% CI: 117 - 434 individuals). These low densities reflect the large areas of unoccupied territory that were surveyed. The highest density observed, 0.0807 individuals/ha at the Santa Rosa Plateau, may more closely reflect the density of this species in more optimal habitat. Density estimates were based on a total of 93 observations and a calculated detection probability of 0.11 (95% CI: 0.065 - 0.18). Within individual Core Areas, density estimates ranged from 0.00167 - 0.0807 individuals/ha with population size estimates ranging from 3 to 97 (Figure 3).

HOLA density for the entire study area was 0.00961 individuals/ha (95% CI: 0.00558 to 0.0150 individuals/ha) for an estimated population size of 161 individuals (95% CI: 94 - 251). Both HOLA density and population size were greatest at the San Jacinto Wildlife Area, and varied by an order of magnitude between Core Areas. Density estimates were based on a total of 135 observations and a calculated detection probability of 0.046 (95% CI: 0.035 - 0.060).

Sample sizes for LOSH ( $n = 46$ ) and NOHA ( $n = 21$ ) were too small to calculate density estimates.

### **Occupancy**

BUOW were observed at 2.1% of sample points. Occupancy analysis of BUOW sightings yielded a single-visit detection probability of 0.30 (95% CI: 0.13 - 0.55) and an occupancy estimate of 0.033 (95% CI: 0.015 - 0.070). The most strongly supported model included no covariates and a detection probability that did not vary with survey period.

The overall occupancy estimate for GRSP was 0.15 (95% CI: 0.12 - 0.19), based on observations of the species at 12.7% of sample points. The most strongly supported occupancy

model estimated individual detection probabilities for each survey period. Individual detection probabilities for the surveys were 0.65 (95% CI: 0.50 - 0.78) for the first visit, and 0.56 (95% CI: 0.42 - 0.68) for the second. No GRSP were observed during the third survey period, so a detection probability could not be calculated.

We observed HOLA at 25.9% of sample points, and calculated an occupancy estimate of 0.45 (95% CI: 0.34 to 0.56). The most strongly supported occupancy model estimated individual detection probabilities for each survey period. Individual detection probabilities for the surveys were 0.32 (95% CI: 0.23 - 0.41) for the first visit, 0.31 (95% CI: 0.22 - 0.40) for the second, and 0.10 (95% CI: 0.066 - 0.16) for the third. The cumulative detection probability for this species was 0.58.

We observed LOSH at 7.6% of sample points. The overall occupancy estimate for LOSH was 0.51 (95% CI: 0.069 to 0.93). The most strongly supported occupancy model estimated individual detection probabilities for each survey period. Individual detection probabilities for the surveys were 0.054 (95% CI: 0.013 - 0.20) for the first visit, 0.031 (95% CI: 0.0069 - 0.13) for the second, and 0.073 (95% CI: 0.018 - 0.25) for the third. The cumulative detection probability for this species was 0.15.

The overall occupancy estimate for NOHA was 0.19 (95% CI: 0.026 to 0.68), based on observations of the species at 4.1% of sample points. The most strongly supported occupancy model estimated individual detection probabilities for each survey period. Individual detection probabilities for the surveys were 0.16 (95% CI: 0.022 - 0.62) for the first visit, 0.010 (95% CI: 0.0007 - 0.12) for the second, and 0.050 (95% CI: 0.0067 - 0.29) for the third. The cumulative detection probability for this species was 0.21.

### **Burrowing Owl Breeding Pair Counts**

We conducted 12 breeding pair counts in response to BUOW detected on point transects. During these surveys, we detected a total of 6 unique BUOW pairs, including 3 pairs at Lake Perris/San Jacinto Wildlife Area and 3 pairs at Lake Skinner (including Johnson Ranch). Five birds that were observed on point transects were not located during breeding pair counts despite extensive searches of the area following the counts. These 5 detections represent at least 4 unique individuals, and were located at the San Jacinto Wildlife Area, the Santa Rosa Plateau, Kaban Park, and Sycamore Canyon.

## **DISCUSSION**

Neither occupancy nor detection probability for BUOW was significantly different from the observed occupancy of 0.08 and detection probability of 0.26 from the 2006 BUOW survey. Thus, even though the number of BUOW detections and the number of individual birds detected in census counts appeared to decline, we cannot conclude that total BUOW populations or the proportion of conserved habitat occupied by BUOW has changed from 2006. Both occupied core areas from 2007 were also occupied in 2006, although fewer birds were encountered in 2007. More single BUOW were observed in peripheral areas, such as the North Peak Conservation Bank and the Santa Rosa Plateau. This pattern may be due to decreased site fidelity due to poor conditions (e.g. food availability), an increase in the local population size in these areas, improved survey methods or sampling design, or random sampling variability.

Occupancy estimates for LOSH and NOHA were imprecise, likely due to very low detection probabilities resulting from the low encounter rate for these two species (detections at 7.6% and 4.1% of points for LOSH and NOHA, respectively). It is possible that these low detection probabilities reflect large home ranges relative to the detection radius of an observer at a given point. This would decrease the probability that an observer, standing stationary, would detect these species during a survey.

### **Species Objectives**

Only 2 of the 5 BUOW Core Areas were occupied by breeding owls, and neither of the 2 contained enough breeding pairs to meet the minimum of 5 pairs per Core Area. Although our sample sizes were too small to estimate a reliable population density, the relatively high detection probability (approx. 75% cumulative over 3 visits), the low number of BUOW detections, and the low occupancy estimate (3% of habitat occupied) strongly imply that there are too few BUOW in the Conservation Area to meet the minimum of 120 breeding BUOW, and too few in individual Cores to meet the minimum of 5 breeding pairs per Core Area. To meet BUOW species objectives, the total number of breeding adults within the Conservation Area will have to increase considerably.

We observed GRSP in 6 of 7 Core Areas, including all 3 large Cores and 3 of 4 small Cores. This meets the occupancy objective described in the MSHCP for this species. However, GRSP density was low in all Core Areas in 2007. For GRSP to be a Covered Species Adequately Conserved, 20 GRSP pairs must be observed in each of 5 Core Areas. In 2007, the Santa Rosa Plateau was the only Core Area with a population estimate significantly greater than 40 individuals. Confidence intervals for the population estimates overlapped 40 for both Lake Skinner and Lake Mathews/Estelle Mountain, indicating that we cannot conclude with certainty that the population is greater or less than 40. Badlands/Potrero had a population estimate significantly smaller than 40. Although a single individual was observed at the Lake Perris/San Jacinto Wildlife Area Core, no distance was recorded for that individual, so no population estimate could be obtained for that Core. However, it is likely that the estimate for the area would have been significantly less than 40 given the results from other Cores. Based on 2007 data, we conclude that the density objective for this species is not being met, as only 3 Cores had population sizes potentially greater than 40. Furthermore, even though 40 is the absolute minimum population size to support 20 pairs, the actual population size needed to support 20 pairs may be higher, as it is likely that not all birds will form pairs every year. It is therefore possible that none of the Core Areas for this species support enough GRSP to meet this objective. Our occupancy analysis generally supported this conclusion, with only an estimated 15% of surveyed habitat occupied by GRSP. However, the results of this occupancy analysis should be interpreted with caution, as only two of the three survey periods were effective at detecting GRSP. Given the timing of this survey, this pattern was likely due to a decrease in detection probability associated with the GRSP nesting cycle, and not due to a violation in the closure assumption of this analysis.

We detected HOLA at all 4 Core Areas during 2007 surveys. Although overall population sizes were relatively low, HOLA appear to be well-distributed within the Conservation Area and were present in a number of areas outside the Cores. We conclude that the species objective for this species is currently being met, and no further monitoring is required within the current 8-year monitoring period (through 2013).

We detected LOSH in 3 of 7 Core Areas (43%), although 1 Core was not surveyed. Although this is not enough to meet the occupancy objective for this species, we cannot conclude that the objective is not being met, because of low detection probability. Our estimate of a cumulative detection probability of 0.15 suggests that, using these methods, we would need to visit the same sites at least 54 times to have 95% confidence that we would detect at least 1 LOSH if it was present at any given site.

NOHA were present in 4 of 7 Core Areas (57%), although 2 Cores were not surveyed. Although this is not enough to meet the occupancy objective for this species, we cannot conclude that the objective is not being met, because of the missed Core Areas and low detection probability. Our estimate of a cumulative detection probability of 0.21 suggests that, using these methods, we would need to visit the same sites at least 39 times to have 95% confidence that we would detect at least 1 NOHA if it was present at any given site.

### **Recommendations for Future Surveys**

Further plan area-wide surveys for BUOW are not recommended at this time. Before BUOW species objectives can be met, additional conservation of BUOW occupied habitat must occur, or additional BUOW must colonize already conserved properties. Intensive surveys during the BUOW breeding season should occur as new properties are conserved. Surveys throughout the plan area should not be performed until enough time has elapsed that significant changes to population size could have occurred (e.g. 5 years). Alternatively, high-productivity years that may drive an increase in the local BUOW population may act as a trigger for future surveys. In this case, surveys should occur in the 2-3 years following at least 2 years of consistent normal-high rainfall.

Additional management and/or land acquisition may be required to demonstrate adequate conservation of GRSP. Based on current data, there are too few GRSP to meet the species-specific objectives allowing this species to be deemed adequately conserved. However, 2007 was an extreme drought year. Low rainfall has been shown to decrease food availability and reproductive success for passerines in southern California, and may reduce population sizes (Patten and Rotenberry 1999; Bolger et al. 2004). Weather conditions in 2007 may have reduced breeding season population sizes for GRSP. Therefore, future GRSP surveys should be conducted during and following non-drought years to determine if GRSP density increases above the minimum requirement to meet the species objectives. Because population sizes are currently too low to meet the species objectives, reproductive surveys for this species are not currently recommended. If population sizes for this species increase beyond the minimum requirement, then counts of breeding pairs and fledgling / nest searches should be conducted to more completely evaluate the status of the species with respect to the species objectives.

Dedicated surveys specifically targeting the biology of loggerhead shrikes and northern harriers will be required to collect reliable data about these species. In particular, if reproductive information is to be successfully collected, cumulative detection probabilities must increase considerably. Accomplishing this will likely require much more field effort than was dedicated to the current survey. To meet the occupancy objective, future surveys should attempt to either provide much more complete transect coverage of the survey area or initiate a mark-recapture type study using either fixed trapping stations or radio telemetry.

Figure 1. Burrowing Owl Survey Locations and Core Areas for Target Species.

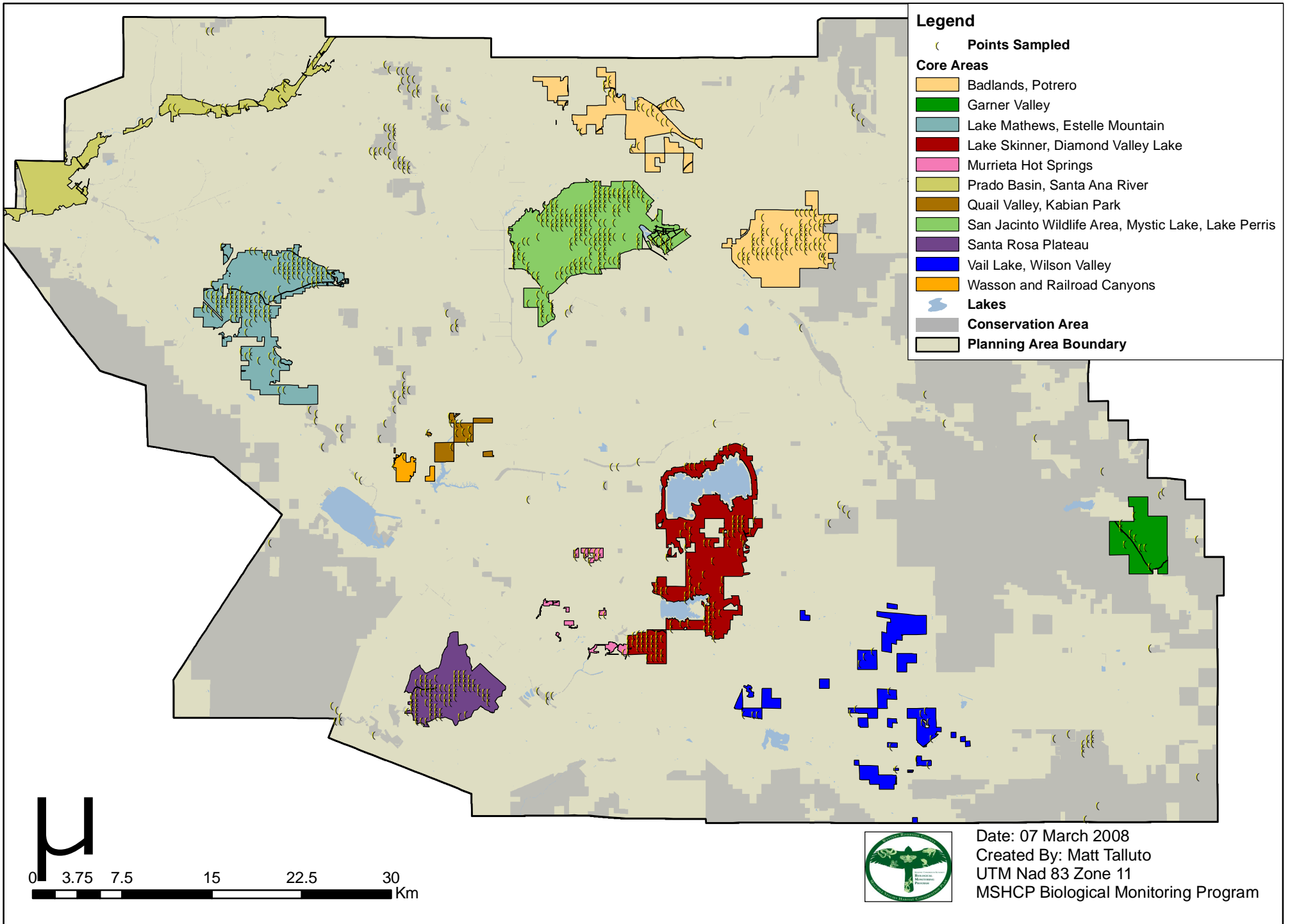
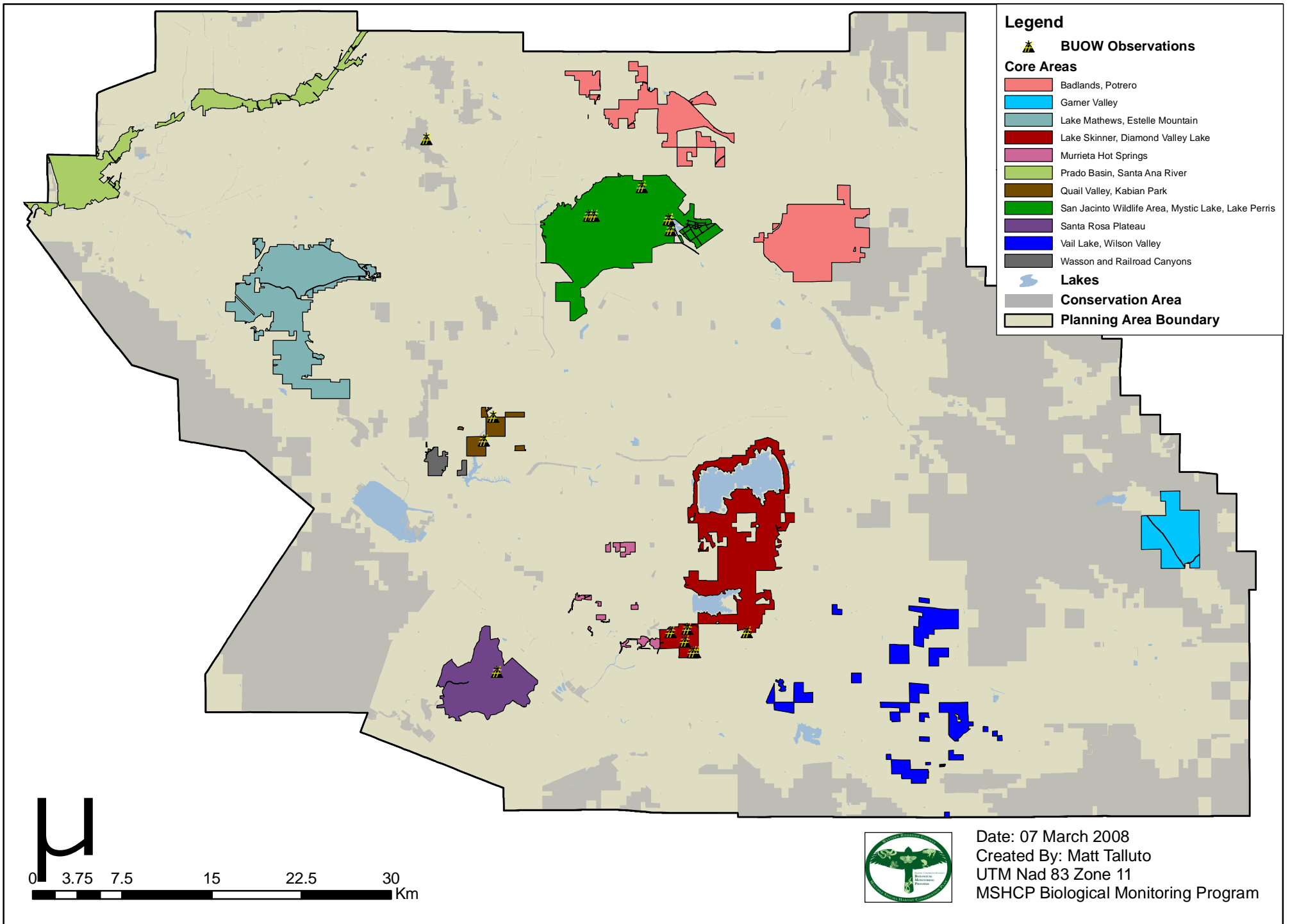
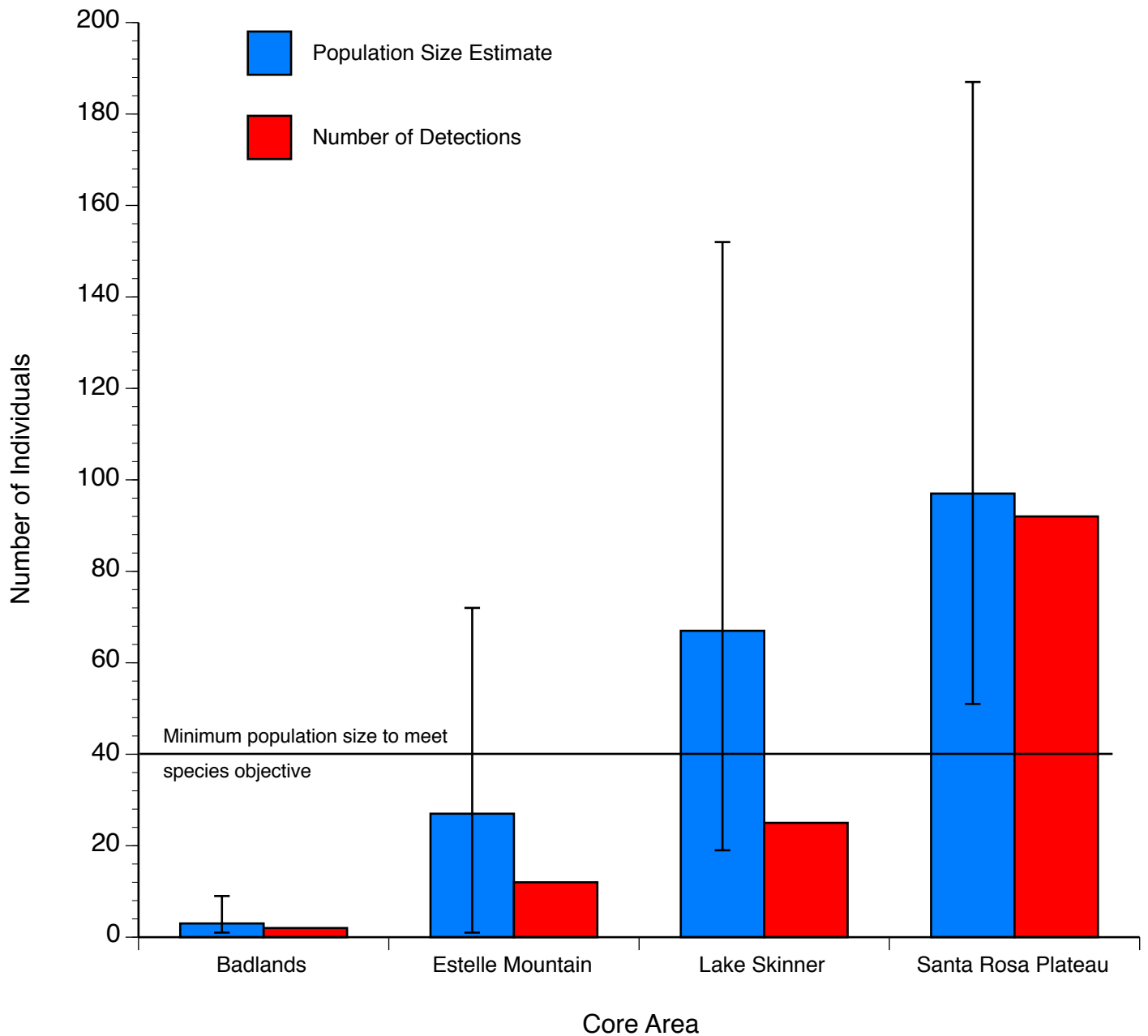


Figure 2. Burrowing Owl Observations in 2007.





**Figure 3.** Population estimates (with 95% confidence intervals) for grasshopper sparrows in the 4 identified Core Areas, along with the number of detections within each area.

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## **Appendix A: Western Riverside County MSHCP Biological Monitoring Program Protocol for Burrowing Owl (*Athene cunicularia*)**

**February 2007**

**Goal: Determine the location and total number of breeding Burrowing Owls (BUOW) in suitable habitat in the Conservation Area, and confirm that there are at least 120 owls with no fewer than five pairs in each of the five Core Areas identified in the Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP).**

### **Objectives**

To achieve the above goal, presence/absence surveys will be conducted in suitable habitat within the Conservation Area at points stationed along walking transects. To improve BUOW detectability during surveys, we will project pre-recorded BUOW calls. Wherever an owl is detected, a return visit will be made to determine BUOW abundance in the area.

### **Timing**

Surveys will be conducted three times during the BUOW breeding season, once during each of the three following nest stages: breeding/laying/incubation (approx. March 12-April 20), incubation/feeding nestlings (approx. April 23-May 25), and fledging (approx. May 28-June 29). Note that the above dates are approximate due to annual climate variations and personnel logistics. Actual survey periods may vary slightly if the breeding season is early or late.

### **Survey Locations**

Survey stations will be placed 400 m apart within suitable BUOW nesting habitat inside the MSHCP Conservation Area. At least one survey station will be placed within each BUOW Core Area that is specified by the MSHCP. The number of points placed in each Core Area will be representative of the number of acres of suitable habitat available for survey.

Survey locations will be chosen by placing a 400 m grid on a GIS layer of suitable habitat. In areas where suitable habitat is patchy or does not conform to the grid structure, locations will be randomly selected. Before the beginning of the survey period, technicians will evaluate the suitability of the habitat surrounding each point. The points will be stratified into primary, secondary, and tertiary habitat based on this evaluation. The final survey points will consist of all points in primary habitat, 50% of points in secondary habitat, and 25% of points in tertiary habitat. This sampling scheme will allow us to make inferences to all habitat in our GIS layer while reducing the amount of effort required by sampling fewer points in less suitable habitat. Data collected during the habitat evaluation will also be used as covariates in statistical models, with the goal of reducing future survey efforts by developing more precise criteria for eliminating points.

During the habitat evaluation, observers will visually estimate percent cover of scrub, tall grass (0.5+ m), short grass (< 0.5 m), rock or bare ground, and other cover types. Short grass, rock, and bare ground will be considered “open” habitats. Observers will also note the presence

of tall perches (2+ m), short perches (< 2 m), mammal burrows of suitable diameter (greater than 10 cm), pipes, culverts, drains, banks, and rock piles.

Observers will walk between stations whenever possible, and will record any BUOW detected between stations. We will visit all stations during each of the three survey periods.

### Equipment

Handheld GPS Unit	Speakers
Thermometer	Hand-held compass
Avian Field Guide	Anemometer
Sound Meter	Data Sheets
Binoculars	CD w/ BUOW recording
Rangefinder	CD Player
Spotting Scope	

## METHODS

### Overview

Technicians will work independently, walking between survey points. Each technician will complete approximately ten survey points in a day under ideal conditions. BUOW presence/absence surveys will be conducted using eight minute point transects. The first four minutes of the survey will consist of passive listening and looking for BUOW and other target species. The second four minutes will incorporate projection of BUOW calls while observing the landscape for BUOW and other target species. When an owl is detected during a survey, its location will be recorded using a compass, rangefinder and GPS. The day after an owl is located, technicians in groups of three will revisit the locations where BUOW have been detected and conduct a multiple observer count to estimate the total number of BUOW in the area.

During point transect surveys and while walking between points, observers will also record the presence of other covered grassland species. Species to be recorded include Grasshopper Sparrow (GRSP), Horned Lark (HOLA), Loggerhead Shrike (LOSH), and Northern Harrier (NOHA).

### **POINT TRANSECTS: Describe the location of BUOW on suitable habitat within MSHCP Conservation Area**

Point transects will commence 0.5 hours before sunrise and will end no later than noon. Surveys will not be conducted when temperatures exceed 35 degrees Celsius, when wind speeds exceed 29 km/hr (a rating of 4 on the Beaufort wind scale), or if it is raining, regardless of time of day, as owls will decrease their activity under any of the above conditions.

While the surveys are being conducted, including moving between points, the observer will take care to make as little noise as possible. All noise-making devices will be turned off. When driving on any portion of the Conservation Area, driving speed will not exceed 15 miles per hour.

Preparation before each survey day:

Survey stations will be chosen and recorded in a handheld GPS unit for each surveyor. Data will be recorded in the NAD83 datum. Each of the CD players and speakers will be tested

at the end of each day to ensure that they work and they are projecting at 84 dB (as measured by a sound meter at 1 m distance from the speaker). Extra, fully-charged batteries will always be stowed in each technician's daypack. The speaker volume is to be checked again at least once during the survey day. This should not be done during a survey or at a point transect location.

Preparation at each survey station:

The observer will walk to each survey point guided by a handheld GPS. Once the waypoint is located, s/he will prepare the thermometer, anemometer, and the playback devices. To prepare the recording device for usage in the second portion of the survey, the speakers will be turned to the highest volume possible and the CD player cued. Each survey will be timed using the portable CD player. The observer should note on the datasheet whether the compass being used is declinated or not so that a correction can be applied later if necessary. Immediately prior to beginning the survey, observers will record starting wind velocity, temperature, and time of day.

Conducting the survey:

When the survey commences, observers will also begin playing the first track on the portable CD player. The CD will contain alternating tracks of silence and BUOW recordings. This will reduce errors in the timing of the playback and allow the observer to focus attention on the birds without being distracted by checking a timer. For the first four minutes, observers will scan the 360 degree area around the point with binoculars. The BUOW recording will then play for 30 seconds facing one of the cardinal directions. During playback, observers will continue to scan in all directions for the target species. Once playback is finished, observers will orient the speakers 90 degrees from the previous orientation, and then continue scanning in silence for 30 seconds. This process (30 seconds of playback followed by 30 seconds of silence) will repeat for each of the four cardinal directions. The observer should be watchful during this period because owls may respond to the recording with movement instead of vocalization.

Recording data during the survey:

The distance from the survey point to any BUOW seen or heard will be recorded, along with the azimuth of the detected owl. Distance and direction will be estimated for birds that are heard but not seen. Other target species will be recorded with distance only. Observers will also record the age (adult or juvenile), sex, and identification cues (visual, song, call, other) for all birds, if known. Each individual bird observed will be recorded on a separate line on the datasheet.

The comments column can be used to describe extra, non-essential information. It is more important to get an accurate count of the BUOW present than to determine and record the behavior of observed owls. Therefore, any commentary outside of juvenile presence and count is considered of a secondary importance. When possible, note whether juveniles are alone, what the group size is, and if parents are present. If the observer sees a parent feeding any juveniles or carrying food at any point, this should be recorded as it might indicate an active and potentially successful nest. Other suitable information in the "Comments" column includes specific postures or behaviors of the BUOW observed. If the bird is banded and the number is easily observed, then this number can also be recorded in the "Comments" column.

After each survey station:

At completion at each survey station, the temperature and wind velocity will be recorded on the datasheet. Then the observer will pack up all gear and walk to the next survey point. Observers will record all target species between survey stations in the incidental portion of the datasheet for the closest survey station. Observers will also record a GPS waypoint for all incidental BUOW observed to facilitate relocating these birds for multiple observer counts.

After all points have been surveyed during a given day, observers will return to any points where BUOW were observed and map the terrain and burrow locations. This will aid technicians that return the following day for a multiple observer count.

**MULTIPLE OBSERVER COUNTS: Complete count of owls observed on point counts**

When BUOW are found during a presence/absence survey, their approximate location will be recorded by taking azimuth and distance from the survey station to the bird and by mapping burrow locations after the survey. To conduct a multiple observer count of BUOW located within the Conservation Area, observers will return in teams of three surveyors to places where BUOW were identified during the initial survey. Multiple observer counts will be repeated the day following point count surveys in each subsequent survey period. Incidental observations of BUOW will also trigger multiple observer counts.

To count BUOW, technicians will return during the same morning hours that the surveys were conducted. This starts half an hour before sunrise and continues until noon. Technicians will approach the location at a slow speed and park vehicles out of sight of the BUOW colony, if possible. Observers will then use the map produced the previous day to find observation locations. All three observers will be situated at individual observation stations roughly evenly distributed around the colony and located a minimum of 50 m from the known BUOW and burrow locations. Stations will be chosen to maximize visibility of the colony. Observers will then quietly approach their vantage points, taking care to reduce their visibility to the owls. Once at the survey location, observers will stay low to the ground minimize all movement. Observers will wait at least 20 minutes after all observers have reached their observation points to begin surveying. The survey start time must be determined in advance to insure that all observers being making observations at the same time.

The multiple observer surveys will last for 30 minutes. Observers will map the location of every owl in the area and indicate age and sex, if known. All movements during the survey period will also be recorded, as well as the time of initial observation and the time of any movements. Observers will also pay attention to BUOW behavior and use this information to estimate the number of adult pairs in the colony. Once the survey is over, observers will immediately compare maps and notes in order to determine how many owls were detected and which observers detected each owl.

### **Qualifications and Necessary Training for Technicians:**

Surveyors and crew leaders must be able to distinguish between an adult and a juvenile Burrowing Owl using plumage characteristics. They must be familiar with BUOW vocalizations and be able to recognize them from at least 200 m. Technicians should also be able to identify GRSP, HOLA, LOSH, and NOHA by sight and sound. Technicians will be trained to operate binoculars, spotting scopes, CD players, speakers, GPS handheld units, and all other required equipment. Each observer will also be trained to determine the difference between the burrows of a Burrowing Owl burrow and other burrowing species. Training will be provided prior to the field season.

### **Data Analysis**

We will use the data collected from point transects to calculate detection probability and occupancy for all target species. For BUOW, this analysis will indicate the probability that a colony is detected when present at a site as well as the number of survey points occupied by BUOW. The point transect data will also be used to generate a distance model and estimate density for all target species.

The multiple observer counts will be used to estimate average BUOW colony size for colonies within the Conservation Area by calculating the probability of detecting an individual owl within a given multiple observer count. This analysis can be combined with the occupancy model to estimate total owl abundance within the Conservation Area. If sample size is insufficient for this analysis, we will only report the total number of owls observed on these counts, without correcting for imperfect detection.