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

2014 Stephens' Kangaroo Rat (*Dipodomys stephensi*) Survey Report

Stephens' kangaroo rat (*Dipodomys stephensi*)

9 June 2015

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NOTE TO READER:

This report is an account of survey activities conducted by the Biological Monitoring Program for the Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP). The MSHCP was permitted in June 2004. Reserve assembly is ongoing and is expected to take 20 or more years to complete. The Conservation Area includes lands acquired under the terms of the MSHCP and other lands that have conservation value in the Plan Area (called public or quasi-public lands in the MSHCP). In this report, the term "Conservation Area" refers to these lands as they were understood by the Monitoring Program at the time the surveys were conducted.

The Monitoring Program monitors the status and distribution of the 146 species covered by the MSHCP 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 Wildlife (CDFW, formerly California Department of Fish and Game) and the U.S. Fish and Wildlife Service]. Monitoring Program activities are guided by defined conservation objectives for each Covered Species, other information needs identified in MSHCP Section 5.3 or elsewhere in the document, and the information needs of the Permittees. A list of the lands where data collection activities were conducted in 2013 is included in Section 7.0 of the Western Riverside County Regional Conservation Authority (RCA) Annual Report to the Wildlife Agencies.

The primary author of this report was the 2014 Mammal Program Lead, Jennifer Hoffman. This report should be cited as:

Biological Monitoring Program. 2015. Western Riverside County MSHCP Biological Monitoring Program 2014 Stephens' Kangaroo Rat Survey Report. Prepared for the Western Riverside County Multiple Species Habitat Conservation Plan. Riverside, CA. Available online: http://wrc-rca.org/about-rca/monitoring/monitoring-surveys/.

While we have made every effort to accurately represent our data and results, it should be recognized that data management and analysis are ongoing activities. Readers 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.

Please contact the Monitoring Program Administrator with questions about the information provided in this report. Questions about the MSHCP should be directed to the Executive Director of the RCA. Further information on the MSHCP and the RCA can be found at www.wrc-rca.org.

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INTRODUCTION

Stephens' kangaroo rat (*Dipodomys stephensi*; "SKR") is a state threatened and federally endangered species. Like all kangaroo rats, SKR are saltatorial, nocturnal, burrow-dwelling rodents with fur-lined cheek pouches (Ingles 1965, Wilson and Ruff 1999, Reid 2006). The geographic range of SKR lies entirely within portions of western Riverside and north-central San Diego Counties (Bleich 1977). Stephens' kangaroo rat most often occurs in open grasslands or sparse shrub-lands, and is only rarely detected in shrub dominated habitats (O'Farrell 1990; Price et al 1991). Density of vegetation cover may also be an important characteristic of SKR habitat, since the species has often been recorded in sparsely vegetated areas with a predominance of bare ground (Bleich 1973; O'Farrell and Clark 1987; O'Farrell 1990).

Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP) species-specific objective 1 for SKR requires that a minimum 15,000 ac (6,070 ha) of occupied habitat (as measured across any consecutive 8-year period) be conserved among at least 6 Core Areas within the boundaries of the SKR HCP (Lake Mathews-Estelle Mountain, Motte Rimrock Reserve, Lake Skinner-Domenigoni Valley, San Jacinto State Wildlife Area-Lake Perris, Sycamore Canyon-March Air Force Reserve Base, Steele Peak, and Potrero ACEC). Species-specific objective 2 states that an additional 3,000 ac (1,214 ha) of occupied habitat be conserved in Anza-Cahuilla Valleys and Potrero Valley (Dudek & Associates 2003). Moreover, species-specific objective 3 states that at least 30% of the total occupied habitat conserved within the Plan Area must maintain a population of medium or higher density (i.e., 5-10 individuals per ha) with no single Core Area accounting for more than 30% of the conservation target.

The Biological Monitoring Program conducted surveys for SKR from 2006 to 2008. In 2006, we trapped in conjunction with, the Riverside County Habitat Conservation Authority (RCHCA), in an effort to refine the trapping protocol for estimating population size and determining the relationship between population size and burrow density, using the protocol developed by Diffendorfer and Deutschman (2002). In addition to gathering data to evaluate species objectives, we learned that a majority of animals were captured on the 3rd night of a 3-night trap effort. Therefore in 2007 we increased the number of nights we surveyed each grid from three nights to five nights in an attempt to bolster sample sizes. We ultimately concluded that a 4-night trapping effort at each trapping grid was most efficient, providing good assurance that if animals were present they were caught, but ending before diminishing returns meant squandered resources. We also tested the efficacy of grid size for estimating SKR occupancy, concluding that 5 x 5 trapping grids are an effective method of estimating occupancy. In 2008, we incorporated habitat covariates into occupancy models to refine the habitat index and we focused on obtaining SKR occupancy and density at Anza-Cahuilla and Potrero Valley. Density objectives were met at both Core Areas. We also found shrub cover was negatively correlated with SKR distribution while percent cover of *Erodium* was positively correlated with occupied habitat.

We discuss here the methods and results from 2014 surveys used to address species-specific objective 2 in Anza-Cahuilla Valleys and Potrero Valley. Specifically, our survey goals and objectives for 2014 were as follows:

Goals and Objectives

1. Estimate area of suitable habitat occupied by Stephens' kangaroo rat at Potrero Valley and Anza-Cahuilla Valley.

   a. Sample Stephens' kangaroo rat populations with 5x5 (60 m x 60 m, 25 trap) grids.

   b. Estimate occupancy with a closed-capture model using Program MARK.

METHODS

Study Site Selection

For our 2014 field season, we surveyed grid locations previously trapped in 2008 by the Biological Monitoring Program (see Biological Monitoring Program 2009 for grid site selection design). We sampled areas of Potrero Valley (elevation 600 to 750 m) that included the Potrero Unit of the San Jacinto State Wildlife Area (Potrero) and two adjoining Bureau of Land Management (BLM) parcels. We also trapped conserved lands in the Anza-Cahuilla Valley (elevation 600 to 800 m), including the Wilson Valley Preserve which is owned by the Regional Conservation Authority (RCA) and managed by the Center for Natural Lands Management (CNLM), and two small BLM parcels directly south of Wilson Valley Preserve.

Survey Locations

We conducted seven trapping sessions at Potrero Valley from 12 May to 26 September 2014. Prior to trapping we removed six grids from Potrero Valley due to inaccessibility on very steep and degraded roads. In an effort to cover more SKR habitat, we added 18 trapping grids to those from 2008, resulting in a total of 98 trapping grids. We conducted one trapping session at Anza-Cahuilla Valley from 15 – 19 September 2014, sampling a total of 10 trapping grids. We surveyed each trapping grid over a single 4-night effort (Monday-Thursday).

Survey Methods

We used 12″ × 3″ × 3.5″ Sherman live traps (H.B. Sherman Traps, Tallahassee, FL) modified with paper clips to prevent trap doors from potentially damaging animals' tails. Traps were spaced 15 m apart in a 5 trap × 5 trap grid, covering a 60 m × 60 m footprint (Fig. 1). We marked individual traps (n = 25 per grid) using pin flags labeled with an alpha-numeric code. Traps were placed ≤1 m from each pin flag and baited with 1 tbsp of sterilized large white proso millet (*Panicum miliaceum*). A trap station consisted of a pin flag and a single Sherman trap.

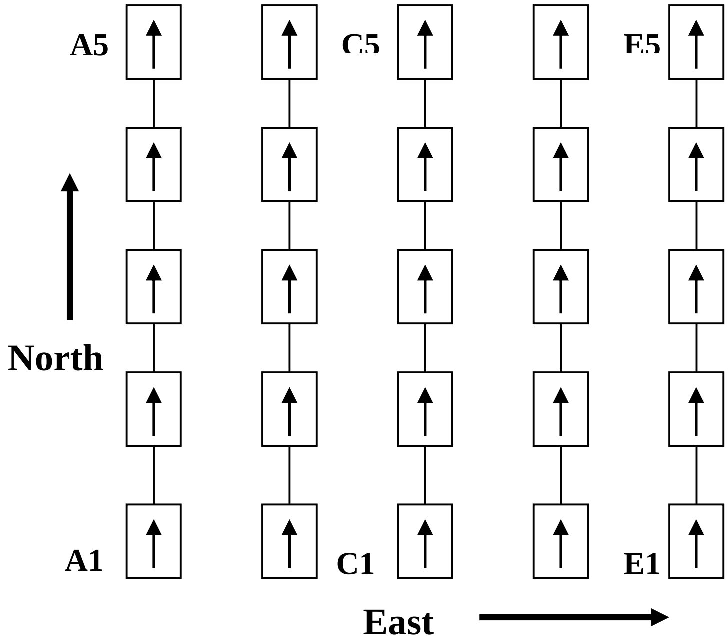

Figure 1. Grid design (5 × 5) for trapping SKR. Boxes represent individual traps and small arrows indicate direction that open doors face.

We checked traps twice each night in accordance with U.S. Fish and Wildlife Service 10(a)(1)(B) permit specifications (USFWS TE088609-0). We opened traps 1–3 h before sunset and started the first check near midnight. We reset each trap after checking it, and added fresh bait if necessary. The second check began 1 h before dawn, after which we removed excess millet to avoid attracting ants and closed the traps. After the final dawn shift of the trapping effort, we removed all survey equipment.

Before surveying grids we recorded moon phase (quarter, half, three-quarter, full, no moon), sky code (0 = clear/few clouds, 1 = 50% clouded, 2 = overcast, 3 = fog, 4 = light drizzle) and ground moisture (wet, dry). We did not bait or open traps during significant precipitation. We noted the visit number, trap check, grid ID, recorder, handler, and start and end times of each grid check. We recorded the status of individual trap stations as either open, animal, closed-empty, robbed, or missing on a quality control form. We used the unique four-letter species code to record each trapped animal. We processed captured animals according to standard operating procedures developed by the Biological Monitoring Program. We examined the quality control form to ensure that all traps were checked, baited and left open after the midnight check. At dawn, we used the quality control form to ensure that all traps were checked and closed. Prior to leaving the grid, we recorded ambient air and soil temperature. For a more complete description of survey methods, see Small Mammal Trapping Standard Operating Procedures V.5, available from the Biological Monitoring Program.

Training

All Biological Monitoring Program field personnel were trained prior to the 2014 SKR trapping field season. Program training focused on proper animal handling and identification, and data collection procedures. Additionally, the 2014 SKR trapping crew visited the San Diego Natural History Museum to examine study skins and general characteristics of species we would most likely encounter during our survey. Only crew members with this training, or those trained on-site and working under the supervision of trained biologists, were allowed to handle animals during this effort. Crew members were able to identify seven covered and six non-covered small mammal species in-hand. Crew members handling small mammals could do so safely and proficiently and take measurements according to standard operating procedures.

Data Analysis

The 2014 survey was designed to allow us to estimate occupancy based upon repeated captures of Stephens' kangaroo rat. However, due to lack of sufficient data, we were unable to conduct this analysis. Instead, we evaluated survey findings by mapping observations in a geographic information system and assessing the distribution within Core Areas.

RESULTS

We captured Stephens' kangaroo rat on 13 of 98 grids (13%) at Potrero Valley (Fig.2). We did not capture Stephens' kangaroo rat at Wilson Valley Preserve (Fig. 3). We captured two additional Covered Species (Dulzura kangaroo rat and northwestern San Diego pocket mouse) at both Potrero and Wilson Valley, and four non-covered species (Appendix A). Due to small sample size, we were unable to run our occupancy analysis as planned. Therefore we were unable to estimate the total area of occupied moderate-to high- quality habitat and are limited to mapping confirmed locations within the study area.

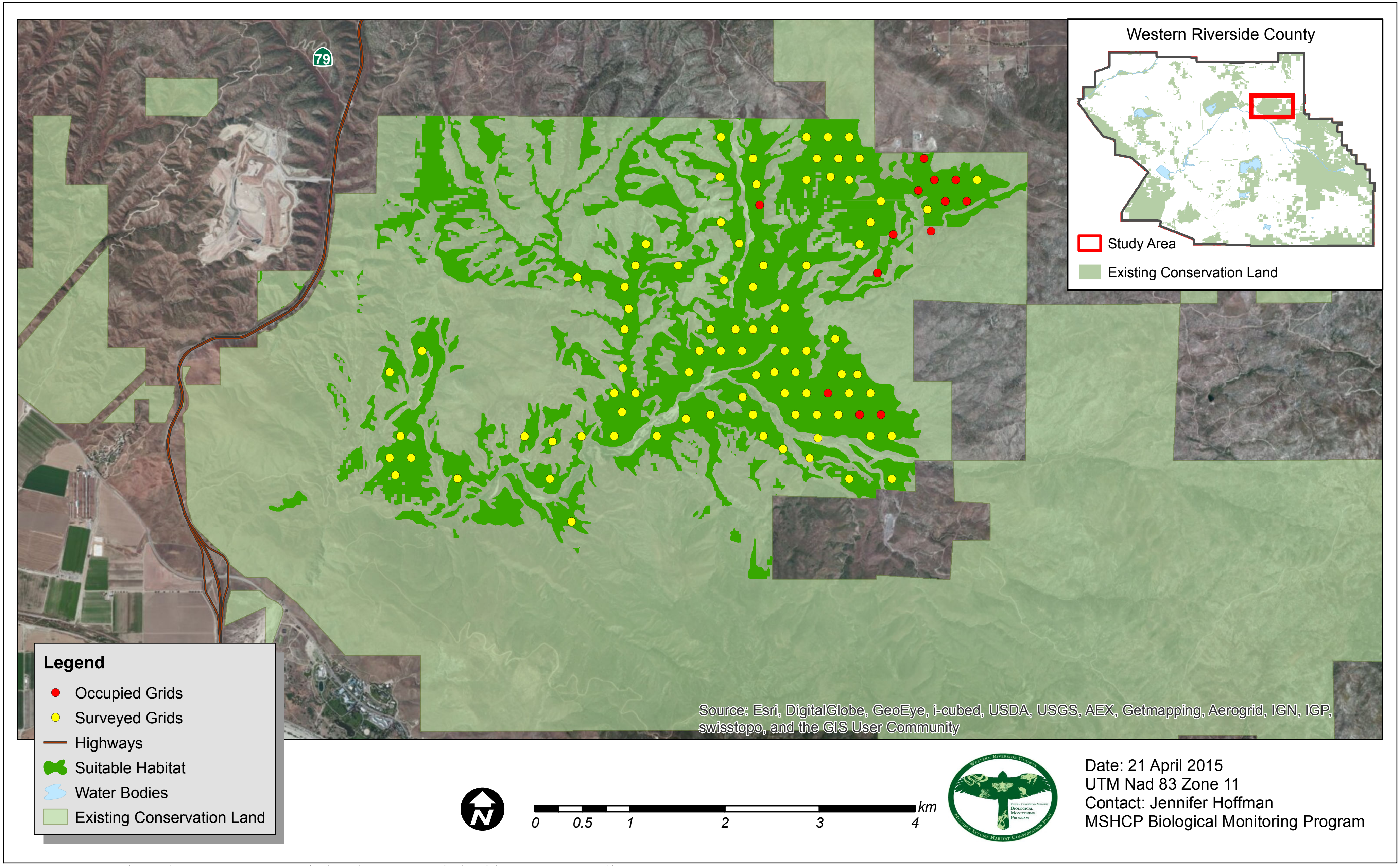

Figure 2. Stephens' kangaroo rat occupied and non-occupied grids at Potrero Valley, 12 May - 26 Sept 2014.

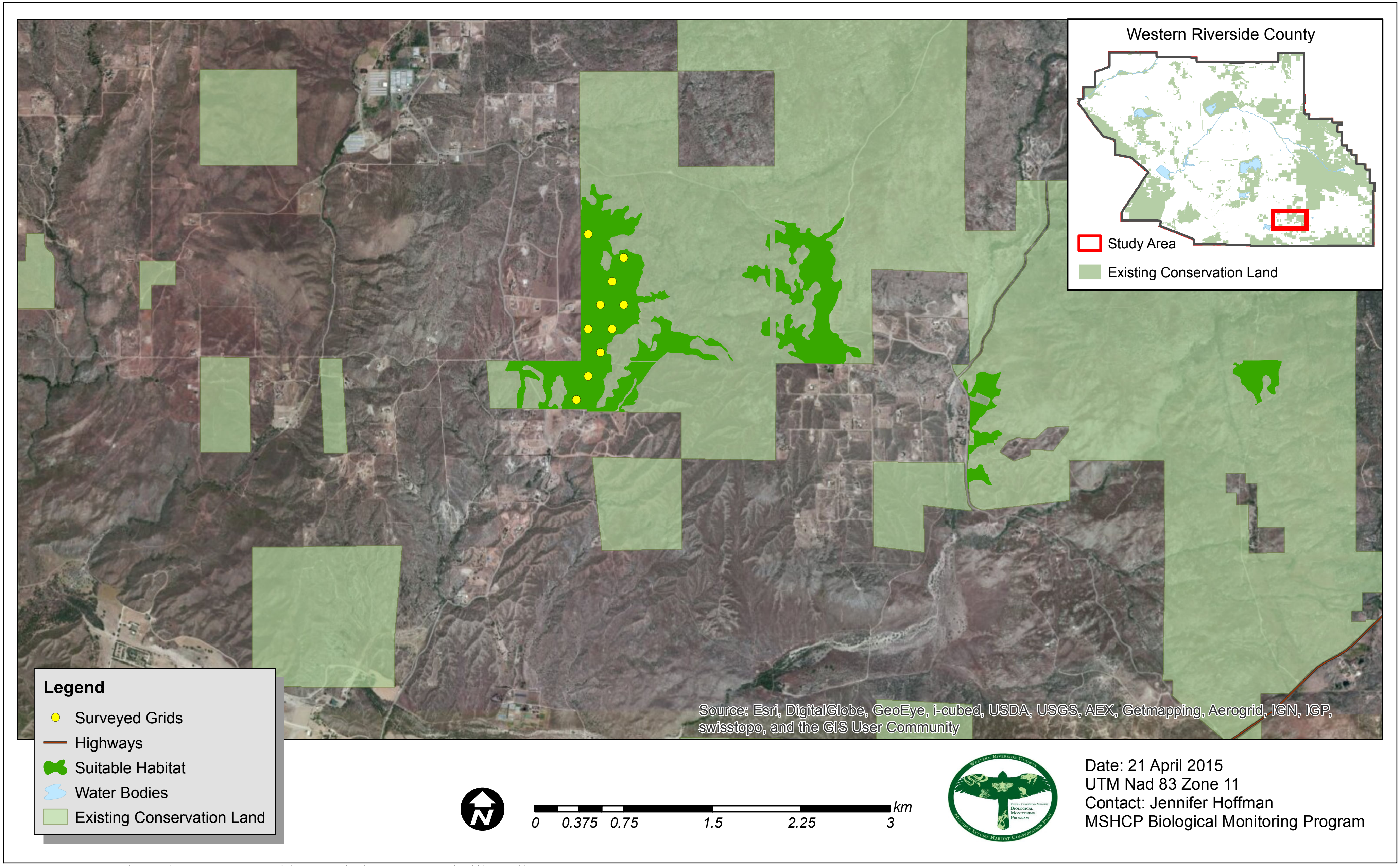

Figure 3. Stephens' kangaroo rat grids sampled at Anza-Cahuilla Valley 15-19 Sept 2014.

DISCUSSION

Data collected in 2014 indicate that species-specific objective 2 for Stephens' kangaroo rat is not currently met. Our capture rates at Potrero Valley were too low to complete the analysis that would have given us an estimate of occupied habitat. We trapped additional suitable habitat at Potrero, by adding more trapping grids in a non-random fashion to those trapped in 2008. However, the percentage of occupied grids was greatly reduced in 2014 compared to 2008 (13%, down from 75%). The total number of unique animals per grid was also substantially lower (0.08% in 2014, compared to 80% in 2008).

Near the end of our trapping effort at Potrero Valley, we trapped a small portion of suitable habitat in Anza-Cahuilla Valley. In addition to obtaining data to evaluate species objectives, this trapping would supply genetic material to Debra Shier and provide the CNLM data for their preserve. While three of these grids were occupied in 2008, we did not catch any SKR in 2014.

Due to very limited trap success in 2014, including no SKR caught in the Anza-Cahuilla Valley, and the high resource demands of small mammal trapping we decided to delay further SKR trapping in the Anza-Cahuilla Valley. We will conduct a more thorough sampling effort when either targeted surveys for SKR or co-occurring species show that SKR is present and available for capture.

It is well known that kangaroo rats are adapted to life in arid environments (i.e., burrowing to escape the heat, not requiring free water) (Vorhies 1945, Forman and Philips 1993). California is currently experiencing a severe drought and it is tempting to blame the drought for our low capture rates. However, with the physiological adaptions within this taxonomic group and better capture success reported anecdotally from land managers in western Riverside County and San Diego County, we can surmise that drought is likely not the reason for our low capture success. In contrast, declines in kangaroo rat populations tend to follow heavy rain events or years with higher than average rainfall (Kelt et al 2008). Therefore, the issue at hand is likely not one of climatic conditions but of habitat quality.

Stephens' kangaroo rat populations thrive with an abundance of bare ground, whether it's the result of shrub removal, prescribed fire, or a mixture of grazing and mowing (O'Farrell and Uptain 1989; Price et al 1994; Price et al 1995; Kelt et al 2005). While we did not survey habitat characteristics in 2014, it is likely that a decrease in habitat quality negatively affected SKR occupancy. Habitat in 2008 was in an early successional state following the 2006 Esperanza Fire. The extent of this fire was quite large (40,200 ac), burning nearly all suitable SKR habitat in Potrero Valley. In the eight years since the Esperanza fire, we are likely witnessing a degradation of SKR habitat quality as it moves through post-fire seral stages, filling in the bare ground (Quinn 1979, Price et al 1995). Following the smaller (2,171 ac) and possibly less intense Highland Fire which burned part of Potrero Valley in 2012, the habitat did not appear to be as ideal as it was in 2008 (personal observation). Price et al (1995) found that SKR population densities increase following prescribed fires, likely due to reduction in thatch and encroaching shrubs. Finally, positive effects on population density and an increase in species richness may continue from two to ten years post-fire, until the habitat becomes denser with shrubs (Quinn 1979, Price et al 1995).

Analysis following our 2008 trapping season showed shrub cover had a strong negative effect on SKR distribution (Biological Monitoring Program 2009). Others have shown that a lack of aerial cover as well as increased vertical patchiness, greater percentage of bare ground and reduced mean plant height, increased habitat utilization by SKR (O'Farrell and Clark 1987). Similarly, Lackey (1967) found Stephens' kangaroo rat on level or rolling topography with sparse vegetation. We therefore strongly recommend that land managers with occupied or potential SKR habitat work to reduce the percent cover and height of vegetation by whatever management measures are best suited for their location (e.g., prescribed fire, grazing, herbicide, mowing) to increase the habitat suitability for SKR.

Recommendations for Future Surveys

Though we were unable to estimate Stephens' kangaroo rat occupancy, and subsequently area of suitable habitat following our 2014 trapping season, we did observe a slight trend in capture rates. Our capture rates tended to increase as the trapping effort progressed. Of the 13 total grids occupied, we saw an increase in occupancy throughout the trapping effort: 1st and 2nd trap nights (n = 1 of 13 grids occupied; 8%), 3rd night (n = 9; 69%), and 4th night (n = 11; 85%). We have seen this trend in past trapping efforts as well and therefore should continue to trap at least four nights per effort.

We should perform habitat quality surveys to coincide with any trapping effort for SKR. These data would better prepare us to answer questions regarding the relationship between low capture rates and current habitat characteristics. Photo documenting the appearance of trapping grids each year they are surveyed can provide a long lasting visual aide on habitat conditions at the time of trapping and should be done with each trapping effort as well. Additionally, photos should be taken of Stephens' and Dulzura kangaroo rats (*D. simulans*) heads and ears to further document and solidify the differences between these species as they are similar in size and general appearance. While we followed established field protocols regarding how to best identify these species, some difficulty remained. Use of calipers to measure the pre- and post-orbital breadth of kangaroo rats should also be added to the protocol.

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Appendix A. Species recorded per grid while surveying for Stephens' kangaroo rat, 12 May - 26 Sept 2014.

Station Code	Scientific Name	Common Name	Covered	Total
PR066	*Dipodomys simulans*	Dulzura kangaroo rat	Y	3
PR067	*Dipodomys* spp	unidentified kangaroo rat	-	1
	Dipodomys stephensi	Stephens' kangaroo rat	Y	1
	Peromyscus maniculatus	deer mouse	N	18
PR068	*Dipodomys stephensi*	Stephens' kangaroo rat	Y	1
	Peromyscus maniculatus	deer mouse	N	9
PR069	*Dipodomys* spp	unidentified kangaroo rat	-	1
	Dipodomys simulans	Dulzura kangaroo rat	Y	2
	Dipodomys stephensi	Stephens' kangaroo rat	Y	2
	Peromyscus maniculatus	deer mouse	N	1
PR070	*Dipodomys* spp	unidentified kangaroo rat	-	2
	Dipodomys simulans	Dulzura kangaroo rat	Y	8
	Dipodomys stephensi	Stephens' kangaroo rat	Y	1
PR071	*Dipodomys stephensi*	Stephens' kangaroo rat	Y	1
	Peromyscus maniculatus	deer mouse	N	21
PR072	*Chaetodipus fallax fallax*	northwestern San Diego pocket mouse	Y	1
PR073	*Peromyscus maniculatus*	deer mouse	N	1
PR074	*Peromyscus maniculatus*	deer mouse	N	5
PR077	*Chaetodipus fallax fallax*	northwestern San Diego pocket mouse	Y	2
PR078	*Peromyscus maniculatus*	deer mouse	N	1
PR080	*Chaetodipus fallax fallax*	northwestern San Diego pocket mouse	Y	1
	Dipodomys simulans	Dulzura kangaroo rat	Y	1
	Peromyscus maniculatus	deer mouse	N	3
PR081	*Dipodomys simulans*	Dulzura kangaroo rat	Y	4
	Chaetodipus fallax fallax	northwestern San Diego pocket mouse	Y	3
PR082	*Dipodomys simulans*	Dulzura kangaroo rat	Y	2
PR083	*Chaetodipus fallax fallax*	northwestern San Diego pocket mouse	Y	1
	Dipodomys simulans	Dulzura kangaroo rat	Y	4
	Peromyscus maniculatus	deer mouse	N	2
PR086	*Dipodomys stephensi*	Stephens' kangaroo rat	Y	1
PR087	*Dipodomys simulans*	Dulzura kangaroo rat	Y	1
PR088	*Peromyscus maniculatus*	deer mouse	N	1
PR092	*Peromyscus maniculatus*	deer mouse	N	9
PR093	*Peromyscus maniculatus*	deer mouse	N	1
PR096	*Dipodomys simulans*	Dulzura kangaroo rat	Y	1
PR097	*Dipodomys simulans*	Dulzura kangaroo rat	Y	2
PR099	*Dipodomys simulans*	Dulzura kangaroo rat	Y	2
	Thomomys bottae	Botta's pocket gopher	N	1
PR102	*Reithrodontomys megalotis*	western harvest mouse	N	1
PR104	*Dipodomys simulans*	Dulzura kangaroo rat	Y	1
PR107	*Chaetodipus fallax fallax*	northwestern San Diego pocket mouse	Y	1

Appendix A. Con't				
PR108	*Peromyscus maniculatus*	deer mouse	N	2
PR109	*Peromyscus maniculatus*	deer mouse	N	1
PR110	*Dipodomys stephensi*	Stephens' kangaroo rat	Y	1
PR113	*Chaetodipus fallax fallax*	northwestern San Diego pocket mouse	Y	1
	Dipodomys simulans	Dulzura kangaroo rat	Y	1
	Peromyscus maniculatus	deer mouse	N	3
PR114	*Dipodomys simulans*	Dulzura kangaroo rat	Y	1
	Peromyscus maniculatus	deer mouse	N	2
PR115	*Chaetodipus fallax fallax*	northwestern San Diego pocket mouse	Y	1
	Peromyscus boylii	brush mouse	N	1
	Peromyscus maniculatus	deer mouse	N	5
PR116	*Chaetodipus fallax fallax*	northwestern San Diego pocket mouse	Y	1
	Dipodomys stephensi	Stephens' kangaroo rat	Y	2
	Peromyscus maniculatus	deer mouse	N	1
PR117	*Dipodomys stephensi*	Stephens' kangaroo rat	Y	1
PR118	*Chaetodipus fallax fallax*	northwestern San Diego pocket mouse	Y	1
	Peromyscus maniculatus	deer mouse	N	7
PR119	*Chaetodipus fallax fallax*	northwestern San Diego pocket mouse	Y	10
PR121	*Chaetodipus fallax fallax*	northwestern San Diego pocket mouse	Y	5
	Dipodomys simulans	Dulzura kangaroo rat	Y	1
	Dipodomys spp	unidentified kangaroo rat	-	1
PR122	*Peromyscus maniculatus*	deer mouse	N	1
PR123	*Dipodomys simulans*	Dulzura kangaroo rat	Y	1
	Peromyscus maniculatus	deer mouse	N	10
PR126	*Chaetodipus fallax fallax*	northwestern San Diego pocket mouse	Y	1
	Peromyscus maniculatus	deer mouse	N	1
PR127	*Dipodomys simulans*	Dulzura kangaroo rat	Y	1
PR130	*Dipodomys simulans*	Dulzura kangaroo rat	Y	1
	Peromyscus maniculatus	deer mouse	N	1
PR131	*Thomomys bottae*	Botta's pocket gopher	N	1
PR136	*Dipodomys simulans*	Dulzura kangaroo rat	Y	2
	Peromyscus maniculatus	deer mouse	N	2
PR139	*Peromyscus maniculatus*	deer mouse	N	1
PR141	*Dipodomys simulans*	Dulzura kangaroo rat	Y	1
PR142	*Chaetodipus fallax fallax*	northwestern San Diego pocket mouse	Y	2
PR143	*Dipodomys simulans*	Dulzura kangaroo rat	Y	2
PR145	*Dipodomys simulans*	Dulzura kangaroo rat	Y	1
PR154	*Dipodomys simulans*	Dulzura kangaroo rat	Y	2
PR156	*Chaetodipus fallax fallax*	northwestern San Diego pocket mouse	Y	5
	Dipodomys spp	unidentified kangaroo rat	-	1
	Dipodomys simulans	Dulzura kangaroo rat	Y	2
	Dipodomys stephensi	Stephens' kangaroo rat	Y	2
	Thomomys bottae	Botta's pocket gopher	N	1

Appendix A. Con't				
PR157	*Dipodomys stephensi*	Stephens' kangaroo rat	Y	1
PR158	*Chaetodipus fallax fallax*	northwestern San Diego pocket mouse	Y	5
	Dipodomys simulans	Dulzura kangaroo rat	Y	1
PR159	*Reithrodontomys megalotis*	western harvest mouse	N	1
PR160	*Dipodomys simulans*	Dulzura kangaroo rat	Y	2
	Peromyscus maniculatus	deer mouse	N	7
PR161	*Chaetodipus fallax fallax*	northwestern San Diego pocket mouse	Y	1
PR166	*Dipodomys simulans*	Dulzura kangaroo rat	Y	1
	Dipodomys stephensi	Stephens' kangaroo rat	Y	2
	Peromyscus maniculatus	deer mouse	N	2
PR167	*Dipodomys simulans*	Dulzura kangaroo rat	Y	5
	Dipodomys stephensi	Stephens' kangaroo rat	Y	2
	Peromyscus maniculatus	deer mouse	N	5
PR168	*Peromyscus maniculatus*	deer mouse	N	2
PR169	*Dipodomys simulans*	Dulzura kangaroo rat	Y	2
WV001	*Dipodomys simulans*	Dulzura kangaroo rat	Y	4
WV002	*Chaetodipus fallax fallax*	northwestern San Diego pocket mouse	Y	1
WV003	*Dipodomys simulans*	Dulzura kangaroo rat	Y	4
WV004	*Dipodomys simulans*	Dulzura kangaroo rat	Y	1
WV005	*Dipodomys simulans*	Dulzura kangaroo rat	Y	3
WV006	*Dipodomys simulans*	Dulzura kangaroo rat	Y	2
	Peromyscus maniculatus	deer mouse	N	2
WV007	*Dipodomys simulans*	Dulzura kangaroo rat	Y	4
	Peromyscus maniculatus	deer mouse	N	2
WV008	*Chaetodipus fallax fallax*	northwestern San Diego pocket mouse	Y	3
	Dipodomys simulans	Dulzura kangaroo rat	Y	2
	Reithrodontomys megalotis	western harvest mouse	N	1
WV009	*Chaetodipus fallax fallax*	northwestern San Diego pocket mouse	Y	5
	Dipodomys simulans	Dulzura kangaroo rat	Y	1
	Peromyscus maniculatus	deer mouse	N	1
WV010	*Chaetodipus fallax fallax*	northwestern San Diego pocket mouse	Y	3
	Dipodomys simulans	Dulzura kangaroo rat	Y	1