

# Rare Butterfly Monitoring and Translocation

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TASK 1.5

*HERMES COPPER SURVEY - 2018*

*19 August 2018*

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**SAN DIEGO STATE  
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## Executive Summary

The Hermes copper (*Lycaena hermes*) is a rare butterfly endemic to San Diego County and northern Baja California. This species is threatened by recent urbanization and wildfires throughout its range in the United States. Since most individuals and larger populations are found in the southern portion of San Diego County, one large fire could nearly extirpate the species. Wildfires in 2003 and 2007 have already caused extirpations in this region and few recolonizations have been observed.

Past efforts have contributed to our understanding of the distribution of the Hermes copper so it is fairly well understood. However, there may still be unknown populations. Surveys associated with the SDG&E Sunrise Powerlink Project discovered several populations by searching linear transects through Cleveland National Forest without specifically targeting Hermes copper. Based on these results, we thought that additional surveys through potential habitat could yield detections of unknown populations.

The objective of this project was to search for these populations by conducting surveys in areas not previously searched. Surveys were also conducted in the Elfin Forest area, near previously occupied areas, and three sites that experiences wildfires since 2003 to assess recolonization. During the 2018 flight season, we conducted surveys for Hermes copper adults at 35 sites (transects) determined in consultation with USFWS and USFS biologists. These sites were selected based on habitat, proximity to known populations, and considered previous survey efforts and results.

The 2018 Hermes copper flight season started the last couple days of May and extended through the first three weeks of June. This flight season started later than in recent years. Hermes copper adults were detected along only three transects, including at least 55 different adults on the CNF07 transect, 8 on CNF08, and 1 along the maintained Boulder Creek Road. There were no observations at the other transects. Most sites were experiencing very dry conditions, represented by suppressed butterfly numbers, regardless of species, and water stressed plants.

## Introduction

The Hermes copper (*Lycaena hermes*) is a rare butterfly endemic to San Diego County and northern Baja California. This species is threatened by recent urbanization and wildfires throughout its range in the United States. In April of 2011, the United States Fish and Wildlife Service (USFWS) issued a 12-month finding which concluded that listing the Hermes copper butterfly as threatened or endangered was warranted, and is currently on the USFWS list of candidate species (USFWS 2011).

Over the years, there have been several efforts to describe the Hermes copper distribution (Figure 1) over large geographic areas (more than one or a few sites/preserves). This started with Thorne (1963) publishing the first distributional map. More recently, since 2002, Marschalek and Deutschman at San Diego State University have maintained a research program focusing on this species (e.g. Marschalek and Deutschman 2008, Marschalek and Klein 2010). Finally, wide-ranging surveys were conducted in 2010 throughout many areas in Cleveland National Forest in preparation for the SDG&E Sunrise Powerlink Project (Chambers Group, Inc 2011).

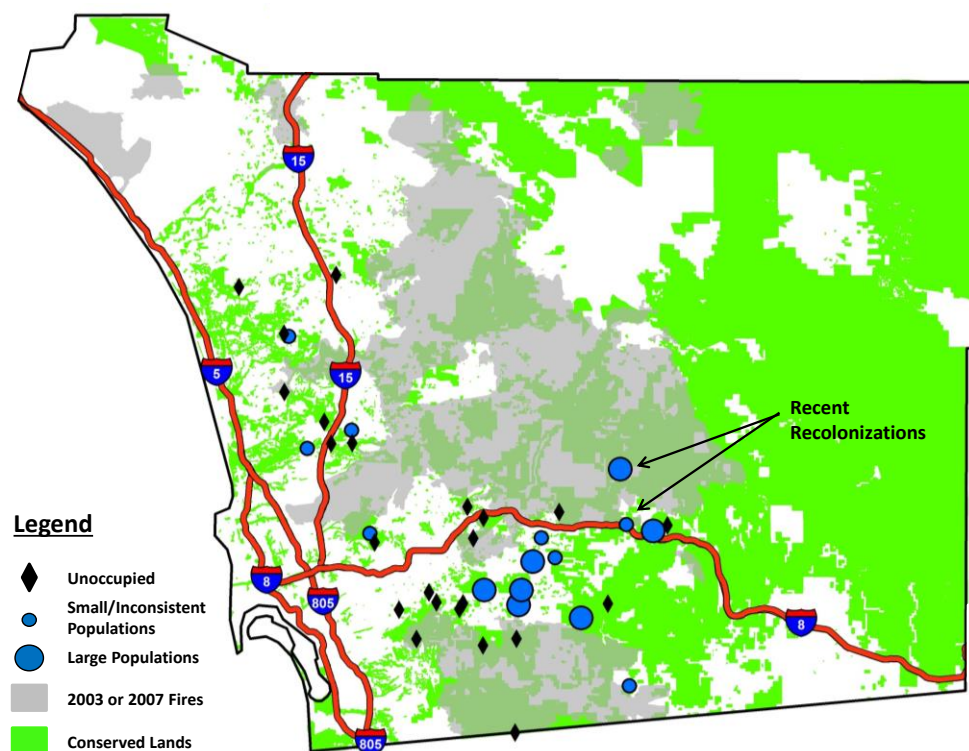


Figure 1. Detections of Hermes copper butterflies on conserved lands, 2010-2013. Sampling locations where Hermes copper was not detected are represented by black diamonds. Small and large Hermes copper populations are indicated by different sized circles.

Despite these efforts, there are still areas in San Diego County that may have unknown Hermes copper populations or harbor the majority of a known population. Considering Chambers Group, Inc (2011) were able to document several large local populations by surveying transects determined by infrastructure rather than habitat, there may be other areas occupied by Hermes copper. The goal of this project was to search for these populations by conducting surveys in areas not previously searched. Surveys were also conducted in the Elfin Forest area, near previously occupied areas. This report describes the field work conducted during the 2018 Hermes copper flight season.

## **Methods**

In 2018, we conducted surveys for Hermes copper adults at 35 transects (Figure 2) determined in consultation with USFWS and USFS biologists and considering previous survey efforts and results. Slight modifications were made to sites surveyed in the middle of the flight season when spiny redberry plants were not found at particular locations. Our goal was to assess presence/absence of Hermes copper at each site and qualitatively determine the relative population size if present. The location of each Hermes copper observation was recorded with a handheld GPS unit. We also recorded the general location of redberry patches. If a redberry plant or patch was observed from the transect, a GPS point was recorded on the transect. All surveys were conducted during periods of appropriate weather (sunny or partly sunny, 20 to 35 degrees C, and modest wind speeds) between 900 to 1500. Each site was surveyed roughly one time per week during the four-week flight season (late May- late June).

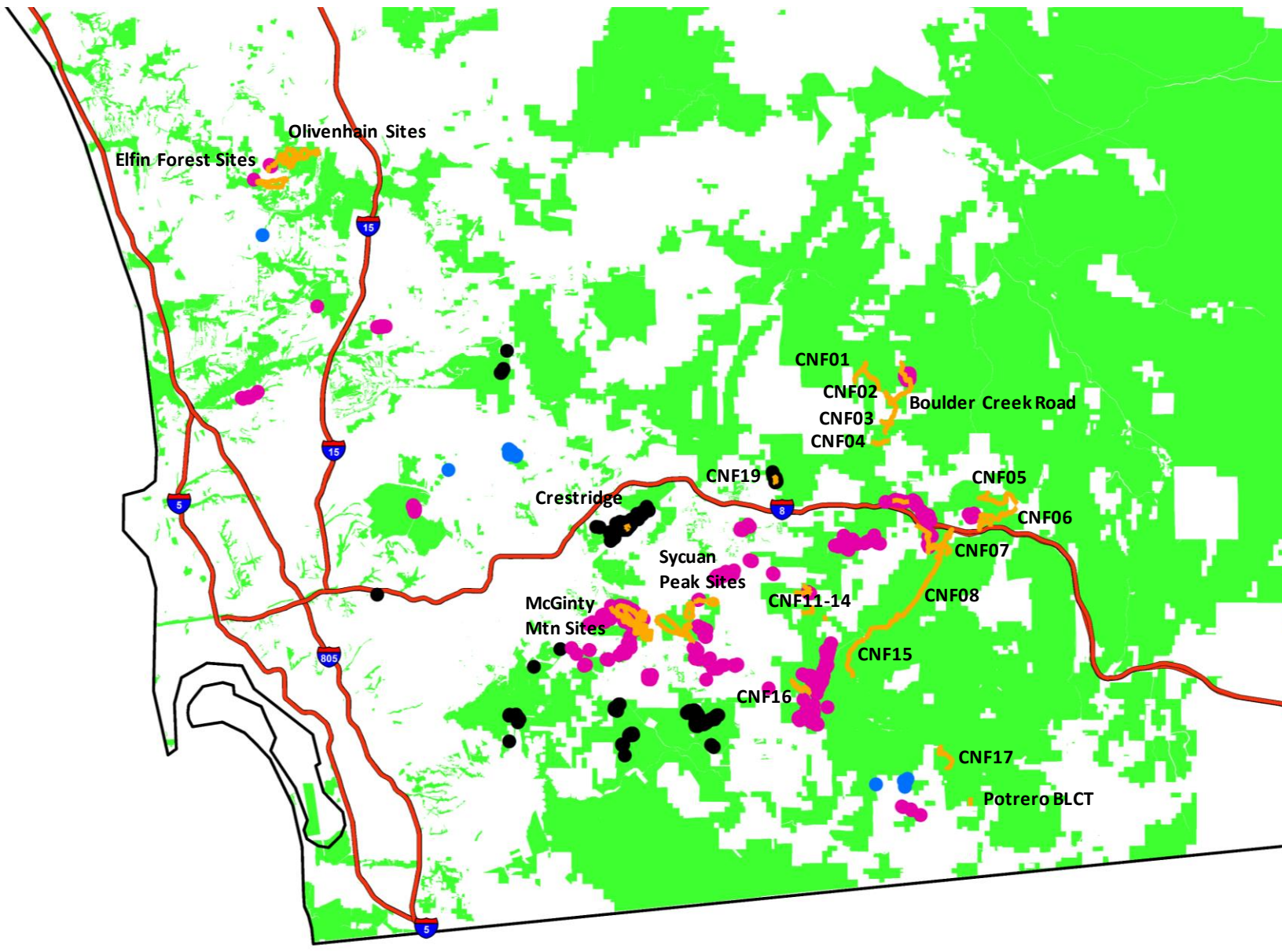


Figure 2. Map of sites that were surveyed for Hermes copper in 2018, with survey transect shown in orange and labeled. Purple and black circles represent extant populations and extirpated populations, respectively. Blue circles denote sites of unknown status. Green shading are conserved lands (SANDAG).



## Results

May was cool and cloudy, resulting in a later flight season compared to previous years. The first Hermes copper was observed on 29 May along Boulder Creek Road. Of the 35 transects we surveyed, we detected the presence of Hermes copper adults at only three (Table 1). This includes a large local population along the CNF07 transect in Cleveland National Forest, with at least 55 individuals present. The second highest count (8 individuals) was found along transect CNF08, which was immediately south and adjacent to the CNF07. A single individual was observed while walking a 10 km (6 mile) length of Boulder Creek Road.

A few modifications to the original sampling plan were made after starting surveys. No redberry plants were detected along the Olivenhain 1 and 2 transects so they were only surveyed on the initial day (29 May 2018). No redberry was detected on CNF17 and Sycuan Area N so those sites were replaced by the Potrero BCLT and Sycuan 2 transects, respectively. The McGinty Mountain transects were difficult to impossible to completely survey due to dense, tall vegetation and very steep terrain. With no Hermes copper observations early in the flight season, we chose to survey the flatter, top portion (McGinty Loop). This is an area where we have seen many Hermes copper adults in previous years (2010, 2011- Deutschman et al. 2011) but did not detect Hermes copper adults in 2018.

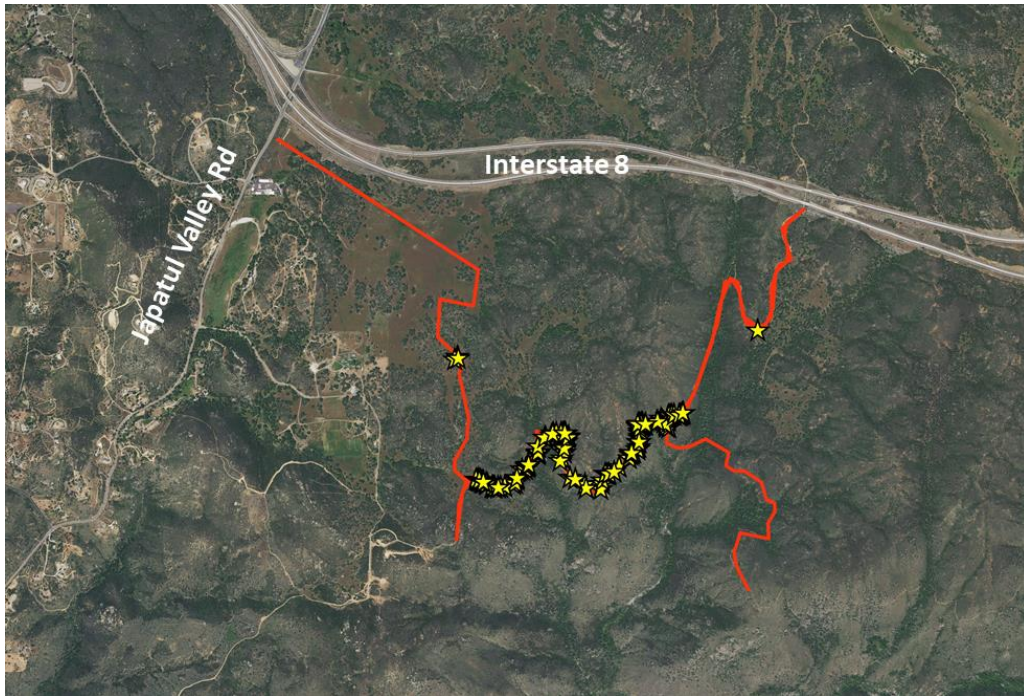
Transects CNF01 and CNF04 did not have redberry in the immediate area so we stopped surveying these sites after the peak of the flight season. Since Hermes copper adults were detected in the general region, surveys did not stop as early as at Olivenhain. Crestridge Ecological Reserve and Wildwood Glen Lane transects were added. We also walk about a 10 km (6 mile) stretch of Boulder Creek Road on 8 June since early observations were along this road and relatively high numbers of Hermes have been observed in this area in past years (Marschalek and Deutschman 2018). Surprisingly, there was little redberry in the immediate area of the road (visible from the road) and only one Hermes copper adult was detected.



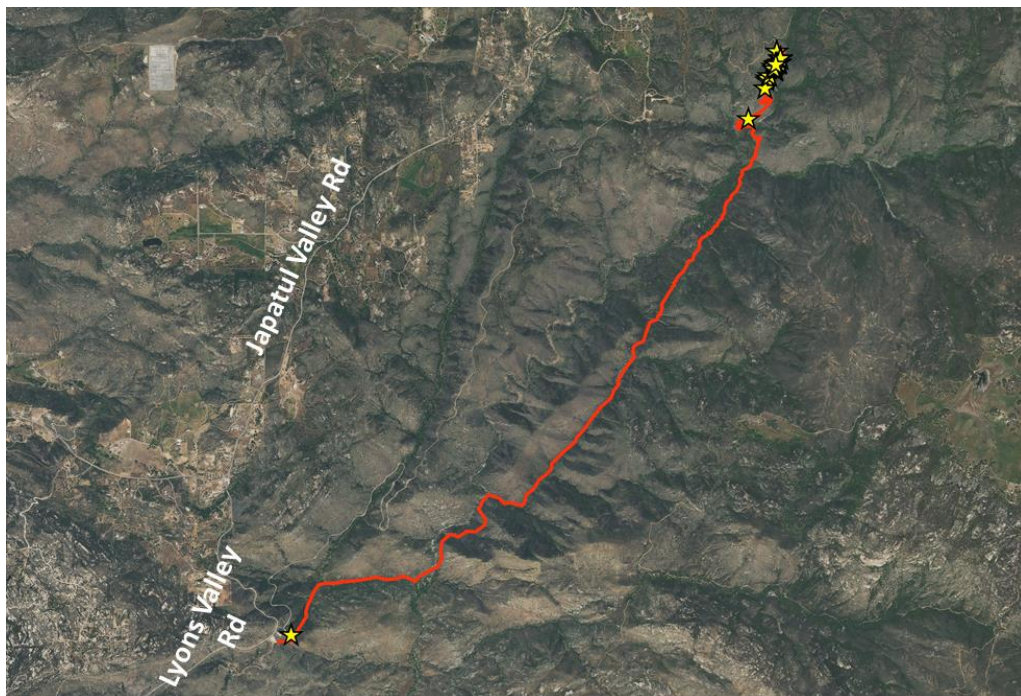
**Table 1. Maximum count of Hermes copper adults and dates of surveys for each survey transect.**

Site	Hermes Copper Maximum Count	Survey Dates								
Boulder Creek Road*	1	8-Jun-18								
CNF01	0	25-May-18	1-Jun-18	14-Jun-18						
CNF02	0	24-May-18	7-Jun-18	14-Jun-18	19-Jun-18	26-Jun-18				
CNF03	0	23-May-18	24-May-18	7-Jun-18	14-Jun-18	19-Jun-18	26-Jun-18			
CNF04	0	24-May-18	4-Jun-18							
CNF05	0	25-May-18	1-Jun-18	8-Jun-18	15-Jun-18	21-Jun-18	27-Jun-18			
CNF06	0	25-May-18	1-Jun-18	8-Jun-18	15-Jun-18	21-Jun-18	27-Jun-18			
CNF07	55	25-May-18	31-May-18	7-Jun-18	9-Jun-18	11-Jun-18	13-Jun-18	20-Jun-18	22-Jun-18	26-Jun-18
CNF08	8	31-May-18	7-Jun-18	11-Jun-18	15-Jun-18	19-Jun-18	26-Jun-18			
CNF11	0	24-May-18	31-May-18	7-Jun-18	14-Jun-18	22-Jun-18	28-Jun-18			
CNF12	0	24-May-18	31-May-18	7-Jun-18	14-Jun-18	22-Jun-18	28-Jun-18			
CNF13	0	24-May-18	31-May-18	7-Jun-18	14-Jun-18	22-Jun-18	28-Jun-18			
CNF14	0	24-May-18	31-May-18	7-Jun-18	14-Jun-18	22-Jun-18	28-Jun-18			
CNF15	0	24-May-18	31-May-18	7-Jun-18	12-Jun-18	20-Jun-18	25-Jun-18			
CNF16	0	1-Jun-18	8-Jun-18	14-Jun-18	1-Jun-18					
CNF17	0	25-May-18	1-Jun-18							
CNF19	0	25-May-18	29-May-18	5-Jun-18	12-Jun-18	27-Jun-18				
Crestridge	0	5-Jun-18	12-Jun-18							
Elfin Forest	0	29-May-18	5-Jun-18	12-Jun-18	19-Jun-18	27-Jun-18				
Elfin Forest S Area	0	6-Jun-18	13-Jun-18							
Elfin Forest West	0	6-Jun-18								
McGinty 1	0	5-Jun-18	25-Jun-18							
McGinty Area 01	0	28-May-18	6-Jun-18							
McGinty Area 02	0	28-May-18	5-Jun-18							
McGinty Area 03	0	5-Jun-18								
McGinty Loop	0	11-Jun-18	19-Jun-18							
Olivenhain 01	0	29-May-18								
Olivenhain 02	0	29-May-18								
Potrero BCLT	0	8-Jun-18	15-Jun-18	22-Jun-18						
Sycuan 1	0	25-May-18	7-Jun-18	12-Jun-18	21-Jun-18	27-Jun-18				
Sycuan 2	0	21-Jun-18	28-Jun-18							
Sycuan Area E	0	29-May-18	4-Jun-18	11-Jun-18						
Sycuan Area N	0	29-May-18	4-Jun-18	14-Jun-18	21-Jun-18	28-Jun-18				
Sycuan Area W	0	4-Jun-18	20-Jun-18	26-Jun-18						
Wildwood Glen Lane	0	17-May-18	7-Jun-18	12-Jun-18	18-Jun-18	25-Jun-18				

\*Not the sentinel site



**Figure 3. Hermes copper observations along the CNF07 transect. Transect route represented by the red line and each Hermes copper observation represented by a yellow star.**



**Figure 4. Hermes copper observations along the CNF08 transect. Transect route represented by the red line and each Hermes copper observation represented by a yellow star.**

## Discussion

Overall, the number of Hermes copper adults and the number of sites that had flying adults in 2018 was low compared to those observed over the last 15 years. But this is a common observation over the last four years as rainfall (Nov-May) has been well below average for three of these years and spring rainfall (Mar-May) has been extremely low all four years.

Despite the suboptimal conditions, we were able to discover a large local population in Cleveland National Forest along transect CNF07. Hermes copper was known from this general area, but the large population size was not fully understood. To our knowledge, few historic observations of Hermes copper exist to the northwest of the dirt road where we recorded this population. This includes four individuals on 2 June 2009 and three individuals on 4 June 2009 (HDR & E2M 2009). These are likely part of the same population. Most of the sightings on CNF08 were adjacent to this area and are likely part of the same population as well.

In 1930, William S. Wright, curator of the San Diego Natural History Museum entomology collection, wrote about the butterflies of San Diego County (Wright 1930). This included the following about Hermes copper:

“Its beautiful combination of brown and yellow makes it a veritable fairy and gives untold joy to the collector fortunate enough to get one. Its trysting places are being rapidly taken over by realtors and the species may soon become extinct, unless colonies yet undiscovered are located in other regions.”

It has been decades since Hermes copper has been detected in Mission Valley where it once occurred; however, a number of new populations have been found further east since 1930. It appears that the eastern limit of the distribution is relatively well described as. Based on our results this year, as well as previous years (Marschalek and Deutschman 2015; 2016a,b; 2017), it appears that the easternmost populations at higher elevations are more resilient to drought. Few adults have been detected at lower elevation sites over the last four years and these observations were restricted to immediately east of Jamul.

## Acknowledgements

We would like to thank many people for assistance with this project, including permits, access to reserves, and sharing of data. These include, but are not limited to (alphabetically): California Department of Fish & Wildlife, Endangered Habitats League, Escondido Creek Conservancy, San Diego Gas and Electric, United States Fish & Wildlife Service, and United States Forest Service. We would also like to thank the following people for assisting with these surveys:

Also, much appreciation to our field crew (Jen Blackhall, Cory Blackwelder, Kimberly Cole, Emily Dunlap, Halia Eastburn, David Faulkner, Gabriel Greenberg-Pines, Brandon Grubaugh, Julia Hoopes, Sam O'Dell, Hannah Ogden, Sophia Smith, Dalton Whittle), volunteers (Jenille Daly, Ekaterina Gracheva, Lance Heinemann, Amanda Miller, Karina Ornelas, Heather Hough), and Elyse Levy (CDFW) and Eric Hollenbeck (CDFW) for assistance conducting butterfly surveys and/or habitat assessments.

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## Appendix A. GPS coordinates of Hermes copper adults in 2018.

Date	Site	Latitude	Longitude
1-Jun-18	Boulder Creek	32.929608	-116.636217
4-Jun-18	Boulder Creek	32.929341	-116.635315
7-Jun-18	CNF 07	32.808532	-116.613866
7-Jun-18	CNF 07	32.808661	-116.61419
7-Jun-18	CNF 07	32.808664	-116.608627
7-Jun-18	CNF 07	32.808673	-116.612699
7-Jun-18	CNF 07	32.808686	-116.607654
7-Jun-18	CNF 07	32.808686	-116.607654
7-Jun-18	CNF 07	32.808686	-116.607654
7-Jun-18	CNF 07	32.808776	-116.614396
7-Jun-18	CNF 07	32.808862	-116.612502
7-Jun-18	CNF 07	32.808878	-116.612516
7-Jun-18	CNF 07	32.809141	-116.607356
7-Jun-18	CNF 07	32.809496	-116.60668
7-Jun-18	CNF 07	32.809496	-116.60668
7-Jun-18	CNF 07	32.809536	-116.611902
7-Jun-18	CNF 07	32.809536	-116.611902
7-Jun-18	CNF 07	32.809578	-116.611858
7-Jun-18	CNF 07	32.809578	-116.611858
7-Jun-18	CNF 07	32.809578	-116.611858
7-Jun-18	CNF 07	32.810162	-116.611304
7-Jun-18	CNF 07	32.810176	-116.605945
7-Jun-18	CNF 07	32.810176	-116.605945
7-Jun-18	CNF 07	32.81018	-116.605861
7-Jun-18	CNF 07	32.81018	-116.605861
7-Jun-18	CNF 07	32.81018	-116.605861
7-Jun-18	CNF 07	32.810358	-116.60981
7-Jun-18	CNF 07	32.810429	-116.605565
7-Jun-18	CNF 07	32.810429	-116.605565
7-Jun-18	CNF 07	32.810883	-116.610902
7-Jun-18	CNF 07	32.810945	-116.605502
7-Jun-18	CNF 07	32.810945	-116.605502
7-Jun-18	CNF 07	32.810945	-116.605502
7-Jun-18	CNF 07	32.810945	-116.605502
7-Jun-18	CNF 07	32.810945	-116.605502
7-Jun-18	CNF 07	32.811074	-116.60972
7-Jun-18	CNF 07	32.811075	-116.609886
7-Jun-18	CNF 07	32.811075	-116.609886



Appendix A. GPS coordinates of Hermes copper adults in 2018 continued.

Date	Site	Latitude	Longitude
7-Jun-18	CNF 07	32.811094	-116.609849
7-Jun-18	CNF 07	32.811551	-116.605526
7-Jun-18	CNF 07	32.811621	-116.60455
7-Jun-18	CNF 07	32.811621	-116.60455
7-Jun-18	CNF 07	32.811621	-116.60455
7-Jun-18	CNF 07	32.811632	-116.6045
7-Jun-18	CNF 07	32.811946	-116.603755
7-Jun-18	CNF 07	32.811946	-116.603755
7-Jun-18	CNF 07	32.811946	-116.603755
7-Jun-18	CNF 07	32.811946	-116.603755
7-Jun-18	CNF 07	32.811968	-116.603239
7-Jun-18	CNF 07	32.811968	-116.603239
7-Jun-18	CNF 07	32.811968	-116.603239
7-Jun-18	CNF 07	32.814749	-116.61588
7-Jun-18	CNF 08	32.747654	-116.666397
7-Jun-18	CNF 08	32.810595	-116.603871
8-Jun-18	Boulder Creek Road	32.925988	-116.632097
8-Jun-18	Roberts Ranch North	32.827884	-116.614336
9-Jun-18	Boulder Creek Road	32.92683	-116.631532
9-Jun-18	CNF 07	32.808427	-116.60773
9-Jun-18	CNF 07	32.808476	-116.608557
9-Jun-18	CNF 07	32.80851	-116.613757
9-Jun-18	CNF 07	32.80851	-116.613757
9-Jun-18	CNF 07	32.808696	-116.61423
9-Jun-18	CNF 07	32.808786	-116.614475
9-Jun-18	CNF 07	32.808792	-116.614502
9-Jun-18	CNF 07	32.808847	-116.614628
9-Jun-18	CNF 07	32.808847	-116.607621
9-Jun-18	CNF 07	32.808979	-116.61247
9-Jun-18	CNF 07	32.808979	-116.609482
9-Jun-18	CNF 07	32.809164	-116.607462
9-Jun-18	CNF 07	32.809364	-116.6122
9-Jun-18	CNF 07	32.809541	-116.611877
9-Jun-18	CNF 07	32.809541	-116.611877
9-Jun-18	CNF 07	32.809903	-116.606107
9-Jun-18	CNF 07	32.809905	-116.609919
9-Jun-18	CNF 07	32.810073	-116.606035
9-Jun-18	CNF 07	32.81009	-116.611308
9-Jun-18	CNF 07	32.810152	-116.605967

\*Not associated with standard transect sampling at the Boulder Creek Road sentinel site.



Appendix A. GPS coordinates of Hermes copper adults in 2018 continued.

Date	Site	Latitude	Longitude
9-Jun-18	CNF 07	32.810167	-116.61129
9-Jun-18	CNF 07	32.810201	-116.611274
9-Jun-18	CNF 07	32.810407	-116.609814
9-Jun-18	CNF 07	32.810687	-116.609756
9-Jun-18	CNF 07	32.810862	-116.605516
9-Jun-18	CNF 07	32.810865	-116.610902
9-Jun-18	CNF 07	32.810987	-116.610525
9-Jun-18	CNF 07	32.810987	-116.610525
9-Jun-18	CNF 07	32.811066	-116.609871
9-Jun-18	CNF 07	32.811076	-116.609733
9-Jun-18	CNF 07	32.811152	-116.605484
9-Jun-18	CNF 07	32.811315	-116.605499
9-Jun-18	CNF 07	32.811441	-116.605607
9-Jun-18	CNF 07	32.811441	-116.605607
9-Jun-18	CNF 07	32.811445	-116.605606
9-Jun-18	CNF 07	32.811459	-116.60399
9-Jun-18	CNF 07	32.811531	-116.605331
9-Jun-18	CNF 07	32.811546	-116.605358
9-Jun-18	CNF 07	32.81155	-116.605359
9-Jun-18	CNF 07	32.811597	-116.604536
9-Jun-18	CNF 07	32.811615	-116.604131
9-Jun-18	CNF 07	32.811617	-116.604131
9-Jun-18	CNF 07	32.8117	-116.604214
9-Jun-18	CNF 07	32.811802	-116.604293
11-Jun-18	Boulder Creek	32.925844	-116.632295
11-Jun-18	Boulder Creek	32.926001	-116.632086
11-Jun-18	Boulder Creek	32.926125	-116.631948
11-Jun-18	Boulder Creek	32.926192	-116.631147
11-Jun-18	Boulder Creek	32.926319	-116.631384
11-Jun-18	Boulder Creek	32.92713	-116.631982
11-Jun-18	Boulder Creek	32.928995	-116.63479
11-Jun-18	CNF 07	32.808519	-116.613576
11-Jun-18	CNF 07	32.808526	-116.613783
11-Jun-18	CNF 07	32.808531	-116.613834
11-Jun-18	CNF 07	32.808533	-116.613425
11-Jun-18	CNF 07	32.808684	-116.614181
11-Jun-18	CNF 07	32.808707	-116.614247
11-Jun-18	CNF 07	32.808722	-116.612586
11-Jun-18	CNF 07	32.80877	-116.614422

Appendix A. GPS coordinates of Hermes copper adults in 2018 continued.

Date	Site	Latitude	Longitude
11-Jun-18	CNF 07	32.808851	-116.614575
11-Jun-18	CNF 07	32.808861	-116.614678
11-Jun-18	CNF 07	32.809135	-116.607274
11-Jun-18	CNF 07	32.809137	-116.607271
11-Jun-18	CNF 07	32.809138	-116.607278
11-Jun-18	CNF 07	32.809481	-116.611888
11-Jun-18	CNF 07	32.810175	-116.609797
11-Jun-18	CNF 07	32.810179	-116.611296
11-Jun-18	CNF 07	32.810453	-116.611275
11-Jun-18	CNF 07	32.810655	-116.609739
11-Jun-18	CNF 07	32.810878	-116.610858
11-Jun-18	CNF 07	32.811083	-116.610416
11-Jun-18	CNF 07	32.811084	-116.609974
11-Jun-18	CNF 07	32.811094	-116.609841
11-Jun-18	CNF 07	32.811095	-116.609836
11-Jun-18	CNF 07	32.811101	-116.609828
11-Jun-18	CNF 07	32.811103	-116.609831
11-Jun-18	CNF 07	32.811363	-116.605522
11-Jun-18	CNF 07	32.811407	-116.60557
11-Jun-18	CNF 07	32.811411	-116.605579
11-Jun-18	CNF 07	32.811411	-116.605578
11-Jun-18	CNF 07	32.811562	-116.605397
11-Jun-18	CNF 07	32.811698	-116.603878
11-Jun-18	CNF 07	32.81186	-116.603882
11-Jun-18	CNF 07	32.811867	-116.603878
11-Jun-18	CNF 07	32.81187	-116.603877
11-Jun-18	CNF 07	32.811873	-116.603874
11-Jun-18	CNF 07	32.811939	-116.603291
11-Jun-18	CNF 07	32.811957	-116.603554
11-Jun-18	CNF 07	32.811984	-116.603158
11-Jun-18	CNF 07	32.812015	-116.603111
11-Jun-18	CNF 07	32.812026	-116.603089
11-Jun-18	CNF 07	32.815998	-116.598798
11-Jun-18	CNF 08	32.807476	-116.605162
11-Jun-18	CNF 08	32.807691	-116.605116
11-Jun-18	CNF 08	32.807971	-116.604806
11-Jun-18	CNF 08	32.808524	-116.604017
11-Jun-18	CNF 08	32.809407	-116.603497
11-Jun-18	CNF 08	32.809856	-116.603371

Appendix A. GPS coordinates of Hermes copper adults in 2018 continued.

Date	Site	Latitude	Longitude
11-Jun-18	Roberts Ranch North	32.828008	-116.614083
11-Jun-18	Skyline Truck Trail 2	32.730574	-116.79759
11-Jun-18	Skyline Truck Trail 2	32.73081	-116.797103
13-Jun-18	Boulder Creek	32.925833	-116.633702
13-Jun-18	Boulder Creek	32.926346	-116.631317
13-Jun-18	Boulder Creek	32.926623	-116.631413
13-Jun-18	Boulder Creek	32.926802	-116.631548
13-Jun-18	Boulder Creek	32.926862	-116.631537
13-Jun-18	Boulder Creek	32.927073	-116.631597
13-Jun-18	Boulder Creek	32.928067	-116.634926
13-Jun-18	Boulder Creek	32.928381	-116.634865
13-Jun-18	Boulder Creek	32.929244	-116.634767
13-Jun-18	Boulder Creek	32.929398	-116.635054
13-Jun-18	Boulder Creek	32.929944	-116.634075
13-Jun-18	Boulder Creek	32.930066	-116.631221
13-Jun-18	CNF 07	32.808537	-116.61384
13-Jun-18	CNF 07	32.808563	-116.613184
13-Jun-18	CNF 07	32.808695	-116.61424
13-Jun-18	CNF 07	32.808793	-116.614441
13-Jun-18	CNF 07	32.808843	-116.614565
13-Jun-18	CNF 07	32.808871	-116.614713
13-Jun-18	CNF 07	32.808875	-116.614746
13-Jun-18	CNF 07	32.808894	-116.61482
13-Jun-18	CNF 07	32.8089	-116.609175
13-Jun-18	CNF 07	32.808969	-116.612499
13-Jun-18	CNF 07	32.809154	-116.607263
13-Jun-18	CNF 07	32.80926	-116.606971
13-Jun-18	CNF 07	32.809393	-116.612005
13-Jun-18	CNF 07	32.809498	-116.611916
13-Jun-18	CNF 07	32.809504	-116.611916
13-Jun-18	CNF 07	32.809556	-116.611892
13-Jun-18	CNF 07	32.809784	-116.610038
13-Jun-18	CNF 07	32.810156	-116.606
13-Jun-18	CNF 07	32.810168	-116.606023
13-Jun-18	CNF 07	32.81034	-116.605619
13-Jun-18	CNF 07	32.810464	-116.611306
13-Jun-18	CNF 07	32.810647	-116.605563
13-Jun-18	CNF 07	32.810673	-116.609748
13-Jun-18	CNF 07	32.810685	-116.60557

Appendix A. GPS coordinates of Hermes copper adults in 2018 continued.

Date	Site	Latitude	Longitude
13-Jun-18	CNF 07	32.810727	-116.609725
13-Jun-18	CNF 07	32.810893	-116.61091
13-Jun-18	CNF 07	32.810955	-116.609554
13-Jun-18	CNF 07	32.811065	-116.605498
13-Jun-18	CNF 07	32.811076	-116.605502
13-Jun-18	CNF 07	32.811089	-116.60999
13-Jun-18	CNF 07	32.811103	-116.610251
13-Jun-18	CNF 07	32.811105	-116.609758
13-Jun-18	CNF 07	32.811197	-116.605476
13-Jun-18	CNF 07	32.811353	-116.605519
13-Jun-18	CNF 07	32.811368	-116.603855
13-Jun-18	CNF 07	32.811416	-116.603985
13-Jun-18	CNF 07	32.811419	-116.605603
13-Jun-18	CNF 07	32.81144	-116.605601
13-Jun-18	CNF 07	32.811501	-116.605201
13-Jun-18	CNF 07	32.81151	-116.605621
13-Jun-18	CNF 07	32.811536	-116.605357
13-Jun-18	CNF 07	32.811553	-116.605445
13-Jun-18	CNF 07	32.811644	-116.604529
13-Jun-18	CNF 07	32.811787	-116.603893
13-Jun-18	CNF 07	32.811877	-116.603906
13-Jun-18	CNF 07	32.811878	-116.6039
13-Jun-18	CNF 07	32.811912	-116.60388
13-Jun-18	CNF 07	32.811937	-116.603847
13-Jun-18	CNF 07	32.811939	-116.603842
13-Jun-18	CNF 07	32.81194	-116.603763
13-Jun-18	CNF 07	32.811941	-116.603843
13-Jun-18	CNF 07	32.811962	-116.603233
13-Jun-18	CNF 07	32.811967	-116.603578
13-Jun-18	CNF 07	32.811971	-116.603694
13-Jun-18	CNF 07	32.814612	-116.616034
13-Jun-18	Roberts Ranch North	32.828182	-116.613837
15-Jun-18	Boulder Creek	32.925437	-116.633065
15-Jun-18	Boulder Creek	32.926187	-116.631855
15-Jun-18	Boulder Creek	32.926193	-116.631282
15-Jun-18	Boulder Creek	32.926205	-116.63185
15-Jun-18	Boulder Creek	32.926373	-116.631241
15-Jun-18	Boulder Creek	32.926738	-116.631647
15-Jun-18	Boulder Creek	32.927125	-116.631588

Appendix A. GPS coordinates of Hermes copper adults in 2018 continued.

Date	Site	Latitude	Longitude
15-Jun-18	Boulder Creek	32.927648	-116.635029
15-Jun-18	Boulder Creek	32.928065	-116.634908
15-Jun-18	Boulder Creek	32.928069	-116.634909
15-Jun-18	Boulder Creek	32.92935	-116.631014
15-Jun-18	Boulder Creek	32.929391	-116.635051
15-Jun-18	Boulder Creek	32.929942	-116.634046
15-Jun-18	CNF 08	32.803322	-116.607517
15-Jun-18	CNF 08	32.806618	-116.605398
15-Jun-18	CNF 08	32.807946	-116.60481
15-Jun-18	CNF 08	32.808641	-116.603965
15-Jun-18	CNF 08	32.808943	-116.604332
15-Jun-18	CNF 08	32.809889	-116.603349
18-Jun-18	Boulder Creek	32.928047	-116.634925
18-Jun-18	Boulder Creek	32.928063	-116.631298
18-Jun-18	Boulder Creek	32.928617	-116.634833
18-Jun-18	Boulder Creek	32.929283	-116.634746
18-Jun-18	Boulder Creek	32.929283	-116.634742
18-Jun-18	Boulder Creek	32.929402	-116.634721
18-Jun-18	Boulder Creek	32.929476	-116.634702
18-Jun-18	Boulder Creek	32.930967	-116.632676
19-Jun-18	CNF 08	32.80871	-116.604211
19-Jun-18	CNF 08	32.808953	-116.604332
19-Jun-18	CNF 08	32.809184	-116.60408
19-Jun-18	CNF 08	32.809285	-116.603608
19-Jun-18	CNF 08	32.809305	-116.603824
19-Jun-18	CNF 08	32.809342	-116.603545
19-Jun-18	CNF 08	32.809774	-116.603394
19-Jun-18	CNF 08	32.809842	-116.603391
19-Jun-18	Skyline Truck Trail 1	32.731944	-116.805959
19-Jun-18	Skyline Truck Trail 1	32.732046	-116.805986
19-Jun-18	Skyline Truck Trail 1 (near)	32.730682	-116.803036
20-Jun-18	Boulder Creek	32.929286	-116.634762
20-Jun-18	Boulder Creek	32.929451	-116.634747
20-Jun-18	Boulder Creek	32.929859	-116.634233
20-Jun-18	Boulder Creek	32.929909	-116.634128
20-Jun-18	Boulder Creek	32.930194	-116.633742
20-Jun-18	CNF 07	32.808501	-116.613757
20-Jun-18	CNF 07	32.808557	-116.613897
20-Jun-18	CNF 07	32.808685	-116.61424

Appendix A. GPS coordinates of Hermes copper adults in 2018 continued.

Date	Site	Latitude	Longitude
20-Jun-18	CNF 07	32.808689	-116.614237
20-Jun-18	CNF 07	32.808735	-116.614381
20-Jun-18	CNF 07	32.808829	-116.614583
20-Jun-18	CNF 07	32.808846	-116.614632
20-Jun-18	CNF 07	32.808963	-116.61249
20-Jun-18	CNF 07	32.809594	-116.611828
20-Jun-18	CNF 07	32.810152	-116.605954
20-Jun-18	CNF 07	32.810323	-116.605627
20-Jun-18	CNF 07	32.810382	-116.609811
20-Jun-18	CNF 07	32.810383	-116.60981
20-Jun-18	CNF 07	32.810678	-116.605549
20-Jun-18	CNF 07	32.810885	-116.609591
20-Jun-18	CNF 07	32.811061	-116.610461
20-Jun-18	CNF 07	32.811339	-116.605507
20-Jun-18	CNF 07	32.811517	-116.604046
20-Jun-18	CNF 07	32.811534	-116.605558
20-Jun-18	CNF 07	32.811648	-116.604496
20-Jun-18	CNF 07	32.81165	-116.604497
20-Jun-18	CNF 07	32.814668	-116.615831
22-Jun-18	Boulder Creek	32.759279	-117.062835
22-Jun-18	Boulder Creek	32.925428	-116.632975
22-Jun-18	Boulder Creek	32.925442	-116.633035
22-Jun-18	Boulder Creek	32.925776	-116.632391
22-Jun-18	Boulder Creek	32.925982	-116.632026
22-Jun-18	Boulder Creek	32.926213	-116.631157
22-Jun-18	CNF 07	32.808508	-116.613554
22-Jun-18	CNF 07	32.808763	-116.614411
22-Jun-18	CNF 07	32.808763	-116.614411
22-Jun-18	CNF 07	32.808769	-116.614404
22-Jun-18	CNF 07	32.808769	-116.614404
22-Jun-18	CNF 07	32.810151	-116.605978
22-Jun-18	CNF 07	32.811089	-116.609771
22-Jun-18	CNF 07	32.811509	-116.605596
22-Jun-18	CNF 07	32.811522	-116.605621
22-Jun-18	CNF 07	32.811526	-116.605185
22-Jun-18	CNF 07	32.811967	-116.603552
22-Jun-18	CNF 07	32.812047	-116.60303
26-Jun-18	Boulder Creek	32.92669	-116.63464

Appendix A. GPS coordinates of Hermes copper adults in 2018 continued.

Date	Site	Latitude	Longitude
26-Jun-18	CNF 07	32.810149	-116.605977
26-Jun-18	CNF 07	32.811949	-116.603276
26-Jun-18	CNF 07	32.812067	-116.603055
26-Jun-18	CNF 08	32.808714	-116.604249
26-Jun-18	CNF 08	32.809191	-116.603996
26-Jun-18	CNF 08	32.809196	-116.603996
28-Jun-18	Boulder Creek	32.926341	-116.631163



## Appendix B. GPS coordinates of spiny redberry in 2018.

Site	Latitude	Longitude	Notes
Boulder Creek Road	32.895426	-116.645555	redberry
Boulder Creek Road	32.911222	-116.643951	redberry
Boulder Creek Road	32.911851	-116.643587	redberry
CNF01	32.917857	-116.656727	
CNF02	32.62944	-116.581088	1 med bush N of trail, near BW
CNF02	32.629701	-116.58112	1 small bush, SW of trail no BW
CNF02	32.910045	-116.645275	
CNF02	32.910644	-116.647359	
CNF02	32.911279	-116.647009	4 small bushes SW off trail no BW
CNF02	32.913072	-116.646763	
CNF05	32.83986	-116.557838	two rb
CNF05	32.840158	-116.558511	three on each side no buckwheat near
CNF05	32.840318	-116.558913	one bush sw side of trail no buckwehat near
CNF05	32.840407	-116.559111	one small bush sw side no buckwheat near
CNF05	32.840422	-116.559156	one rb
CNF05	32.840534	-116.559249	one small bush sw side no buckwheat near
CNF05	32.840544	-116.552908	one sm bush north of trail no buckwheat near
CNF05	32.840552	-116.559279	one rb
CNF05	32.841014	-116.560196	one small bush sw side no buckwheat near
CNF05	32.841209	-116.561491	two bushes west side of trail no buckwheat
CNF05	32.841233	-116.561482	several rb
CNF05	32.841854	-116.561796	one wide bush, west of trail no BW
CNF05	32.842389	-116.563273	one bush south no buckwheat
CNF05	32.842404	-116.563273	several rb
CNF05	32.842455	-116.565733	one bush south no buckwheat
CNF05	32.842484	-116.566075	one bush north no buckwheat
CNF05	32.84252	-116.565715	one bush north no buckwheat
CNF05	32.842621	-116.564838	one small bush northwest no buckwheat
CNF05	32.84286	-116.568561	one large bush north no buckwheat
CNF05	32.843169	-116.551398	one rb
CNF05	32.843523	-116.573632	several rb at peak
CNF06	32.761389	-116.842099	one meter wide rb on right
CNF06	32.761517	-116.836662	three on left, two on right

Appendix B. GPS coordinates of spiny redberry in 2018 continued.

Site	Latitude	Longitude	Notes
CNF06	32.830385	-116.571954	
CNF06	32.831393	-116.568636	
CNF06	32.83161	-116.552682	three rb 2m wide one large, two small 1m wide
CNF06	32.831862	-116.55317	small, 0.5m on right
CNF07	32.808852	-116.61457	several to many rb adjacent
CNF07	32.809122	-116.612473	consistant from 6 to 7
CNF07	32.809416	-116.609928	large rb
CNF07	32.809788	-116.600495	red berry
CNF07	32.810602	-116.603988	few plants in between 9 & 10
CNF07	32.810966	-116.603894	RB 3ft cubed
CNF07	32.816666	-116.61556	several to many rb adjacent
CNF07	32.822323	-116.623403	2 rb on right
CNF08	32.749764	-116.664615	large rb left
CNF08	32.764467	-116.633431	small rb on right
CNF08	32.788671	-116.614486	medium rb on right
CNF08	32.790045	-116.613853	large rb right
CNF08	32.790449	-116.613422	medium rb on right
CNF08	32.790934	-116.61268	small rb on left
CNF08	32.791142	-116.61212	about 4 on path
CNF08	32.791726	-116.611535	end point
CNF08	32.792427	-116.611108	start of rb patch
CNF08	32.792713	-116.610978	end point
CNF08	32.792844	-116.610866	start of large patch on trail
CNF08	32.793593	-116.610581	patch of 6 rb
CNF08	32.794326	-116.610125	small on left
CNF08	32.795439	-116.609033	small on left
CNF08	32.795765	-116.608818	small on right side
CNF08	32.796989	-116.608429	one on left /right
CNF08	32.800294	-116.606449	one medium on right
CNF08	32.807003	-116.605306	smal rb on right
CNF08	32.807579	-116.605196	small rb on right
CNF08	32.809222	-116.603615	one large rb on left
CNF08	32.809628	-116.603538	one large rb
CNF08	32.8098	-116.603382	six rb along transect
CNF08	32.810423	-116.603492	2 large rb
CNF08	32.810546	-116.603626	end of RB
CNF08	32.811153	-116.603847	Within 3 meters of trail going down hill - start of RB

Appendix B. GPS coordinates of spiny redberry in 2018 continued.

Site	Latitude	Longitude	Notes
CNF11	32.77825	-116.724945	Single RB 1.5m wide, 2 m from road
CNF12	32.77739	-116.715401	single RB 3m from road, 2 m wide
CNF12	32.777592	-116.714581	single RB on roadside, 1m wide
CNF12	32.777627	-116.714628	single RB 1m wide, 4-5 m from road
CNF12	32.77779	-116.714803	large single plant 3m from road. 2 m wide
CNF12	32.777948	-116.714247	large single plant 5m from road. 2 m wide
CNF15	32.727205	-116.682738	RB with BW nearby
CNF15	32.728657	-116.682551	RB with BW nearby
CNF15	32.732781	-116.681356	RB with BW nearby
CNF16	32.708312	-116.714346	small rb on right in creek - Lots of RB on ridges above dry creek and inside creek bed. No BW blooming, very little at all or already gone to seed
CNF16	32.708368	-116.714439	medium rb on right in creek bed
CNF16	32.708433	-116.714473	medium rb on left
CNF16	32.708519	-116.714524	large rb on right
CNF16	32.708653	-116.714709	1 redberry plant
CNF16	32.708688	-116.714689	large rb on right
CNF16	32.708937	-116.714683	1 redberry plant
CNF16	32.70928	-116.714672	2 redberry plant. Several in vicinity
CNF16	32.709331	-116.71466	two plants on right 10 ft apart
CNF16	32.709455	-116.714603	six rb along transect
CNF16	32.709576	-116.720703	1 redberry
CNF16	32.709605	-116.714464	rb along ridge on right
CNF16	32.709672	-116.714785	six rb on peninsula
CNF16	32.710401	-116.714743	1 reberry
CNF16	32.710637	-116.722983	1 rb
CNF16	32.710722	-116.719336	1 redberry plant, several nearby
CNF16	32.711084	-116.723414	1 rb several nearby
CNF16	32.711902	-116.723643	1 rb
CNF16	32.712182	-116.724384	redberry in middle of trail
CNF16	32.714825	-116.727351	2 redberries
CNF16	32.715741	-116.728242	1 redberry
CNF19	32.853565	-116.74177	2 RB 10-20m off trail
CNF19	32.85366	-116.742096	3 RB 10-20m off trail
CNF19	32.853744	-116.741964	2 RB 10-20m off trail, up steep slope 4m
CNF19	32.853776	-116.742246	3 RB 10-20m off trail
CNF19	32.853945	-116.742362	1 RB 10-20m off trail
CNF19	32.854043	-116.742382	3 off trail marked at road

Appendix B. GPS coordinates of spiny redberry in 2018 continued.

Site	Latitude	Longitude	Notes
CNF19	32.854616	-116.742239	2 RB 14m off trail
CNF19	32.854749	-116.741938	2 large
CNF19	32.855387	-116.741138	1 large 10 m off trail
CNF19	32.855508	-116.741183	1 small 8 m off trail
CNF19	32.855531	-116.741276	1 RB
CNF19	32.855692	-116.741294	2 small, 10 m off trail
CNF19	32.856387	-116.742078	1 small
CNF19	32.856492	-116.741639	continuous RB on hiking trail, good HC habitat, stopped here but trail and RB continues off transect
CNF19	32.856539	-116.741808	continuous RB on hiking trail, good HC habitat, stopped here but trail and RB continues off transect
CNF19	32.856565	-116.741634	continuous RB on hiking trail, good HC habitat, stopped here but trail and RB continues off transect
CNF19	32.856584	-116.741574	continuous RB on hiking trail, good HC habitat, stopped here but trail and RB continues off transect
CNF19	32.856606	-116.741433	continuous RB on hiking trail, good HC habitat, stopped here but trail and RB continues off transect
CNF19	32.856636	-116.74201	1 RB
CNF19	32.856687	-116.741944	2 RB
CNF19	32.856809	-116.741276	continuous RB on hiking trail, good HC habitat, stopped here but trail and RB continues off transect
CNF19	32.856862	-116.740992	continuous RB on hiking trail, good HC habitat, stopped here but trail and RB continues off transect
CNF19	32.85688	-116.741131	continuous RB on hiking trail, good HC habitat, stopped here but trail and RB continues off transect
CNF19	32.856904	-116.741883	1 10m off trail up steep slope
CNF19	32.856913	-116.740998	continuous RB on hiking trail, good HC habitat, stopped here but trail and RB continues off transect
CNF19	32.85694	-116.741218	continuous RB on hiking trail, good HC habitat, stopped here but trail and RB continues off transect

Appendix B. GPS coordinates of spiny redberry in 2018 continued.

Site	Latitude	Longitude	Notes
CNF19	32.857049	-116.740933	continuous RB on hiking trail, good HC habitat, stopped here but trail and RB continues off transect
CNF19	32.857083	-116.740875	continuous RB on hiking trail, good HC habitat, stopped here but trail and RB continues off transect
CNF19	32.857084	-116.740785	continuous RB on hiking trail, good HC habitat, stopped here but trail and RB continues off transect
CNF19	32.857149	-116.74078	continuous RB on hiking trail, good HC habitat, stopped here but trail and RB continues off transect
CNF19	32.857304	-116.740501	continuous RB on hiking trail, good HC habitat, stopped here but trail and RB continues off transect
CNF19	32.857308	-116.740428	continuous RB on hiking trail, good HC habitat, stopped here but trail and RB continues off transect
CNF19	32.857312	-116.740567	continuous RB on hiking trail, good HC habitat, stopped here but trail and RB continues off transect
CNF19	32.857352	-116.741741	1 on NW side
CNF19	32.857445	-116.741709	1 on NW side
CNF19	32.857545	-116.740344	continuous RB on hiking trail, good HC habitat, stopped here but trail and RB continues off transect
CNF19	32.857584	-116.740257	continuous RB on hiking trail, good HC habitat, stopped here but trail and RB continues off transect
CNF19	32.857627	-116.740155	continuous RB on hiking trail, good HC habitat, stopped here but trail and RB continues off transect
CNF19	32.857666	-116.741531	2 RB, 10+m off trail
CNF19	32.857687	-116.739809	continuous RB on hiking trail, good HC habitat, stopped here but trail and RB continues off transect
CNF19	32.857749	-116.739986	continuous RB on hiking trail, good HC habitat, stopped here but trail and RB continues off transect

Appendix B. GPS coordinates of spiny redberry in 2018 continued.

Site	Latitude	Longitude	Notes
CNF19	32.857805	-116.739745	continuous RB on hiking trail, good HC habitat, stopped here but trail and RB continues off transect
CNF19	32.857879	-116.741892	1 RB 3m off trail
CNF19	32.857921	-116.741973	1 RB 3m off trail
CNF19	32.858129	-116.742309	2 RB
CNF19	32.858186	-116.742315	2 small
CNF19	32.858272	-116.742411	3, 4-10m off trail
CNF19	32.858344	-116.742564	1, 4m off trail
CNF19	32.858483	-116.742741	1 on trail, 3 off trail
CNF19	32.85859	-116.742802	about 5 bushes on trail
CNF19	32.85871	-116.742757	3 bushes 10m off trail
CNF19	32.858717	-116.742886	about 5 bushes on trail
CNF19	32.85902	-116.743015	1 bush 10m off trail
CNF19	32.859068	-116.743057	5 bushes 10m off trail
Elfin Forest	32.629663	-116.581439	redberry grove off trail ~100m from start
Elfin Forest	32.629715	-116.581931	single RB med size
Elfin Forest	32.630029	-116.580699	RB along path 3+
Elfin Forest	32.630292	-116.581426	3 small RB
Elfin Forest	32.630896	-116.58126	path littered with RB 50m stretch
Elfin Forest	32.631088	-116.5812	RB along path 50m
Elfin Forest	33.074596	-117.158746	
Elfin Forest	33.074642	-117.157618	
Elfin Forest	33.074664	-117.156791	
Elfin Forest	33.074741	-117.156559	
Elfin Forest	33.074785	-117.159761	
Elfin Forest	33.074789	-117.159759	
Elfin Forest	33.075482	-117.155916	
Elfin Forest	33.077377	-117.155694	
Elfin Forest	33.078155	-117.154833	RB surrounded by one, more 10ft away, buckwheat
Elfin Forest	33.084836	-117.153168	1 large plant
Elfin Forest West	33.071021	-117.161142	buckwheat nearby
Elfin Forest West	33.073812	-117.160279	no buckwheat nearby
Lawson Peak	32.714557	-116.709082	
Lawson Peak	32.714588	-116.709339	
Lawson Peak	32.714603	-116.709048	
Lawson Peak	32.714619	-116.70943	
Lawson Peak	32.71466	-116.70907	

Appendix B. GPS coordinates of spiny redberry in 2018 continued.

Site	Latitude	Longitude	Notes
Lawson Peak	32.714682	-116.709054	
Lawson Peak	32.714748	-116.709111	
Lawson Peak	32.714764	-116.705953	
Lawson Peak	32.714931	-116.709021	
Lawson Peak	32.71497	-116.708919	
Lawson Peak	32.71506	-116.710378	
Lawson Peak	32.715115	-116.709017	
Lawson Peak	32.71512	-116.708979	
Lawson Peak	32.715204	-116.708934	
Lawson Peak	32.715224	-116.710461	
Lawson Peak	32.715236	-116.708988	
Lawson Peak	32.715306	-116.708865	
Lawson Peak	32.715399	-116.708891	
Lawson Peak	32.715405	-116.706331	
Lawson Peak	32.715408	-116.706315	
Lawson Peak	32.715417	-116.706298	
Lawson Peak	32.715494	-116.706749	
Lawson Peak	32.715554	-116.708799	
Lawson Peak	32.715621	-116.710406	
Lawson Peak	32.715665	-116.708424	
Lawson Peak	32.715754	-116.710544	
Lawson Peak	32.715929	-116.710569	
Lawson Peak	32.716228	-116.710987	
Lawson Peak	32.716248	-116.711046	
Lawson Peak	32.716255	-116.711496	
Lawson Peak	32.71627	-116.711419	
Lawson Peak	32.716276	-116.710909	
Lawson Peak	32.716338	-116.711128	
Lawson Peak	32.716356	-116.71154	
Lawson Peak	32.71642	-116.711751	
Lawson Peak	32.716539	-116.711895	
Lawson Peak	32.716708	-116.712136	
Lawson Peak	32.716963	-116.712259	
Lawson Peak	32.719272	-116.712571	
Lawson Peak	32.719541	-116.71244	
Lawson Peak	32.719646	-116.71252	
Lawson Peak	32.719764	-116.716121	
Lawson Peak	32.719766	-116.712433	
Lawson Peak	32.719853	-116.712857	



Appendix B. GPS coordinates of spiny redberry in 2018 continued.

Site	Latitude	Longitude	Notes
Lawson Peak	32.71988	-116.715773	
Lawson Peak	32.719904	-116.712571	
Lawson Peak	32.719984	-116.715118	
Lawson Peak	32.719993	-116.715467	
Lawson Peak	32.720008	-116.71554	
Lawson Peak	32.720013	-116.714522	
Lawson Peak	32.720049	-116.714935	
Lawson Peak	32.720054	-116.714211	
Lawson Peak	32.720068	-116.71473	
Lawson Peak	32.720081	-116.714501	
Lawson Peak	32.720165	-116.713991	
Lawson Peak	32.720173	-116.713841	
Lawson Peak	32.7202	-116.713923	
McGinty	32.759589	-116.851056	
McGinty 1	32.765843	-116.876114	Hermes habitat
McGinty 1	32.767242	-116.877642	rb continues: RB continues along valley trail, we did not finish the transect, only went to the first peak
McGinty 1	32.767549	-116.877859	lots of reberry at bottom of valley near buckwheat
McGinty Area 1	32.756859	-116.854721	medium size two meter on left of trail
McGinty Area 1	32.756882	-116.854562	two large up slope
McGinty Area 1	32.756916	-116.85513	both sides of trail for 200 m
McGinty Area 1	32.757056	-116.854387	few small plants on right
McGinty Area 1	32.757952	-116.854286	small group on right
McGinty Area 1	32.758028	-116.854324	large single plant up path on left
McGinty Area 1	32.758738	-116.854216	medium size one meter on left uphill single plant
McGinty Area 1	32.760887	-116.85583	one large bush sw moderate buckwheat
McGinty Area 1	32.76096	-116.855513	one large bush north east moderate buckwheat
McGinty Area 1	32.762138	-116.856571	two large bushes good buckwheat everywhere
McGinty Area 1	32.762262	-116.857364	one large bush east good buckwheat
McGinty Area 1	32.762415	-116.857076	one large bush north moderate buckwheat
McGinty Area 1	32.764431	-116.858315	one large bush east moderate buckwheat outside perimeter
McGinty Area 1	32.764584	-116.858712	three large bushes between wp6 and wp7 and buckwheat

Appendix B. GPS coordinates of spiny redberry in 2018 continued.

Site	Latitude	Longitude	Notes
McGinty Area 1	32.765413	-116.859719	three medium bushes abundant buckwheat
McGinty Area 1	32.765425	-116.860178	one large bush south abundant buckwheat
McGinty Area 1	32.765867	-116.861306	several bushes south abundant buckwheat
McGinty Area 1	32.766641	-116.862771	six bushes abundant buckwheat
McGinty Area 1	32.767581	-116.864206	one large bush south abundant buckwheat
McGinty Area 1	32.76791	-116.866276	one large bush southeast abundant buckwheat
McGinty Loop	32.751892	-116.857072	several bushes, no bw
McGinty Loop	32.752603	-116.857906	several bushes, no bw
McGinty Loop	32.75353	-116.858361	few bushes, no bw
McGinty Loop	32.754265	-116.858375	few bushes, no bw
McGinty Loop	32.754656	-116.858812	several bushes, no bw 30 ft up trail
McGinty Loop	32.754845	-116.859454	few bushes, no bw
McGinty Loop	32.755023	-116.859737	several bushes, no bw
McGinty Loop	32.755405	-116.861174	several bushes, no bw
McGinty Loop	32.755501	-116.861516	couple bushes, no bw
McGinty Loop	32.756114	-116.861844	couple bushes, no bw
McGinty Loop	32.756472	-116.863081	several bushes, buckwheat nearby
McGinty Loop	32.756907	-116.864401	several bushes, buckwheat nearby
McGinty Loop	32.757538	-116.865955	Several bushes, moderate buckwheat
McGinty Loop	32.760814	-116.868422	few bushes, moderate buckwheat
McGinty Loop	32.7615	-116.871587	Several bushes, moderate buckwheat, start of redberry
McGinty Loop	32.76154	-116.870317	few bushes, sparse buckwheat
McGinty Loop	32.766506	-116.872657	end of redberry
McGinty Loop	32.768013	-116.872267	redberry
McGinty Loop	32.768221	-116.87173	next to bw
McGinty Loop	32.768432	-116.867395	lots of redberry
Potrero BCLT	32.630013	-116.58118	
Potrero BCLT	32.635214	-116.580721	
Sycuan 1	32.74676	-116.81593	
Sycuan 1	32.7468	-116.81556	redberry thicket
Sycuan 1	32.7479	-116.81522	
Sycuan 1	32.74818562	-116.814166	Right side of trail, 2, +buckwheat
Sycuan 1	32.7482045	-116.8142592	left side of trail, 2 bushes, +buckwheat

Appendix B. GPS coordinates of spiny redberry in 2018 continued.

Site	Latitude	Longitude	Notes
Sycuan 1	32.74849167	-116.813856	right side, 7 plants
Sycuan 1	32.74849913	-116.8138264	right side, 4 plants
Sycuan 1	32.7485371	-116.8138046	left side, fruiting, 9 plants
Sycuan 1	32.74873685	-116.8137427	right side, 4 plants, fruiting a lot, up canyon
Sycuan 1	32.74883858	-116.8136269	2 plants both sides of trail
Sycuan 1	32.74888	-116.815833	
Sycuan 1	32.74888248	-116.8142004	1 plant, right side
Sycuan 1	32.74900957	-116.8156639	5 plants both sides
Sycuan 1	32.74917748	-116.8156914	4 plants both sides, fruiting
Sycuan 1	32.74940002	-116.8156999	2 plants right side, 1 left
Sycuan 1	32.74960197	-116.8157099	1 plant right side
Sycuan 1	32.75001953	-116.8157163	both sides many plants
Sycuan 1	32.7502	-116.82136	
Sycuan 1	32.75021128	-116.8155697	2 plants right side
Sycuan 1	32.75051	-116.819885	
Sycuan 1	32.75055	-116.82292	
Sycuan 1	32.75055167	-116.8154826	2 plants right side
Sycuan 1	32.75076803	-116.8155295	2 plants right side
Sycuan 1	32.75092778	-116.8154868	very large, 1 plant, right side, wood rat middern
Sycuan 1	32.75095	-116.82275	
Sycuan 1	32.75110858	-116.8156454	right side, 1 plant
Sycuan 1	32.75118393	-116.8157713	1 plant poor condition, fountain grass
Sycuan 1	32.75130063	-116.8168322	1 plant right side
Sycuan 1	32.75135338	-116.8170962	1 plant left side
Sycuan 1	32.75173663	-116.8168973	1 plant left side
Sycuan 1	32.75223522	-116.8166082	1 plant right side
Sycuan 1	32.75237475	-116.8165589	1 plant right side
Sycuan 1	32.75249372	-116.8166236	4 plants both sides
Sycuan 1	32.75279535	-116.8167712	1 plant right side
Sycuan 1	32.75289378	-116.8167647	7 plants both sides
Sycuan 1	32.75346512	-116.8168003	5 plants both sides, fruiting
Sycuan 1	32.75359545	-116.8132974	1 plant left side
Sycuan 1	32.75363262	-116.8136528	3 plants left side
Sycuan 1	32.75363627	-116.8145614	both sides
Sycuan 1	32.75363927	-116.8139554	8 plants both sides
Sycuan 1	32.75366483	-116.814187	1 plant right side
Sycuan 1	32.75372888	-116.8137519	4 plants left side

Appendix B. GPS coordinates of spiny redberry in 2018 continued.

Site	Latitude	Longitude	Notes
Sycuan 1	32.75379272	-116.8141758	2 plants both sides of trail
Sycuan 1	32.75381517	-116.8170204	4 plants both sides
Sycuan 1	32.75382547	-116.8132134	2 plants right side
Sycuan 1	32.7538983	-116.8148106	2 plants right side
Sycuan 1	32.75396913	-116.8140656	3 plants both sides, many plants
Sycuan 1	32.75399598	-116.8138627	4 plants both sides
Sycuan 1	32.75401265	-116.8125853	1 plant right side
Sycuan 1	32.75408885	-116.8149311	1 plant right side
Sycuan 1	32.75412275	-116.8170551	2 plants right side
Sycuan 1	32.75412337	-116.8159372	both sides
Sycuan 1	32.7541354	-116.8156203	2 plants left side
Sycuan 1	32.75413897	-116.8158749	right side
Sycuan 1	32.75417255	-116.8151981	3 plants both sides
Sycuan 1	32.75421477	-116.8153987	4 plants both sides
Sycuan 1	32.75422177	-116.8168998	2 plants right side
Sycuan 1	32.75428565	-116.8168073	many plants left side
Sycuan 1	32.75431313	-116.8136786	3 plants left side
Sycuan 1	32.75442557	-116.8162721	1 plant left side
Sycuan 1	32.75457072	-116.8137311	many (5) plants both sides
Sycuan 1	32.75463347	-116.8164189	3 plants right side
Sycuan 1	32.75472217	-116.8137137	1 plant left side
Sycuan 1	32.75491323	-116.8137846	many plants both sides
Sycuan 1	32.75506383	-116.8138529	2 plants both sides
Sycuan 1	32.75519482	-116.8139238	2 plants both sides
Sycuan 1	32.75557417	-116.8140114	1 plant left side, fruiting
Sycuan 1	32.75571348	-116.8139857	many plants
Sycuan 1	32.75571843	-116.8117925	6 plants both sides
Sycuan 1	32.7557519	-116.8119075	2 plants left side trail to top
Sycuan 1	32.7558654	-116.8125841	2 plants left side
Sycuan 1	32.75590215	-116.8139849	2 plants left side down slope
Sycuan 1	32.75597997	-116.8128306	1 plant right side
Sycuan 1	32.75611782	-116.8131701	2 plants both sides
Sycuan 1	32.75611838	-116.8138843	2 plants left side
Sycuan 1	32.75618073	-116.8133702	1 plant right side
Sycuan 1	32.75623327	-116.8134994	2 plants both sides
Sycuan 1	32.75628343	-116.8137335	3 plants both side (????)
Sycuan 2	32.771703	-116.8086	no BW nearby
Sycuan 2	32.772005	-116.802345	a lot on right side of trail, a little bit of buckwheat nearby

Appendix B. GPS coordinates of spiny redberry in 2018 continued.

Site	Latitude	Longitude	Notes
Sycuan 2	32.772043	-116.806166	Bw in front
Sycuan 2	32.772065	-116.801039	BW nearby
Sycuan 2	32.772167	-116.801748	left of trail, not much buckwheat nearby
Sycuan 2	32.772374	-116.806214	buckwheat nearby
Sycuan 2	32.772391	-116.803972	buckwheat nearby
Sycuan 2	32.772891	-116.80525	buckwheat nearby
Sycuan 2	32.772892	-116.80544	buckwheat nearby
Sycuan Area North	32.76969	-116.814811	right side of road
Sycuan Area North	32.770196	-116.81145	med single RB
Sycuan Area North	32.770263	-116.81139	small single RB
Sycuan Area North	32.770452	-116.811708	large stand of RB up road, cut, surrounded by manzanita & BW
Sycuan Area North	32.770459	-116.811465	small single RB
Sycuan Area North	32.770476	-116.811497	small single RB
Sycuan Area North	32.770602	-116.81232	grouping of small plants on side of road near buckwheat
Sycuan Area North	32.770669	-116.81144	large RB
Sycuan Area North	32.770824	-116.81158	large RB off road
Sycuan Area West	32.750948	-116.823308	2 bushes, no buckwheat
Sycuan Area West	32.751021	-116.82302	2 bushes, moderate buckwheat
Sycuan Area West	32.751144	-116.823485	2 bushes, no buckwheat
Sycuan Area West	32.751293	-116.823818	2 bushes, no buckwheat
Sycuan Area West	32.751443	-116.826076	several bushes, no buckwheat
Sycuan Area West	32.751466	-116.824863	several bushes, no buckwheat
Sycuan Area West	32.752279	-116.826641	1 bush
Sycuan Area West	32.758797	-116.845154	
Sycuan Area West	32.759074	-116.844217	
Sycuan Area West	32.761143	-116.842823	
CNF01			No redberry detected
CNF03			No redberry detected
CNF13			No redberry detected
CNF14			No redberry detected
CNF17			No redberry detected
Olivenhain 1			No redberry detected
Olivenhain 2			No redberry detected
Sycuan Area East			No redberry detected