Task 13: 2025 Hermes Copper Adult Surveys

Hermes Copper Butterfly Surveys and Translocation Efforts

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Photo by D Marschalek

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Executive Summary

The Hermes copper (*Tharsalea hermes*) is a rare butterfly endemic to San Diego County and northern Baja California. This species is Federally listed as Threatened, with its decline attributed to urbanization, wildfires, and drought throughout its range in the United States. Since most individuals and the two (known) remaining large populations are found in the southern portion of San Diego County, one large fire could extirpate the species in this country.

Past efforts have contributed to our understanding of the distribution of the Hermes copper, so it is fairly well understood. This includes wildfires in 2003 and 2007 causing several extirpations with few recolonizations, and more recent droughts further restricting the distribution of this butterfly. We conducted widespread surveys in 2018 with the goal of detecting unknown populations; however, conditions were suboptimal due to below average rainfall. Efforts in 2019 and 2020 followed winters with closer to average precipitation. In 2018, one large population (Roberts Ranch South) was discovered to be larger than previously documented. Since this discovery, no new populations were documented and there was no evidence of recolonization within the 2003 or 2007 wildfire at selected sites. The objective of this project (2025 surveys) was to further assess the distribution and annual population sizes of the Hermes copper butterfly. We conducted surveys in 2025, similar to the 2024 efforts and more sites than sampled during 2019 – 2023.

The 2025 status of Hermes copper populations is similar to the last couple years, with few and continued observations at Lyons Valley and Lawson Peak. Two Hermes copper adults were observed west of Potrero at a site not having been documented for this species previously. Given these observations, as well as recent observations at the Potrero BLM transect and past observations at a location between the two, there may be relatively widespread occupied habitat near Potrero. However, given these data, the long-term viability of the species still appears to be highly dependent on the Roberts Ranch South-Bell Bluff area.

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Introduction

The Hermes copper (*Tharsalea hermes*) is a rare butterfly endemic to San Diego County and northern Baja California. 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 due to threats of urbanization and wildfires (USFWS 2011). The species was later listed as Threatened by the USFWS (USFWS 2021). Recently, Zhang et al. (2020) suggested a taxonomic revision, resurrecting *Tharsalea* as the genus for Hermes copper, and has been adapted by Pelham (2023).

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 and now the University of Central Missouri have maintained a research program focusing on this species (e.g., Marschalek and Deutschman 2008, Marschalek and Klein 2010).

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). Considering Chambers Group, Inc. (2011) were able to document several previously unknown large local populations by surveying transects with their locations determined based on infrastructure rather than habitat, there may be other areas occupied by Hermes copper. To investigate further, 2018 surveys were conducted to search for these populations in areas not previously searched. Marschalek and Deutschman (2018b) conducted surveys at 35 transects across a large area of the Hermes copper range. Hermes copper adults were detected at only three of these transects, and only one transect had more than 10 adults.

Surveys in 2019 – 2022 have included areas with redberry and no historic Hermes copper observations as well as sites with historic observations to monitor the status of the species (Marschalek and Deutschman 2019, Marschalek 2020, 2021, 2022). Surveys in 2023 included fewer sites, focusing on sentinel sites and six other sites that we thought had higher chances of being recolonized (Marschalek et al. 2023). Counts at sentinel sites have declined; however, 95 Hermes copper adults were observed at Roberts Ranch South on a single day and two adults were observed in the Potrero area. Surveys in 2024 (Marschalek et al. 2024), similar to those in 2019 – 2022, included many sites with historic Hermes copper records or apparently suitable habitat near these locations. The known distribution has not changed drastically over the last six years.

Initially (2003-2007), wildfires greatly influenced the distribution of Hermes copper, as Wildwood Glen Lane and Boulder Creek are the only documented recolonizations following the large wildfires of 2003 and 2007 (Figure 1). Determination of recolonization was based on multiple adults observed over the period of at least two weeks, including female butterflies. More recently, a several year drought appears to have further reduced the distribution of Hermes copper (Marschalek and Deutschman 2018a, 2018b, 2019). The mortality resulting from wildfires and drought, lack of recolonizations following fire or drought, and evidence of restricted dispersal (Marschalek et al. 2016) places the Hermes copper at increased risk of extinction. Assisted dispersal achieved by translocation of individuals has the potential to mitigate wildfire impacts. The risk of extinction will decrease as the number and spatial extent of populations increase. The long-term viability of this species is dependent on expanding its range, whether natural or assisted, and more urgent than previously known.

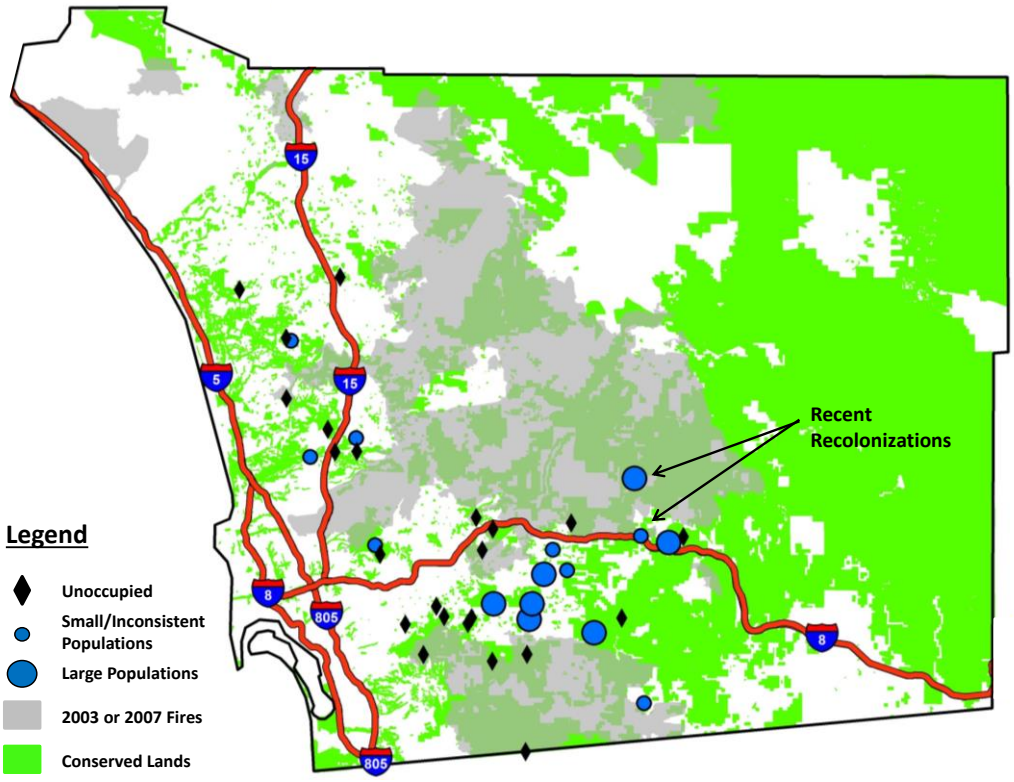

Figure 1. Detections of Hermes copper butterflies on conserved lands, 2010 – 2013. Sampling locations where Hermes copper was not detected are represented by black diamonds. Small and large Hermes copper populations are indicated by different sized circles.

Efforts to translocate Hermes copper from larger populations (San Diego National Wildlife Refuge-McGinty Mountain, a property on Skyline Truck Trail, and Sycuan Peak Ecological Reserve) to an area of suitable habitat at Hollenbeck Canyon Wildlife Area had promising

results (Marschalek and Deutschman 2016). In 2014, 11 adults (6 males and 5 females) were translocated to an unoccupied patch of spiny redberry. In 2015, of the 14 translocated eggs, 3 were missing from the original clipping and lost prior to the first survey date, 9 eggs exhibited signs consistent with larval eclosion, and 2 eggs remained intact. During the 2015 and 2016 Hermes copper flight season, only one male was detected during surveys at the adult release site and no Hermes copper adults were observed at the egg release site. Continued translocation efforts were attempted but population sizes were too small to capture and move individuals (Marschalek and Deutschman 2016, 2018a, 2019).

The goal of this project was to further assess the distribution and annual population sizes of Hermes copper. In 2025, we conducted surveys in many areas that were sampled in 2010 or later, and have current or historic Hermes copper observations. Sites surveyed were similar to 2023 and 2024 efforts.

Methods

Sentinel Sites

In 2025, we conducted surveys for Hermes copper adults at five sites we previously designated as sentinel sites (Boulder Creek, Lawson Peak, Roberts Ranch North, Roberts Ranch South, and Sycuan Peak Ecological Reserve) (Figure 2). In 2025 (as well as 2023 – 2024), surveys were also conducted at Lawson Peak along roads at higher elevations than the sentinel transect and reported in the "Exploratory Sites" section below. These sentinel sites are relatively widely spaced across the landscape. This captures a range of climatic conditions throughout much of the Hermes copper range and decreases the likelihood of a single wildfire extirpating all five populations.

Our goal was to record the maximum number of Hermes copper adults present on a single day at each site (***maximum count***). 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. The location of each Hermes copper observation was recorded with a handheld GPS unit. Surveys started on 19 May 2025, and frequently included Roberts Ranch South because the 2019 – 2024 survey efforts have shown this area to regularly produce the first adults of the season and this site was expected to have Hermes copper adults present due to the relative size of the local population.

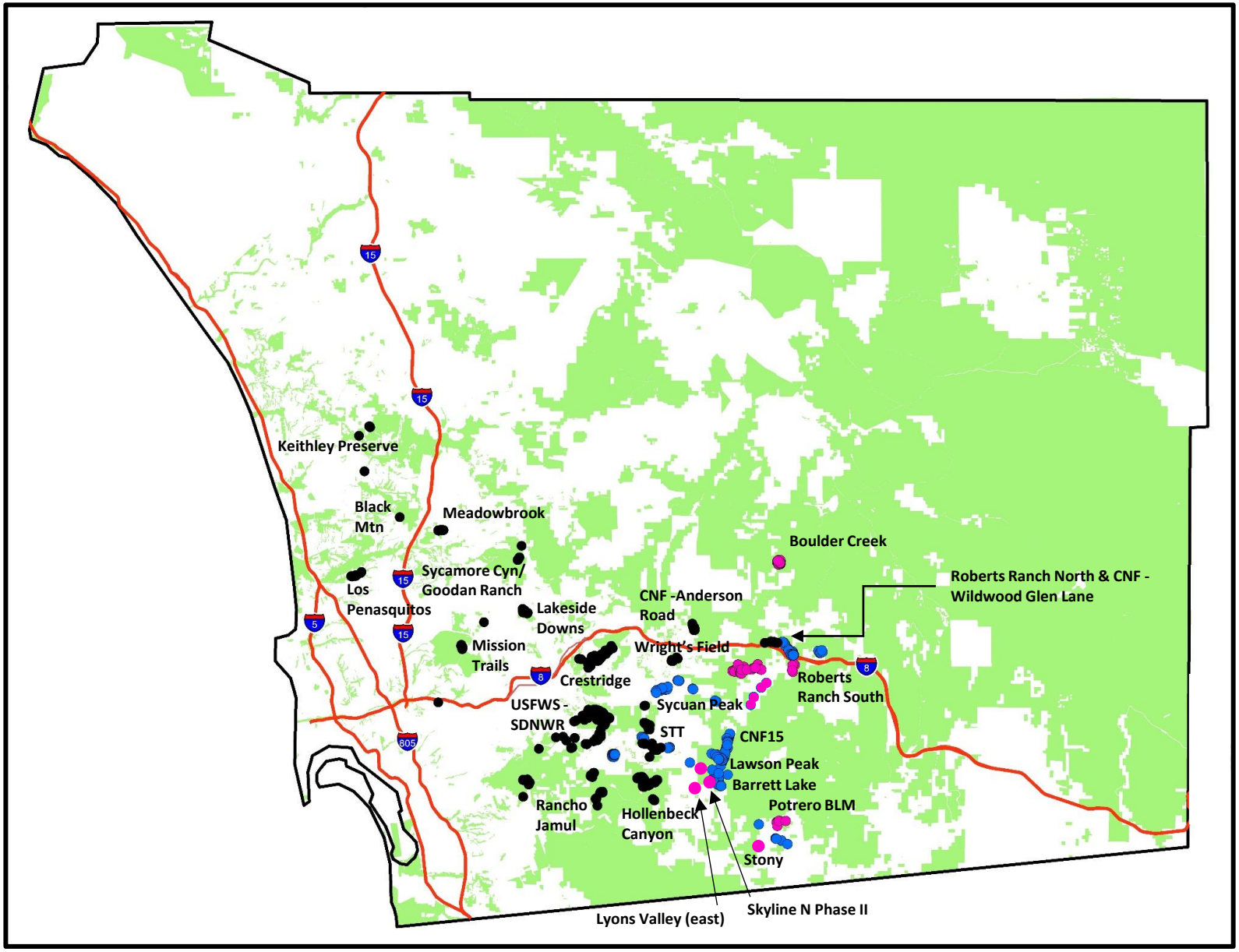

Figure 2. Map of sites that were surveyed for Hermes copper adults in 2025. Purple circles represent extant populations, black circles represent extirpated populations, and blue circles denote sites of unknown status. Status of each site presumed as of August 2025. Green shading are conserved lands (SANDAG).

Exploratory Sites

In 2025, in addition to the five sentinel transects, we conducted surveys for Hermes copper adults at 29 transects (Figure 2) determined in consultation with USFWS and USFS biologists and considering recent survey efforts and results (Marschalek and Deutschman 2019; Marschalek 2020, 2021, 2022; Marschalek et al. 2023, 2024, 2025). 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. 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 multiple times during May and June 2025.

Results

Sentinel Sites

The first Hermes copper adult observed in 2025 was on 31 May at Roberts Ranch South, when one adult was observed. As was the case in recent years, most Hermes copper observations were at Roberts Ranch South with a maximum count of 67 individuals on 14 June (Figure 3, Table 1). Five adults were observed west of the Roberts Ranch South transect in an area that was searched in 2022 without any observations (one was seen in 2023, three in 2024). No Hermes copper adults were detected at Roberts Ranch North or Sycuan Peak Ecological Reserve in 2025. This is the ninth consecutive year we did not detect adults at the Sycuan Peak transect and the sixth consecutive year we did not detect Hermes copper adults at Roberts Ranch North. At the Boulder Creek sentinel transect, we observed only one Hermes copper adult (also see next paragraph for more details regarding this site).

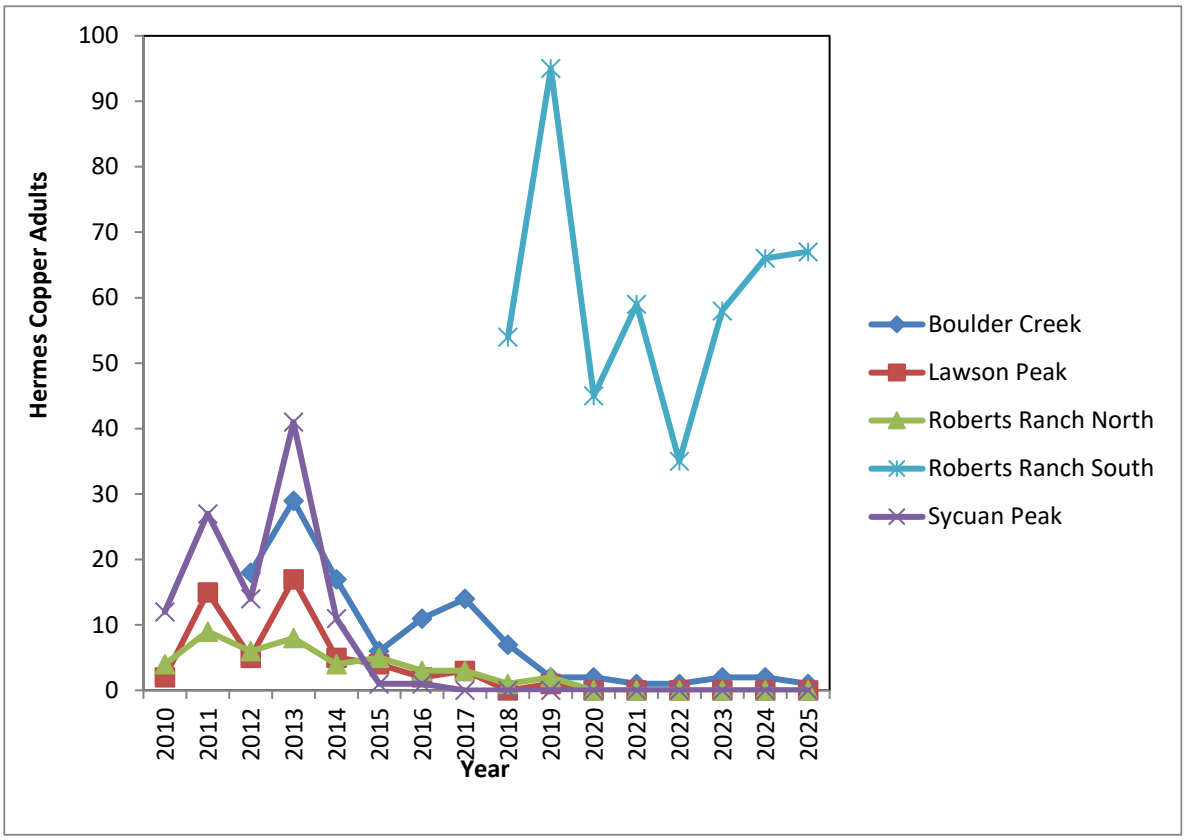

Figure 3. Maximum daily counts of Hermes copper adults at five sentinel sites, 2010 – 2025.

Table 1. Maximum counts of Hermes copper adults at five sentinel sites and an additional site that received frequent visits, 2010 – 2025. Sampling at sentinel sites consisted of repeated transects to obtain an accurate maximum count.

Sentinel Sites	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Boulder Creek (routes 2 & 3)	---	---	18	29	17	6	11	14	7	2	2	1	1	2	2	1
Boulder Creek (loop- includes routes 2 & 3)*	---	---	---	42	19	10	23	24	26	2	3	2	3	2	2	1
Lawson Peak	2	15	5	17	5	4	2	3	0	1	0	0	0	0	0	0
Roberts Ranch North	4	9	6	8	4	5	3	3	1	2	0	0	0	0	0	0
Sycuan Peak	12	27	14	41	11	1	1	0	0	0	0	0	0	0	0	0
Roberts Ranch South (CNF7)**	---	---	---	---	---	---	---	---	54	95	45	59	35	58	66	67

" --- " indicates no survey

* In 2012, two transects (routes 2 & 3) off of Boulder Creek road were surveyed. Starting in 2013, a longer loop that contains both routes 2 & 3 was surveyed to include butterflies that occupied areas along Boulder Creek Road between the two transects.

** Roberts Ranch South, referred to as CNF7 in 2018, transect was shortened in 2019. The 2018 count in this table reflects the number of Hermes copper adults detected on the shorter transect in 2018 (54 compared to 55 in the 2018 report).

Initial surveys at Boulder Creek in 2012 were restricted to two shorter transects. To more completely cover the area, including the public and maintained road, a new transect was created to include both shorter transects and the road (Figure 4). To be consistent, summary tables in previous reports have included only those Hermes copper butterflies detected in the areas of the two shorter transects. This report also presents the counts recorded from the full loop transect that started in 2013 (Table 1). Like Sycuan Peak in 2013, it was one of the largest known populations but has also experienced a decline in numbers since that time.

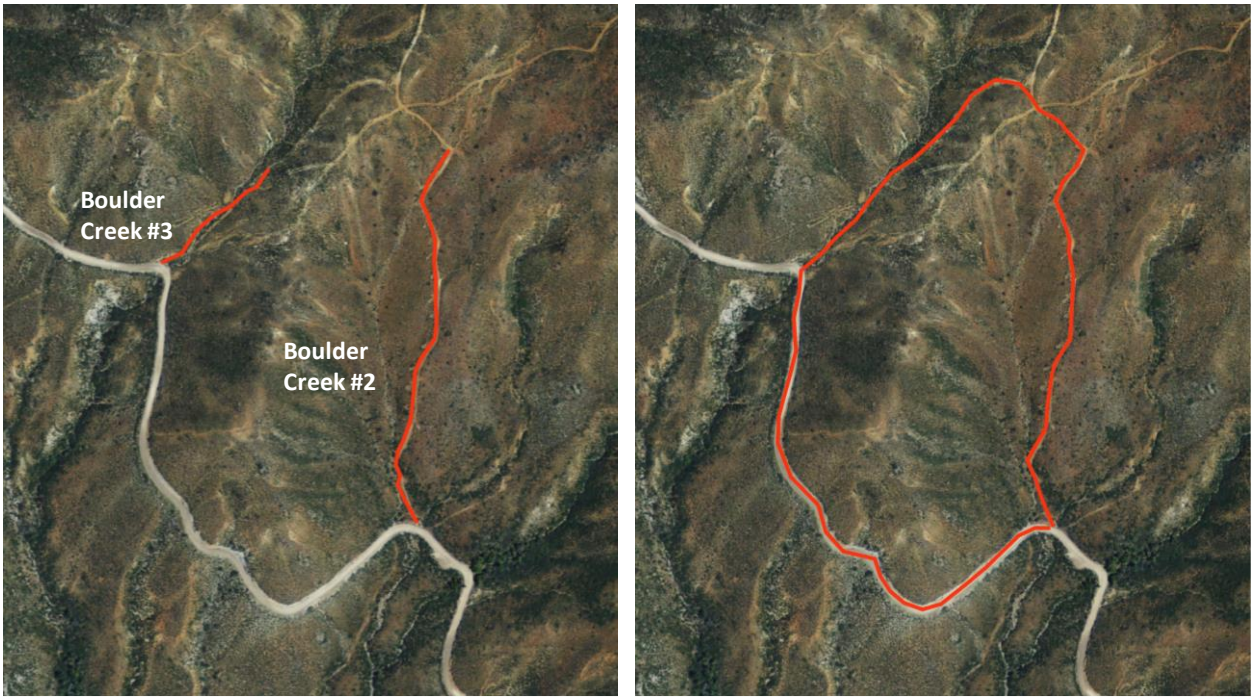

Figure 4. Comparison of survey transects (shown in red) at the Boulder Creek sentinel site. Left: Boulder Creek 2 and Boulder Creek 3 transects were surveyed in 2012. Right: A loop was surveyed in 2013 – 2025, but only Hermes copper counts from transects 2 and 3 were reported in 2013 – 2018 report summary tables.

Exploratory Sites

Surveys were conducted 19 May – 30 June, with Hermes copper adults detected at three of the 29 exploratory transects (Table 2). A maximum count of one Hermes copper adult was observed on the Potrero BLM transect, with another three individuals observed on a small trail extending off of the original transect on a different day. The initial sampling transect at this site was restricted to a public road, but since two Hermes copper adults were observed on a trail extending off of that road in 2020, this area was surveyed in 2021 – 2025. Five Hermes copper adults were observed at Lawson Peak, at a higher elevation than the sentinel survey transect. In

2023, a single individual appeared to be moving through this same area and five were observed in 2024.

Table 2. Maximum count of Hermes copper adults and number of surveys for each survey transect at the exploratory sites.

Site	Hermes Copper Maximum Count	Survey Dates
Black Mountain	0	27 May 2025; 8, 17, 29 June 2025
CNF15	0	20, 27 May 2025; 6, 10, 18, 20, 24 June 2025
CNF – Anderson Road	0	23, 30 May 2025; 3 , 9, 18, 24 June 2025
CNF – Wildwood Glen	0	19, 26 May 2025; 2, 9, 16, 25 June 2025
Crestridge Ecological Reserve (3 transects)	0	21, 28 May 2025; 11, 18, 24 June 2025
Hollenbeck Canyon Wildlife Area (2 transects)	0	20 May 2025; 15, 16, 18, 26, 26 June 2025
Lakeside Downs	0	30 May 2025; 10 , 18, 30 June 2025
Lawson Peak Extension	**5**	19, 28 May 2025; 4, 11, 17, 23, 28 June 2025
Los Penasquitos (Lopez) Canyon Preserve	0	27 May 2025; 8, 17, 29 June 2025
Meadowbrook Ecological Reserve	0	24, 27 May 2025; 8, 17, 29 June 2025
Mission Trails Regional Park (2 transects)	0	22, 30 May 2025; 12, 19, 26 June 2025
Potrero BLM	**1 (3)***	19 May 2025; 5, 12, 16, 19, 24 June 2025
Skyline Truck Trail (2 transects)	0	21, 29 May 2025; 2, 8, 16, 25 June 2025
Stony Property	**2**	19 May 2025; 16, 24 June 2025
Sycamore Canyon/Goodan Ranch County Park	0	24, 30 May 2025; 9, 18 June 2025
Sycuan Peak 2	0	21, 28 May 2025; 18, 24 June 2025
USFWS – Las Montanas (4 transects)	0	16, 18, 19, 25 June 2025
USFWS – McGinty Mountain	0	12, 19, 26 June 2025
USFWS – Par 4/Steele Canyon	0	19 June 2025
Wright's Field (2 transects)	0	23 May 2025; 1, 9, 24 June 2025

* Three individuals were observed on a trail off of the original transect

Two Hermes copper adults were observed at Stony Property, a private property for which we had access and is close to other past Hermes copper locations. There were no observations on the other two surveys. The inconsistent observations suggest that these could be transient individuals.

There were additional Hermes copper observations in 2025. This includes two adults observed in eastern Lyons Valley (observation by J Martin), in the same area as in 2023 and 2024, a maximum daily count of one adult on the Martin property (likely three different individuals, observation by J Martin), and one adult on the lower western slope of Lawson Peak at a newly acquired preserve - Skyline Ranch North Phase 2 (observation by SDMMP), in the same area as 2024. Locations (GPS coordinates) of all Hermes copper observations are listed in Appendix A.

Table 3. Maximum count of Hermes copper adults and number of surveys for each survey transect/area conducted by others.

Site	Hermes Copper Maximum Count	Survey Dates	Surveyor(s)
Barrett Lake	0	11, 26 June 2025	SDMMP
Loveland Reservoir	0	9, 18 June 2025	E Porter, S Wynn (USFWS)
Lyons Valley (east)	2	12, 28 June 2025; 3, 4, 5, 6 July 2025	J Martin
Lyons Valley Road (SDGE)	0	5, 17, 26 June 2025	SDMMP
Martin Property	1	14, 28, 30 June 2025; 3, 4 July 2025	J Martin
Mission Trals (west side)	0	12, 20 June 2025	SDMMP
Potrero BLM (area search)	4	23 June 2025	SDMMP
Rancho Jamul Ecological Reserve (4 transects)	0	29 May 2025; 5, 10, 19 June 2025	J Blackhall, K Rice (CDFW)
San Diego County Landfill	1	11 June 2025	E Porter, S Wynn (USFWS)
Skyline North Phase II	1	2, 9, 16, 20, 24, 30 June 2025	SDMMP; E Porter, S Wynn (USFWS)
Tierra Santa Open Space	0	2 June 2025	SDMMP

Discussion

The overall picture of the abundance and distribution of Hermes copper is similar to 2019 – 2024 (Marschalek and Deutschman 2019; Marschalek 2020, 2021, 2022; Marschalek et al. 2023, 2024) but still concerning (Figure 2). Despite the observations at Lawson Valley, Lawson Peak, and Potrero the species still appears to be restricted to the southeastern margin of its historical range due to drought. A fire through Roberts Ranch South and Bell Bluff areas would be of moderate size considering recent California wildfires, and would result in the loss of the majority of Hermes copper individuals.

A positive trend involves two consecutive years of Hermes copper observations just off of two sentinel sites (Lawson Peak and Roberts Ranch South) and observations in a new area west of Potrero. Considering that Hermes copper adults were observed on Lawson Peak, and two areas adjacent to Lawson Peak over the last two years, it is likely that this area has occupied habitat. This also suggests that Hermes copper was able to survive the recent drought in this area.

The observations west of Potrero (Stony Property) are within locations of historic observations, including observations for several years at Potrero BLM transect (Marschalek et al. 2023, 2024) and opportunistic past observations along a dirt road (Marschalek et al. 2016). Several of the historic observations are not on conserved lands, which makes it more difficult to assess the current status. Since Hermes copper adults were found on the Stony Property, it suggests that the species could still occupy habitat immediately north of Potrero Peak (also private property).

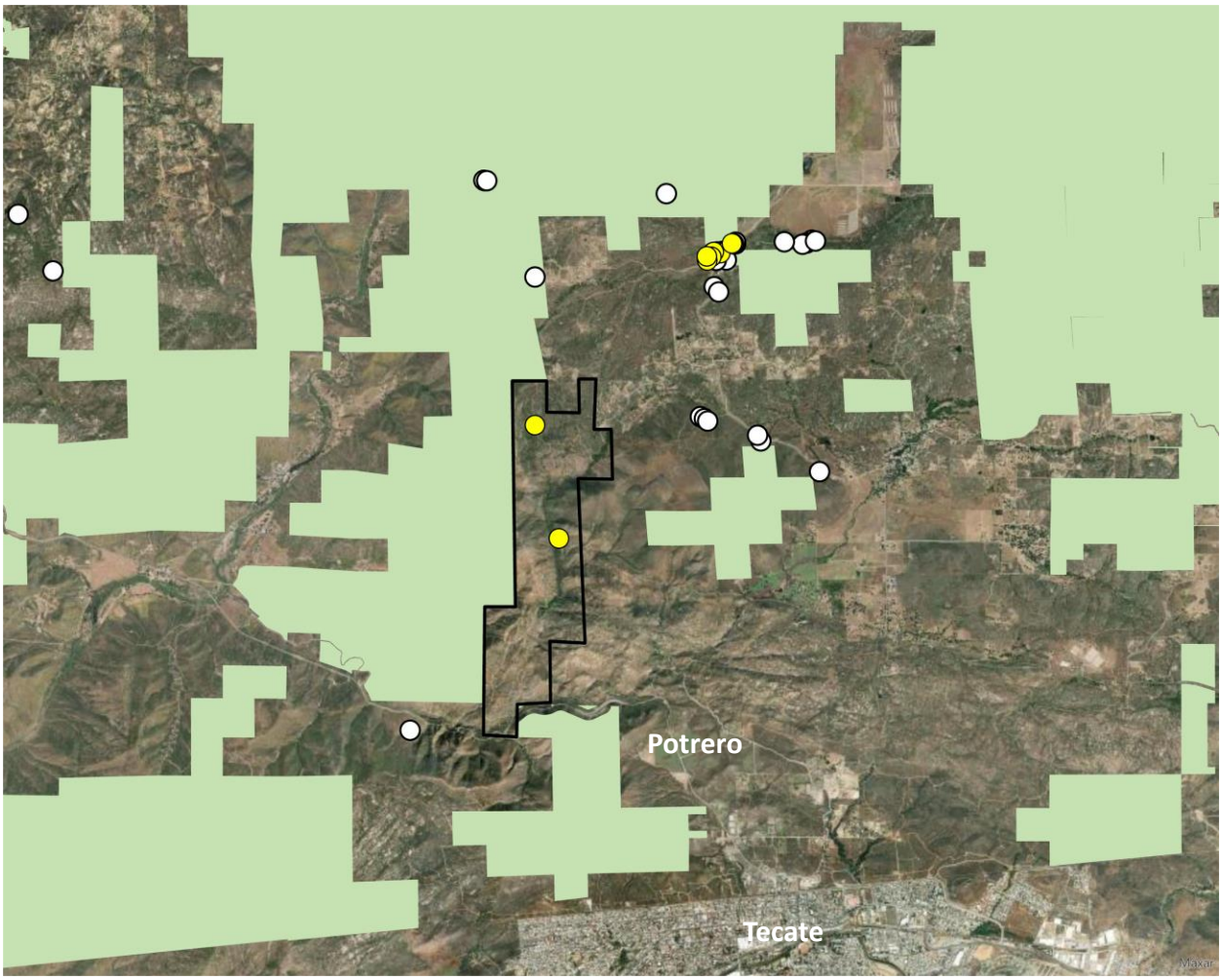

Figure 5. Hermes copper observation near Potrero. White circles represent historic observations (prior to 2022), yellow circles represent 2025 observations, black outline represents the Stony Property. Green shading are conserved lands (SANDAG).

Recommendations

We suggest continuing monitoring around Lawson Peak, including Skyline Ranch North Phase 2 and eastern Lyons Valley, due to having observations for two consecutive years, as well as the Potrero area due to the 2025 observations. This also demonstrates that private property at the higher elevations of the Hermes copper historic range has the potential for extant populations. Conserving these lands should be a priority for conservation of this species. Surveys of other conserved lands around and between Lawson Peak and Potrero should be conducted. If access can be obtained, surveying private lands in these areas would be beneficial to better understanding the Hermes copper distribution and population sizes, as well as identifying properties that should be prioritized for conservation.

Outside of habitat loss, there are two threats to the Hermes copper, wildfires and drought. Recent fires (e.g., Valley Fire in 2020, Border 32 Fire in 2022, Coyote Fire in 2023) highlight the urgency of translocation efforts as fires have been close to extirpating the last known population where females are reliably observed. It is important for additional populations to be established to reduce the probability of extinction due to a single fire. Translocations may be difficult due to dry conditions, as this limits the number of source individuals and reduces the probability of reestablishing a population. Drought is the other substantial threat. The lack of winter rain has illustrated the importance of precipitation for new growth on spiny redberry shrubs, which is required for larval feeding. If there is below average winter rainfall, it is possible that supplemental water will be required to either maintain current population sizes/distribution or enhance other habitat patches for recolonization, or both.

Acknowledgments

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): Back Country Land Trust, Bureau of Land Management, California Department of Fish & Wildlife, City of San Diego, County of San Diego, Endangered Habitats Conservancy, Escondido Creek Conservancy, San Diego Gas and Electric, S Stone, United States Fish & Wildlife Service, and United States Forest Service.

Literature Cited

Chambers Group, Inc. 2011. Hermes copper butterfly (*Hermelycaena* [*Lycaena*] *hermes*) focused survey report for the San Diego Gas & Electric Cleveland National Forest project San Diego County, California. 10 pp.

Marschalek DA. 2020. Hermes copper butterfly surveys and translocation efforts- Task 4: 2020 Hermes copper adult surveys. Final Report for San Diego Association of Governments. 17 pp.

Marschalek DA. 2021. Hermes copper butterfly surveys and translocation efforts- Task 6: 2021 Hermes copper adult surveys, Task 7: Hermes copper translocation. Final Report for San Diego Association of Governments. 18 pp.

Marschalek DA. 2022. Hermes copper butterfly surveys and translocation efforts- Task 7: Hermes copper translocation, Task 9: 2022 Hermes copper adult surveys. Final Report for San Diego Association of Governments. 16 pp.

Marschalek DA, C Beck and K Klutz. 2023. Hermes copper butterfly surveys and translocation efforts- Task 11: 2023 Hermes copper adult surveys. Final Report for San Diego Association of Governments. 20 pp.

Marschalek DA, C Beck, J Hoopes, A Gutierrez and J Martin. 2024. Hermes copper butterfly surveys and translocation efforts- Task 13: 2024 Hermes copper adult surveys. Final Report for San Diego Association of Governments. 23 pp.

Marschalek DA and DH Deutschman. 2008. Hermes copper (*Lycaena* [*Hermelycaena*] *hermes*: Lycaenidae): life history and population estimation of a rare butterfly. Journal of Insect Conservation. 12:97–105.

Marschalek DA and DH Deutschman. 2016. Rare butterfly management studies on conserved lands in San Diego County: Hermes copper (*Lycaena hermes*) translocation final report. Final Report for San Diego Association of Governments. 14 pp.

Marschalek DA and DH Deutschman. 2018a. Hermes copper butterfly translocation, reintroduction, and surveys. Final Report for United States Fish and Wildlife Service. 8 pp.

Marschalek DA and DH Deutschman. 2018b. Rare butterfly monitoring and translocation, Hermes copper survey- 2018. Final Report for San Diego Association of Governments. 30 pp.

Marschalek DA and DH Deutschman. 2019. Hermes copper surveys: 2019 flight season. Final Report for San Diego Association of Governments and United States Fish and Wildlife Service. 27 pp.

Marschalek DA, DH Deutschman, S Strahm and ME Berres. 2016. Dynamic landscapes shape post-wildfire recolonization and genetic structure of the endangered Hermes copper (*Lycaena hermes*) butterfly. Ecological Entomology. 41:327–337.

Marschalek DA and MW Klein, Sr. 2010. Distribution, ecology, and conservation of Hermes copper (Lycaenidae: *Lycaena* [*Hermelycaena*] *hermes*). Journal of Insect Conservation. 14:721–730.

Pelham JP. 2023. A catalogue of the butterflies of the United States and Canada website. https://www.butterfliesofamerica.com/US-Can-Cat.htm. Visited on 24 July 2023.

Thorne F. 1963. The distribution of an endemic butterfly *Lycaena hermes*. Journal of Research on the Lepidoptera. 2:143–150.

United States Fish and Wildlife Service. 2011. Endangered and threatened wildlife and plants; 12-Month finding on a petition to list Hermes copper butterfly as endangered or threatened. Federal Register 50 CFR(17):20918–20939.

United States Fish and Wildlife Service. 2021. Endangered and Threatened Wildlife and Plants; Threatened Species Status with Section 4(d) Rule for Hermes Copper Butterfly and Designation of Critical Habitat. Federal Register 50 CFR(17):72394–72433.

Zhang J, Q Cong, J Shen, PA Opler and NV Grishin. 2020. Taxon Rep. Int. Lepid. Surv. 8(7): 10-12, fig. 5

Appendix A. GPS coordinates of Hermes copper adults in 2025.

Date	Site	Latitude	Longitude
13-Jun-25	Boulder Creek	32.926403	-116.631355
11-Jun-25	Lawson Peak Extension	32.724478	-116.725051
17-Jun-25	Lawson Peak Extension	32.722509	-116.734357
17-Jun-25	Lawson Peak Extension	32.722181	-116.729215
17-Jun-25	Lawson Peak Extension	32.722848	-116.727145
17-Jun-25	Lawson Peak Extension	32.723578	-116.725917
23-Jun-25	Lawson Peak Extension	32.722347	-116.735748
23-Jun-25	Lawson Peak Extension	32.722541	-116.734407
23-Jun-25	Lawson Peak Extension	32.722248	-116.73171
23-Jun-25	Lawson Peak Extension	32.722205	-116.729079
23-Jun-25	Lawson Peak Extension	32.723135	-116.726621
28-Jun-25	Lawson Peak Extension	32.722623	-116.723524
28-Jun-25	Lawson Peak Extension	32.722347	-116.735744
5-Jun-25	Potrero BLM	32.646805	-116.635665
12-Jun-25	Potrero BLM	32.646859	-116.635412
12-Jun-25	Potrero BLM	32.646809	-116.635655
12-Jun-25	Potrero BLM	32.646668	-116.635308
24-Jun-25	Potrero BLM	32.646767	-116.634813
16-Jun-25	Potrero BLM	32.647818	-116.63326
3-Jun-25	Roberts Ranch South	32.811168	-116.605463
3-Jun-25	Roberts Ranch South	32.811148	-116.605479
3-Jun-25	Roberts Ranch South	32.81012	-116.605983
3-Jun-25	Roberts Ranch South	32.808521	-116.613839
5-Jun-25	Roberts Ranch South	32.809521	-116.615885
7-Jun-25	Roberts Ranch South	32.808632	-116.612837
7-Jun-25	Roberts Ranch South	32.808797	-116.607639
7-Jun-25	Roberts Ranch South	32.810113	-116.60599
7-Jun-25	Roberts Ranch South	32.81012	-116.605974
7-Jun-25	Roberts Ranch South	32.81019	-116.605924
7-Jun-25	Roberts Ranch South	32.810185	-116.605949
7-Jun-25	Roberts Ranch South	32.810742	-116.605513
7-Jun-25	Roberts Ranch South	32.810988	-116.605488
7-Jun-25	Roberts Ranch South	32.81099	-116.605512
7-Jun-25	Roberts Ranch South	32.811226	-116.605474
7-Jun-25	Roberts Ranch South	32.811462	-116.605601
7-Jun-25	Roberts Ranch South	32.811718	-116.604432
7-Jun-25	Roberts Ranch South	32.81196	-116.603376
7-Jun-25	Roberts Ranch South	32.812079	-116.603049
7-Jun-25	Roberts Ranch South	32.812636	-116.602565

Appendix A. GPS coordinates of Hermes copper adults in 2025 continued.

Date	Site	Latitude	Longitude
10-Jun-25	Roberts Ranch South	32.81513	-116.616386
10-Jun-25	Roberts Ranch South	32.814887	-116.616017
10-Jun-25	Roberts Ranch South	32.812304	-116.602765
10-Jun-25	Roberts Ranch South	32.81227	-116.602811
10-Jun-25	Roberts Ranch South	32.811979	-116.603157
10-Jun-25	Roberts Ranch South	32.811941	-116.603233
10-Jun-25	Roberts Ranch South	32.811958	-116.603631
10-Jun-25	Roberts Ranch South	32.811936	-116.603788
10-Jun-25	Roberts Ranch South	32.811887	-116.603898
10-Jun-25	Roberts Ranch South	32.811651	-116.604173
10-Jun-25	Roberts Ranch South	32.811681	-116.604466
10-Jun-25	Roberts Ranch South	32.811579	-116.604564
10-Jun-25	Roberts Ranch South	32.811587	-116.604559
10-Jun-25	Roberts Ranch South	32.811435	-116.604806
10-Jun-25	Roberts Ranch South	32.811544	-116.605439
10-Jun-25	Roberts Ranch South	32.811449	-116.605603
10-Jun-25	Roberts Ranch South	32.811261	-116.605483
10-Jun-25	Roberts Ranch South	32.811069	-116.605499
10-Jun-25	Roberts Ranch South	32.811031	-116.605502
10-Jun-25	Roberts Ranch South	32.810959	-116.605522
10-Jun-25	Roberts Ranch South	32.81087	-116.605531
10-Jun-25	Roberts Ranch South	32.81068	-116.605556
10-Jun-25	Roberts Ranch South	32.81009	-116.606002
10-Jun-25	Roberts Ranch South	32.809118	-116.607453
10-Jun-25	Roberts Ranch South	32.809045	-116.607601
10-Jun-25	Roberts Ranch South	32.809003	-116.609537
10-Jun-25	Roberts Ranch South	32.809309	-116.609827
10-Jun-25	Roberts Ranch South	32.811081	-116.609679
10-Jun-25	Roberts Ranch South	32.811062	-116.609877
10-Jun-25	Roberts Ranch South	32.811086	-116.609855
10-Jun-25	Roberts Ranch South	32.811062	-116.609999
10-Jun-25	Roberts Ranch South	32.81	-116.611335
10-Jun-25	Roberts Ranch South	32.809529	-116.61187
10-Jun-25	Roberts Ranch South	32.808652	-116.614164
14-Jun-25	Roberts Ranch South	32.815116	-116.616327
14-Jun-25	Roberts Ranch South	32.814956	-116.616088
14-Jun-25	Roberts Ranch South	32.814817	-116.61587
14-Jun-25	Roberts Ranch South	32.814791	-116.615881
14-Jun-25	Roberts Ranch South	32.814361	-116.615676

Appendix A. GPS coordinates of Hermes copper adults in 2025 continued.

Date	Site	Latitude	Longitude
14-Jun-25	Roberts Ranch South	32.808806	-116.614573
14-Jun-25	Roberts Ranch South	32.808822	-116.614532
14-Jun-25	Roberts Ranch South	32.808592	-116.614069
14-Jun-25	Roberts Ranch South	32.808502	-116.613395
14-Jun-25	Roberts Ranch South	32.808544	-116.613191
14-Jun-25	Roberts Ranch South	32.808561	-116.613095
14-Jun-25	Roberts Ranch South	32.808537	-116.613047
14-Jun-25	Roberts Ranch South	32.808552	-116.613008
14-Jun-25	Roberts Ranch South	32.808556	-116.613004
14-Jun-25	Roberts Ranch South	32.808965	-116.612485
14-Jun-25	Roberts Ranch South	32.808983	-116.612455
14-Jun-25	Roberts Ranch South	32.809395	-116.612319
14-Jun-25	Roberts Ranch South	32.80943	-116.612353
14-Jun-25	Roberts Ranch South	32.809494	-116.611927
14-Jun-25	Roberts Ranch South	32.809536	-116.611889
14-Jun-25	Roberts Ranch South	32.810464	-116.611254
14-Jun-25	Roberts Ranch South	32.810631	-116.611346
14-Jun-25	Roberts Ranch South	32.810844	-116.610787
14-Jun-25	Roberts Ranch South	32.811136	-116.609814
14-Jun-25	Roberts Ranch South	32.81114	-116.609798
14-Jun-25	Roberts Ranch South	32.811138	-116.609811
14-Jun-25	Roberts Ranch South	32.811095	-116.609878
14-Jun-25	Roberts Ranch South	32.811082	-116.609872
14-Jun-25	Roberts Ranch South	32.811091	-116.609898
14-Jun-25	Roberts Ranch South	32.810462	-116.60982
14-Jun-25	Roberts Ranch South	32.809145	-116.609629
14-Jun-25	Roberts Ranch South	32.809128	-116.609616
14-Jun-25	Roberts Ranch South	32.8092	-116.607126
14-Jun-25	Roberts Ranch South	32.809316	-116.606886
14-Jun-25	Roberts Ranch South	32.809917	-116.606048
14-Jun-25	Roberts Ranch South	32.810069	-116.606007
14-Jun-25	Roberts Ranch South	32.810136	-116.60597
14-Jun-25	Roberts Ranch South	32.810143	-116.605947
14-Jun-25	Roberts Ranch South	32.81019	-116.605933
14-Jun-25	Roberts Ranch South	32.810951	-116.60547
14-Jun-25	Roberts Ranch South	32.811112	-116.605448
14-Jun-25	Roberts Ranch South	32.81123	-116.60541
14-Jun-25	Roberts Ranch South	32.8112	-116.605467
14-Jun-25	Roberts Ranch South	32.811241	-116.605408

Appendix A. GPS coordinates of Hermes copper adults in 2025 continued.

Date	Site	Latitude	Longitude
14-Jun-25	Roberts Ranch South	32.811428	-116.605539
14-Jun-25	Roberts Ranch South	32.81149	-116.605579
14-Jun-25	Roberts Ranch South	32.811475	-116.605594
14-Jun-25	Roberts Ranch South	32.811601	-116.605607
14-Jun-25	Roberts Ranch South	32.811566	-116.60559
14-Jun-25	Roberts Ranch South	32.811579	-116.605547
14-Jun-25	Roberts Ranch South	32.811606	-116.605534
14-Jun-25	Roberts Ranch South	32.811577	-116.605454
14-Jun-25	Roberts Ranch South	32.811565	-116.605435
14-Jun-25	Roberts Ranch South	32.811548	-116.605153
14-Jun-25	Roberts Ranch South	32.811562	-116.605146
14-Jun-25	Roberts Ranch South	32.811563	-116.605133
14-Jun-25	Roberts Ranch South	32.811586	-116.604573
14-Jun-25	Roberts Ranch South	32.811582	-116.604559
14-Jun-25	Roberts Ranch South	32.81161	-116.604544
14-Jun-25	Roberts Ranch South	32.811616	-116.60455
14-Jun-25	Roberts Ranch South	32.811622	-116.604521
14-Jun-25	Roberts Ranch South	32.811708	-116.604419
14-Jun-25	Roberts Ranch South	32.811706	-116.604421
14-Jun-25	Roberts Ranch South	32.81179	-116.604406
14-Jun-25	Roberts Ranch South	32.811946	-116.603875
14-Jun-25	Roberts Ranch South	32.81201	-116.603558
14-Jun-25	Roberts Ranch South	32.812008	-116.603544
14-Jun-25	Roberts Ranch South	32.812063	-116.603094
14-Jun-25	Roberts Ranch South	32.812074	-116.603086
14-Jun-25	Roberts Ranch South	32.812072	-116.603089
14-Jun-25	Roberts Ranch South	32.812073	-116.6031
14-Jun-25	Roberts Ranch South	32.812598	-116.6026
17-Jun-25	Roberts Ranch South	32.814938	-116.616048
17-Jun-25	Roberts Ranch South	32.812915	-116.602521
17-Jun-25	Roberts Ranch South	32.812804	-116.602541
17-Jun-25	Roberts Ranch South	32.812169	-116.602882
17-Jun-25	Roberts Ranch South	32.812187	-116.60288
17-Jun-25	Roberts Ranch South	32.81211	-116.602966
17-Jun-25	Roberts Ranch South	32.812059	-116.603034
17-Jun-25	Roberts Ranch South	32.812053	-116.603036
17-Jun-25	Roberts Ranch South	32.812056	-116.60309
17-Jun-25	Roberts Ranch South	32.811987	-116.60317
17-Jun-25	Roberts Ranch South	32.811981	-116.603161

Appendix A. GPS coordinates of Hermes copper adults in 2025 continued.

Date	Site	Latitude	Longitude
17-Jun-25	Roberts Ranch South	32.81195	-116.603279
17-Jun-25	Roberts Ranch South	32.811951	-116.603336
17-Jun-25	Roberts Ranch South	32.811965	-116.603787
17-Jun-25	Roberts Ranch South	32.811907	-116.603879
17-Jun-25	Roberts Ranch South	32.811625	-116.603866
17-Jun-25	Roberts Ranch South	32.811549	-116.604034
17-Jun-25	Roberts Ranch South	32.811613	-116.604522
17-Jun-25	Roberts Ranch South	32.811425	-116.605022
17-Jun-25	Roberts Ranch South	32.811417	-116.605036
17-Jun-25	Roberts Ranch South	32.811541	-116.60541
17-Jun-25	Roberts Ranch South	32.811538	-116.605476
17-Jun-25	Roberts Ranch South	32.811448	-116.605609
17-Jun-25	Roberts Ranch South	32.811441	-116.6056
17-Jun-25	Roberts Ranch South	32.811255	-116.605492
17-Jun-25	Roberts Ranch South	32.811253	-116.605479
17-Jun-25	Roberts Ranch South	32.811178	-116.605461
17-Jun-25	Roberts Ranch South	32.811082	-116.605484
17-Jun-25	Roberts Ranch South	32.810917	-116.6055
17-Jun-25	Roberts Ranch South	32.810354	-116.605593
17-Jun-25	Roberts Ranch South	32.810191	-116.605973
17-Jun-25	Roberts Ranch South	32.810182	-116.605967
17-Jun-25	Roberts Ranch South	32.810181	-116.605969
17-Jun-25	Roberts Ranch South	32.810103	-116.60598
17-Jun-25	Roberts Ranch South	32.809328	-116.606885
17-Jun-25	Roberts Ranch South	32.809141	-116.607515
17-Jun-25	Roberts Ranch South	32.809768	-116.61004
17-Jun-25	Roberts Ranch South	32.810665	-116.609732
17-Jun-25	Roberts Ranch South	32.811092	-116.609719
17-Jun-25	Roberts Ranch South	32.811112	-116.609813
17-Jun-25	Roberts Ranch South	32.811123	-116.609828
17-Jun-25	Roberts Ranch South	32.811121	-116.609814
17-Jun-25	Roberts Ranch South	32.811093	-116.609874
17-Jun-25	Roberts Ranch South	32.811014	-116.610536
17-Jun-25	Roberts Ranch South	32.80941	-116.612454
17-Jun-25	Roberts Ranch South	32.809413	-116.612441
17-Jun-25	Roberts Ranch South	32.809414	-116.612444
17-Jun-25	Roberts Ranch South	32.809045	-116.612464
17-Jun-25	Roberts Ranch South	32.80904	-116.612457
17-Jun-25	Roberts Ranch South	32.808579	-116.61309

Appendix A. GPS coordinates of Hermes copper adults in 2025 continued.

Date	Site	Latitude	Longitude
17-Jun-25	Roberts Ranch South	32.808571	-116.613084
17-Jun-25	Roberts Ranch South	32.808556	-116.613199
17-Jun-25	Roberts Ranch South	32.808757	-116.614296
17-Jun-25	Roberts Ranch South	32.808783	-116.614407
19-Jun-25	Roberts Ranch South	32.646914	-116.635195
19-Jun-25	Roberts Ranch South	32.646798	-116.635644
21-Jun-25	Roberts Ranch South	32.723182	-116.724011
21-Jun-25	Roberts Ranch South	32.812052	-116.603053
21-Jun-25	Roberts Ranch South	32.812059	-116.60305
21-Jun-25	Roberts Ranch South	32.812034	-116.603113
21-Jun-25	Roberts Ranch South	32.812	-116.603176
21-Jun-25	Roberts Ranch South	32.812	-116.603177
21-Jun-25	Roberts Ranch South	32.81194	-116.603457
21-Jun-25	Roberts Ranch South	32.811963	-116.603753
21-Jun-25	Roberts Ranch South	32.811929	-116.60382
21-Jun-25	Roberts Ranch South	32.811629	-116.603822
21-Jun-25	Roberts Ranch South	32.811645	-116.603878
21-Jun-25	Roberts Ranch South	32.811715	-116.604453
21-Jun-25	Roberts Ranch South	32.811434	-116.605035
21-Jun-25	Roberts Ranch South	32.811581	-116.605554
21-Jun-25	Roberts Ranch South	32.811579	-116.605563
21-Jun-25	Roberts Ranch South	32.811561	-116.605603
21-Jun-25	Roberts Ranch South	32.811549	-116.605614
21-Jun-25	Roberts Ranch South	32.811518	-116.605621
21-Jun-25	Roberts Ranch South	32.811512	-116.605619
21-Jun-25	Roberts Ranch South	32.811273	-116.605478
21-Jun-25	Roberts Ranch South	32.811098	-116.605487
21-Jun-25	Roberts Ranch South	32.810997	-116.605458
21-Jun-25	Roberts Ranch South	32.810973	-116.605496
21-Jun-25	Roberts Ranch South	32.810856	-116.605516
21-Jun-25	Roberts Ranch South	32.810735	-116.605553
21-Jun-25	Roberts Ranch South	32.810186	-116.605968
21-Jun-25	Roberts Ranch South	32.809955	-116.606075
21-Jun-25	Roberts Ranch South	32.808523	-116.60771
21-Jun-25	Roberts Ranch South	32.810477	-116.609814
21-Jun-25	Roberts Ranch South	32.811095	-116.609694
21-Jun-25	Roberts Ranch South	32.811118	-116.609735
21-Jun-25	Roberts Ranch South	32.81115	-116.609811
21-Jun-25	Roberts Ranch South	32.811148	-116.609804

Appendix A. GPS coordinates of Hermes copper adults in 2025 continued.

Date	Site	Latitude	Longitude
21-Jun-25	Roberts Ranch South	32.811148	-116.609804
21-Jun-25	Roberts Ranch South	32.811113	-116.609883
21-Jun-25	Roberts Ranch South	32.810179	-116.61129
21-Jun-25	Roberts Ranch South	32.809549	-116.611896
21-Jun-25	Roberts Ranch South	32.809526	-116.611908
21-Jun-25	Roberts Ranch South	32.809535	-116.611912
21-Jun-25	Roberts Ranch South	32.809421	-116.612315
21-Jun-25	Roberts Ranch South	32.809023	-116.61244
21-Jun-25	Roberts Ranch South	32.808587	-116.613242
21-Jun-25	Roberts Ranch South	32.808764	-116.614367
21-Jun-25	Roberts Ranch South	32.814842	-116.615846
21-Jun-25	Roberts Ranch South	32.815144	-116.616272
27-Jun-25	Roberts Ranch South	32.811702	-116.604425
27-Jun-25	Roberts Ranch South	32.811516	-116.605162
27-Jun-25	Roberts Ranch South	32.810986	-116.605506
27-Jun-25	Roberts Ranch South	32.809068	-116.607574
27-Jun-25	Roberts Ranch South	32.810659	-116.60971
27-Jun-25	Roberts Ranch South	32.808538	-116.613801
27-Jun-25	Roberts Ranch South	32.81442	-116.615662
24-Jun-25	Stony Property (private)	32.615441	-116.6557
24-Jun-25	Stony Property (private)	32.627886	-116.658778

Other Hermes copper adult observations in 2025.

Date	Site	Latitude	Longitude
28-Jun-25	Lyons Valley (east)	32.715081	-116.755696
28-Jun-25	Lyons Valley (east)	32.715617	-116.755760
14-Jun-25	Martin Property	32.714322	-116.762147
28-Jun-25	Martin Property	32.715416	-116.758681
30-Jun-25	Martin Property	32.715416	-116.758681
3-Jul-25	Martin Property	32.715416	-116.758681
4-Jul-25	Martin Property	32.715416	-116.758681
23-Jun-25	Potrero BLM	32.645961	-116.636451
23-Jun-25	Potrero BLM	32.646371	-116.635948
23-Jun-25	Potrero BLM	32.646413	-116.636498
23-Jun-25	Potrero BLM	32.646871	-116.635627
11-Jun-25	San Diego Co Landfill	32.806532	-116.64759
24-Jun-25	Skyline North Phase II	32.74314	-116.72676