U.S. FISH AND WILDLIFE SERVICE SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

Scientific Name:

Lycaena hermes

Common Name:

Hermes copper

Lead region:

Region 8 (California/Nevada Region)

Information current as of:

05/05/2014

Status/Action

___ Funding provided for a proposed rule. Assessment not updated.

___ Species Assessment - determined species did not meet the definition of the endangered or threatened under the Act and, therefore, was not elevated to the Candidate status.

___ New Candidate

_X_ Continuing Candidate

___ Candidate Removal

> ___ Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status
>
> ___ Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species
>
> ___ Range is no longer a U.S. territory
>
> ___ Insufficient information exists on biological vulnerability and threats to support listing
>
> ___ Taxon mistakenly included in past notice of review
>
> ___ Taxon does not meet the definition of "species"
>
> ___ Taxon believed to be extinct
>
> ___ Conservation efforts have removed or reduced threats

___ More abundant than believed, diminished threats, or threats eliminated.

Petition Information

___ Non-Petitioned

_X_ Petitioned - Date petition received: 10/26/2004

90-Day Positive:05/04/2010

12 Month Positive:04/14/2011

Did the Petition request a reclassification? **No**

For Petitioned Candidate species:

Is the listing warranted(if yes, see summary threats below) **Yes**

To Date, has publication of the proposal to list been precluded by other higher priority listing? **Yes**

Explanation of why precluded:

We find that the immediate issuance of a proposed rule and timely promulgation of a final rule for this species has been, for the preceding 12 months, and continues to be, precluded by higher priority listing actions (including candidate species with lower LPNs). During the past 12 months, the majority our entire national listing budget has been consumed by work on various listing actions to comply with court orders and court-approved settlement agreements; meeting statutory deadlines for petition findings or listing determinations; emergency listing evaluations and determinations; and essential litigation-related administrative and program management tasks. We will continue to monitor the status of this species as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures. For information on listing actions taken over the past 12 months, see the discussion of Progress on Revising the Lists, in the current CNOR which can be viewed on our Internet website (http://endangered.fws.gov/).

Historical States/Territories/Countries of Occurrence:

- **States/US Territories**: California
- **US Counties**: San Diego, CA
- **Countries**: Mexico

Current States/Counties/Territories/Countries of Occurrence:

- **States/US Territories**: California
- **US Counties**: San Diego, CA
- **Countries**: Mexico

Land Ownership:

In the United States, the current range of Hermes copper butterfly is entirely within San Diego County and consists of approximately 29 percent Federal land, 4 percent State land, 15 percent local government land,

and 52 percent private land.

Lead Region Contact:

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Lead Field Office Contact:

CARLSBAD FISH AND WILDL OFC, Alison Anderson, 760-431-9440, alison_anderson@fws.gov

Biological Information

Species Description:

Hermes copper butterfly is a small, brightly-colored butterfly approximately 1 to 1.25 inches (2.5 to 3.2 centimeters (cm)) in length, with one tail on the hindwing. On the upperside, the forewing is brown with a yellow or orange area enclosing several black spots, and the hindwing has orange spots that may be merged into a band along the margin. On the underside, the forewing is yellow with four to six black spots, and the hindwing is bright yellow with three to six black spots (USGS 2006). Mean last instar (period between molts) larval body length is 0.6 inches (in) (15 millimeters (mm)) (Ballmer and Pratt 1988, p. 4). Emmel and Emmel (1973, pp. 62, 63) provide a full description of the early stages of the species (eggs, larvae, and pupae).

Taxonomy:

Hermes copper butterfly was first described as *Chrysophanus hermes* by Edwards (1870, p. 21). Scudder (1876, p. 125) placed this species in the genus *Tharsalea* based on the presence of hindwing tails. Freeman (1936, p. 279) placed Hermes copper butterfly in the genus *Lycaena* as *L. hermes* based on the assessment of the male genetalia, finding that *L. hermes* was distinctly a lycaenid and not typical of the other taxa of *Tharsalea*. Miller and Brown (1979, p. 22) erected a monotypic genus to accommodate Hermes copper butterfly as *Hermelycaena hermes*. This segregation appears to be supported by allozyme data presented by Pratt and Wright (2002, p. 223); although these authors did not recommend separate genus or subgenus placement (Pratt and Wright 2002, p. 225). The broadly based morphological assessment of Miller and Brown (1979) coupled with the more recent allozyme work of Pratt and Wright (2002) support recognition of Hermes copper butterfly as a distinct genus; however, *Lycaena hermes* is the name predominantly used in recent literature (Scott 1986, p. 392; Faulkner and Brown 1993, p. 120; Emmel 1998, p. 832; Opler and Warren 2005, p. 22), and we recognize it as such for the purposes of this assessment.

Habitat/Life History:

Females deposit single eggs on *Rhamnus crocea* (spiny redberry) in the early summer, often where a branch splits or on a leaf (Marschalek and Deutschman 2009, p. 401). Eggs overwinter, with larvae reported from mid-April to mid-May (Marschalek and Deutschman 2009, p. 400) followed by pupation on the host plant (Emmel and Emmel 1973, p. 63). Not much is known regarding larval biology, as this life stage is little-studied and extremely difficult to find in the field (Marschalek and Deutschman 2009, pp. 400, 401). Hermes copper butterflies have one flight period (termed univoltine) typically occurring in mid-May to early July, depending on weather conditions and elevation (Marschalek and Deutschman 2008, p. 100; Marschalek and Klein 2010, p. 5). Emergence appears to be influenced by weather; however this relationship is not well understood. For example, weather conditions in the spring of 2010 were cool and moist and resulted in a late emergence; however, the spring of 2006 was hot and dry and also resulted in a late emergence period (Deutschman et al. 2010, p. 4). We have no information regarding the ability of immature life stages to undergo multiple-year diapause (a low metabolic rate resting stage) during years with poor conditions (Deutschman *et al*. 2010, p. 4). Multiple year diapause is rare and can occur in stages more advanced than the

egg, such as pupae or larvae, after larvae have fed and accumulated energy reserves (USFWS 2003, p. 8; Gullan and Cranston 2010, p. 169); it is less likely to occur with Hermes copper butterflies because they overwinter (diapause) as eggs. However, Strahm *et al*. (2012, p. 37) noted that three of six eggs they detected in 2012 did not hatch, which could indicate that Hermes copper butterfly eggs are capable of multiyear diapause. In 2013, these eggs will be monitored, and additional egg searches will continue with the goal of increasing the sample size.

Hermes copper butterfly inhabits coastal sage scrub and southern mixed chaparral (Marschalek and Deutschman 2008, p. 98). Hermes copper butterfly larvae use only spiny redberry as a host plant (Thorne 1963, p. 143; Emmel and Emmel 1973, p. 62). The range of spiny redberry extends throughout coastal northern California, as far north as San Francisco (Consortium of California Herbaria 2010); however, Hermes copper butterfly has never been documented north of San Diego County (Carlsbad Fish and Wildlife Office (CFWO) GIS database). Therefore, some factor other than host plant availability apparently has historically limited or currently limits the range of the species. Researchers report adults are rarely found far from spiny redberry (Thorne 1963, p. 143) and take nectar almost exclusively from *Eriogonum fasciculatum* (California buckwheat) (Marschalek and Deutschman 2008, p. 5). The densities of host plants and nectar sources required to support a Hermes copper population are not known. Recent research has not added much to Thornes (1963, p. 143) basic description of Hermes copper butterfly habitat: It is very difficult to analyze the complex factors which determine why a certain plant has been successful in a given spot*** In the case of spiny redberry, the only consistent requirement seems to be a well-drained soil of better than average depth, yet not deep enough to support trees. Such soils occur along canyon bottoms and on hillsides with a northern exposure; therefore, it is in these situations that [Hermes copper butterfly] is generally found.

Hermes copper butterflies exhibit a preference for micro-sites within stands of spiny redberry, which may be related to temperature because adults become active around 72 degrees Fahrenheit (°F) (22 degrees Celsius (°C)) (Marschalek and Deutschman 2008, p. 5). Marschalek and Deutschman (2008, p. 3) recorded densities of Hermes copper butterflies on paired transects along edges and within the interior of host plant stands in rural areas. Their study indicates that Hermes copper butterfly densities are significantly higher near host plant stand edges than in the interior (Marschalek and Deutschman 2008, p. 102). Adult males have a strong preference for openings in the vegetation, including roads and trails, specifically for the north and west sides of canopy openings (Marschalek and Deutschman 2008, p. 102). These areas capture the first morning light and reach the temperature threshold for activity more quickly than other areas (Deutschman *et al*. 2010, p. 4). Hermes copper butterflies tend to remain inactive under conditions of heavy cloud cover and cooler weather (Marschalek and Deutschman 2008, p. 5). Across all four sites sampled by Marschalek and Deutschman, Hermes copper butterfly presence was positively associated with California buckwheat, but negatively associated with *Adenostema fasciculatum* (chamise) (Marschalek and Deutschman 2008, p. 102). Therefore, woody canopy openings with a northern exposure in stands of spiny redberry and adjacent stands of California buckwheat appear to be components of suitable habitat for Hermes copper butterfly.

In general, Hermes copper butterflies have limited directed movement ability (Marschalek and Klein 2010, p. 1), though lyceanids can be dispersed by the wind (Robbins and Small 1981 p. 312). Marschalek and Klein (2010) studied intra-habitat movement of Hermes copper butterflies using mark-release-recapture techniques. They found the highest median dispersal distance for a given site in a given year was 146 ft (44.5 m), and their maximum recapture distance was 0.7 mile (mi) (1.1 kilometers (km)) (Marschalek and Klein 2010, p. 1). They also found no adult movement across non-habitat areas, such as type-converted grassland or riparian woodland (Marschalek and Klein 2010, p. 6). Hermes copper butterfly is typically relatively sedentary (Marschalek and Klein 2010, p. 1), although winds may aid dispersal (Robbins and Small 1981, p. 312). Studies infer that most individuals typically move less than 656 ft. (200 m) (Marschalek and Deutschman 2008, p. 102, Marschalek and Klein 2010, pp. 725726), supporting the assumption that Hermes copper butterflies are typically sedentary compared to other butterfly species such as painted ladies (*Vanessa cardui*). However, genetic research indicates that females may disperse longer distances than males (Deutschman *et al*. 2010, p. 16) contradicting previous methods used such as mark-release-recapture (Marschalek and Deutschman 2008, p. 102) that may not detect the movement of females and over sample territorial males.

More information is needed to fully understand movement patterns of Hermes copper butterfly; however, dispersal is likely inhibited by lack of available habitat in many areas (Deutschman *et al*. 2010, p. 17).

Recent expansion of landscape genetic studies has allowed researchers to develop a more complete description of the genetic population structure of Hermes copper butterfly, with the goal of making inferences about dispersal (Strahm *et al*. 2012, p. 23). Individuals were found to be genetically similar to each other, with most of the differences found in individuals in peripheral populations in the northern and western portion of the Hermes copper butterfly distribution (Strahm *et al*. 2012, pp. 2, 32). Although these results provide evidence that individuals can disperse across much of the landscape, Strahm *et al*. (2012, p. 32) suggest these genetic patterns likely reflect historical processes, as genetic differences reflecting contemporary influences such as habitat fragmentation would probably require more time to reach detectable levels. Additionally, historic wildfire regimes included large fires, but recolonization events following large fires in 2003 and 2007 have been rare, suggesting that current dispersal is limited (Strahm *et al*. 2012, p. 32). However, historical dispersal data does not exist, thus the expected length of time for recolonization is unknown (Strahm *et al*. 2012, p. 33).

Historical Range/Distribution:

Hermes copper butterfly is endemic to the southern California region, primarily occurring in San Diego County, California (Thorne 1963, p. 143). All records of Hermes copper butterflies in the United States are within San Diego County, with most occurrences concentrated in the southwest portion of the County (Marschalek and Klein 2010, p. 4). Notable exceptions to the southwestern distribution pattern are two old museum specimens collected in north San Diego County, one from the vicinity of the community of Bonsall in 1934, and another from the vicinity of the community of Pala in 1932. Historical data indicate Hermes copper butterflies ranged from the vicinity of the community of Pala, California, in northern San Diego County (CFWO GIS database) to approximately 18 mi (29 km) south of Santo Tomas in Baja California, Mexico, and from Pine Valley in eastern San Diego County to Mira Mesa, Kearny Mesa, and Otay Mesa in western San Diego County (Thorne 1963, pp. 143, 147). They have never been recorded immediately adjacent to the coast, and have not been found east of the western slopes of the Cuyamaca Mountains above approximately 4,264 ft (1,300 m) (Marschalek and Klein 2010, p. 4).

The distribution of Hermes copper butterfly in Mexico is not well-known and researchers have not explored this area (Marschalek and Klein 2010, p. 4). Of the two museum specimens from Mexico, one collected in 1936 was labeled 12 miles north of Ensenada, and another collected in 1983 was labeled Salsipuedes (Marschalek and Klein 2010, p. 4). Assuming older specimens were usually collected relatively close to roads that existed at the time (Thorne 1963, p. 145), these Mexican locations probably were collected from approximately the same location, which is a popular surf destination known as Salsipuedes, located approximately 12 mi (19 km) north of Ensenada off the Esconica Tijuana-Ensenada (coastal highway to Ensenada). The known distribution in Mexico of spiny redberry is relatively contiguous with that in the U.S., extending to approximately 190 mi (312 km) south of the border into Mexico along the western Baja California Peninsula (Little 1976, p. 150). Hermes copper butterflies have been recorded as far south into Mexico as 18 mi (29 km) south of Santo Tomas, which is approximately half the distance of the extent of spiny redberrys Mexican range (Thorne 1963, p. 143). There is still uncertainty as to the distribution of Hermes copper butterfly within the known historical range because we have very little information on the status of the species in Mexico.

A species range can be defined at varying relevant scales of resolution, from maximum geographic range capturing all areas within the outermost record locations (coarsest scale, hereafter called known historical range), to the scale of individual population distributions (finest scale, hereafter called population distributions). This concept was discussed by Thorne (1963, p. 143): However within this range [Hermes copper butterfly] distribution is limited to pockets where the larval food plant occurs, so that the total area where the insect actually flies is probably not more than a fraction of one percent of the maximum area.

To more precisely determine the historical range of Hermes copper butterfly, we entered all Hermes copper butterfly observation records that had information about collection location in our GIS database as of 2013, and mapped all observed and museum specimen records with an appropriate level of detail and location description. To better determine the geographic locations of historical Hermes copper butterfly records mapped by Thorne (1963, p. 147), we overlaid a transparent image of his map on Google Earth imagery, and scaled it appropriately to ensure that geographic features and community locations corresponded with those of the imagery. Examination of Thornes (1963 p. 147) map expanded the known historical range as described by Deutschman *et al*. (2010, p. 3) to the southeast in the vicinity of the community of Pine Valley and Corte Madera Valley. The resulting known historical range of Hermes copper butterfly within the United States can be described as comprised of a narrow northern portion within the Central Valley and Central Coast ecoregions, north of Los Penasquitos Canyon and Scripps Poway Parkway (latitude midway between the northernmost record location and the international border), and a wider southern portion encompassing the Southern Coast, Southern Valley, and Southern Foothills ecoregions (see Figure 1 and Table 1 below; San Diego County Plant Atlas 2010). Although the distribution of Hermes copper butterfly populations in Mexico is not well understood, the U.S. populations minimally encompass half the species known historical latitudinal range. The results of our population distribution analysis indicate areas in the United States most likely to harbor possible extant undiscovered Hermes copper butterfly populations within the known historical range are primarily limited to a relatively narrow area within the southern portion of the range bordered on the north and south by the 2003 Cedar Fire and 2007 Harris Fire perimeters, and on the west and east roughly by Sycuan Peak and Long Valley (see Figure 1 and Table 1 below).

TABLE 1 - All known Hermes copper butterfly populations in the United States and Mexico.

Map #	Population name (other names)	Last Observed	Presumed Status	Extant in 2000[1]	Fire	Extirpated Why?
1	Elfin Forest (Onyx Ridge).	2011	Extant*	Y	2007	
2	Rancho Santa Fe (Del Dios)	2004	Extirpated	Y	2007	Fire, Development
3	Black Mountain	2004	Unknown	Y		
4	Van Dam Peak (Meadowbrook)	2011	Extant*	Y		
5	Lopez Canyon	2011	Extant	Y		
6	Sycamore Canyon	2003	Extirpated	Y	2003	Fire
7	North Santee (Fanita Ranch)	2005	Unknown	Y	2003	
8	Mission Trails (Mission Gorge, Mission Dam)	2010	Extant	Y	2003	
9	Crestridge	2007	Extirpated[3]	Y	2003	Fire
10	Anderson Truck Trail	2003	Extirpated	Y	2003	Fire
11	Alpine (Wright's Field)	2010	Extant	Y		
12	North McGinty Mountain	2010	Extant	Y		
13	South McGinty Mountain	2010	Extant	Y		
14	Los Montanas	2010	Extant	Y		
15	Rancho San Diego	2009	Extant	Y	2007	
16	San Miguel Mountain	2006	Extirpated	Y	2007	Fire
17	Rancho Jamul	2007	Extirpated	Y	2003, 2007	Fire
18	North Jamul	2004	Unknown	Y	2003	
19	East McGinty Mountain	2001	Unknown	Y		
20	Loveland Reservoir	2010	Extant	Y		
21	Sycuan Peak	2012	Extant	Y		
22	Skyline Truck Trail (Lawson Valley)	2010	Extant	Y		
23	Lyons Peak	2003	Unknown	Y	2007	
24	Hollenbeck Canyon	2007	Extirpated	Y	2003, 2007	Fire
25	Dulzura (Near Marron Valley Road)	2005	Extirpated	Y	2003, 2007	Fire
26	Lawson Valley (Lawson Peak)	2012	Extant	Y	2006, 2007	
27	Hidden Glen (Japutal Valley, Lyons Valley Road)	2008	Extant	Y		
28	Willows (Viejas Grade Road)	2003	Extirpated	Y	2003	Fire

29	North Guatay Mountain	2004	Unknown	Y	2003	
30	North Descanso (Wildwood Glen, Descanso)	2010	Extant	Y	2003	
31	South Descanso (Roberts Ranch)	2012	Extant	Y	2003	
32	Japutal (Japutal Valley)	2012	Extant	Y		
33	South Guatay Mountain	2008	Extant	Y		
34	Hartley Peak, Potrero Peak (Portrero)	2012	Extant	Y	2007	
35	Pala	1932	Extirpated			Unknown
36	Bonsall	1934	Extirpated			Unknown
37	San Elijo Hills (San Marcos Creek, San Elijo Road and Questhaven Road)	1979	Extirpated			Development
38	Lake Hodges	1982	Extirpated		2007	Fire
39	Sabre Springs (Poway Road and 395)	2001	Extirpated	Y		Development
40	Miramar	1996	Extirpated			Development
41	Mira Mesa	Prior to 1963	Extirpated			Development
42	Cowles Mountain (Big Rock Road Park)	1973	Extirpated			Isolation
43	Kearny Mesa	1939	Extirpated			Development
44	Mission Valley (Fairmont Canyon, Canyons near Mission Valley)	1908	Extirpated			Development
45	San Diego State University (San Diego State College)	1957	Extirpated			Development
46	El Monte (El Monte Park, El Monte Road)	1960	Extirpated			Fire, Development
47	Pine Valley	Pre-1963	Unknown			
48	Corte Madera	Pre-1963	Unknown			
49	Tecate Peak	1980	Extirpated		2007	Fire
50	Deerhorn Valley	1970	Extirpated		2007	Fire
51	Dictionary Hill	1962	Extirpated			Isolation (Development)
52	Otay Mountain (Little Cedar Canyon, Otay foothill)	1979	Extirpated		2003, 2007	Fire
53	South Otay Mesa	Pre-1920	Extirpated			Development
54	Salsipuedes (12 miles North of Ensenada)[2]	1983	Unknown			

55	Santo Tomas (18 miles south of Santo Tomas)[2]	Pre-1920	Unknown			
56	South Santee	1967	Extirpated			Development
57	North Ensenada (Bajamar)[2]	1936	Unknown			
58	Lakeside Downs	2004	Extant*	Y		
59	Boulder Creek Road	2012	Extant*	Y	2003	

*Changed status to extant, or extant population newly identified, since the 2012 species assessment (USFWS 2012).
1 - Populations with last observation prior to 2000 have lower geographic accuracy.
2 - Map #s 54, 55, and 57 are populations in Mexico that are not represented on Figure 1 in this document.
3 - Extirpation was a result of high mortality from fire, followed by reduced population density. Only one male was observed in 2007, and none after that.

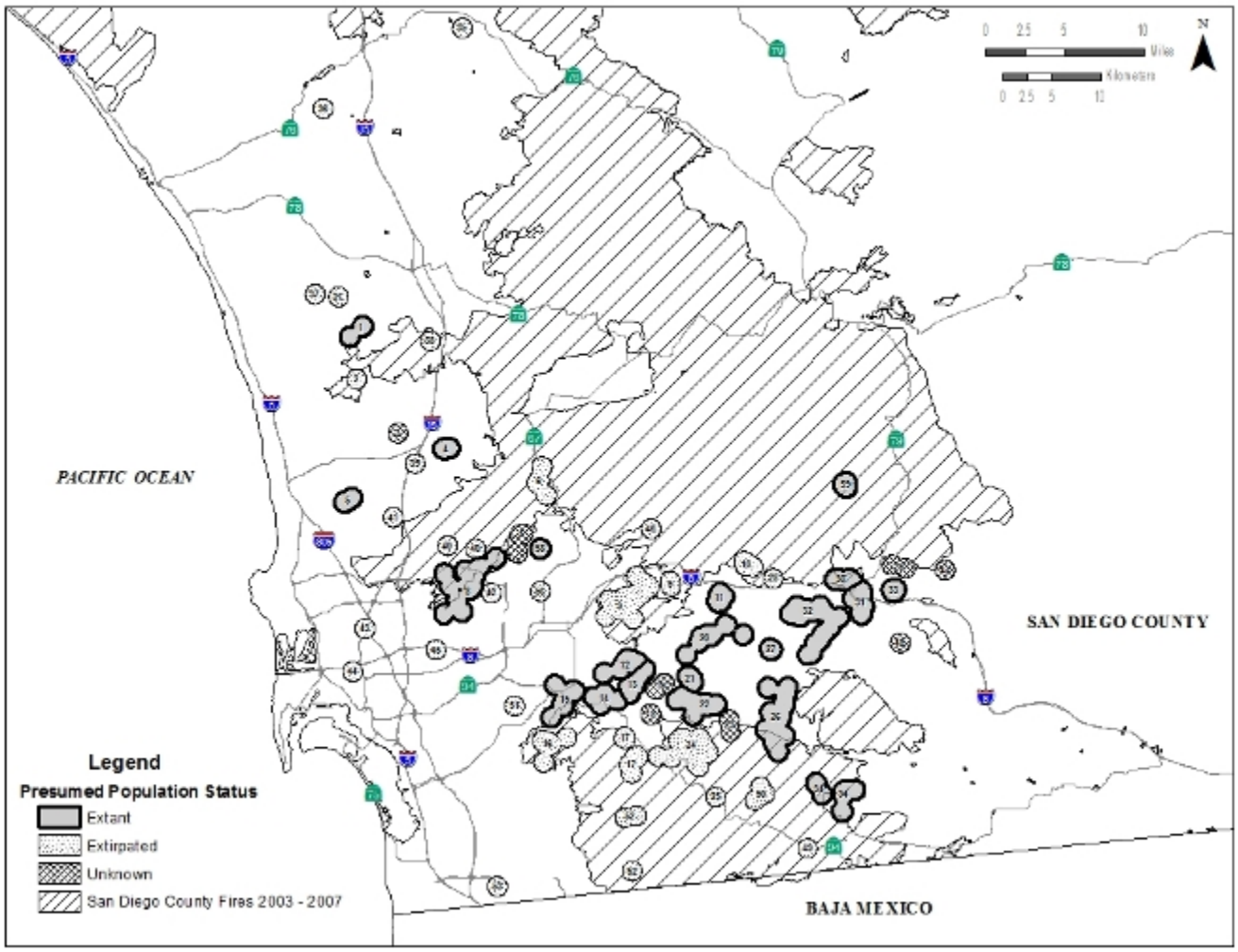

FIGURE 1 - Hermes copper butterfly populations in the United States and their current presumed status.

Current Range Distribution:

To evaluate the status of Hermes copper butterflys current range and populations, we considered all available historical data and recent research results as of 2013, including record locations (CFWO GIS databases), monitoring data, (Marschalek and Deutschman 2008; Marschalek and Klein 2010), movement data

(Marschalek and Deutschman 2009; Marschalek and Klein 2010), and data from recent distribution studies (Deutschman *et al*. 2010; Deutschman *et al*. 2011; Strahm *et al*. 2012). To estimate the geographic population distribution of Hermes copper butterfly, we used all occurrence records as of 2013 and mapped areas within approximately 0.6 mi (1 km) of known observation sites. This distance is greater than the average recapture distance recorded by Marschalek and Klein (2010, p. 1), but just under the maximum recorded recapture distance, an approximate within-population movement distance further supported by Deutschman *et al*.s (2010, p. 16) genetic data. Locations within approximately 1.2 mi (2 km) (where 0.6 mi (1 km) movement distances overlapped) were considered part of the same population, unless topographic or genetic information indicated the possibility of barriers to movement. We used recent fire footprint data and aerial GIS information, in addition to the information referenced above, to determine which Hermes copper butterfly populations may be extant, extirpated, or of unknown status. A Hermes copper population was considered to be extant if the species was recorded based on recent survey records and not affected by recent fires. A Hermes copper population was considered to be extirpated if the area had been developed and no habitat remained, a fire footprint encompassed the area and subsequent surveys were negative, or if the record was very old with no recent detections. In some instances, we had no recent information to make a determination on Hermes copper butterflys current status and it was therefore classified as unknown. See Figure 1 and Table 1 above for a list of populations and information used to determine population status.

Since our 2012 species assessment (USFWS 2012), we received information on historic populations that were rediscovered. Of particular interest are two small, peripheral populations in the northern and western portion of the species distribution (Elfin Forest (see Figure 1 and Table 1 above; Map #1) and Van Dam Peak (Map #4)) that were previously identified as unknown and extirpated, respectively, in the species assessment and are now considered extant. One individual was observed at each location in 2011; none were detected in 2012. Although these two populations are small and isolated by development, they could represent important refugia outside of the larger populations to the south (Strahm *et al*. 2012, p. 20). Also of interest is the large Boulder Creek Road population (Map #59) that was not known to us at the time of our 2012 species assessment, but was previously known by species experts as an historical population of unknown status within the perimeter of the 2003 Cedar Fire (Strahm *et al*. 2012, p. 21). Strahm *et al*. (2012, p. 21) confirmed this populations status as extant in 2012. Higher levels of genetic differentiation observed from individuals of this population support Strahm *et al*.s (2012, p. 31) hypothesis that this population survived the fire nearby in an unknown location that was not burned, rather than recolonizing the site from outside the fire perimeter approximately 3.6 mi (5.8 km) away. Thus, this population appears to be currently isolated from other populations by past fire disturbance. Finally, we received information on the Lakeside Downs population (Map #58), whichsimilar to the Boulder Creek Road populationwas not known to us at the time of our 2012 species assessment, but was previously known as an historic population by species experts and confirmed as extant in 2004 (FEC 2004, p. 1) in an area isolated by the 2003 Cedar Fire and development.

In summarizing the results of our analysis of Hermes copper butterflys current range and population distributions (see Figure 1 and Table 1 above), information currently available identifies 59 total historic populations, of which 21 are extant, 27 are extirpated, and 11 are of unknown status. In the year 2000, 37 populations were thought to be extant. Since that time, 10 populations have been extirpated (1 by development, 1 by fire and development, 8 by fire alone) and 6 are of unknown status. In the northern portion of the range, most remaining suitable habitat is limited to the relatively isolated and fragmented undeveloped lands between the cities of San Marcos, Carlsbad, and Escondido and the community of Rancho Santa Fe, and the habitat islands containing the Black Mountain and Van Dam Peak observation locations. In the southern portion of the range, all extant populations except Lopez Canyon, the southern portion of Mission Trails Park, Lakeside Downs, and Boulder Creek Road (isolated from other extant populations by development and fire) are within relatively well-connected undeveloped lands east of the City of El Cajon between the 2003 Cedar Fire and 2007 Harris Fire perimeters (see Figure 1 and Table 1 above). The Mission Trails Park population remains extant even after approximately 74 percent of the population area burned in 2003, presumably because burned areas were recolonized (after host plant and nectar sources regrew) by Hermes copper butterflies from nearby unburned areas. The best information available leads us to conclude that the northern portion of the species known historical range has contracted but supports small, peripheral

populations, and we estimate that approximately 27 percent of the populations within the southern portion of the species known historical U. S. range that were extant in 2000 have been extirpated (Map #s 6, 9, 10, 16, 17, 24, 25, 28). Further investigation is needed to accurately determine the status of Hermes copper butterfly in Mexico (Marschalek and Klein 2010, p. 2). Klein (2010, pers. comm.) visited the Salsipuedes location in the first week of June 2005 for approximately 30 minutes. He did not observe any Hermes copper butterflies; however, he described the habitat as having a decent number of spiny redberry, a large amount of California buckwheat, and said he believed the area was very good for Hermes copper butterfly.

Population Estimates/Status:

Data from standardized transect monitoring of four reference populations from 2010 to 2013 indicate a possible upward trend in abundance. In 2013 a four year high in the total number of Hermes copper butterfly observations was recorded at Sycuan Peak and Lawson Peak, while the total count at the recently discovered Boulder Creek population was approximately 40 percent higher than 2012 (Marschalek and Deutschman 2013, p. 14; D. Marschalek pers. comm. 2014; Figure 2). Abundances at the Roberts Ranch population site stayed relatively stable, but it was a small sample size (Figure 2).

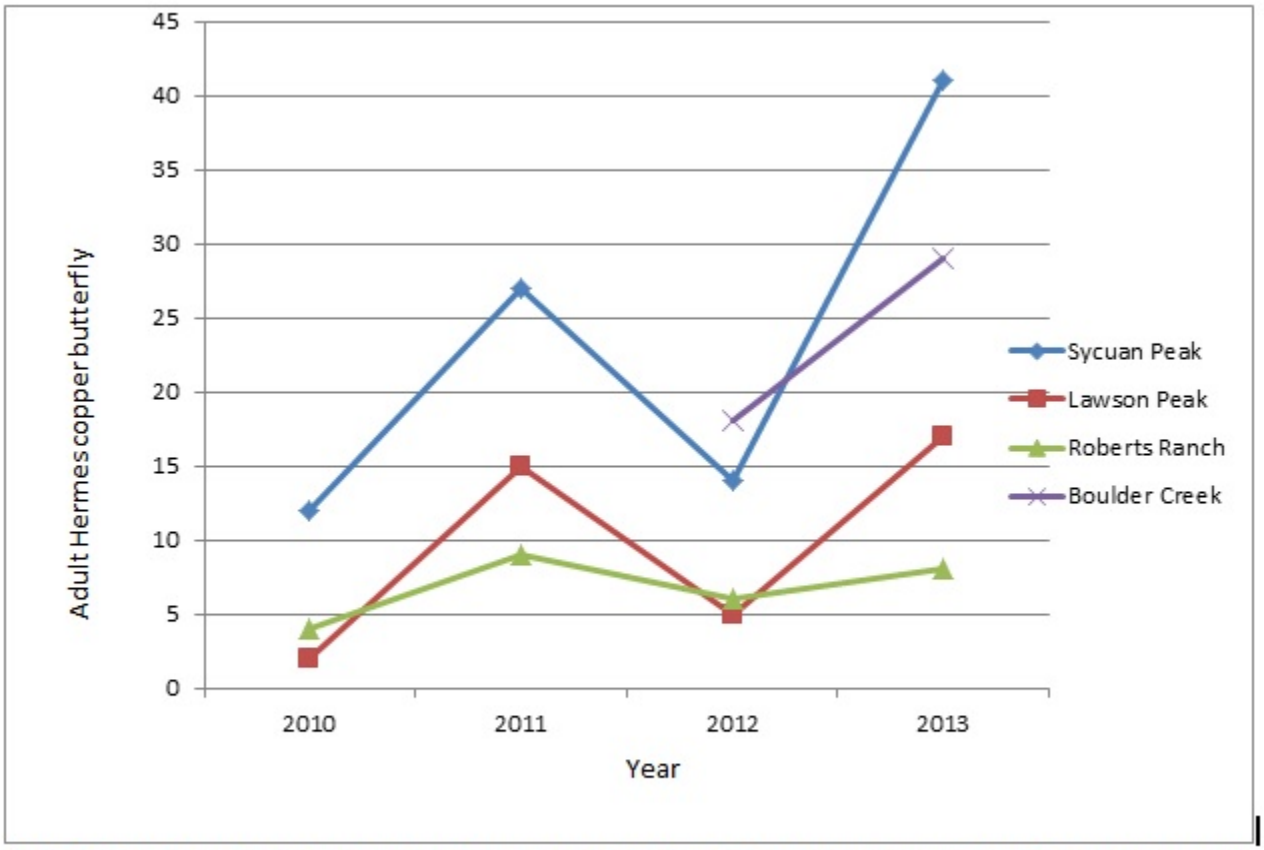

FIGURE 2. Data from standardized transect monitoring of 4 Hermes copper butterfly populations in San Diego County, California from 2010 to 2013 (from Marschalek and Deutschman 2013).

Distinct Population Segment(DPS):

Threats

A. The present or threatened destruction, modification, or curtailment of its habitat or range:

Development

The current distribution of Hermes copper butterfly habitat in San Diego County is largely due to previous urban development within coastal and interior San Diego County which resulted in the loss and fragmentation of Hermes copper butterfly habitat (CalFlora 2010; Consortium of California Herbaria 2010; San Diego County Plant Atlas 2010). Of the 27 known extirpated Hermes copper butterfly populations, loss and fragmentation of habitat as a result of development has contributed to the extirpation of 13 populations (48 percent) (see Biological Information section above and, Table 1 above, and Factor E discussion below). Since the year 2000, occupied habitats containing Hermes copper butterflys host plant, spiny redberry, in Rancho Santa Fe and Sabre Springs were lost due to urban development. In the City of San Marcos, one spiny redberry stand near Jacks Pond was lost to development (Anderson 2010a, pp. 1, 2) and another spiny redberry stand was significantly reduced in the vicinity of Palomar College (Anderson 2010b, pp. 1, 2). The spiny redberry stand in Lopez Canyon is currently found within a relatively small preserve (roughly rectangular area 0.4 mi (0.6 km) by 0.5 mi (0.8 km)) that is contiguous with suitable Hermes copper butterfly habitat in Del Mar Mesa where development is ongoing. This stand of spiny redberry is likely all that remains of what was once a wider distribution, encompassing the community of Mira Mesa and the western portion of Miramar Naval Air Station (per Thornes 1963 map, p. 147).

Although a significant amount of habitat has been lost due to development throughout the range of Hermes copper butterfly within the United States, the remaining currently occupied population areas are protected from destruction by development due to their presence on federally owned lands or on lands conserved under regional habitat conservation plans (approximately 48 percent of the total area currently occupied by Hermes copper butterfly populations occurs on Federal lands and non-federal conserved lands) and the remaining 52 percent of occupied habitat occurs on lands subject to local resource protection ordinances in San Diego County. Our GIS analysis indicates that of the total conserved area discussed above (48 percent of all occupied areas), approximately 19 percent (encompassing portions of 13 populations) is located within established regional habitat conservation plan preserve lands (see Factor D San Diego Multiple Species Conservation Program (MSCP) discussion below), approximately 20 percent (encompassing portions of 12 populations) falls within U.S. Forest Service lands, approximately 6 percent (encompassing portions of 4 populations) falls within U.S. Fish and Wildlife Service lands, and approximately 2 percent (encompassing portions of 4 populations) falls within Bureau of Land Management (BLM) land. These lands are therefore afforded protection from development. Additionally, as described in Factor D below, the County of San Diego now has in place two ordinances that restrict new development or other proposed projects within sensitive habitats. The Biological Mitigation Ordinance of the County of San Diego Subarea Plan (County of San Diego 1998, Ord. Nos. 8845, 9246) regulates development within coastal sage scrub and mixed chaparral habitats that currently support portions of 10 extant Hermes copper butterfly populations on non-federal land within the boundaries of the Countys MSCP subarea plan. The County of San Diego Resource Protection Ordinance (County of San Diego 2007) restricts development within coastal sage scrub and mixed chaparral habitats that currently support all extant Hermes copper butterfly populations on non-federal lands throughout the county. These ordinances provide some regulatory measures of protection for the remaining 52 percent of extant Hermes copper butterfly habitat throughout the species occupied range. Although past development in occupied Hermes copper butterfly habitat resulted in a substantial number of extirpations of Hermes copper butterfly populations, restrictions are in place to limit development and the corresponding destruction and modification of Hermes copper butterfly habitat in the future. Therefore, we do not believe future development alone will significantly reduce or fragment remaining Hermes copper butterfly habitat on non-federal lands. However, as discussed below under Habitat Fragmentation, we believe that the combined impacts of existing development, limited future small-scale development, existing dispersal barriers, and megafires could further fragment Hermes copper butterfly habitat and threaten the species. Within U.S. Forest Service lands, we anticipate that future development, if any, will be limited, and the Forest Service has incorporated measures to address threats to Hermes copper butterfly and its habitat as it implements specific activities within forest lands (see Factor D below for additional discussion). The very limited number of

Hermes copper butterfly populations within BLM lands are unlikely to face future development pressure. Therefore, we conclude that Hermes copper butterfly is not currently threatened by habitat loss due to future development alone.

Wildfire

The historical fire regime in southern California likely was characterized by many small lightning-ignited fires in the summer and a few, infrequent large fires in the fall of varying fire intensity (Keeley and Fotheringham 2003, p. 242243). These infrequent, large, high-intensity wildfires, so-called megafires (greater than 123,553 ac (50,000 ha) in size), burned the landscape long before Europeans settled the Pacific coast (Keeley and Zedler 2009, p. 90). As such, modern fire regimes in southern California have much in common with historical regimes (Keeley and Zedler 2009, p. 69). While some researchers claim that the fire regime of chaparral growing in adjacent Baja California is not affected by megafires due to a lack of fire suppression activities (cf. Minnich and Chou 1997, Minnich 2001), Keeley and Zedler (2009, p. 86) believe that the fire regime in Baja California similarly consists of small fires punctuated at periodic intervals by large fire events. The current fire regime in southern California consists of numerous small fires that are periodically impacted by megafires that are generally driven by extreme Santa Ana weather conditions of high temperatures, low humidity, and strong erratic winds (Keeley and Zedler 2009, p. 90). The primary difference between the current fire regime and historical fire regimes in southern California is that human-induced or anthropogenic ignitions have increased the frequency of fires, and in particular, megafires, far above historical levels. While this change may not have demonstrably affected the nectar sources of Hermes copper butterfly in San Diego County, especially within chaparral (Franklin *et al*. 2004, p. 701), frequent fires open up the landscape, particularly coastal sage scrub, making the habitat more vulnerable to invasive, nonnative plants (Keeley *et al* . 2005, p. 2117). However the primary concern with frequent megafires is the Hermes copper butterfly mortality associated with these extensive and intense events (see Factor E discussion below) which precludes recolonization of burned areas by Hermes copper butterfly.

The significance of this concern can be seen in the current distribution of the species in southern California. Analysis of GIS information indicates that, as of 2013, approximately 60 percent of the extant occurrences are found within the footprint of the 1970 Laguna Fire, which Minnich and Chou (1997, p. 240) reported last burned in 1920. In contrast, the areas north and south of the extant Hermes copper butterfly occurrences reburned several times between 2001 and 2007 (Keeley *et al*. 2009, pp. 287, 293). We examined maps of current high fire threat areas in San Diego County based on recent reports by the Forest Area Safety Task Force (Jones 2008, p. 1; SANDAG 2010, p. 1). Areas identified as most vulnerable include all occupied and potentially occupied Hermes copper butterfly habitats in San Diego County within the southern portion of the range bordered on the north and south by the 2003 Cedar Fire and 2007 Harris Fire perimeters. In light of the recent spate of drought-influenced wildfires in southern California, especially the 2007 fires, a future megafire affecting most or all of the area burned by the Laguna Fire in 1970 (40-year chaparral) is likely to occur and would pose a significant threat to Hermes copper butterfly in the United States because it would encompass the majority of extant populations (see Factor E below for direct mortality effects discussion).

As described in our 90-day finding published in 2006 (USFWS 2006, pp. 4497144972), spiny redberry are obligate resprouters after fires and are resilient to frequent burns (Keeley 1998, p. 258). Additionally, although Keeley and Fotheringham (2003, p. 244) indicated that continued habitat disturbance, such as fire, will result in conversion of native shrublands to nonnative grasslands, Keeley (2004, p. 7) also noted that invasive, nonnative plants will not typically displace obligate resprouting plant species in mesic shrublands that burn once every 10 years. Therefore, because spiny redberry is an obligate resprouter, it will likely recover in those areas that retain this burn frequency. Specific information regarding Hermes copper butterflys primary nectar source (California buckwheat) is less understood. California buckwheat is a facultative seeder and high proportions of this nectar source are likely killed by fire, and densities are reduced the following year within burned areas (Zedler *et al*. 1983, p. 814); however, California buckwheat does show minimal resprouting capability (approximately 10 percent) if individuals are young (Keeley 2006, p. 375). The extent of invasion of nonnative plants and type conversion in areas specifically inhabited by

Hermes copper butterfly are unknown. However, information clearly indicates that wildfire results in at least temporary reductions in suitable habitat for Hermes copper butterfly and may result in lower densities of California buckwheat (Zedler *et al*. 1983, p. 814; Keeley 2006, p. 375; Marschalek and Klein 2010, p. 728). In areas where spiny redberry is capable of resprouting, the quantity of California buckwheat nectar source necessary to support a persisting Hermes copper butterfly population may be temporarily unavailable due to recent fire impacts. If areas are repeatedly burned, California buckwheat will not have the time necessary to become reestablished, rendering the habitat unsuitable for Hermes copper butterfly (Marschalek and Klein 2010, p. 728). Increased fire frequency may also pose a threat to Hermes copper butterfly through loss of host plant and nectar source habitat, and fire management plans are not expected to provide protection from megafires such as those that occurred in 2003 and 2007. Based on the above, we consider wildfire, specifically megafires that encompass vast areas and are increasing in frequency, a significant threat to Hermes copper butterfly.

Habitat Fragmentation

Habitat fragmentation can result in smaller, more vulnerable Hermes copper butterfly populations (see Factor E discussion below). The presence of suitable habitat on which Hermes copper butterflies depend often determines the size and range of the local population. Wildfires and past development have caused habitat fragmentation that separates populations and inhibits movement by creating a gap in area that Hermes copper butterflies are not capable of traversing. The connectivity of habitat occupied by a butterfly population is not defined by host plant distribution at the scale of host plant stands or patches, but rather by adult butterfly movement that results in interbreeding (see USFWS 2003, pp. 22, 162165). Any loss of resource contiguity on the ground that does not affect butterfly movement, such as burned vegetation, may degrade habitat, but may not fragment habitat. Therefore, in order for habitat to be fragmented, movement must be prevented by a barrier, or the distance between remaining host plants where larvae develop must be greater than adult butterflies will move to mate or deposit eggs. Genetic analysis (Deutschman *et al*. 2010; p. 16) indicates that butterflies can show differentiation even when close in proximity, presumably due to physical barriers that may be a result of development or a landscape feature (i.e., the three McGinty Mountain sites that are on opposite sides of the mountain may be separated by topography). Alternately, sampling locations that are not close have shown little genetic differentiation, indicating that butterflies can also disperse long distances under the right conditions. Sampling at one location before and after a fire found genetically differentiated groups. Deutschman *et al*. (2010, p. 16) concluded their findings supported the idea that Hermes copper butterfly individuals are capable of long-distance movement, but developed areas and natural landscape features may enhance or restrict dispersal. It is important to note that although movement may be possible, the habitat must be suitable at the time Hermes copper butterflies arrive to ensure successful recolonization.

As described in our 90-day finding published in 2010 (USFWS 2010, p. 23658), Hermes copper butterfly habitat has become fragmented by both past urban development (permanently) and wildfires. Comparison of Hermes copper butterfly occurrences and host plant distribution with mapped wildfire perimeters indicates that wildfires cause short-term fragmentation of habitat, and, historically, Hermes copper butterfly habitat in San Diego County has been fragmented and lost due to the progression of development over the last 50 years. Analysis of the Hermes copper butterfly populations indicates that in the northern portion of the U.S. range, the habitat has been fragmented (and lost) permanently by development and further fragmented temporally by wildfires, resulting in extirpation of at least four Hermes copper butterfly populations (see Table 1 above). As described in the Biological Information section above and Factor E below, a historical Hermes copper butterfly population (Rancho Santa Fe) in the northern portion of the range has been lost since the year 2000, presumably because the habitat burned and became isolated to an extent that connectivity with other populations was lost. We stated in our 2012 species assessment (USFWS 2012, p. 13) that this area is not expected to be recolonized because the distance to the next nearest source population (13 mi (20 km)) exceeds the dispersal capability of the species, however, since our species assessment we learned the Elfin Forest population was rediscovered approximately 2.7 mi (4.3 km) away. Still, the Elfin Forest population is small, with only one individual detected in 2011. Further to the south, Lopez Canyon, Van Dam Peak, Lakeside Downs, and the extant portion of Mission Trails Park are isolated from other extant populations by

development and burned areas that are no longer likely occupied. While we do not expect future development alone to threaten Hermes copper butterfly habitat, we believe that the combined impacts attributable to wildfire and small scale development may fragment habitat further and hence, threaten the species continued existence. Based on the above, we consider habitat fragmentation, due to the combined impact of existing development, possible future (limited) development, existing dispersal barriers, and megafires, a significant threat to Hermes copper butterfly.

Summary of Factor A

Based on the above information, we consider Hermes copper butterfly to be threatened by the present or threatened destruction, modification, or curtailment of the species habitat or range. Specifically, we consider Hermes copper butterfly threatened by habitat fragmentation and wildfire. The combination of habitat fragmentation (as a result of past and potential limited future urban development), existing dispersal barriers, and megafires (that encompass vast areas and are increasing in frequency) that fragment, limit, and degrade Hermes copper butterfly habitat threaten the species with extirpation throughout its range. These threats are evidenced by the loss and isolation of many populations throughout the range; those remaining extant populations fall within areas of high megafire risk. Thus, we consider threats under this factor to be significant.

B. Overutilization for commercial, recreational, scientific, or educational purposes:

We found two Internet postings (accessed in June 2004) offering to sell specimens of Hermes copper butterfly (Martin 2004, pers. comm.). We found no evidence that Hermes copper butterflies, whole or in parts, were being used in a commercial butterfly essence process (Morning Star Essences 2006, pers. comm.) and we have no other information to indicate that other commercial business activities are a threat to Hermes copper butterfly. Neither of these previously viewed websites offered Hermes copper butterfly for sale during a more recent search (November 22, 2010), nor did we locate any additional commercially available specimens. We found no other information to indicate Hermes copper butterfly is used for commercial, scientific, or educational purposes. Therefore, based on our review of the best available scientific and commercial information, we do not consider overutilization for commercial, recreational, scientific, or educational purposes a current threat to Hermes copper butterfly.

C. Disease or predation:

Disease

We evaluated the potential of disease to threaten Hermes copper butterfly rangewide and found no information indicating disease to be current threat to Hermes copper butterfly.

Predation

Predation (including parasitism) is a factor that is known to cause mortality in butterflies, and therefore could potentially threaten any butterfly species. Faulkner and Klein (2005, p. 26) stated that no papers have reported any parasites or predators for the Hermes copper butterfly, though they obviously exist. Birds may consume Hermes copper butterfly larvae, although we are not aware of any data that indicate bird predation is a significant threat to Hermes copper butterfly. Furthermore, heavy predation of adult insects and their progeny is a common ecological phenomenon, and most species have evolved under conditions where high mortality due to natural enemies has shaped their evolution (see Ehrlich *et al*. 1988). However, we found no information to indicate predation to be current threat to Hermes copper butterfly.

Therefore, based on our review of the best available scientific and commercial information, we do not consider disease or predation a current threat to Hermes copper butterfly.

D. The inadequacy of existing regulatory mechanisms:

The Act requires us to examine the adequacy of existing regulatory mechanisms, with respect to threats, that may ameliorate the danger of Hermes copper butterfly becoming either endangered or threatened. Existing regulatory mechanisms that may have an effect on potential threats to Hermes copper butterfly can be placed into two general categories: (1) Federal mechanisms, and (2) State and local mechanisms.

Federal Mechanisms

There are five primary Federal regulatory mechanisms that we discuss below: the National Forest Management Act (16 U.S.C. 1600 *et seq*.); the Federal Land Policy and Management Act; the Sikes Act as amended (16 U.S.C. 670a *et seq*.); the Healthy Forests Restoration Act of 2003 (16 U.S.C. 6501 *et seq*.); and the National Environmental Policy Act (NEPA; 42 U.S.C. 4321 *et seq*.).

Under the National Forest Management Act of 1976, the U.S. Forest Service (Forest Service) is required to prepare a comprehensive land and natural resource management plan for each unit of the Forest Service, in accordance with NEPAs procedural requirements, to guide the maintenance and use of resources within national forests. The plans require an interdisciplinary approach, including a provision providing for diversity for plant and animal communities (16 U.S.C. 1604(g)(3)(B)). The Forest Service is currently operating under the transition provisions of the 2000 Planning Rule (65 FR 67514; November 9, 2000) as an interim measure until a new planning rule is issued (see 74 FR 67059; December 18, 2009). The 2000 rule allows forests to develop, revise and amend forest plans using the procedures of the 1982 Rule (47 FR 43037; September 30, 1982). All existing forest plans have been developed using the 1982 Planning Rule procedures, including the Cleveland National Forest Plan.

In preparing the Cleveland National Forest (CNF) Plan, the Forest Service evaluated and identified Hermes copper butterfly as a species of concern and then evaluated this species relative to its potential of risk from Forest Service activities and plan decisions in its 2005 Final Environmental Impact Statement (USFS 2005). Hermes copper butterfly, along with 148 other species, was defined as a species-at-risk (USFS 2005, Appendix B, p. 36), requiring a further individual viability assessment. The subsequent threat category identified for Hermes copper butterfly was 5 or Uncommon, narrow endemic, disjunct, or peripheral in the plan area with substantial threats to persistence or distribution from Forest Service activities (USFS 2005, Appendix B, p. 43). The specific threat associated with Hermes copper butterfly and Forest Service management activities is described as Prescribed fire or fuel reduction projects in habitat (affecting host plant, *Rhamnus crocea*) (USFS 2005, Appendix B, p. 52). There are approximately 7,860 acres (ac) (3,181 hectares (ha)) of extant Hermes copper butterfly habitat (encompassing 7 populations) within the CNF and approximately 2,100 ac (850 ha) of Hermes copper butterfly habitat that has been extirpated or is of unknown status. The Forest Service incorporates measures into its planning efforts to address identified threats as it implements specific activities on forest lands. As an example, in 2007, measures were included to protect Hermes copper butterfly habitat ahead of the Horsethief Fuels Reduction Project (Jennings 2007, pers. comm.). Although the proposed project has not yet been implemented, the recommendations of flagging and avoidance of all spiny redberry bushes are standard management measures for relevant CNF activities (Winter 2010, pers. comm.).

The Service has an extensive consultation history with the USFS. Most recently, the USFS submitted a biological assessment to review the effects of ongoing management activities of CNF (USFS 2012, p. 1). This assessment is intended to tier to and update the Services consultation on the 2005 revision of the Land and Resource Management Plans for the Four Southern California Forests, including the CNF Plan. The biological assessment provides updated site-specific information on existing conditions and effects of USFS management within the CNF on Hermes copper butterfly and its habitat, specifically: 1) recreation activities, and 2) construction, use, and maintenance of roads and motorized trails. It also outlines conservation measures such as road use monitoring and, if necessary, installation of barricades or fencing to minimize effects to the species (USFS 2012, pp. 1516).

The CNF has initiated two projects for restoration of habitat at Barber Mountain related to impacts from the Harris Fire (Metz 2010, pers. comm.). In an effort to restore nectar and host plants at this site, seeds from both California buckwheat and spiny redberry plants have been collected locally and California buckwheat seeds have already been planted (Metz 2010, pers. comm.).

Because fires, particularly recent wildfires (megafires), have been identified as a factor affecting the distribution of this species, the CNF has been monitoring Hermes copper butterfly populations in burned and unburned areas of CNF to assist in monitoring the recovery and management of this species on its lands (HDR and E2M, 2009, p. 1). As part of the Forest Services approach to management of Hermes copper butterfly and its habitat, the Forest Service commissioned a 2009 survey to determine the current status of Hermes copper butterfly populations at eight locations in the Descanso Ranger District of the CNF. A total of 16 Hermes copper butterflies was observed at 12 locations at 5 study sites (HDR and E2M 2009, p. 11). The 2009 study concluded that the low number of observations were reflective of the on-going recovery of Hermes copper butterfly habitats from the effects of wildfires, the precipitation pattern in Hermes copper butterfly habitat in 2009, and host plant health (HDR and E2M 2009, p. 25).

Previous monitoring surveys conducted on CNF lands include a 2005 survey for assessment of recolonization at Viejas Mountain, an area impacted by the Cedar Fire in 2003, in which no Hermes copper butterflies were observed (Klein 2005, pers. comm.). Additionally, a 2005 survey at Barber Mountain, an area that had not recently burned, revealed 95 specimens of Hermes copper butterflies (Faulkner 2005, pers. comm.) while a wider 2008 survey of the area after the Witch Fire in 2007 found scattered populations with only two sites containing more than a single specimen (Faulkner, 2008, pers. comm.). Locations were marked for revegetation with California buckwheat and spiny redberry in an attempt to extend the unburned chaparral habitat so as to expand the existing Hermes copper butterfly populations or establish new populations (Faulkner 2008, pers. comm.).

Recent fire events appear to have negatively affected the current occupancy of Hermes copper butterfly at the surveyed locations on CNF lands. The 2009 survey results indicate that of the study sites affected by fires in 2003 and 2007, Hermes copper butterfly was only found at one site (North Descanso), an area located on the southern edge of the area affected by the 2003 Cedar Fire and adjacent to unburned private lands, which the authors speculate contain a source population of Hermes copper butterflies (HDR and E2M 2009, p. 25). The current monitoring, management efforts, and conservation measures implemented and planned by the Forest Service indicate that the CNF is actively working towards conservation of Hermes copper butterfly and its habitat.

The Federal Land Policy and Management Act of 1976 (FLPMA) governs the management of public lands under the jurisdiction of the BLM. The legislative goals of FLPMA are to establish public land policy; to establish guidelines for its [BLMs] administration; and to provide for the management, protection, development and enhancement of the public lands. While FLPMA generally directs that public lands be managed on the basis of multiple use, the statute also directs that such lands be managed to protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values; ***[to] preserve and protect certain public lands in their natural condition; [and to] provide food and habitat for fish and wildlife ***. (43 U.S.C. 1701(a)(8)). Although the BLM has a multiple-use mandate under the FLPMA which allows for grazing, mining, and off-road vehicle use, the BLM also has the ability under the FLPMA to establish and implement special management areas such as Areas of Critical Environmental Concern, wilderness areas, research areas, etc. BLMs South Coast Resource Management Plan covers the San Diego County area. Approximately 2 percent, or 1,468 ac (593 ha) of the total Hermes copper butterfly habitat occupied by extant populations or populations of unknown status (4 populations in this case) occur within the BLM owned lands. Hermes copper butterfly was a species considered but not addressed in the BLMs South Coast Resource Management Plan (SCRMP; BLM 1994, p. 76) but many components of Hermes copper butterfly habitat (coastal sage scrub and chaparral) are contained within the SCRMP planning area, and receive some regulatory protection under the plan. An approximately 201 ac (81 ha) portion of the Descanso South population (see Table 1 and Figure 1 above; Map #31;) falls

within the Pine Creek Wilderness Area and therefore benefits from BLMs wilderness protection policies. The Pine Creek Wilderness Area is managed in accordance with the provisions of the Wilderness Act of 1964 (16 U.S.C. 1131 *et seq*.). The Wilderness Act of 1964 strictly limits use of wilderness areas, imposing restrictions on use of vehicles, new developments, chainsaw use, mountain bike use, leasing, and mining, in order to protect the natural habitats of the areas, maintain species diversity, and enhance biological values. Lands acquired by BLM within wilderness area boundaries become part of the designated wilderness area and are managed in accordance with all provisions of the Wilderness Act and applicable laws. We believe existing BLM regulations provide adequate protection from the threat of development described in Factors A above, but not from mortality and habitat fragmentation due to megafire as described in Factors A above and E below. However, megafire is not a threat that is susceptible to reduction or elimination by regulatory mechanisms.

The Sikes Act requires the Department of Defense to develop and implement integrated natural resources management plans (INRMPs) for military installations across the United States. We are not aware of any currently extant Hermes copper butterfly populations on military installations; however there are historical Hermes copper butterfly observation locations and potential Hermes copper butterfly habitat (see Table 1 and Figure 1 above, Map # 40) on Marine Corps Air Station, Miramar (MCAS Miramar) and the adjacent Mission Gorge Recreational Facility (also known as Admiral Baker Field), which is owned by the U.S. Navy.

The INRMPs are reviewed every year by military installations and modified as needed, and are reviewed at least every 5 years with the U.S. Fish and Wildlife Service (Service) and States. Through its 2011 INRMP, the U.S. Marine Corps manages natural resources on MCAS Miramar following principles of ecosystem management. In general, the MCAS Miramar strategy for conservation and management is to: (1) limit activities, minimize development, and mitigate actions in areas supporting high densities of vernal pool habitat, threatened or endangered species, and other wetlands; and (2) manage activities and development in areas of low densities, or no regulated resources, with site-specific measures and programmatic instructions. Management Areas (MAs) were identified primarily to support the conservation and management of Special Status Species (species listed by the federal government as threatened, endangered, proposed for listing as threatened or endangered, or are candidates for such listings), wetlands, and other areas warranting special attention (USMC 2011, Executive Summary, p. 4 and chapter 4, p. 16). For Hermes copper butterfly, all sites identified as supporting the species prior to the 2003 Cedar Fire remain undeveloped, and most of these sites and other areas of potential habitat are within MAs identified to conserve other threatened and endangered species. This species was not detected on MCAS Miramar during 2010 surveys of previously occupied and potential habitat. However, the INRMP specifies that if Hermes copper butterfly is listed as threatened or endangered, focused surveys for the species must be completed prior to actions that would remove stands of spiny redberry (USMC 2011, chapter 7, p. 19).

Through the 2002 Naval Base San Diego INRMP, which is currently under revision, the Navy manages its open space areas, including those on Mission Gorge Recreational Facility, using an ecosystem-level approach that includes invasive species removal, habitat restoration and enhancement, and natural resource inventories (Stathos 2010, pers. comm.). In the 2002 INRMP, the Navy identified the following focus areas for management actions: wildlife conservation and management, rare wildlife species, exotic vegetation control, habitat restoration, and fire management (U.S. Navy 2002, section 3, pp. 3740 and 4547). Hermes copper butterfly is not identified as a rare species in the INRMP; however, some existing management recommendations and actions may also be beneficial to Hermes copper butterfly, if it is rediscovered on Navy lands.

The Healthy Forests Restoration Act of 2003 includes the first meaningful statutory incentive for the US Forest Service and the Bureau of Land Management to give consideration to prioritized fuel reduction projects identified by local communities. In order for a community to take advantage of this opportunity, a Community Wildfire Protection Plan (CWPP) must be prepared. The process of developing a CWPP can help a community identify and clarify priorities for the protection of life, property and critical infrastructure in the wildland-urban interface (WUI) (Fire Safe Council of San Diego County 2011). See our discussion of

CWPPs below under the State and Local Regulations subsection. Combined, the Healthy Forests Restoration Act and the Community Wildfire Protection Plan emphasize the need for Federal, State and local agencies to work collaboratively with communities in developing hazardous fuel reduction projects, and place priority on treatment areas identified by the communities themselves in a CWPP (Fire Safe Council of San Diego County 2011). While these regulations reduce the impact of wildfire to some extent, especially with regard to human property and safety, the impact of megafires on wildlands is not a threat that is susceptible to elimination by such regulatory mechanisms.

All Federal agencies are required to adhere to the National Environmental Policy Act (NEPA) of 1970 for projects they fund, authorize, or carry out. The Council on Environmental Quality's regulations for implementing NEPA (40 CFR 15001518) state that in their environmental impact statements agencies shall include a discussion on the environmental impacts of the various project alternatives (including the proposed action), any adverse environmental effects which cannot be avoided, and any irreversible or irretrievable commitments of resources involved (40 CFR 1502). NEPA itself is a disclosure law that provides an opportunity for the public to submit comments on the particular project and propose other conservation measures that may directly benefit listed species; however, it does not require subsequent minimization or mitigation measures by the Federal agency involved. Although Federal agencies may include conservation measures for listed species as a result of the NEPA process, Hermes copper butterfly may be provided indirect protections due to its co-occurrence with listed species. Any such measures are typically voluntary in nature and are not required by the statute. Additionally, activities on non-federal lands are subject to NEPA if there is a Federal nexus.

As stated above, land and resource management plans prepared by the Forest Service and BLM must be developed in accordance with NEPA requirements and, as noted above, the Forest Service prepared an environmental impact statement for its 2005 Land Management Plans (including the Cleveland National Forest Plan) and will be required to meet NEPA requirements in preparing its revised plan. Similarly, the U.S. Navy must meet the procedural requirements of NEPA in developing its INRMPs.

State and Local Mechanisms

The California Environmental Quality Act (CEQA) (Public Resources Code 21000-21177) and the CEQA Guidelines (California Code of Regulations, Title 14, Division 6, Chapter 3, sections 15000-15387) requires State and local agencies to identify the significant environmental impacts of their actions and to avoid or mitigate those impacts, if feasible. CEQA applies to projects proposed to be undertaken or requiring approval by State and local government agencies and the lead agency must complete the environmental review process required by CEQA, including conducting an initial study to identify the environmental impacts of the project and determine whether the identified impacts are "significant." If significant impacts are determined, then an environmental impact report must be prepared to provide State and local agencies and the general public with detailed information on the potentially significant environmental effects (CERES 2010). Thresholds of Significance are comprehensive criteria used to define environmental significant impacts based on quantitative and qualitative standards and include impacts to biological resources such as candidate, sensitive, or special status species identified in local or regional plans, policies, or regulations, or by the California Department of Fish and Game (CDFG) or the Service; or impacts to any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the CDFG or Service (Appendix G, CEQA 2010). Defining these significance thresholds helps ensure a rational basis for significance determinations and provides support to the final determination and appropriate revisions or mitigation actions to a project in order to develop a mitigated negative declaration rather than an environmental impact report (Governors Office of Planning and Research 1994, p. 5).

The County of San Diego has developed the *Guidelines for Determining Significance and Report Format and Content Requirements Biological Resources* (Guidelines) (County of San Diego 2010) to review discretionary projects and environmental documents pursuant to the CEQA. The Guidelines provide guidance for evaluating adverse environmental effects that a proposed project may have on biological resources and

are consulted during the evaluation of any biological resource pursuant to CEQA. Included in the specific guidelines, under Special Species Status, is a determination as to whether a project will impact occupied Hermes copper butterfly habitat. Section 4.1 K (p. 14) of the guidelines states: Though not state or federally listed, the Hermes copper meets the definition of endangered under CEQA Sec. 15380 because its survival and reproduction in the wild are in immediate jeopardy from one or more causes, including loss of habitat, change in habitat, overexploitation, predation, competition, disease, or other factors. The Countys determination that the Hermes copper meets the definition of endangered under CEQA is based on the loss of Hermes copper populations by development and wildfire, and the review of published and unpublished literature. Interim guidelines for surveying, assessing impacts, and designing mitigation for Hermes copper are provided in Attachment C of the Report Format and Content Requirements Biological Resources. (County of San Diego 2010, p. 14). The newly added Hermes copper butterfly section of the guidelines offers a proactive requirement for project review under CEQA that can provide a specific protective measure to the species and its habitat.

The San Diego Multiple Species Conservation Program (MSCP) is a subregional habitat conservation plan (HCP) and Natural Community Conservation Plan (NCCP) made up of several subarea plans that have been in place for more than a decade. Under the umbrella of the MSCP, each of the 12 participating jurisdictions is required to prepare a subarea plan that implements the goals of the MSCP within that particular jurisdiction. The MSCP covers 582,243 ac (235,625 ha) and the County of San Diego Subarea Plan covers 252,132 ac (102,035 ha) of unincorporated county lands in the southwestern portion of the MSCP plan area. The County subarea plan is implemented in part by the Biological Mitigation Ordinance (BMO), which outlines specific project design criteria and species and habitat protection and mitigation requirements for projects within subarea boundaries (see MSCP Subarea Plan, County of San Diego 2007, and Biological Mitigation Ordinance (Ord. Nos. 8845, 9246), County of San Diego 1998). All projects within the Countys subarea plan boundaries must comply with both the MSCP requirements and the Countys policies under CEQA. Hermes copper butterfly is not a covered species under any MSCP subarea plans; however, the protections afforded by the BMO indirectly benefit the species by establishing mitigation ratios and project development conditions that restrict development within coastal sage scrub and mixed chaparral habitats. Of the 21currently extant Hermes copper butterfly populations, the BMO affords some indirect protection to the 10 that fall all or partially within the Countys subarea plan boundaries.

The County of San Diego Resource Protection Ordinance (RPO) (County of San Diego 2007) applies to all non-federal lands within the County located within and outside of the County of San Diego subarea plan boundaries. The RPO imposes restrictions on development to reduce impacts to natural resources including sensitive habitat lands. Sensitive habitat lands are those that support unique vegetation communities or those that are either necessary to support a viable population of sensitive species, are critical to the proper functioning of a balanced natural ecosystem, or which serve as a functioning wildlife corridor (County of San Diego 2007, p. 3). They can include areas that contain maritime succulent scrub, southern coastal bluff scrub, coastal and desert dunes, calcicolous scrub, and maritime chaparral, among others. Impacts to RPO sensitive habitat lands, which include lands with potential host and nectar plant habitat for Hermes copper butterfly (*i.e*., scrub and chaparral), are only allowed when all feasible measures have been applied to reduce impacts and when mitigation provides an equal or greater benefit to the affected species (County of San Diego 2007, p. 13).

The California Department of Forestry and Fire Protection (CAL FIRE) is an emergency response and resource protection department. CAL FIRE protects lives, property and natural resources from fire; and protects and preserves timberlands, wildlands, and urban forests. The CAl FIRESs varied programs work together to plan protection strategies incorporating concepts of the National Fire Plan, the California Fire Plan, individual CAL FIRE Unit Fire Plans, and Community Wildfire Protection Plans (CWPPs). Fire Plans outline the fire situation within each CAL FIRE Unit, and CWPPs do the same for communities (CALFIRE 2011a, p. 1; County of San Diego 2011). Each plan identifies prevention measures to reduce risks, informs and involves the local communities in the area, and provides a framework to diminish potential wildfire losses and implement all applicable fire management regulations and policies (CALFIRE 2011b; County of

San Diego 2011). Planning includes other Federal, State, and local government agencies as well as Fire Safe Councils (CALFIRE 2011a, p. 1). Cooperative efforts via contracts and agreements between Federal, State, and local agencies are essential to respond to wildland fires (CALFIRE 2011a, p. 1). Because of these types of cooperative efforts, fire engines and crews from many different agencies may respond at the scene of an emergency (CALFIRE 2011a, p. 1); however CAL FIRE typically takes the lead with regard to planning for megafire, prevention, management, and suppression, and CAL FIRE is in charge of incident command during a wildfire. The San Diego County Fire Authority (SDCFA), local governments, and CAL FIRE cooperatively protect 1.42 million acres of land with 54 fire stations throughout San Diego County (County of San Diego 2011, p. 1). Wildfire management plans and associated actions can help to reduce the impacts of wildfire on natural resources, including Hermes copper butterfly, but their first priority is human health and safety. While these plans and associated measures ameliorate the impacts of wildfire to some extent, especially with regard to human property and safety, the impact of megafires on wildlands is not a threat that is susceptible to elimination by such regulatory mechanisms.

Summary of Factor D

In summary, we considered the adequacy of existing regulatory mechanisms to protect Hermes copper butterfly. On Forest Service lands, the Cleveland National Forest Plan addresses the conservation of natural resources, including Hermes copper butterfly, and specific management practices have been identified and are being implemented to conserve existing populations of Hermes copper butterfly and its habitat. Approximately 2 percent of Hermes copper butterfly habitat occurs on BLM lands and is afforded some protection through the South Coast Management Plan and Wilderness Area designation through management of habitat areas for listed and other sensitive species and land use limitations Although the Navy has not recorded extant populations of Hermes copper butterfly on their lands in San Diego County, we believe the management measures identified in their INRMP for the Mission Gorge Recreational Facility provides an adequate protective mechanism for existing coastal sage habitat suitable for Hermes copper butterfly. Hermes copper butterfly and its habitat may also receive protection under NEPA as land management plans, INRMPs, and activity level plans are developed on Forest Service, BLM, U.S. Marine Corps and U.S. Navy lands either occupied by or that contain suitable habitat for the species.

On State and county lands occupied by Hermes copper butterfly or containing its habitat, we believe the requirements of CEQA and the two County ordinances are adequate regulatory mechanisms that protect the species and its habitat from development related impacts. The Biological Mitigation Ordinance of the County of San Diego Subarea Plan and the County of San Diego Resource Protection Ordinance impose restrictions on development within coastal sage scrub and mixed chaparral habitats that support half of the historical distribution of Hermes copper butterfly populations. Although Federal, State, and local regulatory mechanisms help to reduce wildfire impacts, primarily to property and human safety, they do not adequately protect Hermes copper butterfly from direct mortality or habitat fragmentation due to megafires. However, we do not consider the impact of megafire on wildlands to be a threat that is susceptible to elimination by regulatory mechanisms.

Therefore, based on our review of the best available scientific and commercial information, we do not consider the inadequacy of existing regulatory mechanisms to be a threat to Hermes copper butterfly.

E. Other natural or manmade factors affecting its continued existence:

Wildfire

As discussed in the **Biological Information** section and Factor A discussions above, wildfire can result in temporal loss of Hermes copper butterfly habitat. However, the most significant threat posed by wildfire to Hermes copper butterfly is the direct loss (*i.e.*, mortality) of butterflies associated with extensive and intense fire events. The magnitude of this threat is increased by the periodic occurrence of megafires, which are typically created by extreme Santa Ana weather conditions of high temperatures, low humidity, and strong

erratic winds (see **Biological Information** section and Factor As wildfire discussion above; Keeley and Zedler 2009, p. 90). Human-induced or anthropogenic ignitions have increased the frequency of fire far above historical levels (Keeley and Fotheringham 2003, p. 240). Recolonization of burned areas by Hermes copper butterfly can be precluded when fires, and particularly megafires, occur too frequently. The significance of this concern can be seen in the current distribution of the species in southern California; analysis of GIS information indicates approximately 60 percent of the extant occurrences are found within the footprint of the 1970 Laguna Fire, which Minnich and Chou (1997, p. 240) reported last burned in 1920. In contrast, the areas north and south of the extant Hermes copper butterfly occurrences burned several times from 2001 to 2007 (Keeley *et al*. 2009, pp. 287, 293). A single megafire burning most or all of the 40-year old chaparral in the footprint of the Laguna fire would likely imperil the species in the United States (see Figure 1 above). Additionally, as discussed in the **Biological Information** section above, the 2003 Otay and Cedar fires and the 2007 Harris and Witch Creek fires in particular have negatively impacted the species, resulting in or contributing to the extirpation of 9 of the 37 known populations in 2000 (see Table 1 above).

It is well-documented that wildfires that occur in occupied Hermes copper butterfly habitat result in loss of Hermes copper butterflies (Klein and Faulkner 2003, pp. 96, 97; Marschalek and Klein 2010, pp. 4, 5). The butterflies rarely survive wildfire because life stages of the butterfly inhabit host plant foliage, and spiny redberry typically burns to the ground and resprouts from stumps (Deutschman *et al*. 2010, p. 8; Marschalek and Klein 2010, p. 8). This results in at least the temporal loss of both the habitat (until the spiny redberry and nectar source regrowth occurs) and the presence of butterflies (occupancy) in the area. Wildfires can also leave patches of unburned occupied habitat that are functionally isolated (e.g., further than the dispersal distance of the butterfly) from other occupied habitat. Furthermore, large fires can eliminate source populations before previously burned habitat can be recolonized, and can result in long-term or permanent loss of butterfly populations. For example in Mission Trails Park the 7,303 ac (2596 ha) Assist #59 Fire in 1981 and the smaller 126 ac (51 ha) Assist #14 Fire in 1983 (no significant overlap between fires), resulted in an approximate 18-year extirpation of the Mission Trails Park Hermes copper butterfly population (Klein and Faulkner 2003, pp. 96, 97). More recent examples include extirpations of the monitored Crestridge, Rancho Jamul, Anderson Road, Hollenbeck Canyon, and San Miguel Mountain populations, as well as other less-monitored populations (Marschalek and Klein 2010, pp. 4, 5; Deutschman *et al*. 2010, p. 36). After the 2003 Cedar Fire, Hermes copper butterfly records at the regularly monitored Crestridge population, once considered the largest and most robust population within the species range (Klein and Faulkner 2003, p. 86), were limited to presumably the same male for a 6-day period in 2005, and another single male observed in 2007 (Marschalek and Klein 2010, p. 4; Deutschman *et al*. 2010, p. 33). Marschalek (2010, p. 2) described how when his study colonies in the Rancho Jamul population were extirpated by fire in 2003, he discovered additional occupied habitat on the other side of a nearby firebreak in 2004; however the remaining population distribution was extirpated in the 2007 Harris Fire (Marschalek 2010, pers. comm.). Data indicate all historical populations burned in both the 2003 and 2007 fires were extirpated except North Descanso, where record locations were within a narrow extension of the fire perimeter surrounded on three sides by unburned habitat (see Table 1 and Figure 1 above). We know this habitat was recolonized because genetic research determined the colonizing individuals were not related to those collected before the fire (Deutschman *et al*. 2010, p. 16). These facts underscore the importance of having available Hermes copper butterfly source populations to recolonize habitat after fire. As discussed in the **Biological Information** section above, of the 37 extant Hermes copper butterfly populations in 2000, 1 northern Hermes copper butterfly population and 8 southern populations are believed to have been extirpated by fire or a combination of fire and development since 2003 (see Table 1 above).

As discussed above under Factor A, we examined maps of current high fire threat areas in San Diego County based on recent reports by the Forest Area Safety Task Force (Jones 2008; SANDAG 2010). Areas identified as most vulnerable include all occupied and potentially occupied Hermes copper butterfly habitats in San Diego County within the southern portion of the range bordered on the north and south by the 2003 Cedar Fire and 2007 Harris Fire perimeters. Nineteen potential source populations for recolonization of habitats burned in the past 10 years (extant or of unknown status) fall within a contiguous area that has not recently burned (southeastern populations in Figure 1), and where the threat of fire is considered high (SANDAG

2010). All except 3 of these potential source populations (North Descanso, Hartley Peak, and North Guatay Mountain) also fall within the 174,026 ac (70,426 ha) 1970 Laguna Fire perimeter (similar in size to the 2003 and 2007 fires), and the 3 that do not fall within the Laguna Fire perimeter fall partially within the 2003 and 2007 fire perimeters. This analysis of current fire danger and fire history illustrates the potential for permanent loss of the majority of remaining butterfly populations should another large fire occur prior to recolonization of burned habitats (per discussion above, recolonization may not occur for up to 18 years). As discussed by Marschalek and Klein (2010, p. 9) and Deutschman *et al*. (2010, p. 42), there is a risk that one or more wildfires could extirpate the majority of extant Hermes copper butterfly populations. Based on the above, we consider wildfire, specifically megafires that encompass vast areas and are increasing in frequency, a significant threat to Hermes copper butterfly.

Vulnerability of Small and Isolated Populations

Small population size, low population numbers, and population isolation are not necessarily independent factors that threaten a species. Typically, it is the combination of small size and number and isolation of populations in conjunction with other threats (such as the present or threatened destruction and modification of the species habitat or range) that may significantly increase the probability of species extinction.

Population isolation renders smaller populations more vulnerable to stochastic extirpation. Small populations and isolation could also subject Hermes copper butterfly to genetic drift and restricted gene flow that may decrease genetic variability over time and could adversely affect species viability (Allee 1931, pp. 1237; Stephens *et al*. 1999, pp. 185190; Dennis 2002, pp. 389401). The best available scientific information indicates adult Hermes copper butterfly densities have been reduced to low or no detectability, or occupancy has been entirely eliminated in some burned areas (for example Crestridge, see Factor A discussion above), and habitat has been fragmented and isolated by development (Deutschman *et al*. 2010, p. 33). As discussed in the **Biological Information** section and Factor A discussion above, most remaining northern habitats are limited to the relatively isolated and fragmented undeveloped lands between the cities of San Marcos, Carlsbad, and Escondido and the community of Rancho Santa Fe. Additionally, the nearest occupied Hermes copper butterfly location (Mission Trails) to the habitat islands containing the Black Mountain and Van Dam Peak observation locations are approximately 9 mi (14 km) and 7 mi (11 km) away, respectively, and separated by highly developed areas. One Hermes copper butterfly was observed in each area (Elfin Forest in the north and the Van Dam Peak island) in 2011. Should these populations become extirpated, future recolonization of Hermes copper butterfly to these areas is not likely due to their isolation. One population isolated by development was extirpated due to the 2007 Witch Creek Fire (Rancho Santa Fe). Further to the south, Lopez Canyon, Lakeside Downs, and the extant portion of Mission Trails Park are isolated from other extant populations by development and burned areas that are no longer likely occupied. Therefore, we consider the effects of restricted geographical range, population isolation, and reduced population size a significant threat to Hermes copper butterfly.

Global Climate Change

Evaluations by Parmesan and Galbraith (2004, pp. 12, 2933) indicate whole ecosystems may be shifting northward and upward in elevation, or are otherwise being altered by differing climate tolerance among species within communities. Climate change may be causing changes in the arrangement and community composition of occupied habitat patches. Current climate change predictions for terrestrial areas in the Northern Hemisphere and the southwestern United States indicate warmer air temperatures, more intense precipitation events, and increased summer drying (Field *et al*. 1999, pp. 13; Hayhoe *et al*. 2004, p. 12422; Cayan *et al*. 2005, p. 6; Intergovernmental Panel on Climate Change (IPCC) 2007, p. 11). However, predictions of climatic conditions for smaller subregions, such as San Diego County, remain less certain. Tabor and Williams (2010, p. 562) summarized the four major sources of uncertainty in downscaled climate projections: (1) Uncertainties in future greenhouse gas emissions and atmospheric composition (scenario uncertainty); (2) uncertainties in modeling the climate response (Global Circulation Model uncertainty); (3) uncertainties in the observational data sets used as the basemap for the debiasing procedure (historical

observational uncertainty); and (4) uncertainty over the validity of assumptions underlying the change-factor approach (change-factor uncertainty). These uncertainties are a general phenomenon of climate model downscaling and they can be substantial, especially the first two (Tabor and Williams 2010, pp. 562, 564). Thus, discretion is necessary when using downscaled climate projections, because downscaling Global Circulation Models to the finest available resolution may produce misleading results (Tabor and Williams 2010, p. 564). Southern California has a unique and globally rare Mediterranean climate. Summers are typically dry and hot while winters are cool, with minimal rainfall averaging about 10 inches per year. The maritime influence of the Pacific Ocean combined with the coastal and inland mountain ranges creates an inversion layer typical of Mediterranean-like climates, particularly in southern California. These conditions also create microclimates, where the weather can be highly variable within small geographic areas at the same time. These microclimates are difficult to model and make it even more difficult to predict meaningful changes in climate for this region, specifically for small local areas, and the resultant impact on the Hermes copper butterfly and its habitat.

We evaluated the available historical weather data and the species biology to determine the likelihood of effects assuming the climate has been and will continue to change. The typical effect of a warmer climate, as observed with Hermes copper butterfly in lower, warmer elevation habitats compared to higher, cooler elevations, is an earlier flight season by several days (Thorne 1963, p. 146; Marschalek and Deutschman 2008, p. 98). Marschalek and Klein (2010, p. 2) noted that past records suggest a slightly earlier flight season in recent years compared to the 1960s. The earliest published day of flight prior to 1963, after 30 years of extensive collecting, was May 20 (Thorne 1963, pp. 143, 146), but adults began flying on May 16 and May 12 in 2003 and 2004, respectively (Marschalek and Deutschman 2008, p. 100), and were reported as early as April 29 in 2003, and May 14 in 2008 (CFWO GIS database). The record early observation on April 29, 2003, was from Fortuna Mountain in Mission Trails Park, a well-collected population with records dating back to 1958, including collections by Thorne (called Mission Gorge or Mission Dam on museum specimen labels) where May 21 was the earliest documented record from the 1960s and early 1970s (before climate change trends were reasonably detectable as described by the IPCC (2007, pp. 2, 4)). The historical temperature trend in Hermes copper butterfly habitats for the month of April (when larvae are typically developing and pupating) from 1957 to 2006 can be calculated with relatively high confidence (p values from 0.001 to 0.05). The rate of temperature change has been an increase of 0.04 to 0.07 o F (0.07 to 0.13 o C) per year (Climate Wizard 2010), a total increase of which could explain the earlier than average flight seasons. The latest published observation date (presumed end of flight season) of an adult prior to 1970 was on July 30, 1967 (museum specimen collected by Thorne at Suncrest); however, the latest observation date from monitoring and data and other records in the past 10 years was on July 2 in 2010, despite an uncharacteristically late start to the flight season (May 29). Shorter flight seasons are also consistent with higher average temperatures, as a higher metabolism in these exothermic short-lived invertebrates typically results in faster growth and earlier death. Nevertheless, given the temporal and geographical availability of their widespread perennial host plant, and exposure to extremes of climate throughout their known historical range (Thorne 1963, p. 144), Hermes copper butterfly and its host and nectar plants are not likely to be negatively affected throughout the majority of the species range by phenological shifts in development of a few days (unlike species such as Ediths checkerspot (*Euphydryas editha*) that depend on annual host plants; USFWS 2003, pp. 63, 64). While it is possible the species climatic tolerance, such as temperature thresholds for activity (see **Biological Information** section above), could result in a change in the species niche and distribution of suitable habitat as the climate changes, predicting any such changes would be speculative because we do not understand what currently limits the species range to a much smaller geographic area than its host plant. Based on the above, we do not consider global climate change a current threat to Hermes copper butterfly.

Mexico Populations

Although wildfire and isolation of small populations may be threats to Hermes copper butterfly and its habitat in Mexico, especially near the U.S. border where the human population and development is most concentrated, these threats are likely of less magnitude because there is far less development in the more

remote areas of Baja California that may support Hermes copper butterfly. We are not aware of any conservation activities related to Hermes copper butterfly in Mexico.

Summary of Factor E

In summary, we consider Hermes copper butterfly threatened by other natural or manmade factors affecting the species continued existence. Specifically, Hermes copper butterfly is threatened with extirpation due to wildfire (megafire), restricted geographical range, and population isolation. The loss of populations, due to megafires and population fragmentation and isolation, inhibits the ability of Hermes copper butterfly to rebound from stochastic events such as megafires. These threats are evidenced by the loss of populations in the north and south of the U.S. range and subsequent isolation of other populations throughout the range. The majority of remaining extant populations fall within a restricted area bounded by development and face high megafire risk. Thus, we consider threats under this factor to be significant.

Conservation Measures Planned or Implemented :

Hermes copper butterfly has indirectly benefitted from conservation measures implemented for other species by subarea plans of the MSCP. As of 2013, approximately 19 percent of the current range of Hermes copper butterfly is already conserved in preserves within the City of San Diego and County of San Diego subarea plans (USFWS 2013); therefore, these lands are protected from the threat of development.

Summary of Threats :

We identified threats to Hermes copper butterfly attributable primarily to megafires (large wildfires) and small and isolated populations (Factor E), and to a lesser extent, habitat loss due to increased wildfire frequency and due to fragmentation resulting from the combined impacts of existing development, possible future (limited) development, existing dispersal barriers, and megafires (Factor A). The primary threats to the species are mortality from wildfire and small population size. These threats increase the risk of extirpation of Hermes copper butterfly populations rangewide. Hermes copper butterfly occupies scattered areas of sage scrub and chaparral habitat in an arid region susceptible to wildfires of increasing frequency and size. The likelihood that the species will be burned by catastrophic wildfires, combined with the isolation and small size of extant populations makes Hermes copper butterfly particularly vulnerable to population extirpation rangewide. Therefore, we find that there are threats of sufficient imminence, intensity, or magnitude to indicate that Hermes copper butterfly is in danger of extinction (endangered), or likely to become endangered within the foreseeable future (threatened), throughout its range or a significant portion of its range based on the threats described above. We find that listing this species throughout its range is warranted, and therefore, find that it is unnecessary to analyze whether it is threatened or endangered in a significant portion of its range.

For species that are being removed from candidate status:

_____ Is the removal based in whole or in part on one or more individual conservation efforts that you determined met the standards in the Policy for Evaluation of Conservation Efforts When Making Listing Decisions(PECE)?

Recommended Conservation Measures :

Investigations into aspects of Hermes copper butterfly biology that are poorly understood should be continued, specifically: 1) monitoring for adult Hermes copper butterflies at the larger, previously monitored sites to identify environmental variables important for annual densities of adults; 2) monitoring for adult Hermes copper butterflies at small populations in the northern portion of the distribution to determine detection rates; 3) monitoring of sites that experience recent wildfires and local extirpations to detect recolonization events, which would allow inferences about dispersal; 4) behavioral observations of female

adult Hermes copper butterflies; and 5) egg searches and tracking larval development to estimate the rate of hatching, depredation, and diapause as well as better understand habitat requirements (Strahm *et al*. 2012, p. 44). Finally, investigations into *in vitro* rearing of Hermes copper butterfly could be conducted as an insurance policy against fire (Deutchman *et al*. 2011, p. 31).

Priority Table

Magnitude	Immediacy	Taxonomy	Priority
High	Imminent	Monotypic genus	1
		Species	2
		Subspecies/Population	3
	Non-imminent	Monotypic genus	4
		Species	**5**
		Subspecies/Population	6
Moderate to Low	Imminent	Monotype genus	7
		Species	8
		Subspecies/Population	9
	Non-Imminent	Monotype genus	10
		Species	11
		Subspecies/Population	12

Rationale for Change in Listing Priority Number:

Magnitude:

The threats that Hermes copper butterfly faces are high in magnitude because the major threats (particularly mortality due to wildfire and increased wildfire frequency) occur throughout all of the species range and are likely to result in adverse impacts to the status of the species. Based on an evaluation of all known historical populations, approximately 46 percent are believed to have been extirpated. Historical records indicate that development has isolated and modified habitats in the northern portion of the U.S. range. The isolation of these habitats has inhibited the species ability to recolonize after stochastic events such as wildfires. When a wildfire passes through an occupied area, it is highly likely that all individuals or eggs, if present, within the area are killed (see discussion under Factor E: Wildfire above). As populations become more isolated from other occupied areas, their ability to recolonize after such events is lost. As described in the discussions of wildlife under Factors A and E above, wildfires are increasing in frequency and magnitude which increases the potential for isolation of populations and, in turn, increases the risk of extirpation rangewide. Therefore, the magnitude of the threats is high.

Imminence :

Hermes copper butterfly faces actual, identifiable threats as discussed under Factors A and E, including the threat of a large, high-intensity wildfire (megafire) capable of killing Hermes copper butterfly populations and destroying or modifying the species habitat in a way that would cause a rangewide reduction in populations; however, the impact of wildfire to Hermes copper butterfly and its habitat occurs on a sporadic basis and we do not have the ability to predict when wildfires will occur. Therefore, we believe the imminence of threats is non-imminent.

__Yes__ Have you promptly reviewed all of the information received regarding the species for the purpose of determination whether emergency listing is needed?

Emergency Listing Review

__No__ Is Emergency Listing Warranted?

As described above, current threats to the species are considered non-imminent; therefore, emergency listed is not warranted.

Description of Monitoring:

Starting in 2010, research and monitoring of Hermes copper butterfly has been funded by San Diego Association of Governments, with collection of population data the primary focus in 2010 and 2011 (Strahm et al. 2012, p. 2). This included surveys for Hermes copper butterfly on conserved lands within unoccupied, suitable habitat for the species and at sites of current populations (Deutchman et al. 2011, p. 1). In 2012, the emphasis shifted to resolving critical biological uncertainties about the species biology, including dispersal and genetics, egg biology and reproductive behavior, while also evaluating population trends at sites of several of the larger populations (Marschalek and Deutschman 2013, pp. 27; Figure 2). Population monitoring, searching for recolonization events, egg searches and larval observations, and captive rearing studies are funded through 2014. Larval rearing was attempted in the spring of 2013 with eggs obtained from females in June 2012, but no larvae survived to maturity (Marschalek and Deutschman 2013, p. 7). As funding for the project is awarded yearly, it is unknown at this time if the project will continue after May 31, 2014.

Indicate which State(s) (within the range of the species) provided information or comments on the species or latest species assessment:

none

Indicate which State(s) did not provide any information or comment:

California

State Coordination:

The State of California did not comment on this review.

Literature Cited:

REFERENCES CITED

Allee, W.C. 1931. Animal aggregations: a study in general sociology. The University of Chicago Press; Chicago, Illinois.

Anderson, A. 2010a. Hermes Copper Butterfly 12-month Finding Full Status Review with Analysis Table: white paper. Dated December 14, 2010.

_____. 2010b. Notes: North County Hermes copper butterfly surveys. Dated June 14, 2010.

Ballmer, G. and G. Pratt. 1988. A survey of the last instar larvae of the Lycaenidae (Lepidoptera) of California. Journal of Research on the Lepidoptera 27(1):188.

[BLM] Bureau of Land Management. 1994. South Coast Resource Management Plan. June 1994.

[CALFIRE] California Department of Forestry and Fire Protection. 2011a. What is CAL FIRE? Information document downloaded from www.fire.ca.gov. Accessed February 24, 2011.

_____. 2011b. Fire Planning Introduction. Website viewed on February 24, 2011. *http://cdfdata.fire.ca.gov/fire_er/fpp_planning*

CalFlora. 2010. Website viewed on November 30, 2010. *http://www.calflora.org/*

Cayan, D., M. Dettinger, I. Stewart, and N. Knowles. 2005. Recent changes towards earlier springs: early signs of climate warming in western North America. U.S. Geological Survey, Scripps Institution of Oceanography, La Jolla, California.

[CEQA] California Environmental Quality Act (CEQA) Handbook. 2010. Website viewed on November 30, 2010. *http://ceres.ca.gov/planning/sch/*

[CERES] California Environmental Resources Evaluation System. 2010. Website viewed on November 30, 2010. *http://ceres.ca.gov/ceqa/summary.html*

Climate Wizard. 2010. Website viewed on November 30, 2010. *http://www.climatewizard.org/*

Consortium of California Herbaria. 2010. Website viewed on November 30, 2010. *http://ucjeps.berkeley.edu/consortium/*

County of San Diego. 1998. San Diego County biological mitigation ordinance. Ordinance nos. 8845 and 9246. April 2, 2010. Website viewed December 3, 2010. *http://www.sdcounty.ca.gov/dplu/mscp/bmo.html*

_____. 2007. San Diego County resource protection ordinance. Ordinance no. 9842 (new series). Website viewed December 3, 2010. *http://www.sdcounty.ca.gov/cob/ordinances/ord9842.doc*

_____. 2010. Guidelines for determining significance and report format and content requirements biological resources. Department of Planning and Land Use, Department of Public Works, Fourth Revision. September 15, 2010.

_____. 2011. A Systems Approach to Addressing Wildfire and Fire Protection. Information document downloaded from *www.co.san-diego.ca.us*. Accessed February 24, 2011.

Dennis, B. 2002. Allee effects in stochastic populations. Oikos 96:389-401.

Deutschman, D., M. Berres, D. Marschalek, and S. Strahm. 2010. Initial evaluation of the status of Hermes copper (*Lycaena hermes*). Prepared for San Diego Association of Governments. MOU#5001442. 54 pp.

Deutschman, D., M. Berres, D. Marschalek, and S. Strahm. 2011. Two-year evaluation of Hermes copper (*Lycaena hermes*) on conserved lands in San Diego County. Prepared for San Diego Association of Governments. MOU#5001442. 47 pp.

Edwards, W.H. 1870. Descriptions of new species of diurnal lepidoptera found within the United States. Transactions of the American Entomological Society 3:1022.

Emmel, T.C. and J.F. Emmel. 1973. The butterflies of Southern California. Natural History Museum of Los Angeles County, Science Series 26. November 30, 1973.

Emmel, T.C. 1998. Systematics of western North American butterflies. Mariposa Press, Gainesville, Florida.

Faulkner, D.K. and J.W. Brown. 1993. The Hermes copper, Lycaena hermes (Edwards). *In* Conservation biology of Lycaenidae (butterflies). International Union for Conservation of Nature, T.R. New (ed.), Gland, Switzerland. 173 pp.

Faulkner, D. K. and M. Klein. 2005. San Diegos sensitive butterflies: a workshop focusing on 10 local species. San Diego, California. Unpublished document.

[FEC] Forensic Entomology Services. 2004. Hermes Copper Butterfly Surveys, 2004, Helix Land Co., and Helix 1960, Ltd., Lakeside Downs Property, USFWS Permit #TE-838743-3. Unpublished document submitted to Affinis Environmental Services, El Cajon, California.

Field, C.B., G.C. Daily, F.W. Davis, S. Gaines, P.A. Matson, J. Melack, and N.L. Miller. 1999. Confronting climate change in California. Ecological impacts on the Golden State. A report of the Union of Concerned Scientists, Cambridge, Massachusetts, and the Ecological Society of America, Washington, DC.

Fire Safe Council of San Diego County. 2011. Community Wildfire Protection Plans (CWPP). Website viewed February 24, 2011. *http://www.wildfirezone.org/your_property.asp?page_idno=627*

Franklin, J., C.L. Coulter, S.J. Rey. 2004. Change over 70 years in a southern California chaparral community related to fire history. Journal of Vegetation Science 15:701710.

Freeman, T.N. 1936. Notes on the specific grouping of the genus Lycaena (Lepidoptera). Canadian Entomologist 68:277279.

Governors Office of Planning and Research. 1994. Thresholds of Significance: Criteria for Defining Environmental Significance. CEQA Technical Advice Series. 12 pp.

Gullan, P.J., and P.S. Cranston. 2010. The insects: an outline of entomology. Wiley-Blackwell Publishing, Hoboken, New Jersey.

Hayhoe, K, D. Cayan, C.B. Field, P.C. Frumhoff, E.P. Maurer, N.L. Miller, S.C. Moser, S.H. Schneider, K.N. Cahill, E.E. Cleland, L. Dale, R. Drapek, R.M. Hanemann, L.S. Kalkstein, J. Lenihan, C.K. Lunch, R.P. Neilson, S.C. Sheridan, and J.H. Verville. 2004. Emissions pathways, climate change, and impacts on California. Proceedings of the National Academy of Sciences of the United States of America (PNAS). 101: 12422-12427. doi: 10.1073/pnas.0404500101.

HDR and E2M. 2009. 2009 Hermes Copper Butterfly Survey Descanso Ranger District, Cleveland National Forest, San Diego, California. Prepared for Cleveland National Forest, San Diego, California; October 2009.

[IPCC] Intergovernmental Panel on Climate Change. 2007. Climate change 2007: the physical science basis - summary for policymakers. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, IPCC Secretariat, World Meteorological Organization and United Nations Environment Programme, Geneva, Switzerland.

Jones, J.H. 2008. Fire danger zones updated maps show 3 areas at most risk of burning in giant blazes. San Diego Union Tribune, September 28, 2008. Accessed through SignOnSanDiego.com. *http://www.signonsandiego.com/uniontrib/20080928/news_1n28nextfire.html*

Keeley, J.E. 1998. Coupling demography, physiology and evolution in chaparral shrubs. In Landscape Degradation and Biodiversity in Mediterranean-Type Ecosystems, Ecological Studies Volume 136, Rundel et al. (eds.), pp. 257-264.

_____. 2004. Invasive plants and fire management in California Mediterranean-climate ecosystems. Proceedings 10th MEDECOS Conference, April 25 May 1, 2004. Rhodes, Greece, eds. Arianoutsou and Papnanstasis.

_____. 2006. Fire severity and plant age in postfire resprouting of woody plants in sage scrub and chaparral. MadroÃ±o 53(4):373379.

Keeley, J.E. and C.J. Fotheringham. 2003. Impact of past, present, and future fire regimes on North American mediterranean shrublands. In Fire and Climatic Change in Temperate Ecosystems of the Western Americas, T.T. Veblen, W.L. Baker, G. Montenegro, and T.W. Swetnam (eds.), pp. 218262.

Keeley, J.E., and P.H. Zedler. 2009. Large, high-intensity fire events in southern California shrublands: debunking the fine grain age patch model. Ecological Applications 19(1) 6994.

Keeley, J.E., M. Baer-Keeley, C. J. Fotheringham. 2005. Alien plant dynamics following fire in mediterranean-climate California shrublands. Ecological Applications 15(6):21092125.

Keeley, J.E., H. Scafford, C.J. Fotheringham, J. Franklin, and M. Moritz. 2009. The 2007 southern California wildfires: lessons in complexity. Journal of Forestry. September 2009, pp. 287296.

Klein, M.W. and D.K. Faulkner. 2003. Hermes copper (*Lycaena (Hermelycaena) hermes*): An update on this unique species. News of the Lepidopterists Society. 45:9698.

Little, E.L., Jr. 1976. Atlas of United States trees, Volume 3, minor Western hardwoods: U.S. Department of Agriculture Miscellaneous Publication 1314, 13 p., 290 maps.

Marschalek, D.A. and D.H. Deutschman. 2008. Hermes copper (*Lycaena [Hermelycaena] hermes : Lycaenidae*): Life history and population estimation of a rare butterfly. Journal of Insect Conservation. 12:97105.

_____. 2009. Larvae and oviposition of Hermes copper (Lepidoptera: Lycaenidae). Journal of Entomological Science 44(4):400401.

_____. 2013. Exhibit A- Scope of Work, rare Butterfly Management Studies on Conserved Lands in San Diego County: Hermes Copper Butterfly (Lycena hermes), Harbison's Dun Skipper (Euphys vestris harbisoni), October 1, 2013 to August 30, 2016. Prepared for the San Diego Association of Governments, submitted to the Carlsbad Fish and Wildlife Office for review. 31 pp.

Marschalek, D.A. and M.W. Klein, Sr. 2010. Distribution, ecology, and conservation of Hermes copper (*Lycaenidae: Lycaena [Hermelycaena] hermes*). Journal of Insect Conservation. Published online doi:10.1007/s10841-010-9302-6, June 22, 2010.

Miller, L.D. and F.M. Brown. 1979. Studies in the Lycaeninae (Lycaenidae) the higher classification of the American coppers. Bulletin of the Allyn Museum, 51:130.

Minnich, R.A. 2001. An integrated model of two fire regimes. Conservation Biology 15(6):15491553.

Minnich, R.A. and Y.H. Chou. 1997. Wildland fire patch dynamics in the chaparral of southern California and northern Baja California. International Journal of Wildland Fire 7(3):221248.

Opler, P.A., and A.D. Warren. 2005. Lepidoptera of North America scientific names list for butterfly species of North America, north of Mexico. C.P. Gillette Museum of Arthropod diversity, Department of Bioagricultural Sciences and Pest management, Colorado State University, Fort Collins, Colorado. 79 pp.

Parmesan, C. and H. Galbraith. 2004. Observed impacts of global climate change in the U.S. Prepared for the Pew Center on global climate change. 55 pp.

Pratt, G.F. and D.W. Wright. 2002. Allozyme phylogeny of the North American coppers (Lycaeninae: Lycaenidae). Pan-Pacific Entomologist 78(4):219229.

Robbins, R.K. and G.B. Small, Jr. 1981. Wind dispersal of Panamanian hairstreak butterflies (Lepidoptera: Lycaenidae) and its evolutionary significance. Biotropica 13(4):308315.

SANDAG. 2010. County of San Diego Threat From Wildfires. SanGis Map, Updated August 13, 2008.

San Diego County Plant Atlas. 2010. Website viewed on December 20, 2010. *http://www.sdplantatlas.org/(S(0eeky055ph34ryjjpgwmeuyj))/index.aspx*

Scott, J.A. 1986. The butterflies of North America a natural history and field guide. Stanford University Press, Stanford, California.

Scudder, S.H. 1876. Synonymic list of the butterflies of North America, north of Mexico. In Bulletin of the Buffalo Society of Natural Sciences, Volume III, pp. 98129.

Stephens, P.A., W.J. Sutherland, and R.P. Freckleton. 1999. What is the allee effect? Oikos. 87:185190.

Strahm, S.L., D.A. Marschalek, D.H. Deutschman, and M.E. Berres. 2012. Monitoring the Status of Hermes Copper (*Lycaena hermes*) on Conserved Lands in San Diego County: 2010 2012. Prepared for San Diego Association of Governments. MOU#5001442. 61 pp.

Tabor, K. and J.W. Williams. 2010. Globally downscaled climate projections for assessing the conservation impacts of climate change. Ecological Applications 20(2):554565.

Thorne, F. 1963. The distribution of an endemic butterfly *Lycaena hermes*. Journal of Research on the Lepidoptera. 2:143150.

[USFS] U.S. Department of Agriculture, Forest Service. 2005. Final Environmental Impact Statement, Volume 1: Land Management Plans. Angeles National Forest, Cleveland National Forest, Los Padres National Forest, San Bernardino National Forest. R5MB074A.

_____. U.S. Department of Agriculture, Forest Service. 2012. Biological Assessment for Ongoing Activities (Recreation Management, Forest Roads, Forest Trails, and Forest Administrative Infrastructure) under the Revised Land Management Plan, Cleveland National Forest. Document submitted to the U.S. Fish and Wildlife Service, 53 pp.

[USFWS] U.S. Fish and Wildlife Service. 2003. Recovery Plan for the Quino checkerspot butterfly (*Euphydryas editha quino*), Region 1, Portland Oregon. August 11, 2003.

_____. U.S. Fish and Wildlife Service. 2006. Endangered and threatened wildlife and plants; 90-day finding on a petition to list the Hermes Copper Butterfly as endangered. Federal Register 71: 4496644976.

_____. U.S. Fish and Wildlife Service. 2010. Endangered and threatened wildlife and plants; 90-day finding on a petition to list Hermes Copper Butterfly as endangered or threatened. Federal Register 75: 2365423663.

_____. U.S. Fish and Wildlife Service. 2012. U.S. Fish and Wildlife Service Species Assessment and Listing Priority Assignment Form. Entered Hermes Copper in search tool. Under Candidate Information,

viewed Species Assessment Form for the Lycaena hermes. *http://www.fws.gov/endangered/*

_____. U.S. Fish and Wildlife Service. 2013. GIS Data, Carlsbad, California.

[USGS] U.S. Geological Survey. 2006. Butterflies of North America, Butterflies of California, Hermes Copper (Lycaena [Hermelycaena] hermes), Northern Prairie Wildlife Research Center Website. *http://www.npwrc.usgs.gov/resource/distr/lepid/bflyusa/ca/263.htm*

[USMC] U.S. Marine Corps. 2011. Integrated Natural Resources Management Plan for Marine Corps Air Station, Miramar, California, 20112015, Subject to Annual Review and Revision. Unpublished document submitted to the U.S. Fish and Wildlife Service, Carlsbad, California.

U.S. Navy. 2002. Naval Base San Diego Integrated Natural Resources Management Plan. Unpublished document submitted to the U.S. Fish and Wildlife Service, Carlsbad, California.

Zedler, P.H., C.R. Gautier, and G.S. McMaster. 1983. Vegetation change in response to extreme events: the effect of a short interval between fires in California chaparral and coastal scrub. Ecology 64(4):809818.

PERSONAL AND IN LITTERIS COMMUNICATIONS

Couffer, M. 20014. Biolgist, Grey Owl Biological Consulting. Phone Converstaion with Alison Anderson, US Fish and Wildlife Service, May 2, 2014.

Faulkner, D.K. 2005. Entomologist, Forensic Entomology Services. Survey report to Kirsten Winter, Cleveland National Forest, dated June 20, 2005.

_____. 2008. Entomologist, Forensic Entomology Services. Survey report to Kirsten Winter, Cleveland National Forest, dated September 20, 2008.

Jennings, M. 2007. Biologist, Cleveland National Forest. Memorandum to Tom Gillett, District Ranger, Cleveland National Forest, dated July 27, 2007.

Klein, M. 2005. Biologist, Klein-Edwards Professional Services. Letter to Kirsten Winter, Cleveland National Forest, dated June 14, 2005

_____. 2010. Biologist, Klein-Edwards Professional Services. Email to Alison Anderson, U.S. Fish and Wildlife Service, dated December 6, 2010.

_____. 2014. Biolgist, Klein-Edwards Professional Services. Phone conversation with Alison ANderson, US Fish and Wildlife Service, May 2, 2014.

Marschalek, D. 2010. Entomologist, University of Wisconsin. Email to Alison Anderson, U.S. Fish and Wildlife Service, dated December 6, 2010.

_____. 2014. Entomologist, San Diego State University. Phone conversation with Alison ANderson, US Fish and Wildlife Service, May 2 2014.

Martin, J. 2004. John Martin, Biologist, Carlsbad Fish and Wildlife Office. Internal memo to Tannika Engelhard, Joel Pagel, and Susan Wynn, dated July 28, 2004. Subject: draft assessment and listing priority assignment form for Hermes copper (*Lycaena hermes*).

Metz, W. 2010. Forest Supervisor, Cleveland National Forest. Letter to Jim Bartel, U.S. Fish and Wildlife Service, dated May 5, 2010.

Morning Star Essences. 2006. E-mail to Bianca Streif, U.S. Fish and Wildlife Service, dated March 11. 2006. Subject: validation this company does not use butterflies to make their products.

Stathos, C.L. 2010. U.S. Navy. Letter to U.S. Fish and Wildlife Service, dated July 6, 2010.

Winter, K. 2010. Kirstin Winter, Forest biologist, Cleveland National Forest. U.S. Department of Agriculture, Forest Service. Phone record between Carey Galst, Biologist, U.S. Fish and Wildlife Service, Carlsbad Fish and Wildlife Office, and Kirstin Winter dated April 13, 2010. Subject: Hermes copper butterflys status in Cleveland National Forest.

Approval/Concurrence:

Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve: 06/10/2014
Date

Concur: 11/18/2014
Date

Did not concur: _____ _____
Date

Director's Remarks: