

Callippe Silverspot Butterfly
(Speyeria callippe callippe)

**5-Year Review:
Summary and Evaluation**



Photo: David Kelly, USFWS

**U.S. Fish and Wildlife Service
Sacramento Fish and Wildlife Office
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5-YEAR REVIEW

Callippe silverspot butterfly (*Speyeria callippe callippe*)

I. GENERAL INFORMATION

Purpose of 5-Year Reviews:

The U.S. Fish and Wildlife Service (USFWS) is required by section 4(c)(2) of the Endangered Species Act (Act) to conduct a status review of each listed species at least once every 5 years. The purpose of a 5-year review is to evaluate whether or not the species' status has changed since it was listed (or since the most recent 5-year review). Based on the 5-year review, we recommend whether the species should be removed from the list of endangered and threatened species, be changed in status from endangered to threatened, or be changed in status from threatened to endangered. Our original listing of a species as endangered or threatened is based on the existence of threats attributable to one or more of the five threat factors described in section 4(a)(1) of the Act, and we must consider these same five factors in any subsequent consideration of reclassification or delisting of a species. In the 5-year review, we consider the best available scientific and commercial data on the species, and focus on new information available since the species was listed or last reviewed. If we recommend a change in listing status based on the results of the 5-year review, we must propose to do so through a separate rule-making process defined in the Act that includes public review and comment.

Species Overview:

The callippe silverspot butterfly (*Speyeria callippe callippe*) is a member of the brush-foot family (Nymphalidae) and is part of a species that contains 19 subspecies that are found throughout the western and northwestern United States eastward to the Dakotas, Wyoming and Colorado, and northward to southern Canada as far east as Manitoba (Opler and Wright 1999; Shapiro and Manolis 2007; Pelham 2008). *Speyeria callippe callippe* is commonly called the San Francisco silverspot butterfly or the callippe silverspot butterfly. For the purpose of this five year review the common name callippe silverspot butterfly will refer to the endangered subspecies *S. c. callippe*. The callippe silverspot butterfly is found exclusively within grassy hills surrounding San Francisco Bay that support its native host-plant, *Viola pedunculata* (California golden violet or Johnny jump-up). The callippe silverspot is a medium sized butterfly with a wingspan of about 5.5 centimeters (2.2 inches) with upper wings that are brown showing extensive black spots and lines, and having melanic (dark colored) basal areas. The undersides of the wings are brown, orange-brown, and tan showing black lines and distinctive black and bright silver spots. The body and basal area of the wings of the callippe silverspot butterfly are densely pubescent (covered with hair). This butterfly is univoltine (one flight of adults annually), has five larval instars, and develops for two weeks in a pupal case before emerging as an adult. The adult flight period averages from mid-May to mid-July. The adult callippe silverspot butterfly nectars on several native and non-native flowering plants.

Methodology Used to Complete This Review:

This review was prepared by the Sacramento Fish and Wildlife Office (SFWO), following the Region 8 guidance issued in March 2008. We used information from the original listing, an internal draft version of the Recovery Plan, survey information from experts who have been monitoring various localities of this species, and from messages exchanged with various lepidopterists. The Internal Draft Recovery Plan and personal communications with experts were our primary sources of information used to update the species' status and threats. We received two letters from the public in response to our Federal Register Notice initiating this 5-year review. This 5-year review contains updated information on the species' biology and threats, and an assessment of that information compared to that known at the time of listing or since the last 5-year review. We focus on current threats to the species that are associated with the Act's five listing factors. The review synthesizes all this information to evaluate the listing status of the species and provide an indication of its progress towards recovery. Finally, based on this synthesis and the threats identified in the five-factor analysis, we recommend a prioritized list of conservation actions to be completed or initiated within the next 5 years.

Contact Information:

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Federal Register (FR) Notice Citation Announcing Initiation of This Review: A notice announcing initiation of the five year review of this taxon and the opening of a 60-day period of time to receive information from the public was published on March 5, 2008 [73 FR 11945]. We received two letters from the public.

Listing history:

Original Listing

FR notice: 62 FR 64306 - 64320 (USFWS 1997)

Date listed: December 5, 1997

Entity listed: Callippe silverspot butterfly (*Speyeria callippe callippe*), an insect subspecies.

Classification: Endangered

Associated rulemakings:

Critical habitat for the callippe silverspot butterfly was proposed in 1978 (USFWS 1978), but then withdrawn in 1979 (USFWS 1979) because of procedural and substantive changes in prior law made by the Endangered Species Act Amendments of 1978. In 1980 critical habitat was again proposed for the butterfly (USFWS 1980), but was withdrawn when the listing for the species expired without a final rule being made within two years of the proposed listing being published. The butterfly was again petitioned for listing in 1991, and a proposed listing rule

(USFWS 1994) was published in 1994, followed by the final listing rule published in 1997 (USFWS 1997). At the time of listing (1997) it was determined that the designation of critical habitat would not provide additional benefit for the butterfly beyond that provided by the listing. None of the remaining suitable habitat for the callippe silverspot butterfly was believed to exist on Federal lands (USFWS 1997).

Review History: No formal status review has been conducted since the species was listed in 1997

Species' Recovery Priority Number at Start of Five Year Review: The recovery priority number for the callippe silverspot butterfly is 9C according to the Service's 2008 Recovery Data Call for the Sacramento Fish and Wildlife Office, based on a 1-18 ranking system where 1 is the highest-ranked recovery priority and 18 is the lowest (Endangered and Threatened Species Listing and Recovery Priority Guidelines, 48 FR 43098, September 21, 1983). This number indicates that the taxon is a subspecies that faces a moderate degree of threat and has a high potential for recovery. The "C" indicates conflict with construction or other development projects or other forms of economic activity.

Recovery Plan or Outline

Name of plan: Internal Draft Recovery Plan for the Callippe Silverspot Butterfly

II. REVIEW ANALYSIS

Application of the 1996 Distinct Population Segment (DPS) Policy

The Endangered Species Act defines "species" as including any subspecies of fish or wildlife or plants, and any distinct population segment (DPS) of any species of vertebrate wildlife. This definition of species under the Act limits listing as distinct population segments to species of vertebrate fish or wildlife. Because the species under review is an invertebrate, the DPS policy is not applicable, and the application of the DPS policy to the species' listing is not addressed further in this review.

Information on the Species and its Status

Species Biology and Life History

Most of what was written in the proposed (1994) and in the final listing rule (1997) for this species was derived from correspondence with entomologist Sterling Mattoon in 1992, the 1982 San Bruno Mountain survey report by Thomas Reid and Associates, and a 1981 scientific journal article by Dr. Richard Arnold. A summary of what was known of the species biology and life history at listing follows:

The callippe silverspot is found in native grassland and associated habitat. The females lay their eggs in the dried remains of their host plant, *Viola pedunculata* or on the surrounding debris. Within a week the larvae hatch and eat their egg shells, wander a short distance, and spin a silk pad upon which they pass the summer and winter in diapause (an inactive period). Upon termination of diapause in the spring, the larvae search for food plants, grow through five larval stages or instars, and pupate in a composite leaf and silk chamber. Adults emerge in about 2

weeks and fly for about 3 weeks from about mid-May to about late July, depending on environmental conditions. Hilltopping behavior is practiced by this butterfly, which allows males and receptive females to congregate on topographic summits to find mates (USFWS 1997).

The following information on the biology and life history, spatial distribution, abundance, habitat, changes in taxonomy, genetics, and species specific research supplements and updates the background provided in the listing. Some of the information provided below predates the proposed listing of the butterfly, but was not included in the listing package; we include this older material to provide a complete review of the species biology and status:

Adult stage – The average flight season of the adult callippe silverspot butterfly has been determined at San Bruno Mountain to began in mid-May when the adults eclose (emerge) from the pupae, and typically ends in mid-July (TRA Environmental 2007). The length and timing of the flight season was found to correspond (as statistical artifacts) to both the number of individuals observed and the death rate of the adults. An increase in adult individuals observed during a flight season statistically increases the chances of observing both the earliest adult sighting and the latest adult sighting, thus increasing the probability of observing a longer flight season (Mattoni *et al.* 2001, Thomas Reid Associates 2002). Early death rates of adults that result from unfavorable conditions (drought, lack of nectar plants) will tend to shorten the flight season. As is common among many butterfly species, males tend to eclose about a week earlier than females (protandry), yet this may vary with the population at San Bruno Mountain from year to year (Thomas Reid Associates 2002). Protandry was found to increase the chance of males successfully mating in populations of butterflies where females mate only once and where males must compete for receptive females (Calabrese and Fagan 2004). The average life span of the adult callippe silverspot butterfly was determined to be about 5 days for males and 7 days for females (Arnold 1981).

Adult callippe silverspot butterflies are known to use a variety of nectar plants (see list below under habitat section). The preferred nectar plants of the callippe silverspot butterfly are in flower throughout the flight season, thus, allowing continuous use by the adults without the need to shift among different species (Thomas Reid Associates 1982). Adults of the *Speyeria* genus of butterflies are known to be strong fliers and can disperse over relatively long distances, up to 1.2 kilometers (0.8 mile) between breeding colonies (Howe 1975).

Mating behavior has been observed for the callippe silverspot butterfly. Hilltopping, a behavior where butterflies congregate on hilltops presumably to find mates, is observed frequently with this species. Males were found to actively patrol territories on hilltops, and they have been observed both aggressively chasing away other males and searching for and pursuing females for mating opportunities (Mattoon *et al.* 1971). Mating commonly occurs soon after the females emerge from the pupae by males that, owing to protandry, have reached sexual maturity earlier than the females (Mattoon *et al.* 1971). One observed mating ritual of this species involves a spiraling flight together of male and female. Females will reject advances of other males once mating is completed (Thomas Reid Associates 1982). Males have been found performing hilltopping behavior more often than females (Thomas Reid Associates 1982). This disparity is probably a result of the post-mating behavior of females, where they tend to go through an inactive period (diapause) prior to oviposition and then will search for oviposition sites near host plants, down off the hill tops (Thomas Reid Associates 1982). Females are capable of producing

more than 600 eggs in one clutch, which enables them to lay their eggs rather “haphazardly” near the larval host plant. The vast numbers of first instar larvae dampens the effect of a high mortality rate these larvae experience in the process of securing “homes” on an appropriate *Viola pedunculata* plant (Mattoon *et al.* 1971, Kopper *et al.* 2000).

Egg Stage - Observations at San Bruno Mountain revealed that callippe silverspot butterfly females do not oviposit directly on the host plant, but oviposit on dirt, dry grass, plant debris, and rodent trails and holes at a distance from a few centimeters up to 0.9 meters (3 feet) away from the host *Viola pedunculata* (Thomas Reid Associate 1982). Further observation revealed that females oviposit at sites that are shaded by grasses or forbs, usually between 10 a.m. and 2 p.m. Females oviposit throughout the early summer (Thomas Reid Associates 1982).

Larval Stage - Larvae of all instars feed exclusively on the herbaceous foliage of the *Viola pedunculata*, which has suitable foliage available only during a short time of the year (Arnold 1981). Larvae have been observed feeding in the late afternoon and twilight, which has been suggested to serve as predator avoidance (Arnold 1981), and is a behavior that was correlated to illumination levels but not to ambient temperature (Kopper *et al.* 2001).

Pupal Stage - After completing five stages of growth, or larval instars, the callippe silverspot larvae constructs a pupal case and after two weeks of structural transformation, the adult ecloses (emerges) from the pupal case, continuing the life cycle.

Spatial Distribution

When listed in 1997 only 2 populations throughout the historic range of the butterfly were believed to remain extant. One population was on San Bruno Mountain in San Mateo County, while the other population was in a city park in Alameda County (USFWS 1997). It is believed that the population in the city park is now extirpated. A population located in the hills between the City of Vallejo and the City of Cordelia (the Cordelia Hills, Solano County) is considered to be *S. c. callippe* and has been observed and photographed at the King/Swett Ranch, along St. John’s Mine Road, at Hunter Hill, and around Lake Herman (Murphy and Weiss 1990; Mattoon in litt. 1992; Arnold 2007; Solano Land Trust 2009; USFWS 2008a, 2009a, b). Currently, three additional populations have been observed; however, their taxonomic status as *S. c. callippe* has not been verified. These include (1) a population around Sears Point in Sonoma County (Mattoon in litt. 1992; Emmel 1998), (2) a population in the hills in the City of Pleasanton in Alameda County (Mattoon in litt. 1992; LSA Associates 2002), and (3) along the watershed to the east of Calaveras Reservoir (just east of the city of Milpitas) in Alameda County (Arnold 2004a, b). Dr. Arnold noted that the individuals from the Calaveras reservoir population displayed morphological characteristics intermediate between the callippe silverspot butterfly (*S. c. callippe*) and Comstock’s silverspot butterfly (*S. c. comstocki*); however, Dr. Arnold judged that this population was closer in appearance to the callippe silverspot butterfly (Arnold 2004a, b).

In summary, the Service recognizes two populations of callippe silverspot butterflies, a San Bruno Mountain population and a Cordelia Hills population and the Service believes that the population at the city park in Alameda County has been extirpated. Other populations that have been described as possible callippe silverspot populations have not yet been taxonomically verified.

Abundance

When listed in 1997, the abundance of the two extant populations was unknown. Since 1980 a bi-annual survey of the adult callippe silverspot butterfly population at San Bruno Mountain has been the only consistent survey conducted for the callippe silverspot butterfly. This survey has produced various estimates of the population abundance that show a large amount of annual fluctuation (Thomas Reid Associates 1999). In 1980 and 1981 the survey was performed as a mark-recapture study revealing a population estimate of 11,000 and 8,000 consecutively for the two seasons. This type of survey was discontinued because it was time consuming and may have been harming the population (Murphy 1988). From 1982 to 1997 a series of wandering transect style surveys were conducted annually. The abundance figure calculated from this survey method was the number of butterflies sighted per hour, which was calculated by dividing the total butterflies sighted during the survey by the number of man hours used for conducting the surveys. Monitoring conducted at San Bruno Mountain from 1982 to 2001 revealed a range in the population size from 216 to 1,749 individuals. Although surveys were not performed during some years (1989, 1990, 1991, 1993, 1994), the average population trend appears to be stable during this time period (Thomas Reid Associates 1999).

Monitoring surveys since 1998 were changed to the fixed transect method (TRA Environmental Sciences 2007) based on a consultation revealing that the fixed transect method would provide statistically, more sound results (Longcore *et al.* 2004). Monitoring data in 2006, continuing with the fixed transect method, revealed that there were a total of 443 callippe silverspot butterflies observed during five passes through the transects, with a rate of 14.5 sightings per hour. This rate is not significantly different from the earlier years of fixed transect surveys, with the exception of the 2001 survey, which saw a relatively large abundance of the callippe silverspot butterfly (TRA Environmental Sciences 2007). The survey completed in 2008 revealed a slightly increased number of butterflies sighted (476 total) and an increase in sightings per hour (19.4), but overall reveals an apparently stable population trend (TRA Environmental Sciences 2009).

Informal surveys for presence/absence of any and all species of butterflies have also been performed annually at San Bruno Mountain preserve as part of the North American butterfly count; however, these surveys do not provide data from which abundance or population trends can be determined. The most recent count, for example, was performed as a one day/one time walking survey in the summer of 2009 where 21 callippe silverspot butterflies were counted within the San Bruno Mountain preserve (P Kobernus, Coast Range Ecology, *in litt.* 2009).

Monitoring surveys of the callippe silverspot butterfly at San Bruno Mountain were compared with several environmental factors to determine if abundance of butterflies correlated to environmental factors (TRA Environmental Sciences 2007). An association was found that showed that increased rainfall during the wet season was followed by increased numbers of adults counted as compared to years with less rainfall when fewer adults were counted (TRA Environmental Sciences 2007).

The population at the city park in Alameda County has not been surveyed since 1973 (S. Mattoon, private consultant, *in litt.* 1992) and the grassland habitat appears to have been significantly altered. Thus, the Service believes that population at the city park in Alameda County has been extirpated. The population in the Cordelia Hills has been observed as recently as spring 2009 at the King/Swett Ranch area; however, surveys have not been conducted for this

population with the exception of Dr. Arnold's 2006 survey, which did not estimate a population size (Arnold 2007, Solano Land Trust 2009).

In summary, only the population at San Bruno Mountain has been consistently surveyed. Surveys at that location demonstrate large annual fluctuations in numbers; however, the overall long term trend appears to show a stable population.

Habitat or Ecosystem

Typically, the distribution and dynamics of butterfly populations are influenced by larval host plant health and abundance, nectar source availability, topography, size of available habitat and its degree of isolation from other habitat, and weather (Arnold 1983; Matter *et al.* 2003; Ehrlich and Hanski 2004). The habitat for the callippe silverspot butterfly was described in the listing as native grasslands and associated habitats in the San Francisco Bay area (USFWS 1997).

Essential features of callippe silverspot habitat are now considered to include:

- Grasslands with proper topography in the San Francisco Bay area,
- Sufficient larval host plant (*Viola pedunculata*),
- Adequate nectar sources,
- Within the area influenced by coastal fog, and
- Hilltops for mating congregations.

Grasslands: The topography of the grassland is an important factor influencing larval host plant growth and survival (Weiss and Murphy 1990; Weiss *et al.* 1993; Weiss and Weiss 1998). Topography influences the amount of seasonal sun exposure, temperature variations, and site specific moisture, which in turn will affect *Viola pedunculata* abundance and health, as well as larval thermoregulation and water balance. For instance, studies by Dr. Stuart Weiss (Weiss and Murphy 1990; Weiss *et al.* 1993; Weiss and Weiss 1998) have demonstrated that the best grassland habitat for the callippe silverspot butterfly based on the distribution of adults included cooler north and east facing slopes with fairly dense occurrences of both the larval host plant and nectar source plants. Murphy and Weiss (1990) also stated that "continuous" grassland is important, because continuous grasslands will support a variety of nectar sources (see below), since the callippe is a large and vagile butterfly that can have a home range up to many hectares of grassland habitat.

Larval Host Plant: *Viola pedunculata* in the San Francisco Bay area is associated with deep soils that have established grass cover. Studies have not revealed a correlation between *V pedunculata* abundance and specific soil characteristics (pH, moisture content, soil depth, clay content, or micro-climate) (Thomas Reid and Associates 1982).

Nectar Sources: Nectar flowers provide an invaluable source of energy for adult butterflies. Boggs and Ross (1993) demonstrated that the amount of nectar imbibed by the congeneric (same genus as the callippe silverspot) female, Mormon silverspot butterfly (*Speyeria mormonia*), was positively correlated with lifespan and egg production. A variety of flowering plants provide nectar sources used by the adult callippe silverspot butterfly. Preferred nectar sources include *Carduus* spp (non-native thistles), *Cirsium quercetorum* (the native Alameda County thistle), *Silybum marianum* (the non-native blessed milk thistle), and *Monardella villosa* (the native coyote wildmint) (Thomas Reid and Associates 1982). Native species that are also used by the

butterfly include *Heterotheca villosa* (hairy false goldenaster), *Eriogonum latifolium* (coast buckwheat), *Scabiosa atropurpurea* (mourning bride), and *Aesculus californica* (California buckeye) (Thomas Reid Associates 1982). Studies have also found that callippe silverspot butterflies may, at less regular intervals, visit a variety of other plants, both native and non-native, including *Carduus pycnocephalus* (Italian thistle), *Wyethia angustifolia* (mule ears), and *Horkelia californica* (California horkelia) (Weiss and Murphy 1990). A 2006 study of callippe silverspot butterfly nectar sources at the King/Swett Ranch in the Cordelia Hills revealed that adults may travel up to 1 mile in order to nectar from the native *Aesculus californica* (California buckeye), that thistles were commonly used for nectar plants (*Silybum marianum* and *Cirsium vulgare*), and that, apparently, the favorite nectaring plant of the callippe silverspot butterfly at the King/Swett Ranch includes mints, particularly *Monardella* (Arnold 2007; Bernhardt and Swiecki 2007).

Coastal Fog: The callippe silverspot butterfly is found within the fog influenced zone which surrounds San Francisco Bay at a regional level; however, at a local, site specific level it appears that the distribution of this butterfly may be limited by avoidance of fog during the flight season (Murphy and Weiss 1990). For example, a large scale map of the distribution of adults on San Bruno Mountain shows a clear boundary of adult presence on the sunny side of the summer persistent fog line (Weiss and Murphy 1990). San Bruno Mountain, Vallejo, the Cordelia Hills, and the Berkeley Hills are all within the fog influenced zone of the San Francisco Bay.

Hilltops: Hilltops that have connectivity with grasslands containing nectar sources and larval host plants are vital to the hill-topping behavior of the callippe silverspot butterfly (Weiss and Murphy 1990). Hilltopping allows the congregation of males and females, which promotes mate selection (Shields 1967; Thomas Reid Associates 1982; Murphy and Weiss 1990; Longcore *et al.* 2004).

Changes in Taxonomic Classification or Nomenclature

The taxonomic status of the callippe silverspot butterfly has not changed since listing. The subspecies complex of *Speyeria callippe* in 2008 had 19 members with a combined range that includes most of the Pacific Northwest eastward to the Rocky Mountains, and north to lower southwestern Canada, and along the California coast and Central Valley to northern Baja California, Mexico (Opler and Wright 1999; Pelham 2008).

Two other subspecies in the *Speyeria callippe* complex are described to occur in proximity to *S. c. callippe*: Comstock's fritillary (*S. c. comstockii*) occurs to the south and east of the historic range of *S. c. callippe*, and the Liliana fritillary (*S. c. liliana*) occurs to the north of *S. c. callippe* in and around the Napa Valley (Mattoon in litt. 1992; Emmel 1998; Opler and Wright 1999; Pelham 2008). However, where these sub-species ranges overlap, hybridization (genetic intercrossing) is believed to occur, which can render discerning the proper subspecies of *S. callippe* by using morphological characteristics difficult (Mattoon in litt. 1992; USFWS 1999). Thus, the precise extant range of the callippe silverspot butterfly (*S. c. callippe*) remains unclear at this time. No detailed study involving systematic surveys and genetic sampling throughout the historic known range of the species has been performed. To update and define the extant range of this subspecies and to discover locales where hybridization has taken place with *S. c. comstockii* or *S. c. liliana*, a genetic study using a proper combination of genetic markers would be required. There is currently a study in progress which began in spring 2009 to conduct range-wide habitat assessments and surveys for *S. c. liliana* (Kobernus 2008).

Genetics

The Service is not aware of any published genetic studies of the callippe silverspot butterfly since listing.

Species-specific Research and/or Grant-supported Activities

There are two recently funded studies concerning the callippe silverspot butterfly:

One study is designed to determine the effects on the host plant (*Viola pedunculata*) of the callippe silverspot butterfly of extending cattle grazing periods into June. Cattle grazing has been determined to be beneficial in ameliorating the effects of invasive plant species; however, inappropriate grazing may result in both the increased consumption of *Viola pedunculata* and destructive trampling. This study will take place on suitable habitat located within property managed by the Solano Land Trust (King Ranch) in the hills between Vallejo and Cordelia (Solano Land Trust 2009). Two *Viola pedunculata* areas on the ranch are targeted for the proposed study. Changes in cover of *Viola pedunculata* as well as forbs, grasses, and bare soil or rock will be determined using a point count method and statistically analyzed (Solano Land Trust 2009).

The other study is a range wide survey of the Liliانا silverspot butterfly (*Speyeria callippe liliana*), which has a distribution bordering on the northern boundary of the callippe silverspot extant range. The two subspecies are known to hybridize where their distributions overlap. This survey will refine the current extant range of both species, better define the hybrid zone and morphological characters of the hybrids, and may determine if the Liliانا silverspot butterfly merits listing as a candidate species (Kobernus 2008).

III. FIVE FACTOR ANALYSIS

The following five-factor analysis describes and evaluates the threats attributable to one or more of the five listing factors outlined in section 4(a)(1) of the Act.

Factor A. Present or threatened destruction, modification or curtailment of its habitat or range:

The final listing describes that the primary cause of the decline of the callippe silverspot butterfly is the loss and degradation of habitat from human activities, including off-road vehicle (ORV) use, trampling by hikers and horses, inappropriate levels of grazing, and invasive exotic vegetation (USFWS 1997). Currently, the loss and fragmentation of habitat (discussed below), and competition with invasive exotic vegetation (discussed in Factor E) threaten the callippe silverspot butterfly. Additionally, inappropriate levels of grazing (discussed in Factor E) potentially threatens individual callippe silverspot butterflies.

The final listing considered the San Bruno Mountain population to be protected from further decline (caused by habitat degradation or loss) by virtue of the San Bruno Mountain Habitat Conservation Plan (HCP), which protects 92 percent of callippe silverspot butterfly habitat on San Bruno Mountain in perpetuity (USFWS 1997).

Currently, it is estimated that the percentage of the original callippe silverspot habitat that is still

protected has not changed (USFWS 2009a). The population at the park site in Alameda is believed to have been extirpated, and the habitat at that location no longer appears to support the larval foodplant (*Kobernus pers. comm.* 2009). The population located in the hills between Vallejo and Cordelia is protected where it occurs on property owned and managed by the Solano Land Trust (Arnold 2007). A Habitat Conservation Plan (HCP) in Solano County is currently being prepared. The callippe silverspot butterfly is proposed as a covered species in the HCP. A strategy for the callippe silverspot butterfly should be included in the HCP that provides for the conservation of this species in Solano County. The remaining callippe silverspot butterfly populations and habitat areas are threatened by the following proposed developments:

1. A proposed Silicon Valley Power wind energy project developed by the city of Santa Clara would result in the loss of callippe silverspot butterfly habitat in the hills between the cities of Vallejo and Fairfield (the Cordelia Hills) (USFWS 2008a).
2. The Fieldcrest Villages housing project proposed for 76.5 acres located on grasslands at the intersection of interstate 80 and interstate 680, on which 394 single family homes are proposed to be built (USFWS 2008b).
3. The McIntyre Ranch nature and science center in conjunction with the U.S. Geological Survey Western Ecological Research Center proposed to be constructed just north of Lake Herman in Solano County. This project may affect surrounding callippe silverspot habitat through the construction of a 5,000 square foot main building, a 3,000 square foot storage building, a 3,600 square foot nature/conference/activity center, and various field infrastructure including 18 tents, campfire rings, and trails (USFWS 2009b).
4. The La Siena development project, close to Lake Herman in Solano County, which would subdivide the property into ranchette sized parcels for residential building (E. Lichtwardt, LSA Associates, *in litt.* 2008).
5. A proposed quarry expansion near Lake Herman in Solano County, which may negatively affect host plants and remove an area that may be used for hilltopping. This project is in the early stages of planning (Service files).
6. The Garibaldi Ranch project is currently being implemented in the Cordelia Hills adjacent to the King-Swett Ranch in Solano County. This project includes construction of a bridge and a multiple residential housing community, which will fragment and degrade natural habitat near known callippe silverspot butterfly populations (USFWS 2008c).

Another threat to the habitat identified in the listing is the fragmentation of areas with suitable habitat caused by urban developments, like those mentioned above, that will cause further isolation of small populations over time and will eventually prevent dispersal and genetic exchange between populations (USFWS 1997). Both the loss and fragmentation of suitable habitat by urban and industrial development are still considered to be valid threats throughout the historic range of the callippe silverspot butterfly.

In summary, one of the two known populations at the time of listing, the park site in Alameda, is believed to be extirpated due to the degradation of habitat. The other population noted in the

listing, at San Bruno Mountain, remains protected and is addressed by the San Bruno Mountain HCP. A population known to occur at several locations in the Cordelia Hills is afforded some protection by preserved areas of suitable habitat that are located on Solano Land Trust properties, but may be threatened by habitat fragmentation and degradation caused by a series of local development projects.

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

At the time of listing we identified collection of this highly prized, attractive butterfly by lepidopterists as a significant threat (USFWS 1997). Currently, we still consider illegal collection as a potential threat because butterflies in small populations are vulnerable to harm due to the removal of adult butterflies (Gall 1984). A population may be reduced below sustainable numbers (Allee effect) by removal of females, reducing the probability that new colonies will be founded. Collectors may not realize if they are depleting colonies of butterflies to below threshold limits for the survival or recovery of the colony (Collins and Morris 1985). For example, the extirpation of the large copper butterfly (*Lycaena dispar*) in Great Britain was preceded by heavy bouts of collecting (Duffey 1968, 1977). Poachers may use various methods to escape detection or to evade prosecution (Thelander 1994). Prior to listing, the callippe silverspot butterfly population at San Bruno Mountain was subject to intensive collecting by lepidopterists (U.S. Attorney's Office 1994). The current amount of illegal collection of this species is not known and, therefore, remains a potential threat.

Factor C. Disease or predation:

Neither disease nor predation was believed to present a threat to the callippe silverspot butterfly at the time of listing (USFWS 1997). It still remains unknown if predation or disease poses a major threat to the butterfly. No studies were performed since listing to identify predation sources or the presence of diseases or parasites. However, non-native sowbugs (Isopoda) and earwigs (Dermaptera) are known to be predators on the eggs, larvae, and pupae of butterfly species (Edney et al. 1974; Langston and Powell 1975; Mattoni et al. 2003). The callippe may also be affected by these two non-natives.

Factor D. Inadequacy of existing regulatory mechanisms:

When first listed, it was identified in the threats section that the callippe silverspot butterfly was not specifically protected under any Federal, State, or local law (USFWS 1997). The following are the regulatory mechanisms that now provide some degree of protection for the callippe silverspot butterfly:

Federal Protections:

Endangered Species Act: The Endangered Species Act of 1973, as amended (Act), is the primary Federal law that provides protection for the callippe silverspot butterfly since the designation of this species as endangered in 1997. Section 7(a)(2) requires Federal agencies to consult with the Service to ensure any project they fund, authorize, or carry out does not

jeopardize a listed species. To jeopardize the continued existence of a species means to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild. If it is determined the proposed project will not result in jeopardy to the affected listed species, the Service may require the agency to implement reasonable and prudent measures, along with the terms and conditions, to minimize the amount of incidental take. Incidental take is the take of a listed species that are incidental to, but are not the purpose of an otherwise lawful activity. If a Federal agency is not involved in the project, and Federally listed species may be taken as part of the project, then the project proponent must obtain an incidental take permit pursuant to section 10(a)(1)(B) of the Endangered Species Act.

Habitat Conservation Plans (HCPs): Congress amended section 10 of the Act in 1982 to authorize “incidental take” through the development and implementation of Habitat Conservation Plans or HCPs. An incidental take permit allows a property owner to conduct otherwise lawful activities that may result in take of listed species. A non-Federal entity (e.g., a landowner or local government) develops an HCP in order to apply for an incidental take permit under section 10(a)(1)(B) of the Act. The HCP integrates the applicant’s proposed project or activity with the needs of the species. It describes, among other things, the anticipated effect of a proposed taking on the affected species and how that take will be minimized and mitigated. Such information must be submitted with any incidental take permit application. The following habitat conservation plans were implemented or are planned that will allow incidental take of the callippe silverspot butterfly:

- *San Bruno Mountain HCP*: This was the first HCP completed and originally included only the mission blue and the San Bruno elfin butterfly. This HCP was amended to include the callippe silverspot butterfly and the bay checkerspot butterfly.
- *Parkside Homes HCP*: Completed in 1996 this HCP covered a 20 acre area in San Mateo County that is privately owned. The HCP expired in 2006.
- *Pacific Gas and Electric Bay Area HCP* is in the early planning process and will consider the callippe silverspot butterfly.
- *Solano County HCP* is also in the planning stages and will address the callippe silverspot butterfly in the Cordelia Hills of Solano County.

National Environmental Policy Act (NEPA): The National Environmental Policy Act (NEPA) [42 U.S.C. 4321 et seq.] was signed into law on January 1, 1970. NEPA establishes national environmental policy and goals for the protection, maintenance, and enhancement of the environment and it provides a process for implementing these goals within the Federal agencies. NEPA also establishes the Council on Environmental Quality (CEQ). Title I of NEPA contains a Declaration of National Environmental Policy which requires the Federal government to use all practicable means to create and maintain conditions under which man and nature can exist in productive harmony. Section 102 requires Federal agencies to incorporate environmental considerations in their planning and decision-making through a systematic interdisciplinary approach. Specifically, all Federal agencies are to prepare detailed statements assessing the environmental impact of and alternatives to major Federal actions significantly affecting the environment. These statements are commonly referred to as environmental impact statements (EISs). Section 102 also requires Federal agencies to lend appropriate support to initiatives and programs designed to anticipate and prevent a decline in the quality of mankind's world environment. All Federally listed species that may be affected by a Federal project must be

addressed by the environmental assessment and environmental impact statements. (Environmental Protection Agency 2008). Prior to implementation of such projects with a Federal nexus, NEPA requires the agency to analyze the project for potential impacts to the human environment, including natural resources. In cases where that analysis reveals significant environmental effects, the Federal agency must propose mitigation alternatives that would offset those effects (40 C.F.R. 1502.16). These mitigations usually provide some protection for listed species. However, NEPA does not require that adverse impacts be fully mitigated, only that impacts be assessed and the analysis disclosed to the public.

The Lacey Act: The callippe silverspot butterfly is protected by the Lacey Act (P.L. 97-79), as amended in 16 U.S.C. 3371. The Lacey Act makes unlawful the import, export, or transport of any wild animals whether alive or dead taken in violation of any U.S. or Indian tribal law, treaty, or regulation as well as the trade of any of these items acquired through violations of foreign law, and further makes unlawful the selling, receiving, acquisition or purchasing of any wild animal, alive or dead. The designation of wild animal includes parts, products, eggs, or offspring.

State and Local Protections:

California Endangered Species Act (CESA): The CESA does not provide protection to insects (sections 2062, 2067, and 2068, California Fish and Game Code).

California Environmental Quality Act (CEQA): The CEQA requires full public disclosure of the potential environmental impact of proposed projects. The public agency with primary authority or jurisdiction over the project is designated as the lead agency and is responsible for conducting a review of the project and consulting with other agencies concerned with resources affected by the project. Section 15065 of the CEQA guidelines requires a finding of significance if a project has the potential to “reduce the number or restrict the range of a rare or endangered plant or animal” (including insects). Species that are eligible for listing as rare, threatened or endangered but are not so listed are given the same protection as those species that are officially listed with the State. Once significant impacts are identified, the lead agency has the option to require mitigation for effects through changes in the project or to decide that overriding considerations make mitigation infeasible. In the latter case, projects may be approved that cause significant environmental damage, such as destruction of endangered species. Protection of listed species through CEQA is, therefore, at the discretion of the lead agency. The CEQA provides that, when overriding social and economic considerations can be demonstrated, project proposals may go forward, even in cases where the continued existence of the species may be jeopardized, or where adverse impacts are not mitigated to the point of insignificance.

County and City

The Service is not aware of any specific county or city ordinances or regulations that provide direct protection for the callippe silverspot butterfly.

Summary of Regulatory Mechanisms

The callippe silverspot butterfly receives some protections under the various Federal and State laws and regulations discussed above. However, the protection afforded the species in many cases relies on the species status under the Endangered Species Act for protections to be extended to the callippe silverspot butterfly. Therefore, other than the Act, regulatory mechanisms are inadequate to meet the conservation needs of this subspecies.

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

Within the final listing rule for the callippe silverspot butterfly the threats assigned to the final factor included the use of pesticides, the effect of inappropriate grazing regimes on the host plant, the competitive effects of invasive plants on the host plant and nectar sources, fire suppression, small numbers and isolated populations, and the generation of dust from quarries at the San Bruno Mountain site (USFWS 1997). The following summaries update the status of these threats:

Invasive Non-native Plants

The effects of invasive, non-native plants: Non-native grasses and forbs that have invaded California grasslands, as well as the conversion to coastal scrub are serious threats to the callippe silverspot butterfly, the larval foodplant, and nectar plants on which the butterfly depends. European annual grasses and forbs have displaced native forbs in California native grasslands, and in turn, have contributed to the decline of the callippe silverspot butterfly (Biswell 1956; Murphy and Ehrlich 1989). This invasion was facilitated by widespread and intensive grazing (Fleischner 1994). Some of the exotic grasses and forbs that have invaded grasslands in San Francisco Bay area are *Lolium multiflorum* (Italian rye grass), *Avena barbata* (slender oats), *Bromus diandrus* (ripgut), *B. madritensis* (red brome), *B. hordaceus* and *B. mollis* (softchess), *Carduus pycnocephalus* (Italian thistle), *Centaurea solstitialis* (yellow star thistle), *Cirsium vulgare* (bull thistle), *Ehrharta erecta* (ehrharta), *Erodium* species (filaree), *Hypochaeris radicata* (cat's ears), *Medicago polymorpha* (burclover), *Oxalis pes-caprae* (yellow oxalis), *Plantago lanceolata* (English plantain), *Rumex acetosella* (sheep sorrel), *Silybum marianum* (blessed milk thistle), and, *Brassica* species and *Sisymbrium* species (mustards) (Amme 2002). Thatch produced as a result of the build up of dead invasive grasses and forbs may inhibit the natural reproductive cycle of native plants and may also adversely alter soil chemistry and composition. Some of the coastal California grasslands may succeed to coastal scrub, in the absence of disturbance mechanisms, such as fire and grazing which may prevent coastal scrub encroachment. In some instances soil conditions, such as serpentine soils, prevent plant invasions (Huenneke *et al.* 1990). Competition from invasive, non-native grasses and forbs remains a threat to the habitat of the callippe silverspot butterfly (TRA Environmental Sciences 2007).

Pesticides: The use of pesticide was considered a threat to the butterfly if the insecticide was used in proximity to occupied habitat. This threat is based on the finding that concentrations of insecticides found in agricultural runoff and the concentration deposited in soil after spraying was lethal to larva of various species in the genus *Speyeria* (Mattoon *et al.* 1971). The listing noted, however, that there were at that time, no specific plans to apply insecticides near the known occupied habitat of the butterfly. Insecticides are not commonly used in the areas which are known to support the callippe silverspot butterflies; however, drifting spray from insecticides, or from other treatments like disease causing bacteria specific to butterflies and moths, which may be used to control infestations of the exotic light brown apple moth (*Epiphyas postvittana*) may threaten all of the butterfly species on San Bruno Mountain (Varela *et al.* 2008; USFWS 2009a). Herbicides have been used to control the spread of invasive plants around the San Francisco Bay Area. The initial results of a study at Washington State University (funded by USFWS) demonstrates that various commonly used herbicides may harm the early life stages

of a common metalmark butterfly at normal application concentrations directly applied to the larvae (Chen et al. 2009). The results of this study can be applied to the larvae of other butterfly species, including the larvae of the callippe silverspot. Thus, the use of herbicide in areas of callippe silverspot habitat should be restricted.

Inappropriate grazing regimes: The final listing discussed inappropriate grazing as a potential threat to the callippe silverspot butterfly, particularly if grazing occurs at harmful levels, such that the vegetation is overgrazed and the food-plants and nectar sources of the butterfly are greatly reduced in abundance. As an indirect result trampling by grazing animals was also considered a potential threat since it may lead to the destruction of larva, food-plants, and nectar sources. Improperly managed cattle grazing remains a potential threat to the callippe silverspot butterfly. Currently, however, the population in the Cordelia Hills at Kings/Swett Ranch owned by Solano Land Trust exists where cattle grazing is used to manage the landscape. This property where the callippe silverpot butterfly lives is the subject of a study that began in 2008 to monitor the effects of the grazing on the species (Solano Land Trust 2009).

Fire suppression: Suppression of naturally occurring grassland fires was identified as a threat because it may lead to the succession of grasslands and coastal prairie, and, thus, eliminate habitat that would support the *Viola pedunculata* host plant. In addition, fire suppression results in the accumulation of dead vegetation or thatch which not only smothers the host plant, but also burns hotter and moves more slowly across the landscape than fires in areas where naturally occurring, periodic fires have removed thatch build-up (Hammond and McCorkle 1983; Kaye et al. 1994). The larvae of the callippe silverspot butterfly may survive in areas where naturally occurring, periodic fires move rapidly through the grassland, and are blown around under windy conditions leaving patchy areas untouched by fire (Hammond and McCorkle 1983). Fire suppression continues to be a potential threat to the callippe silverspot butterfly.

Small population size: At the time of listing we stated that the callippe silverspot butterfly existed only as very small isolated populations (S. Mattoon, *in litt.* 1992). The sizes of the two known callippe silverspot populations were unknown. However, at least one of the two populations was considered to be relatively small, and the listing proposed that isolated, small populations were vulnerable to extinction from random fluctuations in population size or variations in population characteristics (like sex ratios) that may be caused by annual weather patterns, food availability, and other factors (USFWS 1997). This effect was determined to be further exacerbated by the continuing fragmentation of suitable habitat by urban development and the great distance between the known populations of the callippe silverspot butterfly. Further reduction in population numbers along with decreased genetic interchange among the populations through genetic drift, isolation, and inbreeding depression were also discussed as part of the threat of low population numbers since this would result in even less vigorous and adaptable populations of the butterfly (USFWS 1997).

The current numbers of individuals in each of the populations remains unknown, although the population at San Bruno Mountain has been surveyed since 1980 (see in section II on abundance) and it is possible that some of the populations may drop to significantly low levels during certain years. There are several important factors to consider in the management and recovery of rare species with population numbers that fall below a low threshold size, as could be true with the callippe silverspot butterfly. The first factor is that, in general, rare species demonstrate decreased genetic variability or heterozygosity (Spielman *et al.* 2004). Another

important factor is that low populations of any organism are also threatened by extinction through a single catastrophic event, such as an abnormally violent storm, a prolonged drought, or other climatic event, from an infectious disease, or through “stochastic” demographic fluctuations (Awise 2004). Certain density dependent effects, not directly related to genetics, but also stemming from low population numbers are considered a threat to the callippe silverspot butterfly (USFWS 1997). These effects include reduced reproduction potential that results from the lack of necessary social interactions, or the difficulty in finding a mate. Another example of a density dependent factor that may reduce a populations fitness is the consequences of asynchronous reproduction (male and female sexual maturity is offset in time) which may be favorable in greater population densities but deleterious in low densities (Awise 2004; Calabrese and Fagan 2004).

The Service is not aware of any research that has been completed to estimate the minimum effective population size for the callippe silverspot butterfly. However, because the butterfly population sizes remain unknown and the present limited range of the callippe silverspot butterfly is based on the presence of suitable habitat that is threatened with loss or degradation, small population size is still considered a potential threat.

San Bruno Mountain quarries: The air-borne dust generated from nearby quarries was considered to threaten the butterfly with injury or mortality by clogging their respiratory organs or spiracles. Although it has been shown that dust and wind-blown grit can harm insects at various life stages (Wigglesworth 1944), no studies have been conducted at San Bruno Mountain to specifically record the effects of the dusting from the quarry on the life stages of the callippe silverspot butterfly. A study in Colorado recorded a decline in the population of a local butterfly, the alpine (*Erebia epipsodea*), over a period of three decades that was apparently caused by the increase in dust caused by increased vehicle traffic (Ehrlich 1984). Since the quarry is still in operation near known occurrences of the callippe silverspot butterfly, and because more than one study has shown that dust is known to effect various life stages of insects, quarry dust remains a potential threat to the callippe silverspot butterfly. Research in future years may better define the severity of this threat.

The following Factor E threats were identified after the final listing of the callippe silverspot was published in the Federal registrar in December 1997:

Road Mortalities: Although not previously identified as a threat, mortalities of callippe silverspot butterflies due to direct strikes of individuals by cars could potentially be significant to those populations existing near roadways. The threat of road mortalities to populations of various butterfly species has been confirmed in several studies (Ries and Debinski 2001, Ries *et al.* 2001, Rao and Girish 2007; Severns 2008), and remains a threat to this species due to the proximity of callippe silverspot butterfly populations to roads, including Highway 101 and Interstate 80. Posting reduced speed limits on select roads during the adult flight period may help reduce this threat.

Human Interface Activities: The increase in the Bay Area’s human population has increased the chances of human interaction with the callippe silverspot butterfly. The interaction may be destructive and harmful to the butterfly, such as inadvertent trampling of eggs and larvae by hikers, or crushing of eggs, larvae, or pupae by mountain bikes, dirt bikes, or other off road vehicles, both motorized and human propelled [San Francisco Parks and Recreation Department

(SFPRD) 2009] Certain measures may reduce this threat in protected areas that allow recreational use of the property (SFPRD 2009).

Air Pollution: Many potential sites with suitable habitat for the callippe silverspot butterfly exist near heavily used roads, highways and freeways. Weiss (1999) has demonstrated that pollution from cars in these locales can increase depositions of nitrogen compounds into the soil, and, thus, facilitate the spread of invasive grasses and forbs, which have been demonstrated, in these conditions, to out-compete the native plants including the host plant, *Viola pedunculata* (Allen *et al.* 2000). Thus, the loss of host plant will result in a decrease in the numbers of host dependent butterflies.

Climate Change: The global average temperature has risen by approximately 0.6 degrees centigrade during the 20th Century (International Panel on Climate Change 2001, 2007; Adger *et al.* 2007). There is an international scientific consensus that most of the warming observed has been caused by human activities (International Panel on Climate Change 2001, 2007; Adger *et al.* 2007), and that it is “very likely” that it is largely due to increasing concentrations of greenhouse gases (carbon dioxide, methane, nitrous oxide, and others) in the global atmosphere from burning fossil fuels and other human activities (Cayan *et al.* 2005; Adger *et al.* 2007; Environmental Protection Agency 2009). Eleven of the twelve years between 1995 and 2006 rank among the twelve warmest years since global temperature record keeping began in 1850 (Adger *et al.* 2007). The warming trend over the last fifty years is nearly twice that for the last 100 years (Adger *et al.* 2007). Looking forward, under a high emissions scenario, the International Panel on Climate Change estimates that global temperatures will rise another four degrees centigrade by the end of this Century; even under a low emissions growth scenario, the International Panel on Climate Change estimates that the global temperature will go up another 1.8 degrees centigrade (International Panel on Climate Change 2001). The increase in global average temperatures affects certain areas more than others. The western United States, in general, is experiencing more warming than the rest of the Nation, with the 11 western states averaging 1.7 degrees Fahrenheit warmer temperatures than this region’s average over the 20th Century (Saunders *et al.* 2008). California, in particular, will suffer significant consequences as a result of global warming (California Climate Action Team 2006). In California, reduced snowpack will cause more winter flooding and summer drought, as well as higher temperatures in lakes and coastal areas. The incidence of wildfires in the Golden State also will increase and the amount of increase is highly dependent upon the extent of global warming. No less certain than the fact of global warming itself is the fact that global warming, unchecked, will harm biodiversity generally and cause the extinction of large numbers of species. If the global mean temperatures exceed a warming of two to three degrees Centigrade (3.6 to 5.4 degrees Fahrenheit) above pre-industrial levels, twenty to thirty percent of plant and animal species will face an increasingly high risk of extinction (International Panel on Climate Change 2001, 2007). The mechanisms by which global warming may push already imperiled species closer or over the edge of extinction are multiple. Global warming increases the frequency of extreme weather events, such as heat waves, droughts, and storms (International Panel on Climate Change 2001, 2007; California Climate Action Team 2006; Lenihan *et al.* 2003). Extreme events, in turn may cause mass mortality of individuals and significantly contribute to determining which species will remain or occur in natural habitats. As the global climate warms, terrestrial habitats are moving northward and upward, but in the future, range contractions are more likely than simple northward or upslope shifts.

Ongoing global climate change (Inkley *et al.* 2004; Anonymous 2007; Adger *et al.* 2007; Kanter 2007) likely imperils the callippe silverspot butterfly and the resources necessary for its survival. Since climate change threatens to disrupt annual weather patterns, it may result in a loss of their habitats and/or nectar plants, and/or increased numbers of their predators. Where populations are isolated, a changing climate may result in local extinction, with range shifts precluded by lack of habitat. Whole plant communities may either shift or become extirpated from geographic localities as the local climate undergoes small, but significant changes, including possible effect on coastal fog coverages (Field *et al.* 1999). This, of course, will possibly cause a loss or degradation of both the callippe's host and nectar plants, and may also directly influence life stages of the butterfly through abnormal variations in temperature and light.

Summary of Factor E Threats.

The following are considered factor E threats that apply to all of the populations of the callippe silverspot butterfly: Invasive plants, fire suppression, pesticide use, small population size, road mortalities, human interface activities, air pollution, non-native predators, and climate change.

In addition to the threats listed above, the population at San Bruno Mountain faces the threat of dusting from quarry operations.

Within the remaining historic range of the subspecies, various combinations of some or the entire factor E threats could threaten yet undiscovered populations of the callippe silverspot butterfly.

III. RECOVERY CRITERIA

There is no published, final approved recovery plan or approved draft recovery plan that provides objective, measurable recovery criteria for the callippe silverspot butterfly.

IV SYNTHESIS:

The callippe silverspot butterfly (*Speyeria callippe callippe*) is a single subspecies within a 19 subspecies complex of *Speyeria callippe*. The boundaries of the butterfly's range are not completely described and hybridization is believed to occur with two conspecifics: *S. c. liliana* in the northern portion of the subspecies range and *S. c. comstockii* in the north, east and southern portion of the subspecies range. Of two known extant populations described in the listing rule, only the San Bruno Mountain population is known to be extant, while the second described population once observed at a county park in Alameda County is believed to have been extirpated. An additional population in the Cordelia Hills of Solano County, discovered after listing, is considered to be *S. c. callippe*. Other populations observed at the hills near Pleasanton (Alameda County), at Sears Point (Sonoma County), and at the Calaveras Reservoir (Alameda County) have not been verified. Populations of callippe silverspot butterfly that are presently afforded protection include the population found in the hills between Vallejo and Cordelia that are on a preserve that is managed by the Solano Land Trust and the population at San Bruno Mountain that is protected through the Habitat Conservation Plan.

Habitat for this butterfly has been fairly well defined. The following factors have been shown to be necessary components of suitable habitat for the callippe silverspot butterfly: Grasslands with proper topography in the San Francisco Bay area, with sufficient larval host plant (*Viola*

pedunculata), adequate nectar sources, within the area influenced by coastal fog, and hilltops for mating congregations.

Threats to the callippe silverspot butterfly that were identified when the butterfly was listed (1997) and that still persist include the loss to urbanization and fragmentation of suitable habitat in the San Francisco Bay area, poaching by insect collectors, indiscriminate use of herbicides, inappropriate grazing regimes, elimination of *Viola pedunculata* host plants by competition from invasive plants, the suppression of fire within callippe habitat resulting in built up fuel and hotter wildfires, the negative effects of the small and geographically isolated population sizes, and harmful dusting from the active quarries at San Bruno mountain. Threats that were defined after listing include road mortalities, increased interactions with humans that may result in inadvertent injury or mortality to any life stage of the callippe, deposition of nitrogen from local traffic that encourages invasive plants, non-native predators, and global climate change. Regulatory mechanisms in place that assist in the protection and recovery of callippe silverspot butterfly include the Endangered Species Act, the National Environmental Policy Act, and the Lacey Act.

Without intervention the callippe silverspot butterfly clearly remains in peril of extinction. This conclusion is based on the continued loss and fragmentation of suitable habitat from urban development, the spread of non-native, invasive grasses and forbs, and the succession of grasslands. Therefore, the callippe silverspot butterfly should remain listed as an endangered species.

V RESULTS

Recommended Classification:

- Downlist to Threatened
- Uplist to Endangered
- Delist (*Indicate reasons for delisting per 50 CFR 424.11*).
- Extinction
- Recovery
- Original data for classification in error
- No change is needed

New Recovery Priority Number 9C

It is recommended that the recovery priority number for the callippe silverspot butterfly remain as 9C, which is defined as a subspecies with a moderate degree of threat, but having a high potential for recovery. Although the present range of the subspecies is not clearly defined, suitable habitat for the species is threatened within the historic range of the species by pressure to develop or by loss to invasive plants or succession. The abundance of individuals comprising populations, other than at San Bruno Mountain, are not known.

VI. RECOMMENDATIONS FOR FUTURE ACTIONS:

1 Conduct a detailed phylogenetic study throughout the historic range of the callippe silverspot butterfly. Populations of the three local conspecifics (callippe silverspot butterfly, Comstock's

silverspot butterfly and Liliana’s silverspot butterfly) must be analyzed genetically at a fine level of discrimination, using the proper molecular markers, to classify them genetically at a sub-species level.

2. Conduct a non-intrusive study to determine if there are morphological characteristics that best distinguish the subspecies callippe silverspot butterfly from Comstock’s silverspot butterfly and Liliana’s silverspot butterfly and which can be practically used in the field.

3. Conduct surveys for the callippe silverspot throughout the known historic range of the subspecies, including the following locations:

Area	County
Lake Herman Open Space Area	Solano
Northgate	Solano
Briones Regional Park	Contra Costa
Sunol Regional Wilderness	Alameda
Ohlone Regional Wilderness	Alameda
Del Valle Park	Alameda
Joaquin Miller Park	Alameda
Redwood Regional Park	Alameda
Joseph D. Grant County Park	Santa Clara
Lick Observatory	Santa Clara
San Francisco Water District Lands	Santa Clara
Russian Ridge Open Space Preserve	San Mateo
Skyline Ridge Open Space Preserve	San Mateo
La Honda Creek Open Space Preserve	San Mateo

Surveys for undiscovered populations of the butterfly should focus on properties in the San Francisco Bay area that have all of these components: 1) Grasslands with proper topography in the San Francisco Bay area, with 2) Sufficient larval host plant (*Viola pedunculata*), 3) Adequate nectar sources, 4) Within the area influenced by coastal fog, and 5) Having hilltops for mating congregations.

4. Search for and purchase properties within the historic range of the callippe silverspot butterfly for preservation in perpetuity which support populations of or have the required habitat components for supporting the callippe silverspot butterfly. Develop individual management plans once the properties have been purchased that will address the needs of the butterfly, the host plant, and a variety of nectar plants.

5. Review, update, and publish the existing internal draft recovery plan as a final, threats based recovery plan for the callippe silverspot butterfly. The existing internal draft is based on extensive research and was completed under contract to Dr. Travis Longcore of Urban Wildlands, Inc. in 2004.

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Personal Communication

Kobernus, P 2009. Coast Range Ecology, San Francisco, California

U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW

Callippe silverspot butterfly (*Speyeria callippe callippe*)

Current Classification: Endangered

Recommendation resulting from the 5-Year Review

- Downlist to Threatened
 Uplist to Endangered
 Delist
 No change is needed

Review Conducted By: David Kelly

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve Susan K Moore Date 8/17/09