RO-4-128

Quino Checkerspot Butterfly
(*Euphydryas editha quino*)

5-Year Review:
Summary and Evaluation

Painting by Alison Anderson after photo by Frank Ohrmund

U.S. Fish and Wildlife Service
Carlsbad Fish and Wildlife Office
Carlsbad, California

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5-YEAR REVIEW
Quino Checkerspot Butterfly (*Euphydryas editha quino*)

I. GENERAL INFORMATION

Purpose of 5-Year Review:

The U.S. Fish and Wildlife Service (Service) is required by section 4(c)(2) of the Endangered Species Act (Act) to conduct a 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:

As summarized in the Recovery Plan (USFWS 2003a) and recent revisions to critical habitat for this species (USFWS 2009, 74 FR 28776), the Quino checkerspot butterfly (*Euphydryas editha quino*) (Quino) is a member of the family Nymphalidae (brushfooted butterflies) and the subfamily Melitaeinae (checkerspots). It is restricted to Riverside and San Diego Counties in California, and northern areas of Baja California Norte, Mexico (Mexico). Habitat for the Quino is characterized by patchy shrub or small tree landscapes with openings of several meters between woody plants, or a landscape of open swales alternating with dense patches of shrubs, habitats often collectively termed "scrublands". Quino will frequently alight on vegetation or other substrates to mate or bask, and require open areas with high solar exposure to facilitate breeding and movement. *Euphydryas editha* populations often display a metapopulation structure, and require conservation of temporarily unoccupied patches of habitat for population resilience. A metapopulation is composed of a number of local populations. Individuals interact among local populations within a metapopulation just enough to reduce the extinction probability of the metapopulation compared to the extinction probability of any local population.

Methodology Used to Complete the Review:

This review was prepared by the Carlsbad Fish and Wildlife Office (CFWO) using information from the Recovery Plan, survey information from experts, and 10(a)1(A) Recovery Permit reports. The Recovery Plan, published peer-reviewed scientific studies, survey reports, other submitted or collected data, and personal communications with experts were our primary sources of information used to update the species' status and threats. We received two letters containing information from the public in response to our *Federal Register* Notice initiating this 5-year review from: (1) The State of California Attorney General on May 6, 2008; and (2) the Center for Biological Diversity, including copies of cited literature, on May 13, 2008. 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 and at the time of Recovery Plan publication (USFWS 2003a). We focus on current threats to the species that are attributable to 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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FR Notice Citation Announcing Initiation of This Review: A notice announcing initiation of the 5-year review of this taxon and the opening of a 60-day period to receive information from the public was published in the *Federal Register* on March 5, 2008 (USFWS 2008, 73 FR 11945). We received two letters containing information from the public in response to our Federal Notice initiating this 5-year review; relevant information specific to the taxon being reviewed here was incorporated.

Listing History:

<u>Original Listing</u>
FR Notice: 62 FR 2313
Date of Final Listing Rule: January 16, 1997
Entity Listed: Quino checkerspot butterfly (*Euphydryas editha quino*), an insect subspecies
Classification: Endangered

Associated Rulemakings:

<u>Original Proposed Critical Habitat</u>
FR Notice: 66 FR 9476
Date of Proposed Critical Habitat Rule: February 7, 2001

<u>Final Critical Habitat</u>
FR Notice: 67 FR 18356
Date of Final Critical Habitat Rule: April 15, 2002

<u>Proposed Revision to Critical Habitat</u>
FR Notice: 73 FR 3328
Date of Proposed Revised Critical Habitat Rule: January 17, 2008

<u>Final Revision to Critical Habitat</u>
FR Notice: 74 FR 28776
Date of Final Revised Critical Habitat Rule: June 17, 2009

Review History: No previous 5-year reviews have been completed for the Quino.

Species' Recovery Priority Number at Start of 5-Year Review:

The recovery priority number is 6C according to the recovery plan (USFWS 2003, p. iv; the recovery priority number in the USFWS' 2008 Recovery Data Call for the CFWO was in error because it was never updated after the recovery plan was published). This ranking is based on a 1-18 ranking system where 1 is the highest-ranked recovery priority and 18 is the lowest (USFWS 1983, 48 FR 43098). This number indicates the taxon is a subspecies that faces a high degree of threat and has a low 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 or Outline: Recovery Plan for the Quino Checkerspot Butterfly (*Euphydryas editha quino*)
Date Issued: August 11, 2003

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 limits listing as distinct population segments to vertebrate species of fish and wildlife. Because the species under review is an invertebrate and the DPS policy is not applicable, the application of the DPS policy to the species' listing is not addressed further in this review.

Information on the Species and its Status:

The Quino Recovery Plan (USFWS 2003a) was co-authored by a Technical Recovery Team of seven expert biologists and ecologists (USFWS 2003a, p. ii) and provides a comprehensive scientific review and analysis of published and non-published information and data through 2002 relevant to conservation of the Quino. Therefore, the Recovery Plan was cited as a primary source for some of the scientific information discussed below.

<u>Species Description</u>

Quino differ from other *Euphydryas editha* subspecies in a variety of characteristics including size, wing coloration, and larval and pupal phenotypes (Mattoni *et al.* 1997, p. 100). Adult Quino have a wingspan of approximately 1.5 inches (4 centimeters) (USFWS 2003a, p. 6). The dorsal (top) sides of the wings have a red, black, and cream colored checkered pattern; the ventral (bottom) sides are dominated by a checkered red and cream pattern (USFWS 2003a, p. 6). The abdomen of the Quino has red stripes across the top (USFWS 2003a, p. 6).

<u>Species Biology and Life History</u>

The Quino life cycle includes four distinct life stages: egg, larva (caterpillar), pupa (chrysalis), and adult, with the larval stage divided into 5 to 7 instars (periods between molts, or shedding skin) (USFWS 2003a, p. 157). There is usually one generation of adults per year, although larvae may remain in diapause (summer dormancy) for multiple years prior to maturation (USFWS 2003a, p. 8).

Quino are exothermic (cold-blooded) and therefore require an external heat source to increase their metabolic rate to levels needed for normal growth and behavior. Within open, woody-canopy communities, larvae seek microclimates with high solar exposure for basking in order to speed their growth rate (Weiss et al. 1987, p. 161; Weiss et al. 1988, p. 1487; Osborne and Redak 2000, p. 113; USFWS 2003a, p. 20). Like most butterflies, adult Quino frequently bask and remain in sunny areas to increase their body temperature to the level required for normal active behavior (USFWS 2003a, p. 18).

<u>Spatial Distribution</u>

The Quino's historical range included much of non-montane southern California: southwestern Ventura; southwestern San Bernardino; Los Angeles; Western Riverside; and San Diego counties (USFWS 2003a, p. 1; USFWS GIS database). More than 75 percent of the Quino's historical range has been lost (Brown 1991, p. 10), including more than 90 percent of its coastal mesa and bluff distribution (USFWS 2003a, p. 1; USFWS GIS database). At listing, Quino populations were reduced in number and size from historical conditions by more than 95 percent range wide. This reduction was primarily due to direct and indirect human impacts including habitat loss and fragmentation, invasion of nonnative plant species, and catastrophic natural events such as increased frequency of drought and wildfire (USFWS 1997, 62 FR 2313). The current range for Quino includes multiple areas in southern Riverside County, south into Mexico. For detailed current United States population distribution information, see discussions below and Figures 1 and 2.

Delineating Population Distributions

The scientific data available to us for use in delineating Quino population distributions consists of geographic information system (GIS)-based habitat information, subspecies observation locations, and subspecies movement data from mark-release-recapture studies. Population-scale occupancy (a population distribution) is defined by all areas used by adults during the persistence time of a population (years to decades; USFWS 2003a, p. 24). Distribution studies over multiple years are required to quantify Quino population distributions based on recorded subspecies locations. Therefore, we discuss Quino population locations in terms of “occurrence complexes” (USFWS 2003a, p. 35), which are our best estimators of approximate population location and population membership. Occurrence complexes are mapped in the Recovery Plan using a 0.6 mile (1 kilometer) movement radius from each butterfly observation, and may be based on the observation of a single individual (Figures 1 and 2). Occurrences within approximately 1.2 miles (2 kilometers) of each other are considered to be part of the same occurrence complex, as these occurrences are proximal enough that the observed butterflies were likely to have come from the same population (USFWS 2003a, p. 35). Occurrence complexes may expand due to new butterfly observations, or contract due to habitat loss (e.g., occurrence complexes are defined in part by extant habitat, USFWS 2003a, p. 78).

Some occurrence complexes are identified in the Recovery Plan (USFWS 2003a, p. 35) and revised critical habitat rule (USFWS 2009, 74 FR 28776) as “core.” These occurrence complexes are considered likely centers of population density based on characteristics including geographic size, number of reported individuals, documented reproduction, and repeated observations. Such population density centers are likely to contain habitat supporting local “source” populations for a metapopulation (Murphy and White 1984, p. 353; Ehrlich and Murphy 1987, p. 125; Mattoni et al. 1997, p. 111; USFWS 2003a, pp. 25-26), or “source” populations for megapopulations (a group of populations also dependent on one another, but on a time scale greater than that of subpopulations; USFWS 2003a, pp. 21, 24-26). A local source population is one in which the emigration rate typically exceeds the immigration rate, and is thus a source of colonists for unoccupied habitat patches within a metapopulation distribution (USFWS 2003a, p. 166). Therefore, in the final revised critical habitat rule (USFWS 2009, 74 FR 28776), we define a core occurrence complex as an area where at least two of the following criteria apply: (1) 50 or more adults have been observed during a single survey; (2) immature life stages have been recorded; and (3) the geographic area within the occurrence complex (i.e., within 0.6 mile (1 kilometer) of subspecies occurrences) is greater than 1,290 acres (522 hectares). In the final revised critical habitat rule (USFWS 2009, pp. 74 FR 28776), we also described habitat-based population distributions for core occurrence complexes (proposed revised critical habitat units). Habitat-based population distributions include any contiguous habitat within an occurrence complex (described above) and within an additional 0.6 mile (1 kilometer) of an occurrence complex. We used biological and geographic information (primarily USFWS GIS host plant occurrence data, vegetation layers, and satellite imagery) to capture the physical or biological features essential to the conservation of the subspecies in these areas. Any areas within the occurrence complex that we determined did not contain habitat were removed. This process resulted in the identification of a habitat-based population distribution for each core occurrence complex that is occupied at a population distribution scale, but where detectability may vary annually. Though we have not mapped habitat-based population distributions for all occurrence complexes, we are able to estimate habitat-based population distribution membership of all occurrence complexes by distances between them and satellite imagery of intervening habitat (Figures 1 and 2). In this document, we refer to habitat-based population distributions as “core”, instead of occurrence complexes (Table 1; Figures 1 and 2); however, population dynamics have not been studied for this subspecies and it is still possible some habitat-based populations contain more than one population, or more than one distribution belongs to a single population. Because population distributions are estimated, we believe it is prudent not to name populations at this time.

The number of known populations has increased since the time of listing. The listing rule (USFWS 1997, 62 FR 2313) identified "seven or eight" Quino populations within the United States. All extant populations in the United States were said to occur in southwestern Riverside and north-central San Diego Counties. At least one population was known to exist in Mexico, in the Sierra Juarez near Tecate. Based on our current analysis (Table 1) occupied areas known at the time of listing fall within three extant core habitat-based population distributions, and one core and one non-core habitat-based population distribution of unknown status. The remaining habitat-based population distributions documented post-listing were either not known or considered extirpated. Population distributions documented post-listing consist of 6 core and 15 non-core extant distributions, 6 non-core distributions of unknown status, and 4 non-core distributions extirpated post-listing.

Status and Local Distribution of Populations

Mattoni et al. (1997, p. 99) predicted that Quino would be the "passenger pigeon butterfly" – a once common, widespread species crashing to extinction over a few decades; however, those authors underestimated the number of remaining populations and potential of this eruptive species to once more increase its abundance, and possibly its range. Occurrence data collected since the Recovery Plan was published in 2003 expanded many occurrence complexes, merged others, and established new ones (Figures 1 and 2).

Recent survey information indicates the Tule Peak habitat-based population distribution (Riverside County) supports the only extant, resilient population that undergoes periodic high density events similar to the 1977 event described by Murphy and White (1984, p. 351; Ehrlich and Murphy 1987, p. 127) in San Diego County (CFWO 2004; Pratt 2004, p. 17;). Occupancy in the Tule Peak habitat-based population distribution was first documented in 1998 (Pratt 2001, p. 17). Hundreds of adults were observed during surveys in 2001, which was unprecedented, because five or fewer individuals are typically reported during project-based surveys (USFWS GIS database). In 2004, following a year of above-average host plant density in the Anza area (CFWO 2004), another high-density Quino event occurred with higher abundance than was reported in 2001. An estimated 500 to 1,000 adult Quino were reported in a single day in 2004 (Anderson 2007, p. 1; CFWO 2004; Pratt 2004, pp. 16-17). Over 30 new occurrence locations were reported in 2004 in the vicinity of Tule Peak Road (92 to over 100 observations in a single day), south of the Cahuilla Band of Indians Tribal lands and the community of Anza (Osborne 2004, pp. 1-6, 8-10; Anderson 2007, p. 5; CFWO 2004; Osborne 2007, pp. 13-16). Most recently, a relatively high abundance year occurred in 2009, following a year of average to above-average rainfall in 2008 (CFWO 2009; G. Pratt, University of California, Riverside, pers. comm. 2009a, p. 1, 2009b, p. 1). These post-Recovery Plan observations indicate the Tule Peak habitat-based population distribution contains higher densities and produces more emigrants than any other occupied area within the subspecies' range.

New Quino observations in San Diego County (USFWS GIS database) between occurrence complexes identified in the Recovery Plan have resulted in merging of the Otay Valley, West

Otay Mountain, Otay Lakes, Proctor Valley, Dulzura, and Honey Springs occurrence complexes into a single, expanded Otay Occurrence Complex (Table 1, Figure 2). The merging of occurrence complexes in the Otay area was expected based on the Recovery Plan, which noted that occupied habitat in the vicinity of Otay Lakes and Rancho Jamul is an area of key landscape connectivity for all subpopulations in southwest San Diego County (USFWS 2003a, pp. 53-54). The Otay core habitat-based population distribution also includes the Marron Valley, West Otay Valley, Jamul Butte, and Rancho San Diego/Jamul occurrence complexes (Table 1, Figure 2).

Six new Quino observation locations were reported in central San Diego County since the Recovery Plan was published in 2003 (Figure 2). The Recovery Plan described two occurrence complexes in central San Diego County: San Vicente and Alpine (USFWS 2003a, p. 48). Four of the six new occurrence complexes (South San Vicente, Sycamore Canyon, Fanita Ranch, and North East Miramar) combined with the previously known San Vicente Occurrence Complex, belong to the San Vicente core habitat-based population distribution (Table 1, Figure 2). These new occurrence complexes provide the information needed to establish a new Central San Diego Recovery Unit as described in the Recovery Plan (USFWS 2003a, pp. 86-88, 111-112).

Multiple new Quino observation locations have been reported in south-central San Diego County since 2002 east of the community of Campo (Dicus 2005a, p. 1, 2005b, p. 1; PSBS 2005a, p. 18, 2005b, p. 26; O'Conner 2006, pp. 2-4). We consider this cluster of new observations near Campo to belong to a new, independent Campo population (core habitat-based population distribution; Figure 2). The Jacumba Occurrence Complex was not classified as core in the Recovery Plan (USFWS 2003a, p. 52) due to its relatively small geographic size and small number of observed individuals. However, adult Quino are consistently observed in the area (CFWO 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009). As many as 50 individuals are estimated to have been observed in one day near Jacumba Peak (Pratt, pers comm. 2007a, p. 1). Furthermore, reproduction was documented in the Jacumba Occurrence Complex in 1998 and again in 2004 (Pratt, pers. comm. 2007b, p. 1). Therefore, we now consider the Jacumba occurrence complex to represent a relatively resilient population and the associated habitat-based population distribution is therefore classified as core.

<u>Abundance</u>

Accounts of large population density fluctuations at historical Quino population sites (Orsak 1977, pp. 137-138; Murphy and White 1984, pp. 350-354) and collection record data (Anderson 2003, p. 4) indicate that the Quino is a climate-sensitive, "eruptive" species that periodically experiences order of magnitude increases in abundance every 5-20 years, then drop back to much lower abundance over time (Orsak 1977, pp. 137-138; Murphy and White 1984, pp. 350-351; Anderson 2003, p. 4; USFWS GIS database).

Major weather pattern-driven fluctuations in Quino population abundance are similar to long-term population fluctuations in the *Euphydryas editha bayensis* (bay checkerspot butterfly) recorded by Paul Ehrlich's research group at Jasper Ridge (see Ehrlich et al. 1975, pp. 221-228). The balance between resilience and vulnerability may have been disrupted in this case, because the Jasper Ridge bay checkerspot butterfly population was functionally extirpated in 1997 (Mattoni et al. 1997, p. 110). The last rangewide Quino population abundance low was in the late 1980s (Anderson 2003, p. 4). Historically, population abundance lows for this species occurred in the mid 1960s, early 1950s, the late 1930s-early 1940s, and the mid-1920s, corresponding with either drought or one-time extreme weather events such as floods (Anderson 2003, p. 4).

The extirpation of Quino from Orange County is an example of permanent regional-scale loss of populations due to a combination of human impacts and natural (from a historical/evolutionary perspective) fluctuations in abundance. Examination of the history of Orange County Quino populations (Anderson 2003, pp. 3-4) reveals a combination of naturally occurring stochastic events (drought, flood, and fire) exacerbated by ongoing human-caused habitat destruction and degradation (development, agriculture, and grazing), which resulted in the extirpation of Quino populations from Orange County. In 1938, a 100-year flood (Paulson et al. 1989, p. 1) marked the last year of any recorded lower-elevation Quino collection in Orange County (Anderson, 2003, p. 3). Significant changes in Quino abundance were noted by lepidopterists in Orange County for over 60 years (Mattoni et al. 1997, p. 110). Quino were collected in high numbers at Irvine County Park between 1917 and 1922, followed by an almost complete absence of collections correlated with drought (Mattoni et al. p. 110; Anderson 2003, p. 3). In 1933 and 1934, the species was again common, but extirpation quickly followed, correlated with ongoing development and the 1938 flood that filled Irvine Lake (Santiago Reservoir) (USFWS 2003a, p. 30; Anderson 2003, p. 3). The last Quino population was extirpated in Orange County by a fire in 1967 in the Black Star Canyon/Hidden Valley area (see Orsak 1977, p. 137 for description of extirpation). If the lower elevation population that existed at Irvine Park had not been permanently extirpated, it may have served as a source of recolonization for habitat occupied by the higher-elevation Black Star Canyon population (approximately 3 miles (5 kilometers) away). It is difficult for higher elevation populations to recolonize lower elevation habitats because host plant and other aspects of breeding habitat suitability decline earlier at lower elevations with the approach of drier summer weather.

Dispersal and recolonization events were probably high during the 1990s and 2000s, however abundance peaks during the 2000s were reduced relative to the “hundreds to thousands of individuals” (Murphy and White 1984, p. 351) reported from multiple sites in the late 1970s (Anderson 2003, p. 4; USFWS GIS database). Examination of weather patterns and Quino occurrence records indicate drought such as occurred during the 1980s also occurred in the 1960s (Anderson 2003, p. 4). Recent climate evidence (Hidalgo et al. 2007, pp. 54-59; Environmental News Service 2009) suggests we are already experiencing the beginning of a severe drought, possibly exacerbated by climate change, and the effects are likely to cause another Quino population collapse in the next 5-10 years. Recent evidence supports Murphy and White’s (1984, p. 355) hypothesis:

> The extirpation of a single, large reservoir population of [Quino] may effectively deny other habitats necessary migrants, creating a ripple effect of irreversible long-term extinctions. We suspect that just such a circumstance has eliminated [Quino] from Orange County and much of coastal San Diego County, and now threatens populations in Riverside and inland San Diego Counties in California.

On the regional distribution scale, each consecutive Quino abundance peak was reduced from the previous one due to ongoing human-caused destruction of habitat and loss of source populations. With the exception of severe flooding, this series of events and recorded Quino abundance and distribution patterns leading to the regional extirpation of Quino in Orange County mirror the recent extirpation of the subspecies in the Harford Springs habitat-based population distribution (the Gavilan Hills in northwest Riverside County; see Orsak 1977, p. 138; Martin 1970, p. 4; Table 1) and trends in extant core habitat-based population distributions such as Warm Springs Creek, Skinner/Johnson, Oak Mountain/Vail Lake, and western portions of Otay. This long-term downward abundance trend (last population lost was in 2008, Horse Thief Canyon, see Table 1) should be considered when assessing current species' status.

Habitat or Ecosystem

Quino habitat is characterized by patchy shrub or small tree landscapes with openings of several meters between large plants, or a landscape of open swales alternating with dense patches of shrubs (Mattoni et al. 1997, p. 112); such habitats are often collectively termed "scrublands." Quino will frequently perch on vegetation or other substrates to mate or bask, and require open areas to facilitate movement (USFWS 2003a, pp. 10-11).

Adult butterflies will only deposit eggs on species they recognize as host plants. Quino oviposition (i.e., egg deposition) has been documented on *Plantago erecta* (erect or dwarf plantain), *Plantago patagonica* (Patagonian plantain), and *Anterrhinum coulterianum* (white snapdragon) (USFWS 2003a, pp. 14-18). In 2008, oviposition and larval development were recorded for the first time on a new species of host plant, *Collinsia concolor* (Chinese houses) (Pratt, pers. comm. 2008a, p. 1; 2008b, p. 1; 2008c, p. 1; 2008d, p. 1; 2008e, p. 1). Although *C. concolor* commonly occurs in habitats with *P. erecta*, *P. patagonica*, and *A. coulterianum*, (Pratt 2001, pp. 42-43; Anderson unpubl. data 2008, pp. 2-3), this plant species is typically found in cooler and moister micro-habitats that tend to grow in the shade on north facing slopes (Pratt 2001, p. 40; Pratt, pers. comm. 2008b, p. 1).

Newly hatched pre-diapause larvae cannot move more than a few centimeters during the first two instars, restricting their development during this stage to the individual host plant where the eggs were deposited. Older pre-diapause larvae usually wander independently in search of food and may switch to feeding on a different species of host plant (USFWS 2003a, p. 7). All known species of host plant (see species listed above) may serve as primary or secondary host plants, depending on location and environmental conditions (USFWS 2003a, p. 17). Quino egg clusters and pre-diapause larval clusters have also been documented in the field on *Cordylanthus rigidus* (thread-leaved bird's beak) and *Castilleja exserta* (purple owl's-clover) (USFWS 2003a, pp. 14-18). However, use of *C. rigidus* and *C. exserta* is rare, and these species alone are not believed to support Quino breeding (USFWS 2003a, pp. 16-17).

The physical structure of flowers is the primary factor that determines nectar source use. Adult checkerspot butterflies of the genus *Euphydryas* have a short tongue, approximately 0.43 inch (11 millimeters) long (Pratt, pers. comm. 2007a, p. 1), and typically cannot feed on flowers that have deep corolla tubes or flowers evolved to be opened by bees (USFWS 2003a, p. 19). Although adults may nectar on flowers with a corolla length nearly a centimeter longer than their proboscis (0.59-1.10 inch (15-28 millimeters)), such as *Linanthus androsaceus* (false baby stars)

(Murphy 1984, p. 114; Hickman 1993, p. 842), they are not likely to prefer such species (Murphy 1984, p. 114). Therefore, flowers with a corolla tube greater than 0.43 inch (11 millimeters) are less likely to be used as nectar sources by the Quino. Edith's checkerspot butterflies prefer flowers with a platform-like surface on which they can remain upright while feeding (USFWS 2003a, p. 19).

White and Levin (1981, pp. 350-351) found that adult Quino's within-habitat patch movement distances from larval host plant patches to adult nectar sources often exceeded 656 feet (200 meters). Movement distances greater than this distance were the extreme values recorded by White and Levin (1981, p. 349), as 656 feet (200 meters) was more than double the average recapture distance in 1972, and almost 4 times the average distance in 1973. Therefore, nectar sources greater than 656 feet (200 meters) from larval host plants are not likely used by the subspecies.

It is not possible to determine habitat suitability based on standing host plant densities. Densities of *Plantago erecta* required for larval development have been estimated (USFWS 2003a, pp. 22-23); however, it is not always possible to determine typical host plant densities because: (1) Germinating host plants may be entirely consumed by larvae; or (2) seeds may not germinate and larvae may return to in diapause when precipitation levels are below-average (USFWS 2003a, p. 23). These principles apply to all host plant species to some extent; therefore, host plants detected in habitat appearing otherwise suitable should be considered an indicator of habitat suitability.

Changes in Taxonomic Classification or Nomenclature

The taxon now commonly called the Quino has undergone several nomenclatural changes. It was originally described as *Melitaea quino* (Behr 1863, pp. 90-91). Gunder (1929, pp. 5-8) reduced it to a subspecies of *Euphydryas chalcedona*. At the same time, he described *Euphydryas editha wrighti* from a checkerspot butterfly specimen collected in San Diego. After reexamining Behr's descriptions and specimens, Emmel *et al.* (1998, p. 101) concluded that the Quino should be associated with *E. editha*, not *E. chalcedona*, and that it was synonymous with *E. editha wrighti*. Because *E. editha wrighti* is a junior synonym for the Quino, *E. editha quino* is now the accepted scientific name (USFWS 2003a, pp. 5-6).

Genetics

Dr. Michael Singer (University of Texas, Austin) is currently conducting a genetics study with the primary goal of investigating the dispersal and colonization potential of the Quino based on the genetic relationships among populations. This information is needed for decisions regarding reintroduction of extirpated populations from extant populations and augmentation of extant low density populations that are vulnerable to extirpation. In particular, the research should facilitate the restoration of occupancy to historically occupied areas on Otay Mesa. The research focuses on comparing the genetic relatedness of historical Quino on Otay Mesa to potential source sites in San Diego County that could be used in an augmentation effort. Additionally, the research may explore the genetic relatedness of populations surrounding Otay Mountain with populations in southeastern San Diego County, populations in Riverside County, and populations in Mexico.

Initial Amplified Fragment Length Polymorphism analyses (Singer, pers. comm. 2009, p. 1) placed the Marron Valley and Lake Skinner occurrence complexes on the genetic map that already existed for Edith's checkerspot. This analysis clearly supports the integrity of the Quino subspecies as a coherent genetic entity within the species. This genetic map confirms a strong isolation by distance relationship among populations. Approximately 70 percent of the variation among populations can be explained by the geographic distance between them (Wee 2004, p. 13). In other words, populations that are geographically closest to each other are also genetically closest to each other. This relationship can be used to choose the most appropriate source populations for restoration in circumstances where available genetic information from extinct populations is inadequate.

<u>Species-specific Research and/or Grant-supported Activities</u>

See the description above of the ongoing genetic study being conducted by Dr. Michael Singer at the University of Texas, Austin. The project was funded by California Transportation Ventures to satisfy the funding obligation outlined in the biological opinion for the SR 125 South Project (USFWS 1999, 1-6-99-F-14). The money was placed in a non-endowment fund (Quino Checkerspot Butterfly Genetic and Captive Propagation Research Fund) and is currently managed by the San Diego Foundation.

Following the 2003 fires, the Service conducted a post-fire assessment study of affected occurrence complexes in San Diego County (USFWS 2007). The results of post-fire Quino observations and monitoring were generally positive, indicating continued persistence of occupancy after fire (USFWS 2007, p. 2). Most surveyors and Service staff reported small patches of unburned habitat within or adjacent to fire perimeters where host plants and in some cases even larvae were found (CFWO 2004, 2006). Contracted surveyors and CFWO staff noted that the fires are a threat to population resilience because they exacerbate nonnative plant invasion (e.g., *Erodium sp.*; CFWO 2006) that is already ubiquitous throughout the subspecies' range. Monitoring of areas adjacent to the Otay Fire perimeter provided comparative evidence of negative fire impacts as well, and we concluded that Quino population resiliency within the Otay Recovery Unit was likely compromised by the 2003 fires (USFWS 2007, p. 3); although it is not clear what the magnitude of the effect may be, or the time scale on which the effect may be apparent.

Edith Allen (University of California, Riverside) conducted research in 2004 and 2005 to determine effective methods for restoration of Quino habitat that had been converted to agricultural land (Marushia and Allen 2005). The study was conducted at Johnson Ranch (Marushia and Allen 2005, p. 1) in the Skinner/Johnson habitat-based population distribution. They found that discing after initial germination of grasses in the fall was an effective treatment against nonnative species, and provided good site preparation for solarization (tarping), which was the most effective among the treatments tested. Solarization produced the highest diversity and cover of native species, especially the Quino host plants, and the least density and cover of nonnative species (Marushia and Allen 2005, p. 2).

In 2008, the Service coordinated a rangewide study of occupancy using sample sites throughout the species range. Field surveys indicated that 2008 was a year of average detectability (based on environmental conditions). This study was designed to: (1) Help us determine the likelihood of species detectability using standard survey methods; (2) determine the likelihood of occupancy in a given year of habitat proximal to recent Quino observations; and (3) establish an occupancy baseline for future conservation analyses and management. Specific study objectives included estimating the percentage of areas within 262 feet (80 meters) of at least one Quino occurrence between 1997 and 2007 used by adults during the 2008 flight season, and estimating detection probabilities (CFWO 2008, p. 1). Sample plots were approximately 2 acres (0.8 hectare) and centered on randomly placed points within the sample area (described above; CFWO 2008, p. 1). Surveys were conducted by 10(A)1(a) recovery permit holders in a manner similar to that specified in the CFWO presence-absence survey protocol (CFWO 2008, p. 2; CFWO 2002, pp. 1-6). Initial data analysis was conducted using the program MARK (White and Burnham 1999, pp. 120-138). In San Diego County, Quino adults were detected in 7 of 164 plots (4 percent naïve rate, not corrected for detection probability) where at least one survey was conducted (T. Grant, CFWO, pers. obs. 2009, p. 1). The cumulative detection probability was between 0.5 and 0.8 (T. Grant, pers. obs. 2009, p. 1), meaning that there was a 50 to 80 percent chance of observing at least 1 Quino on a plot if it was occupied. The revised occupancy estimate using the calculated detection probability was 5.5 percent (95 percent CI 0.025-0.115) (T. Grant, pers. obs., 2009, p. 3). In Riverside County, Quino adults were detected in 22 out of 107 plots (21 percent naïve rate), where at least one survey was conducted (Western Riverside County Multiple Species Habitat Conservation Plan (Western Riverside County MSHCP) Biological Monitoring Program 2009, p. 11). The cumulative detection probability after 3 visits was 0.96, meaning that there was a 96 percent chance of observing at least 1 Quino on a plot if it was occupied. The revised occupancy estimate using the calculated detection probability was 23 percent (95 percent confidence intervals: 0.16-0.34), a slight increase from the naïve estimate. These results indicate adult Quino presence within an estimated population distribution can vary substantially (approximately 30 percent maximum likelihood of occupancy in habitat where occupancy has been documented since listing), and the likelihood of detecting Quino occupancy using standard survey methods is relatively high (may be greater than 95 percent), but may be as low as 50 percent. Additionally, there may be substantial differences between the north and south portions of the subspecies' range in occupancy rates and detectability.

Dr. Gordon Pratt (University of California, Riverside) has successfully reared Quino in captivity since listing in 1997 under a Service 10(a)1(A) recovery permit. He has obtained funding through the Service and third parties through a Habitat Conservation Plan (HCP) implementation. In 2006, Dr. Pratt (p. 9; Pratt and Emmel 2009, pp. 1, 5) conducted a study of diapause site choice at his captive propagation facility using captive stock and found that Quino larvae prefer to diapause in or near the base of native shrubs, such as *Eriogonum fasciculatum.*

The CFWO monitors Quino reference sites for larval and adult activity during the active season (possible December through May). Sites are monitored and information is posted on the internet for the general public. Monitoring is primarily for phenological information and to document continued Quino presence. Search efforts are not always equal, and negative surveys under unsuitable weather conditions (per survey protocol) are not reported. The CFWO staff also work with permitted volunteers to provide the best biological information possible. We share the most relevant information available to us on our website (e.g., CFWO 2009) regarding habitat areas throughout the subspecies' range.

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. Although we believe that most populations described above were likely extant at the time of listing, the listing rule analyzed threats in the context of approximately seven known populations. Our current analysis applies to all habitat known to be occupied since listing.

FACTOR A: Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range

At the time of listing, the Quino was imperiled primarily because habitat was being damaged, fragmented, and destroyed by human activities. Urban development, grazing, and invasion of nonnative plants were the predominant threats at that time (USFWS 1997, 62 FR 2313). Threats associated with Factor A were identified in the Recovery Plan (section entitled "Reasons for Decline and Current Threats") and included: loss and fragmentation of habitat and landscape connectivity, invasion by nonnative plants, off-road vehicle activity, grazing, enhanced soil nitrogen, and increased atmospheric carbon dioxide concentration (USFWS 2003a, pp. 56-60). Little has changed with regard to the magnitude and immediacy of these threats since publication of the Recovery Plan. We now believe the magnitude and immediacy of the threat of climate change-induced habitat modification to lower latitudes (in Mexico and lower elevation populations) has increased, though the magnitude of development as a threat has likely decreased due to listing, habitat conservation to-date and a slowdown in development caused by the current economic conditions.

<u>Land Use Changes</u>

Since completion of the Recovery Plan in 2003, loss and modification of Quino habitat continue to be a primary threat to the subspecies, especially in areas where urbanization is expected to expand (Southeast San Diego County, and the Bautista Road Occurrence Complex and associated habitat in the final revised critical habitat Unit 7; USFWS 2009, 74 FR 28776) (Table 1). In areas where habitat is protected, urbanization of surrounding lands may result in the fragmentation of protected habitats, which could prevent movement of the subspecies between habitat areas.

Acquisitions of land and conservation easements have resulted in preservation of much habitat for the subspecies (Table 1). We do not yet know how much local Quino abundance, distribution, and habitat availability can be reduced without critically compromising population resiliency. We believe it is important to consider a historical perspective and acknowledge that some insect extinctions occur in places or at spatial scales different from those of vertebrates and plants, and that insects often have extremely high reproductive and dispersal capacities under optimal environmental conditions compared to those taxa, as well as different habitat requirements during different life stages (Dunn 2005, p. 1031). Several documented extinctions have occurred for insect species with high periodic abundance and large geographic ranges for which habitat suitability under suboptimal environmental conditions were extremely limited in at least one life stage (reviewed by Dunn 2005, pp. 1033-1034). Although we know some required

Quino habitat components (e.g., host plant presence), habitat suitability within population distributions has not been studied or quantified, especially with regard to environmental conditions and temporal variability. Because during periods of extreme high or low precipitation the amount of suitable habitat within an Edith's checkerspot population distribution is extremely limited and geographically variable depending on conditions (Weiss *et al.* 1988, p. 1495), some crucial areas for Quino were likely destroyed within many extant population distributions (e.g., Harford Springs habitat-based population distribution; USFWS 2003a, pp. 36 and 39; see Table 1 and Figures 1 and 2 for estimated habitat losses). Such losses of crucial areas within habitat patches might not be apparent until consecutive years of severe drought or high rainfall, but then have an impact disproportional to the size of the area lost (Weiss *et al.* 1988, p. 1495). Therefore, despite slightly elevated population abundances, the discovery of previously unknown population locations, habitat conservation to-date, and additional planned conservation since listing, we believe the subspecies continues to be threatened by habitat loss, degradation, and fragmentation.

Based on our population distribution estimates, there may have been as many as 37 extant populations at the time of listing (6 known, thought to be 7 or 8); there are currently 33, with 10 (4 known at the time of listing) categorized as "core" (Table 1, Figures 1 and 2). The status of all occurrence complexes within 12 habitat-based population distributions are classified as unknown (e.g., Winchester and West Otay mesa habitat-based population distributions), and habitat within two core habitat-based population distributions has been significantly reduced. The entire Warm Springs Creek core habitat-based population distribution is considered highly threatened and the population status is unknown (Table 1, Figure 1). Approximately 52 percent (2,953 acres (1,194 hectares)) of habitat within the Warm Springs Creek occurrence complexes has been lost since listing, and 21 percent (560 acres (227 hectares)) of remaining habitat is outside the planned preserve (see *Regional Planning Efforts* subsection below) and will likely be destroyed (Table 1). The Skinner/Johnson core habitat-based population distribution has more conserved habitat than Warm Springs Creek and is less isolated by development; however, approximately 41 percent (6,491 acres (2,627 hectares)) of habitat within occurrence complexes (including two entire occurrence complexes) has been lost since listing (Table 1).

Of the total 147,359 acres (59,634 hectares) of mapped occurrence complexes extant at the time of listing or documented post-listing (all area within 0.6 mile (1 kilometer) of observations), approximately 42 percent are on public lands or privately owned preserves that are not subject to large-scale land-use conversion, approximately 19 percent are privately owned lands likely to be conserved under an HCP, approximately 24 percent are private and tribal lands where the likelihood of habitat loss is variable, and approximately 15 percent have been destroyed by development or land use changes (Table 1). The fact that the majority of habitat within occurrence complexes has been or is likely to be conserved since listing demonstrates how effective listing under the Act is in achieving and encouraging habitat conservation.

<u>Disturbance</u>

Disturbance of habitat can open woody canopies and may sometimes increase habitat suitability, but frequent off-road vehicle use compacts soil, destroys host plants, increases erosion and fire frequency, creates trails that are conduits of nonnative plant invasion, and in occupied habitat causes direct mortality of Quino (USFWS 2003a, pp. 58-59). If there are no Quino proximal and abundant enough to recolonize disturbed habitat, an increase in habitat suitability the following year due to disturbance is irrelevant. Increased human population densities proximal to occupied habitat increase the rate of disturbance due to recreational activities such as off-road vehicle activity. Recreational disturbance is frequently observed in monitored, occupied habitat where larvae are observed on host plants (USFWS 2003a, p. 59; CFWO 2008).

<u>Nonnatives</u>

Conversion from native vegetation to nonnative annual grassland is the greatest threat to conserved habitat (USFWS 2003a, pp. 57-58), and a high magnitude threat to all habitat that is not managed. Increased dominance of nonnative plant species reduces the abundance (by competition) and suitability (by shading) of Quino host plants (USFWS 2003a, pp. 57-58). Females are less likely to deposit eggs on host plants that are shaded by other plants. Female Quino deposit eggs on plants located in full sun, preferably surrounded by bare ground or sparse, low vegetation (USFWS 2003a, p. 18). Plants shaded through the midday hours (1100 to 1400) or embedded in taller vegetation appear to be less likely targets for oviposition (Singer 1983, p. 392; USFWS 2003a, p. 12), probably because of the high temperature requirements of developing larvae (Osborne and Redak 2000, p. 12). Habitat fragmentation exacerbates vegetation type conversion because ground disturbance and edge effects in fragments with large edge-to-area ratios experience higher rates of invasion. Other causes of vegetation type conversion include fire, grazing, off-road vehicle activity, and increased nitrogen deposition (USFWS 2003a, pp. 57-58; see discussion below).

<u>Altered Host Plant Phenology</u>

The ongoing and predicted climate change trends (see “Factor E” section below) likely contribute to increased prediapause larval death due to early host plant aging at the southern range edge (in Mexico) and at lower elevations in the United States (USFWS 2003a, p. 64). Field studies have documented population crashes and extirpations in several butterfly species; including Edith’s checkerspot, as a direct result of butterfly-host asynchrony (Parmesan 2006, p. 646).

<u>Nitrogen Deposition</u>

Nitrogen deposition influences nonnative plant invasion by increasing soil fertility, as invasive species are often better competitors for soil nutrients than native plant species (Padgett *et al.* 1999, p. 769). Soils in urbanized and agricultural regions are being fertilized by excess nitrogen generated by human activities, and this threat continues to increase in magnitude as human population densities increase (USFWS 2003a, p. 65). Soils in the most polluted regions near Riverside, California, have more than 80 parts per million (weight) extractable nitrogen, more than four times the typical concentration detected in natural, unpolluted soils (Padgett *et al.* 1999, pp. 776 and 778).

Grazing

Grazing by cattle and sheep increase initial rates of invasion by nonnative plants by disturbing the soil, and cause direct mortality of Quino (USFWS 2003a, pp. 59-60). However, once grazing is removed, the rate of nonnative plant invasion increases; therefore the Recovery Plan recommended commercial grazing in occupied habitat be phased out and replaced by other, less destructive, nonnative plant control methods (USFWS 2003a, p. 60). The threat of grazing has been removed (e.g., Marron Valley) or is being managed (e.g., San Bernardino National Forest lands) in most areas, though no plans or actions to control nonnative plant species are currently in place.

Summary of Factor A

Much habitat has been conserved since listing in 1997. Population extirpation within several non-core habitat-based population distributions (e.g. Winchester), and at least one core habitat-based population distribution (Warm Springs Creek) is probable in the near future due primarily to the ongoing effects of Factor A threats, past and present. While it is clear the rate of habitat destruction has slowed and much future destruction has been precluded, some habitat loss is likely to continue. The rate and scope of habitat modification has increased due to impacts of growing proximal human populations, ongoing nonnative species invasion, climate change effects, and nitrogen deposition. Protection of habitat from destruction is a necessary first step toward recovery. The greatest challenge will be to continue managing the remaining habitat and populations to prevent future population losses, and implementing management objectives for Quino under regional HCPs (see "Factor D" section below). Destruction, modification, and curtailment of habitat and range continue to be threats to Quino.

FACTOR B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

At the time of listing, over-collection was considered a potential threat to Quino because of specimen value to collectors (USFWS 1997, 62 FR 2313). The impact of overutilization for any purpose is not known at this time (USFWS 2003a, p. 55).

FACTOR C: Disease or Predation

At the time of listing, disease was not known to be a factor affecting the Quino (USFWS 1997, 62 FR 2313). The listing rule (USFWS 1997, 62 FR 2313) stated there was evidence predation by invasive nonnative species may pose a threat to the Quino; however, the magnitude of this threat was not known. Threats associated with this factor were also identified in the Recovery Plan under the "Reasons for Decline and Current Threats" section (USFWS 2003a, pp. 55). The impacts of disease and predation remain unknown.

FACTOR D: Inadequacy of Existing Regulatory Mechanisms

At the time of listing, regulatory mechanisms thought to have some potential to protect the Quino included: (1) the California Environmental Quality Act (CEQA); (2) the National Environmental

Protection Quality Act (NEPA); and (3) the Act in those cases where Quino occur and is incidentally protected in habitat occupied by a listed wildlife species. The listing rule (USFWS 1997, 62 FR 2313) provides an analysis of the level of protection that was anticipated from those regulatory mechanisms. This analysis remains valid.

State Protections

The State's authority to conserve rare wildlife and plants is comprised of four major pieces of legislation: the California Endangered Species Act, the Native Plant Protection Act, CEQA, and the Natural Community Conservation Planning Act (NCCPA). Insect taxa are not listable entities under the California Endangered Species Act (CESA), therefore this protection does not apply to Quino. The CEQA requires review of any project that is undertaken, funded, or permitted by the State or a local governmental agency. If significant effects are identified, the lead agency has the option of requiring mitigation through changes in the project or to decide that overriding considerations make mitigation infeasible (CEQA section 21002). Protection of listed species through CEQA is, therefore, dependent upon the discretion of the lead agency involved. The Natural Community Conservation Program is a cooperative effort to protect regional habitats and species under the Natural Community Conservation Planning Act. The program helps identify and provide for area wide protection of plants, animals, and their habitats while allowing compatible and appropriate economic activity. Many Natural Community Conservation Plans (NCCPs) are developed in conjunction with HCPs prepared pursuant to the Act.

Federal Protections

<u>National Environmental Policy Act (NEPA)</u>: NEPA (42 U.S.C. 4371 *et seq*.) provides some protection for listed species that may be affected by activities undertaken, authorized, or funded by Federal agencies. 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 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.

<u>Sikes Act</u>: The Sikes Act (16 U.S.C. 670) authorizes the Secretary of Defense to develop cooperative plans with the Secretaries of Agriculture and the Interior for natural resources on public lands. The Sikes Act Improvement Act of 1997 requires Department of Defense installations to prepare Integrated Natural Resource Management Plans (INRMPs) that provide for the conservation and rehabilitation of natural resources on military lands consistent with the use of military installations to ensure the readiness of the Armed Forces. INRMPs incorporate, to the maximum extent practicable, ecosystem management principles and provide the landscape necessary to sustain military land uses. While INRMPs are not technically regulatory mechanisms because their implementation is subject to funding availability, they can be an added conservation tool in promoting the recovery of endangered and threatened species on military lands.

The Navy has updated its Naval Base Coronado INRMP to specifically address the Quino and its habitat at the La Posta Facility and is awaiting approval by the Service. The INRMP will incorporate all conservation measures included in the current Quino Habitat Enhancement Plan and address expansion plans for the La Posta Facility (see above discussion under "Factor A" for further details).

National Park Service (NPS) Organic Act: The NPS Organic Act of 1916 (39 Stat. 535, 16 U.S.C. 1, as amended), states that the National Park Service "shall promote and regulate the use of the Federal areas known as national parks, monuments, and reservations … to conserve the scenery and the national and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations." The National Park Service Management Policies indicate that the Park Service will "meet its obligations under the National Park Service Organic Act and the Endangered Species Act to both pro-actively conserve listed species and prevent detrimental effects on these species." This includes working with the Service and undertaking active management programs to inventory, monitor, restore, and maintain listed species habitats, among other actions.

National Forest Management Act (NFMA): The National Forest Management Act (36 C.F.R. 219.20(b)(i)) has required the USDA Forest Service to incorporate standards and guidelines into Land and Resource Management Plans, including provisions to support and manage plant and animal communities for diversity and for the long-term, rangewide viability of native species. Recent changes to NFMA may affect future management of listed species, particularly rare plant occurrences, on National Forests. On January 5, 2005, the Forest Service revised National Forest land management planning under NFMA (70 FR 1023). The 2005 planning rule changed the nature of Land Management Plans so that plans generally would be strategic in nature and could be categorically excluded from NEPA analysis, and thus not subject to public review. Under the 2005 planning rule, the primary means of sustaining ecological systems, including listed species, would be through guidance for ecosystem diversity. If needed, additional provisions for threatened and endangered species could be provided within the overall multiple-use objectives required by NFMA. The 2005 planning rule did not include a requirement to provide for viable populations of plant and animal species, which had previously been included in both the 1982 and 2000 planning rules. On March 30, 2007, however, the United States District Court in *Citizens for Better Forestry et al. v. USDA* (N.D. Calif.) enjoined (prohibited) the USDA from implementing and utilizing the 2005 rule until the Forest Service provided for public comment and conducted an assessment of the rule's effects on the environment, including listed species.

On April 21, 2008, the Forest Service published a final 2008 planning rule and a record of decision for a final environmental impact statement examining the potential environmental impacts associated with promulgating the new rule (73 FR 21468). The 2008 planning rule also does not include a requirement to provide for viable populations of plant and animal species on Forest Service lands. As part of the environmental analysis, a biological assessment was prepared to address the 2008 planning rule's impact to threatened, endangered, and proposed species and designated and proposed critical habitat. The assessment concluded that the rule does not affect, modify, mitigate, or reduce the requirement for the Forest Service to consult or conference on projects or activities that it funds, permits, or carries out that may affect listed or proposed species or their designated or proposed critical habitat. On August 8, 2008, the Forest Service published an interim directive and requested public comment on its section 7 consultation policy for developing, amending, or revising Land Management Plans under the 2008 planning rule. Thus, the impact of the 2008 rule to listed species is unknown at this time.

Federal Land Policy and Management Act of 1976 (FLPMA): The Bureau of Land Management is required to incorporate Federal, State, and local input into their management decisions through Federal law. The FLPMA (Public Law 94-579, 43 U.S.C. 1701) was written "to establish public land policy; to establish guidelines for its administration; to provide for the management, protection, development and enhancement of the public lands; and for other purposes". Section 102(f) of the FLPMA states that "the Secretary [of the Interior] shall allow an opportunity for public involvement and by regulation shall establish procedures … to give Federal, State, and local governments and the public, adequate notice and opportunity to comment upon and participate in the formulation of plans and programs relating to the management of the public lands". Therefore, through management plans, the Bureau of Land Management is responsible for including input from Federal, State, and local governments and the public. Additionally, Section 102(c) of the FLPMA states that the Secretary shall "give priority to the designation and protection of areas of critical environmental concern" in the development of plans for public lands. Although the Bureau of Land Management has a multiple-use mandate under the FLPMA which allows for grazing, mining, and off-road vehicle use, the Bureau of Land Management also has the ability under the FLPMA to establish and implement special management areas such as Areas of Critical Environmental Concern, wilderness, research areas, etc., that can reduce or eliminate actions that adversely affect species of concern (including listed species).

The Lacey Act: The Lacey Act (P.L. 97-79), as amended in 16 U.S.C. 3371, makes unlawful the import, export, or transport of any wild animals whether alive or dead taken in violation of any United States or Indian tribal law, treaty, or regulation, as well as the trade of any of these items acquired through violations of foreign law. The Lacey Act 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.

National Wildlife Refuge System Improvement Act of 1997: This act establishes the protection of biodiversity as the primary purpose of the National Wildlife Refuge system. This has lead to various management actions to benefit the federally listed species. Much habitat in southern San Diego County has been conserved within the National Wildlife Refuge System (Otay core habitat-based population distribution).

Endangered Species Act of 1973, as amended (Act): The Act is the primary Federal law providing protection for this species. The Service's responsibilities include administering the Act, including sections 7, 9, and 10 that address take. Since listing, the Service has analyzed the potential effects of Federal projects under section 7(a)(2), which requires Federal agencies to consult with the Service prior to authorizing, funding, or carrying out activities that may affect listed species. A jeopardy determination is made for a project that is reasonably expected, either directly or indirectly, to appreciably reduce the likelihood of both the survival and recovery of a listed species in the wild by reducing its reproduction, numbers, or distribution (50 CFR 402.02).

A non-jeopardy opinion may include reasonable and prudent measures that minimize the amount or extent of incidental take of listed species associated with a project.

Section 9 prohibits the taking of any federally listed endangered or threatened species. Section 3(18) defines "take" to mean "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." Service regulations (50 CFR 17.3) define "harm" to include significant habitat modification or degradation which actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering. Harassment is defined by the Service as an intentional or negligent action that creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. The Act provides for civil and criminal penalties for the unlawful taking of listed species. Incidental take refers to taking of listed species that results from, but is not the purpose of, carrying out an otherwise lawful activity by a Federal agency or applicant (50 CFR 402.02).

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Regional Planning Efforts

Incidental take permits, pursuant to section 10(a)(1)(B) of the Act, may be issued to authorize take of listed animal species resulting from projects without a Federal nexus. This section provides protection for the Quino through the approval of HCPs that detail measures to minimize and mitigate the potential impacts of projects to the maximum extent practicable. To qualify for an incidental take permit, applicants must develop, fund, and implement a Service-approved HCP that details measures to minimize and mitigate the project's adverse impacts to listed species. Regional HCPs in some areas now provide an additional layer of regulatory protection for covered species, and many of these HCPs are coordinated with California's related NCCP Program.

City of Chula Vista Subarea Plan under the San Diego MSCP

Although not covered under the umbrella of the of the subregional San Diego County MSCP document, the Quino is a covered species under the City of Chula Vista (City) Subarea Plan (Chula Vista Subarea Plan), which provides for the long-term conservation of this subspecies. The MSCP subregional plan has been in place for more than a decade. The plan provides for establishment and management of approximately 171,920 acres (69,574 hectares) of preserve lands within the Multiple Habitat Preserve Area (MHPA; preserve planning area) and Pre-approved Mitigation Areas (PAMA; area where purchase of land is approved for mitigation). The MSCP was developed in support of applications for incidental take permits for several federally listed species by 12 participating jurisdictions and many other stakeholders in southwestern San Diego County. 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. Planned conservation estimates in Table 1 (PC) are based on the MHPA and PAMA within all approved subarea plans.

The Chula Vista Subarea Plan contains requirements to monitor and adaptively manage Quino habitats. This area-specific management plan is comprehensive and addresses a broad range of management needs at the preserve and species levels intended to reduce threats to the Quino. Lands preserved under the Chula Vista Subarea Plan are adaptively managed and maintained to: (1) Ensure the long-term viability and sustainability of native ecosystem function and natural processes throughout the preserve; (2) protect existing and restored biological resources from the impacts of human activities within the preserve while accommodating compatible uses; (3) enhance and restore, where feasible, appropriate native plant associations and wildlife connections to adjoining habitat to provide viable wildlife and sensitive species habitat; (4) facilitate monitoring of selected target species, habitats, and linkages to ensure long-term persistence of viable populations of priority plant and animal species (including the Quino); and (5) ensure functional habitats and linkages for those species (USFWS 2003b, pp. 18, 70, FWS-SDG-882.1).

The MSCP and the Chula Vista Subarea Plan incorporate many processes that allow for Service oversight and participation in program implementation. These processes include: annual reporting requirements, review and approval of proposed subarea plan amendments or preserve boundary adjustments, review and comment on projects through CEQA, and chairing the Habitat Management Technical Committee and the Monitoring Subcommittee (MSCP 1998, pp. 5-11 to 5-23).

Western Riverside County MSHCP

The Western Riverside County MSHCP is a large-scale, multi-jurisdictional HCP encompassing approximately 1.26 million acres (510,000 hectares) of land in western Riverside County. The Western Riverside County MSHCP addresses 146 listed and unlisted "covered species", including the Quino. The Western Riverside County MSHCP is a multi-species conservation program minimizing and mitigating expected loss of habitat and associated incidental take of covered species. On June 22, 2004, the USFWS issued an incidental take permit (USFWS 2004, TE-088609-0) under section 10(a)(1)(B) of the Act to 22 permittees under the Western Riverside County MSHCP for a period of 75 years.

Preservation and management of approximately 67,493 acres (27,314 hectares) of Quino habitat under the Western Riverside County MSHCP will contribute to conservation and ultimate recovery of this subspecies. The Western Riverside County MSHCP removes or reduces threats to this subspecies by placing large blocks of occupied and unoccupied habitat into preservation throughout the MSHCP Conservation Area. The approximately 67,493 acres (27,314 hectares) that will be conserved under this plan for the Quino capture a variety of habitat characteristics supporting Quino throughout western Riverside County. Distribution of the subspecies within the existing Western Riverside County MSHCP Conservation Area is documented through annual surveys. Surveys will continue annually as lands are added to the Conservation Area. The surveys are intended to verify continued occupancy at a minimum of 75 percent of the occupied locations identified in the plan. An adaptive management program is being implemented to maintain or enhance all conserved habitat to increase its value for, and the viability of, Quino populations (Dudek 2003, Volume I, Section 9, Table 9–2, pp. 9–28, 9–29).

Mexican Law

The Service is not aware of any existing regulatory mechanisms that protect the Quino or its habitat in Mexico. The Quino is not listed under the Mexican equivalent of the Act (Norma Oficial Mexicana NOM-059).

Tribal Policies and Programs

Although all tribes that have occupied Quino habitat within their jurisdictions have environmental programs engaged in general conservation planning, we are not aware of any existing regulatory mechanisms that specifically protect the Quino or its habitat.

Summary of Factor D

In summary, the Act is the primary Federal law that provides protection for this species since its listing as endangered in 1997. Under the Act and the NCCPA, regional HCPs provide considerable conservation benefit for Quino. Other Federal and State regulatory mechanisms provide discretionary protections for the species based on current management direction, but do not guarantee protection for the species absent its status under the Act. Therefore, we believe that State and other Federal laws and regulations have limited ability to protect the species in absence of Act.

FACTOR E: Other Natural or Manmade Factors Affecting Its Continued Existence

The listing rule (USFWS 1997, 62 FR 2313) stated that the restricted range, localized distribution, and small population sizes of the Quino made it more vulnerable to Factor A threats. The listing rule also stated that restricted range, localized distribution, and small population sizes make historical levels of natural events such as fire and periodic drought significant threats to the subspecies. Threats associated with climate change were emphasized in the Recovery Plan (USFWS 2003a, pp. 63-65), and further exacerbate Factor A and other Factor E threats. Current scientific data support the continued existence of those threats. Although the range is less restricted as was believed at the time of listing (Table 1, Figures 1 and 2), it is likely small population size and localized distribution threatens existing populations such as Warm Springs Creek (core habitat-based population distribution) in Riverside County (see above discussion under "Factor A").

Stochastic events

Droughts, wildfires, and floods can severely reduce population abundance of Quino, while intermediate amounts of precipitation, combined with high temperatures, can restore higher population abundance (Murphy and White 1984, pp. 351-352; Anderson 2003, p. 4; see "Abundance" section above for detailed discussion). While natural catastrophic events existed under historical environmental conditions and were likely to temporarily impact resilient populations (see USFWS 2007, p. 2 regarding impacts of recent fires), increased frequency and intensity of stochastic events due to climate change (see below discussion; IPCC 2007, p. 8) and interaction with Factor A threats increase the magnitude and severity of impacts of stochastic events on Quino populations. The more habitat that is lost and degraded, the smaller and more localized populations become, and the more likely catastrophic natural events are to extirpate populations that have reduced resiliency.

Small Population Size

Small population size increases the vulnerability of Quino to stochastic events, makes it more difficult for individuals to find mates, and may result in inbreeding (Pratt pers comm. 2009c, p. 1). Inbreeding depression was found to increase the extirpation probability of a related, similar butterfly species, *Melitaea cinxia* (the Glanville fritillary; Nieminen *et al.* 2001, pp. 242-243).

Climate Change

As discussed in the final revised critical habitat designation, the best available scientific information suggests the Bautista Road Occurrence Complex (above 4,000 feet (1,219 meters) in elevation) supports ongoing range shift for this subspecies upslope in elevation, and extirpation of many populations in lower-elevation, where drier habitats are likely to occur. It is also likely that smaller occurrence complexes north of the community of Anza are the result of relatively recent colonization events (post-1980s drought).

Parmesan (1996, pp. 765-766) concluded that the average position of known Edith's checkerspot butterfly populations shifted north and up in elevation, likely due to a warming, drying climate. Parmesan (1996, pp. 765-766) compared the distribution of the Edith's checkerspot butterfly in the early part of the 20th century to its distribution from 1994 to 1996 using historical records and field surveys. This study identified a rangewide pattern of local Edith's checkerspot butterfly extirpations and noted that 80 percent of historical populations in the southern part of the range were currently extinct in the mid-1990s (with the majority being Quino populations). In contrast, historical populations in the mid-latitude part of Edith's checkerspot butterfly's range experienced only 40 percent extirpations, and the extirpation rate in the northern part was as low as 20 percent (Parmesan 1996, pp. 765-766). Fewer than 15 percent of the Edith's checkerspot butterfly extirpations occurred in the highest elevation band (above 7,874 feet (2,400 meters) (Parmesan 1996, pp. 765-766). Parmesan (1996, pp. 765-766) concluded that this pattern of extirpation indicates contraction of the southern boundary of the subspecies' overall distribution by almost 100 miles (160 kilometers) and a shift in the average location of an Edith's checkerspot butterfly occurrence northward by 57 miles (92 kilometers). A parallel elevation gradient in extirpations shifted the mean location of Edith's checkerspot butterfly populations upward by 407 feet (124 meters). A breakpoint in the pattern of extirpations occurred at approximately 7,874 feet (2400 meters), with about 40 percent of all populations below the breakpoint recorded as extirpated in suitable habitats, while less than 15 percent were extirpated above the breakpoint. This range shift closely matched shifts in mean yearly temperature (Parmesan 1996, pp. 765-766; Karl et al. 1996, pp. 279-292). The Quino may be the subspecies of Edith's checkerspot most affected by climate change, because Parmesan's study found extirpations to be most common at lower elevations and latitudes, and the Quino's range includes both extremes.

Studies demonstrate a correlation of population distribution and phenology changes with climate changes for many other butterfly and insect species in California and around the world (Parmesan et al. 1999, p. 580; Forister and Shapiro 2003, p. 1130; Parmesan and Yohe 2003, pp. 38-39; Karban and Strauss 2004, pp. 251–254; Thomas et al. 2004, pp. 146-147; Osborne and Ballmer 2006, p. 1; Parmesan 2006, pp. 646-647; Thomas et al. 2006, pp. 415-416). Metapopulation viability analyses of other endangered nymphalid butterfly species also indicate that current climate trends pose a major threat to butterfly metapopulations by reducing butterfly growth rates and increasing subpopulation extirpation rates (Schtickzelle and Baguette 2004, p. 277; Schtickzelle et al. 2005, p. 89). Most recently, Preston et al. (2008, p. 2506) incorporated biotic interactions into niche models to predict suitable habitat for species under the range of climate conditions predicted for southern California in recent climate change models (Hayhoe et al. 2004, pp. 12422-12427; IPCC 2007, p. 9). Preston et al. (2008, p. 2508) found that Quino habitat decreased and became fragmented under altered climate conditions based on the climate-only model. For increasing temperatures and 110 percent precipitation, there was a shift in habitat to the eastern portion of the currently occupied range corresponding with an upslope movement of the species to higher elevations in adjacent mountains (Preston et al. 2008, p. 2508). The abiotic–biotic model (better performing model) predicted 98 to 100 percent loss of suitable Quino habitat when the temperature increased 1.7 and 2.8 °C or when the precipitation is 50 percent (significantly lower) or 150 percent (significantly higher) of current levels (Preston et al. 2008, p. 2508). An increase of less than 1.8^{o} F (1 °C) with no change in current precipitation resulted in no predicted habitat shift, although there was an eastward (upslope) shift within the current distributional footprint at 110 percent precipitation (Preston et al. 2008, p. 2508). Such similar climate response patterns in modeled habitat and related and co-occurring insect species further support the validity of Parmesan's (1996, pp. 765–766) Quino observations and conclusions (Preston et al. 2008, pp. 2511-2512). Therefore, the hypothesis of climate-driven range shift occurring in the foothills north of the community of Anza is well supported by the best available scientific information.

Documentation of past climate-related changes that have already occurred in California (Ehrlich and Murphy 1987, p. 124; Croke et al. 1998, pp. 2128, 2130; Davis et al. 2002, p. 820; Breshears et al. 2005, p. 15144) and future drought predictions for the state (e.g., Field et al. 1999, pp. 8-10; Brunelle and Anderson 2003, p. 21; Lenihen et al. 2003, p. 1667; Hayhoe et al. 2004, p. 12422; Breshears et al. 2005, p. 15144; Seager et al. 2007, p. 1181) and North America (IPCC 2007, p. 9), and extirpation of Edith's checkerspot butterfly populations following extreme climate events (Ehrlich et al. 1980, pp. 101-105; Singer and Ehrlich 1979, pp. 53–60; Singer and Thomas 1996, pp. 9–39) indicate prolonged drought and other climate-related changes will continue into the near future, and these changes will affect Quino populations. Thomas et al.

(2004, p. 147) estimated 29 percent of species in scrublands (habitat for the Quino) face eventual extinction, and 7 (with dispersal) to 9 (without dispersal) percent of butterfly species in Mexico will become extinct due to climate change-driven impacts (mid-range climate predictions; Thomas et al. 2004, p. 146). During drought conditions in 2007 surveyors noted that, for the first time since the subspecies was listed, no Quino were observed during Riverside County surveys or occurrence complex monitoring (CFWO 2007). In 2008 and 2009, the only occupied site below 3,500 feet (1067 meters) in elevation in Riverside County where relatively high Quino densities were reported was on the top of Oak Mountain at approximately 2,600 feet (793 meters) in elevation (CFWO 2008, 2009). Oak Mountain is unique in that it is the highest topographic point within an area encompassing over 7,000 acres (2833 hectares) of relatively suitable and contiguous Quino habitat surrounding Vail Lake (Helix Environmental Planning 2003, pp. 1–2, USFWS GIS database and satellite imagery). Above 3,500 feet (1067 meters) in elevation in Riverside County and in southwestern San Diego County adult densities appeared to be relatively high in 2008 (CFWO 2008, 2009) compared to elsewhere in the range. Therefore, recent field evidence supports the hypothesis that more extreme climatic conditions throughout the subspecies' range are causing reduced densities in the lowest elevation, driest habitats.

Comparison of Figures 1 and 2 indicate more populations have been documented in San Diego County than in Riverside County since the Recovery Plan was published, though there is reason to believe these populations do not represent local range expansion, as those north of the community of Anza are believed. The elevation gradient is less pronounced in San Diego County than in Riverside County, and all San Diego populations are below 4,000 feet (1,219 meters) in elevation, well within what we believe is the subspecies' historical elevation range. Furthermore, examination of the difference in weather patterns (less variable climate in San Diego; Anderson 2000, p. 6) and survey detectability (lower detectability in San Diego) indicates San Diego County is more likely to support stable, low-density, difficult-to-detect populations than Riverside County. Therefore, it is likely these recently documented populations in San Diego County have existed since listing and were not detected, or are the result of recolonization of habitat within the subspecies' historical range.

<u>Summary of Factor E</u>

In summary, the restricted range, localized distribution, and small population sizes make Quino more vulnerable to stochastic events (such as drought and fire), climate change effects, and Factor A threats. Of particular concern is the vulnerability of Quino populations to prolonged drought, and the likelihood that climate change significantly increases this vulnerability.

III. RECOVERY CRITERIA

The Service published a final Recovery Plan in 2003. Recovery plans provide guidance to the USFWS, States, and other partners and interested parties on ways to minimize threats to listed species, and on criteria that may be used to determine when recovery goals are achieved. There are many paths to accomplishing the recovery of a species and recovery may be achieved without fully meeting all recovery plan criteria. For example, one or more criteria may have been exceeded while other criteria may not have been accomplished. In that instance, we may determine that, over all, the threats have been minimized sufficiently, and the species is robust enough, to downlist or delist the species. In other cases, new recovery approaches and/or opportunities unknown at the time the recovery plan was finalized may be more appropriate ways to achieve recovery. Likewise, new information may change the extent that criteria need to be met for recognizing recovery of the species. Overall, recovery is a dynamic process requiring adaptive management, and assessing a species' degree of recovery is likewise an adaptive process that may, or may not, fully follow the guidance provided in a recovery plan. We focus our evaluation of species status in this 5-year review on progress that has been made toward recovery since the species was listed (or since the most recent 5-year review) by eliminating or reducing the threats discussed in the five-factor analysis. In that context, progress towards fulfilling recovery criteria serves to indicate the extent to which threat factors have been reduced or eliminated. The Quino recovery plan (USFWS 2003) did not have threat-based recovery criteria.

Recovery Criteria:

The Recovery Plan (USFWS 2003a, pp. v-vi) states the Quino could be downlisted to threatened when the following criteria are met. Below we discuss the current applicability of these criteria, progress toward meeting them, and how they help reduce or eliminate threats attributable to one or more of the listing factors above.

1) Permanently protect the habitat within occurrence complexes (estimated occupied areas based on habitat within 0.6 mile (1 kilometer) of recent butterfly occurrences), in a configuration designed to support resilient populations. One or more occurrence complexes may belong to a single greater population distribution, or an occurrence complex may contain more than one whole or partial population distributions. When population distributions are determined, they will replace the occurrence complex as the protected unit. There are currently 46 described occurrence complexes.

This recovery criterion is still applicable, but requires updating. The number of occurrence complexes should be revised because some have been merged to form a single complex, new occurrences complexes have been discovered, and habitat-based population distributions should be substituted for occurrence complexes as the relevant conservation unit. Habitat-based population distributions better reflect the long-term distributions of populations and associated habitat. Much habitat has been conserved since publication of the Recovery Plan (as described above), and more habitat associated with the occurrence complexes will continue to be conserved under regional HCPs such as the Western Riverside County MSHCP and the San Diego MSCP. Populations in the vicinity of the community of Anza and State Route 371 are likely the most resilient throughout the range of the subspecies; however, development has been steadily reducing the amount of habitat in that area since the subspecies was listed (USFWS GIS database, satellite imagery). The largest gap in plans for protection of habitat needed to support resilient populations is on private lands (Tule Peak and Bautista Road) and the smaller occurrence complexes in the vicinity of the community of Anza. The newly discovered Barbara Trail Occurrence Complex (western edge of the Tule Peak habitat-based population distribution) is privately owned by a landowner who has sold much land in the past for mitigation (Greg Reeden, former owner of the Silverado Mitigation Bank), but is not currently planned for conservation. The newly discovered Terwilliger Valley Occurrence Complex (eastern edge of the Tule Peak habitat-based population distribution) is also largely under private ownership and threatened by encroaching development.

Maintenance of populations in the Tule Peak and Bautista Road core habitat-based population distributions, and habitat connectivity to smaller, higher elevation habitat-based population distributions, is needed to support climate change-driven range shift and prevent an increase in the subspecies' extinction probability (USFWS 2003a, pp. 46-47; Osborne 2007, pp. 9-10). The Anza/Mount San Jacinto foothills area (in and adjacent to the Bautista Road core habitat-based population distribution) supports the greatest elevation gradient within the extant range of the Quino, and is proximal to population that likely produces the most emigrants within the subspecies' range (Tule Peak core habitat-based population distribution, see above discussion). The highest elevation core habitat-based population distributions (Tule Peak and Bautista Road) also support the highest (co-occurring) diversity of host plant species (*Plantago patagonica*, *Antirrhinum coulterianum*, *Collinsia concolor*, *Cordylanthus rigidus*, and *Castilleja exserta*) within the range of the Quino, a factor known to mitigate the effects of climate extremes on Edith's checkerspot butterfly populations (Hellmann 2002, p. 925). Therefore, this high-elevation habitat is most likely to retain climatic suitability, increase in suitability, or expand under the influence of climate change.

This criterion helps reduce or eliminate loss and modification of Quino habitat by eliminating the threat of urban development and other land use changes.

2) Conduct research including: determine the current short-term and potential long-term distributions of populations and associated habitat; and conduct preliminary modeling of metapopulation dynamics for core occurrence complexes.

This recovery criterion is still applicable. As described above habitat-based population distributions have been delineated for these (formerly categorized as "core") occurrence complexes that better reflect the long-term distributions of populations and associated habitat. No metapopulation modeling has been attempted. Genetic research described above will help determine relatedness among individuals at different sites and should help better determine population membership of occupied sites. Other specific current needs are methods for reintroduction (for example in northern Orange County or northwestern Riverside County), site-specific use of primary and secondary host plant species, and effective, safe use of herbicides for habitat restoration (see Russell and Schultz 2009, p. 1).

This criterion helps reduce or eliminate loss and modification of Quino habitat by providing information needed to determine what habitat requires protection and (other research mentioned above) how to restore modified habitat. This criterion also helps reduce the threats posed by fire, enhanced soil nitrogen, increased atmospheric carbon dioxide concentration, and climate change by providing information needed to determine what conservation measures (protection and management) are needed to counteract these threats.

3) Permanently provide for and implement management of occurrence complexes (or population distributions when delineated) to restore or enhance habitat quality and population resilience.

This recovery criterion is still applicable. Although some management is occurring at a few conserved sites scattered throughout the subspecies range (e.g., Johnson Ranch in Riverside County), no occurrence complex/population is currently being managed as a whole. Most sites are not currently managed for Quino conservation and a comprehensive assessment of the success of management practices has not been conducted. This criterion helps reduce or eliminate modification of Quino habitat by providing means to enhance or preserve suitability of habitat required for species recovery.

4) The protected, managed (conserved) population segments within core occurrence complexes (or population distributions when delineated) must demonstrate evidence of resilience. Evidence of resilience is demonstrated if a decrease in the number of occupied habitat patches over a 10- to 20-year period within an occurrence complex (or population distribution when delineated) is followed by increases of equal or greater magnitude. Monitoring must be initiated in the third of three years of favorable climate (total annual January and February precipitation within one standard error of the average total for those months over the past 30 years, based on local or proxy climate data). Populations that do not demonstrate resilience after 20 years should be augmented and monitoring reinitiated.

This recovery criterion is still applicable, but requires updating. Monitoring of threats such as nonnative plant invasion should be incorporated in a measurable way. No formal monitoring has been initiated as described, although the Service continues to qualitatively track the persistence and abundance of Quino in some occurrence complexes. A one-time rangewide survey was conducted in 2008 (described above), and qualitative information suggests some of these populations (none fully protected yet) may be relatively resilient. This criterion may require modification depending on what the population structure may be and how well habitat patches can be defined. Not all populations may be well-defined metapopulations with clearly delineated habitat patches.

This criterion is required to demonstrate successful reduction of all threats and subspecies recovery

5) One additional population should be documented or introduced within the Lake Matthews population site (formerly occupied, not known to be currently occupied) in the Northwest Riverside Recovery Unit. At least one of the extant populations outside of current recovery units (e.g., the San Vicente Reservoir occurrence complex) must meet resilience specifications above unless an additional population is established or documented within 6 miles (10 kilometers) of the ocean (a more stable marine climate influence should minimize susceptibility to drought and reduce probability of extirpation).

The intent of this recovery criterion is still applicable, but it should be updated. It is possible that establishment of an experimental population in the Irvine Ranch Preserve (USFWS 2003a, p. 112) could fulfill the intent of the reintroduction requirement. It is not likely more than one reintroduction is required for downlisting to threatened. The new San Vicente core habitat-based population distribution is evidence that there is a potentially resilient population in this area. Several new populations have been documented at higher elevations, and it is not clear that coastal environments are currently more likely to support resilient Quino populations than more montane environments. Recovery units should be updated (USFWS 2003a, p. 111).

This criterion helps reduce the magnitude of all threats because additional populations reduce the probability of extinction. In particular, this criterion helps reduce the threat of population extirpation due to restricted range.

6) Establish and maintain a captive propagation program for purposes of maintenance of representative refugia populations, research, and reintroduction and augmentation of wild populations, as appropriate.

This recovery criterion is still applicable in part. It is not likely that all populations require refugia populations to prevent extirpation, although some likely do, such as the Warm Springs Creek habitat-based population distribution. We no longer believe refugia populations are needed to prevent extinction of the subspecies as a whole. However, there is still a need for captive populations for research, and possibly for reintroduction or augmentation of extirpated populations (see discussions and criterion 5 above). There is an ongoing captive propagation program, which has developed methodologies for rearing all life stages in captivity in support of Quino research activities.

This criterion helps reduce or eliminate loss and modification of Quino habitat by providing information needed to determine how to restore modified habitat. Second, this criterion helps reduce the threats posed by fire, enhanced soil nitrogen, increased atmospheric carbon dioxide concentration, and climate change by providing information needed to determine what conservation measures (protection and management) are needed to counteract these threats. Finally, this criterion reduces the threat of population extirpation due to restricted range, localized distribution, and small population size.

7) Initiate and implement a cooperative outreach program targeting areas where Quino populations are concentrated in western Riverside and southern San Diego Counties.

This recovery criterion is still applicable. No centralized cooperative outreach program or coordinated tracking of outreach has been established to-date, although various outreach efforts regularly occur through regional HCPs programs and Service staff interactions with entities such as educational institutions and tribes. Outreach also occurs through interactions of such experts as the captive propagation manager, Dr. Gordon Pratt with members of local communities where he works or conducts studies.

This criterion helps reduce or eliminate loss and modification of Quino habitat by informing the public of threat effects and garnering support for conservation.

IV. SYNTHESIS

The extinction vulnerability of Quino based on the number of known populations has been greatly reduced since the subspecies was listed, and has improved since the Recovery Plan was published. The listing rule (USFWS 1997, 62 FR 2313) identified “seven or eight” extant Quino populations within the United States. Based on our current analysis (Table 1), populations described in the listing rule belong to 4 core and one non-core habitat-based population distributions. Three of the core habitat-based population distributions known at the time of listing are extant, and the status of one is unknown. The status of the non-core habitat-based population distribution known at the time of listing is unknown. Based on our current analysis (Table 1) 6 core and 25 non-core habitat-based population distributions were documented post-listing. All 6 core habitat-based population distributions documented post-listing are extant. Of the 25 non-core habitat-based population distributions documented post-listing 15 are extant, 6 are of unknown status, and 4 were extirpated post-listing. The habitat conservation status of the subspecies has also improved, because much habitat has been preserved and more is planned for preservation under regional HCPs (Table 1). However, the species is still vulnerable to extinction with current habitat destruction and population losses. Habitat protection and future management mandates, which occurred as a result of listing, make it possible to manage most core populations to prevent future population collapse. Quino still needs the protection and management of the Act in order to achieve recovery, because of continued threats of habitat loss, stochastic environmental events, altered habitat suitability due to climate change, and nonnative species invasions. Therefore, we recommend no status change at this time.

V. RESULTS

Recommended Listing Action:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist (indicate reason for delisting according to 50 CFR 424.11):
    ____ *Extinction*
    ____ *Recovery*
    ____ *Original data for classification in error*
__X__ No Change

New Recovery Priority Number and Brief Rationale: Change to 9C. This number indicates the taxon is a subspecies that faces a moderate degree of threat and has a high potential for recovery (USFWS 1983, 48 FR 43098). The "C" indicates conflict with construction or other development projects or other forms of economic activity. The degree of threat is considered moderate because if recovery were held off for 1-5 years the subspecies would not face immediate extinction. Recovery potential is considered high because the threats to and biological and ecological limiting factors of Quino are well understood. Habitat loss and nonnative species invasions are manageable threats. Furthermore, there is an increased focus on studying and understanding the effects of climate change.

VI. RECOMMENDATIONS FOR ACTIONS OVER THE NEXT 5 YEARS

1. Work with partners to help protect habitat in the vicinity of the community of Anza, in particular that associated with the new observations west and east of the Tule Peak critical habitat unit (Unit 6; USFWS 2009, 74 FR 28776) and private land within the Bautista critical habitat unit (Unit 7; USFWS 2009,74 FR 28776). Prudent design of

reserves should include landscape connectivity to other habitat patches and ecological connectivity (habitat patches linked by dispersal areas; USFWS 2003a, p. 162) to accommodate range shift due to climate change (USFWS 2003a, p. 64). This action helps meet recovery criterion 1 by reducing or eliminating loss and modification of Quino habitat by eliminating the threat of urban development and other land use changes.

2. Identify partners to conduct potential research to aid in management and conservation of Quino:
    a. Research the effects of common herbicides on immature life stages for use in restoring/managing occupied habitat.
    b. Determine primary and secondary host plant species used in the Campo core habitat-based population distribution.
    c. Determine if larvae are using *Penstamon sp.* as a secondary host plant in the field.

    This action helps meet recovery criterion 2 by providing information needed to determine what habitat requires protection and how to restore modified habitat, which will ultimately contribute to reduced Quino habitat loss and modification.

3. Conduct an experimental reintroduction at Irvine Ranch Preserve using current captive stock (owned by the Irvine Ranch Conservancy) in Orange County at the north end of the Santa Ana Mountains (USFWS 2003a, p. 111). This action helps meet recovery criterion 5 by reducing the threat of population extirpation due to restricted range, localized distribution, and small population size.

4. Conduct surveys to determine the extent of new population discovered in 2009 on CDFG preserve lands (Cañade de San Vicente) in Ramona, and evaluate its status. This action is required to meet recovery criteria 1 and 3, which help reduce or eliminate loss and modification of Quino habitat by eliminating the threat of urban development and other land use changes.

5. Work with partners to help conserve the Quino checkerspot butterfly. Identify opportunities to continue conservation and initiation of formal monitoring of all core habitat-based population distributions (including Warm Springs, Sage, and Bautista Road in Riverside County, and all San Diego County). Currently the Riverside Conservation Authority monitors reference sites in all other core habitat-based population distributions in Riverside County. Other current monitoring is informal and occurs on select conserved lands that may not reflect population status (e.g., in the Warm Springs occurrence complex by Center for Natural Lands Management), or as Service staff or volunteers are available (CFWO 2009). This action helps reduce loss and modification of Quino habitat by eliminating the threat of urban development and other land use changes, and is required to demonstrate successful reduction of all threats and subspecies recovery. This action will help meet recovery criteria 1 and 4.

6. Consider updating the Recovery Plan and recovery units (possible revised units are illustrated in Figures 1 and 2; USFWS 2003a, p. 111). Revision should include a new recovery unit in central San Diego County (USFWS 2003a, pp. 86-88, 111-112) that captures the San Vicente, Cañade de San Vicente, and Mission Trails Park habitat-based

population distributions (Figure 2), and one in northern Orange County that captures suitable habitat for reintroduction (USFWS 2003a, pp. 90-91, 112-113). This action will help achieve subspecies recovery (downlisting or delisting).

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

Quino checkerspot butterfly (*Euphydryas editha quino*)

Current Classification: Endangered

Recommendation Resulting from the 5-Year Review:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
_X_ No change needed

Review Conducted By: Carlsbad Fish and Wildlife Office

FIELD OFFICE APPROVAL:

Lead Field Supervisor, U.S. Fish and Wildlife Service

ACTING

Approve ______________________ Date AUG 13 2009

Scott A. Sobiech

REGIONAL OFFICE APPROVAL:

Assistant Regional Director, U.S. Fish and Wildlife Service, Region 8

Approve ______________________ Date ________

Table 1. Quino checkerspot butterfly occurrence status within the United States, 1986-2009 (time period for recent observations analyzed in the Recovery Plan was within 10 years of listing, 1986- 2002). GIS occurrence data is not available for the portion of the subspecies' range in Mexico.

Occurrence Complex[1]	Habitat-based population distribution[2]	Location (Recovery Unit/ Proposed Recovery Unit)	Status at Listing[3]	Status in Recovery Plan	Status Post-Recovery Plan	Current Conservation Estimate	Current Threats[4]
1. Harford Springs	1. Harford Springs	SW of Lake Matthews, RC (NW Riverside)	Extp	Extant	Extp	33 % C 18 % PC 30 % NC 18 % Dev	High: climate change effects, habitat destruction, degradation, and fragmentation, nonnative plant invasion, drought, and fire.
2. Canyon Lake	2. Canyon Lake	W of Canyon Lake, RC (NW Riverside)	ND	Extant	Unk	29 % C 30 % PC 10 % NC 30 % Dev	High: ”
3. Horse Thief Canyon	3. Horse Thief Canyon	N of Lake Elsinore (none)	Extp	Extp	DE	100 % Dev	N/A
4. N Murrieta	4. Murrieta	Between I 215 and I 15	ND	DE	Extp	100 % Dev	N/A
5. Murrieta	4. Murrieta	Between I 215 and I 15	ND	DE	Extp	100 % Dev	N/A
6. N Warm Springs Creek	5. Warm Springs Creek Core	N of the City of Murrieta, RC (SW Riverside)	ND	Extant	Unk	13 % C 46 % PC 8 % NC 33 % Dev	High: climate change effects, habitat destruction, degradation, and

							fragmentation, nonnative plant invasion, drought, and fire.
7. Warm Springs Creek	5. Warm Springs Creek Core	N of the City of Murrieta, RC (SW Riverside)	Extant	Extant	Unk	2 % C 32 % PC 10 % NC 57 % Dev	High: ”
8. Winchester	6. Winchester	S of the community of Winchester, RC (SW Riverside)	ND	Extant	Unk	9 % C 0 % PC 16 % NC 75 % Dev	High: ”
9. Domenigoni Valley	7. Domenigoni Valley	SW of Domenigini Valley Reservoir, RC (SW Riverside)	ND	Extant	Unk	58 % C 46 % PC 15 % NC 22 % Dev	Medium: climate change effects, habitat destruction, degradation, and fragmentation, nonnative plant invasion, drought, and fire.
10. Skinner/ Johnson	8. Skinner/ Johnson Core	Surrounding Lake Skinner, RC (SW Riverside)	Extant	Extant	Extant	38 % C 9 % PC 20 % NC 33 % Dev	Medium: ”
11. Crowne Hill	8. Skinner/ Johnson Core	City of Temecula, RC (none)	ND	DE	Extp	100 % Dev	N/A
12. N Butterfield Stage Road	8. Skinner/ Johnson Core	City of Temecula, RC (none)	ND	DE	Extp	100 % Dev	N/A

13. Red Hawk	9. Red Hawk	City of Temecula, RC (none)	ND	DE	Extp	100 % Dev	N/A
14. Pauba Valley	10. Oak Mountain/ Vail Lake Core	W of Oak Mountain RC (S Riverside)	ND	Extant	Unk	1 % C 28 % PC 5 % NC 66 % Dev	High: climate change effects, habitat destruction, degradation, and fragmentation, nonnative plant invasion, drought, and fire.
15. Black Hills	10. Oak Mountain/ Vail Lake Core	N of Oak Mountain RC (S Riverside)	ND	Extant	Unk	0 % C 12 % PC 57 % NC 31 % Dev	High: ”
16. Oak Mountain/ Vail Lake	10. Oak Mountain/ Vail Lake Core	Surrounding Vail Lake, RC (S Riverside)	Extant	Extant	Extant	23 % C 62 % PC 6 % NC 9 % Dev	Medium: climate change effects, habitat destruction, degradation, and fragmentation, nonnative plant invasion, drought, and fire.
17. Sage	11. Wilson Valley Core	Surrounding the community of Sage, RC (S Riverside)	Extant	Extant	Unk	5 % C 59 % PC 14 % NC 23 % Dev	High: ”
18. Rocky Ridge	11. Wilson Valley Core	S of the community of Sage, RC	ND	Extant	Unk	18 % C 40 % PC 37 % NC	High: ”

		(S Riverside)				5 % Dev	
19. Wilson Valley	11. Wilson Valley Core	NW of Wilson Valley, RC (S Riverside)	ND	Extant	Extant	26 % C 63 % PC 4 % NC 7 % Dev	Medium: ”
20. Billy Goat Mountain	11. Wilson Valley Core	E of Wilson Valley, RC (S Riverside)	ND	Extant	Unk	49 % C 50 % PC 1 % NC 0 % Dev	Medium: ”
21. Aguanga	12. Dameron Valley	W of community of Aguanga, RC (S Riverside)	ND	Extant	Unk	26 % C 38 % PC 16 % NC 19 % Dev	Medium: ”
22. Dameron Valley	12. Dameron Valley	SE of community of Aguanga, RC (S Riverside)	ND	Extant	Unk	37 % C 7 % PC 42 % NC 14 % Dev	High: ”
23. Oak Grove	13. Oak Grove	Community of Oak Grove, SD (S Riverside)	Extant	Extant	Unk	14 % C 0 % PC 72 % NC 14 % Dev	High: climate change effects, habitat destruction, degradation, and fragmentation, nonnative plant invasion, and fire.
24. Brown Canyon	14. Brown Canyon	SE of the community of Hemet, RC (S Riverside)	ND	Extant	Unk	14 % C 86 % PC 0 % NC 0 % Dev	Medium: habitat degradation, nonnative plant invasion, drought, and fire.

25. Barbara Trail	15. Tule Peak Core	SW of the community of Anza, RC (S Riverside/N San Diego)	ND	Extant	Extant	7 % C 21 % PC 56 % NC 16 % Dev	High: habitat destruction, degradation, and fragmentation, nonnative plant invasion, and fire.
26. Tule Peak	15. Tule Peak Core	S of the community of Anza, RC (S Riverside/N San Diego)	ND	Extant	Extant	26 % C 36 % PC 36 % NC 2 % Dev	Medium: ”
27. Iron Spring Canyon	15. Tule Peak Core	S of the community of Anza, RC (S Riverside/N San Diego)	ND	Extant	Extant	28 % C 71 % PC 2 % NC 0 % Dev	Low: habitat degradation, nonnative plant invasion, and fire.
28. Terwilliger Valley	15. Tule Peak Core	S E of the community of Anza, RC (S Riverside/N San Diego)	ND	ND	Extant	48 % C 0 % PC 38 % NC 15 % Dev	High: habitat destruction, degradation, and fragmentation, nonnative plant invasion, and fire.
29. Cahuilla Creek	16. Cahuilla Creek	SW of the community of Anza, RC (S Riverside/N San Diego)	ND	Extant	Unk	0 % C 0 % PC 92 % NC 8 % Dev	High: habitat destruction, degradation, and fragmentation, nonnative plant invasion, and fire.
30. Cave Rocks	17. Cave Rocks	The community	ND	ND	Unk	66 % C 0 % PC	High: ”

		of Anza, RC (S Riverside/N San Diego)				31 % NC 62 % Dev	
31. Bautista Road	18. Bautista Road Core	N of the community of Anza, RC (S Riverside/N San Diego)	ND	Extant	Extant	45 % C 9 % PC 23 % NC 22 % Dev	Medium: habitat destruction, degradation, and fragmentation, nonnative plant invasion, and fire.
32. Quinn Flat	19. Quinn Flat	NE of Garner Valley, RC (S Riverside/N San Diego)	ND	ND	Extant	100 % C	Low: nonnative plant invasion and fire.
33. Horse Creek	20. Horse Creek	SE of Bautista Spring, RC (S Riverside/N San Diego)	ND	ND	Extant	98 % C 0 % PC 0 % NC 2 % Dev	Low: ”
34. N Rouse Ridge	21. N Rouse Ridge	Rouse Ridge, RC (S Riverside/N San Diego)	ND	ND	Extant	100 % C 0 % PC 0 % NC 0 % Dev	Low: nonnative plant invasion, grazing, and fire.
35. S Fork Trail	22. S Fork Trail	S of State Route 78, NW of Lake Hemet, RC (S Riverside/N San Diego)	ND	ND	Extant	98 % C 0 % PC 2 % NC 0 % Dev	Low: ”

36. Pine Meadow	23. Pine Meadow	W Garner Valley, RC (S Riverside/N San Diego)	ND	Extant	Extant	81 % C 0 % PC 15 % NC 5 % Dev	Low: nonnative plant invasion, grazing, and fire.
37. Lookout Mountain	23. Pine Meadow	S Garner Valley, RC (S Riverside/N San Diego)	ND	Extant	Extant	39 % C 0 % PC 61 % NC 0 % Dev	Medium: habitat destruction, degradation, and fragmentation, grazing nonnative plant invasion, and fire.
38. N Garner Valley	24. N Garner Valley	S Garner Valley, RC (S Riverside/N San Diego)	ND	ND	Extant	79 % C 0 % PC 18 % NC 2 % Dev	Low: nonnative plant invasion and fire.
39. Cañada de San Vicente	25. Cañada de San Vicente	S of community of Ramona SD (none/ Central San Diego)	ND	ND	Extant	89 % C 11 % PC 6 % NC 0 % Dev	Medium: climate change effects, nonnative plant invasion, drought, and fire.
40. San Vicente	26. San Vicente Core	N of San Vicente Reservoir, SD (none/ Central San Diego)	ND	Extant	Extant	88 % C 11 % PC 0 % NC 1 % Dev	Medium: ”
41. S San Vicente	26. San Vicente Core	N of San Vicente Reservoir, SD (none/ Central San	ND	ND	Extant	27 % C 5 % PC 0 % NC 68 % Dev	Medium: ”

		Diego)					
42. Fanita Ranch	26. San Vicente Core	N of the community of Santee, SD (none/ Central San Diego)	ND	ND	Unk	9 % C 36 % PC 54 % NC 1 % Dev	High: climate change effects, habitat destruction, degradation, and fragmentation, nonnative plant invasion, drought, and fire.
43. Sycamore Canyon	26. San Vicente Core	Sycamore Canyon Open Space Preserve S of the City of Poway, SD (none/ Central San Diego)	ND	ND	Extant	88% C 6 % PC 6 % NC 0 % Dev	Medium: climate change effects, nonnative plant invasion, drought, and fire.
44. NE Miramar	26. San Vicente Core	NE border of Miramar Naval Air Station, SD (none/ Central San Diego)	ND	ND	Extant	70 % C 18 % PC 3 % NC 10 % Dev	Medium: climate change effects, habitat degredation, nonnative plant invasion, drought, and fire.
45. Mission Trails Park	27. Mission Trails Park	Mission Trails Regional Park, SD (none/ Central San Diego)	Extp	Extp	Extant	93 % C 0 % PC 1 % NC 6 % Dev	Medium: climate change effects, habitat degradation, nonnative plant invasion, drought, and fire.
46. Alpine	28. Alpine	S of the community	ND	Extant	Unk	13 % C 0 % PC	High: climate change effects,

		of Alpine, SD (none/ Central San Diego)				38 % NC 48 % Dev	habitat destruction, degradation, and fragmentation, nonnative plant invasion, and fire.
47. W Otay Mesa	29. W Otay Mesa	W Otay Mesa, SD (SW San Diego/ S San Diego)	Extp	Extant	Unk	7 % C 0 % PC 0 % NC 93 % Dev	High: climate change effects, habitat destruction, nonnative plant invasion, and drought.
48. W Otay Valley	30. Otay Core	N of Otay Mesa SD (SW San Diego/ S San Diego)	ND	Extirp	Extant	7 % C 15 % PC 8 % NC 69 % Dev	High: ”
49. Otay	30. Otay Core	Vicinity of Otay Mountain, Lakes, Mesa, and River, SD (SW San Diego/ S San Diego)	Extant	Extant	Extant	55 % C 17 % PC 19 % NC 9 % Dev	Medium: climate change effects, habitat destruction, degradation, and fragmentation, nonnative plant invasion, and fire.
50. Rancho San Diego/Jamul	30. Otay Core	Vicinity of the community of Jamul, and E of Sweetwater reservoir,	Extp	Extant	Extant	48 % C 15 % PC 16 % NC 21 % Dev	Medium: ”

		SD (SW San Diego/ S San Diego)					
51. Jamul Butte	30. Otay Core	N of Jamul Butte, SD (SW San Diego/ S San Diego)	ND	ND	Unk	0 % C 0 % PC 59 % NC 41 % Dev	High: climate change effects, habitat destruction, degradation, and fragmentation, nonnative plant invasion, and fire.
52. Marron Valley	30. Otay Core	W of Otay Mountain, Marron Valley, SD (SW San Diego/ S San Diego)	ND	Extant	Extant	76 % C 0 % PC 24 % NC 0 % Dev	Medium: climate change effects, habitat destruction, degradation, and fragmentation, nonnative plant invasion, and fire.
53. Barrett Junction	30. Otay Core	NW of Tecate Peak, SD (SW San Diego/ S San Diego)	Extp	Extant	Extant	22 % C 0 % PC 73 % NC 6 % Dev	High: ”
54. Tecate	31. Tecate	N of the City of Tecate, SD (SW San Diego/ S San Diego)	ND	Extant	Extant	8 % C 0 % PC 43 % NC 48 % Dev	High: ”
55. W Barrett	32. W	W of Barrett	Extp	Extp	Extant	78 % C	Medium: habitat

Lake	Barrett Lake	Lake, SD (none/ S San Diego)				0 % PC 17 % NC 5 % Dev	destruction, degradation, and fragmentation, nonnative plant invasion, and fire.
56. Round Portrero	33. Round Portrero	SE of Barrett Lake, SD (none/ S San Diego)	ND	ND	Extant	85 % C 0 % PC 15 % NC 0 % Dev	Medium: ”
57. SE Morena	34. SE Morena	SE of Lake Morena and Morena Butte, SD (none/ S San Diego)	ND	ND	Extant	62 % C 0 % PC 38 % NC 0 % Dev	Medium: ”
58. Canyon City	35. Canyon City	Vicinity of the community of Canyon City, SD (none/ S San Diego)	ND	ND	Extant	20 % C 0 % PC 80 % NC 0 % Dev	High: ”
59. E Canyon City	35. Canyon City	“	ND	ND	Extant	33 % C 0 % PC 67 % NC 0 % Dev	High: ”
60. N La Posta	36. Campo Core	NE of the Community of Campo, SD (none/ S San Diego)	ND	ND	Extant	91 % C 0 % PC 9 % NC 0 % Dev	Medium: habitat degradation, destruction, nonnative plant invasion, and fire.
61. La Posta	36. Campo	“	ND	ND	Extant	86 % C	Medium: ”

	Core					0 % PC 14 % NC 0 % Dev	
62. E La Posta	36. Campo Core	"	ND	ND	Extant	0 % C 0 % PC 100 % NC 0 % Dev	High: "
63. Campo	36. Campo Core	E of the Community of Campo, SD (none/ S San Diego)	ND	ND	Extant	30 % C 0 % PC 70 % NC 0 % Dev	Medium: "
64. S Campo	36. Campo Core	"	ND	ND	Extant	37 % C 0 % PC 63 % NC 0 % Dev	Medium: "
65. E Campo	36. Campo Core	"	ND	ND	Extant	0 % C 0 % PC 86 % NC 14 % Dev	High: "
66. Jacumba	37. Jacumba Core	NW of the community of Jacumba, SD (SE San Diego/ S San Diego)	Extp	Extant	Extant	59 % C 0 % PC 40 % NC 1 % Dev	Medium: habitat degradation, destruction, nonnative plant invasion, drought, and fire.

Abbreviations: C- conserved based on public ownership or privately owned for conservation purposes, includes tribal lands; Dev- developed or converted to agriculture based on GIS land use data and satellite imagery; DE- documented then subsequently extirpated; E- east; Extp- extirpated; I- Interstate; N- north; N/A- not applicable; NC- no conservation planned based on private ownership and no inclusion in an HCP reserve design; ND- not documented, no historic records; PC- planned for conservation based on a Habitat Conservation Plan reserve design model or map; RC- Riverside County; S- south; SD- San Diego County; Unk- unknown; W- west;

[1]The area within overlapping one km radii of the most recent observation locations (may be a single-non-overlapping area).

[2]Estimated population memberships and categorization based on methods used in the final revised critical habitat rule to map critical habitat units (USFWS 2009, 62 FR 2313). Membership is based on contiguous, suitable habitat between occurrence complexes that are less than 1.2 mile (2 kilometer) apart.

[3]Estimate based on GIS occurrence data and listing rule text, "Currently, only seven or eight populations are known within the United States… All known extant populations in the United States occur in southwestern Riverside and north-central San Diego counties… In 1996, a very small group of [Quino checkerspot butterflies] was sighted on Otay Mesa, but …is not expected to persist" (January 16, 1997, 62 FR, p. 2315).
[4]Climate-change effects are listed as a threat for all lower elevation occurrence complexes that are likely to experience decreasing habitat suitability (Preston et al. 2008, p. 2508), we used a break point of 2,500 feet (762 meters). Non-climate change-related drought is listed as a threat for all occurrence complexes with a 1961-1990 annual average precipitation below 15 inches (38 centimeters) (Oregon Climate Service 1995, p. 1).

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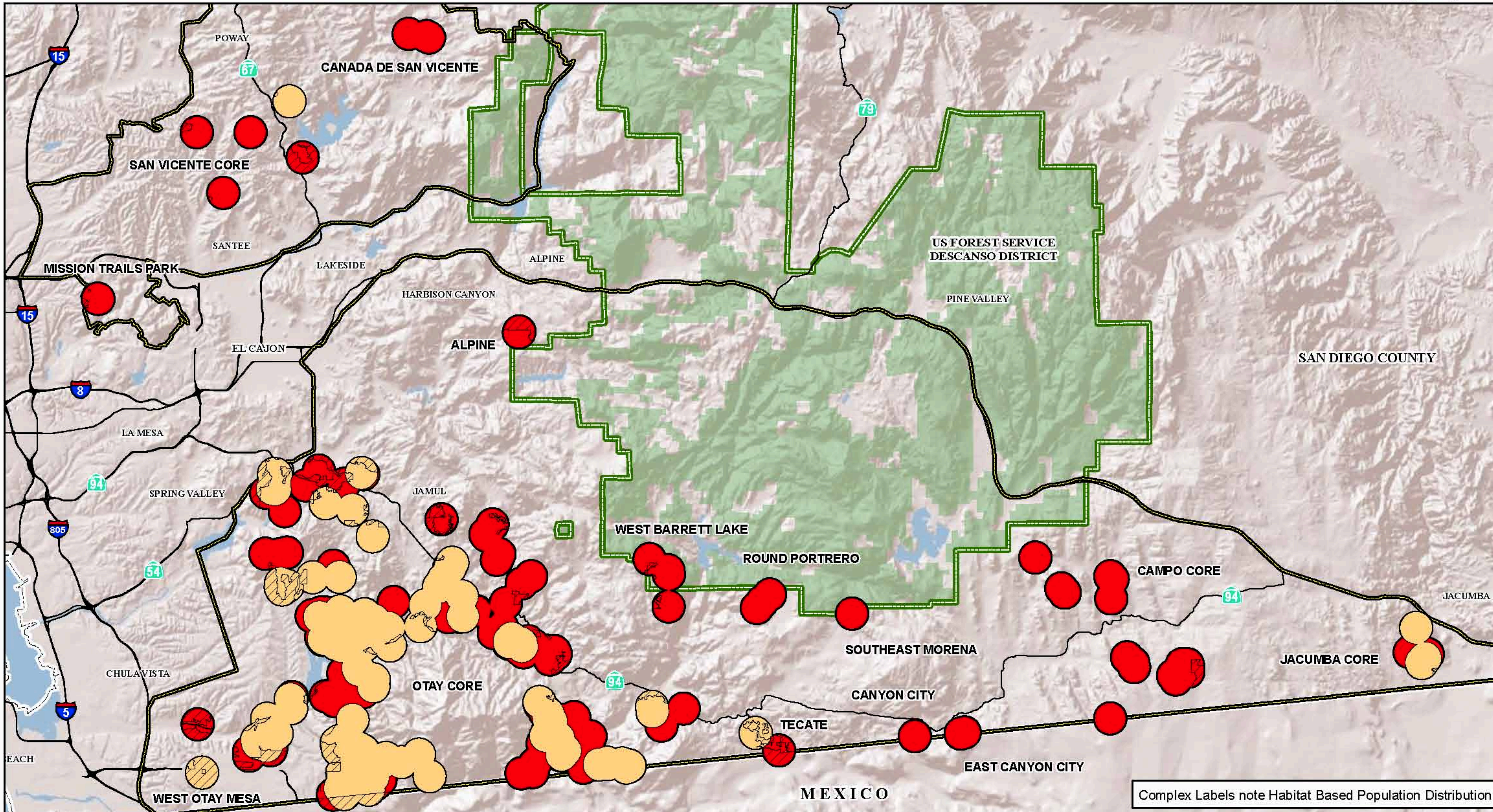
Quino checkerspot butterfly Habitat Complex Map
San Diego County, California



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CARLSBAD FIELD OFFICE
GIS CONTACT: EDWIN TURNER
BIOLOGY CONTACT: ALISON ANDERSON

MAP DATE: 06/23/09
DATA SOURCE: FWS, CNDDB, CASIL
IMAGE SOURCE: I-CUBED 2008
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0 2 4 8 Miles
0 1 2 4 6 8 Kilometers

LEGEND

- Quino checkerspot butterfly Occurrence Complexes Pre-recovery Plan 1986 - 2002
- Quino checkerspot butterfly Occurrence Complexes 2003 - Present
- Possible Quino checkerspot butterfly Recovery Units
- US Forest Service Boundary
- Developed Habitat

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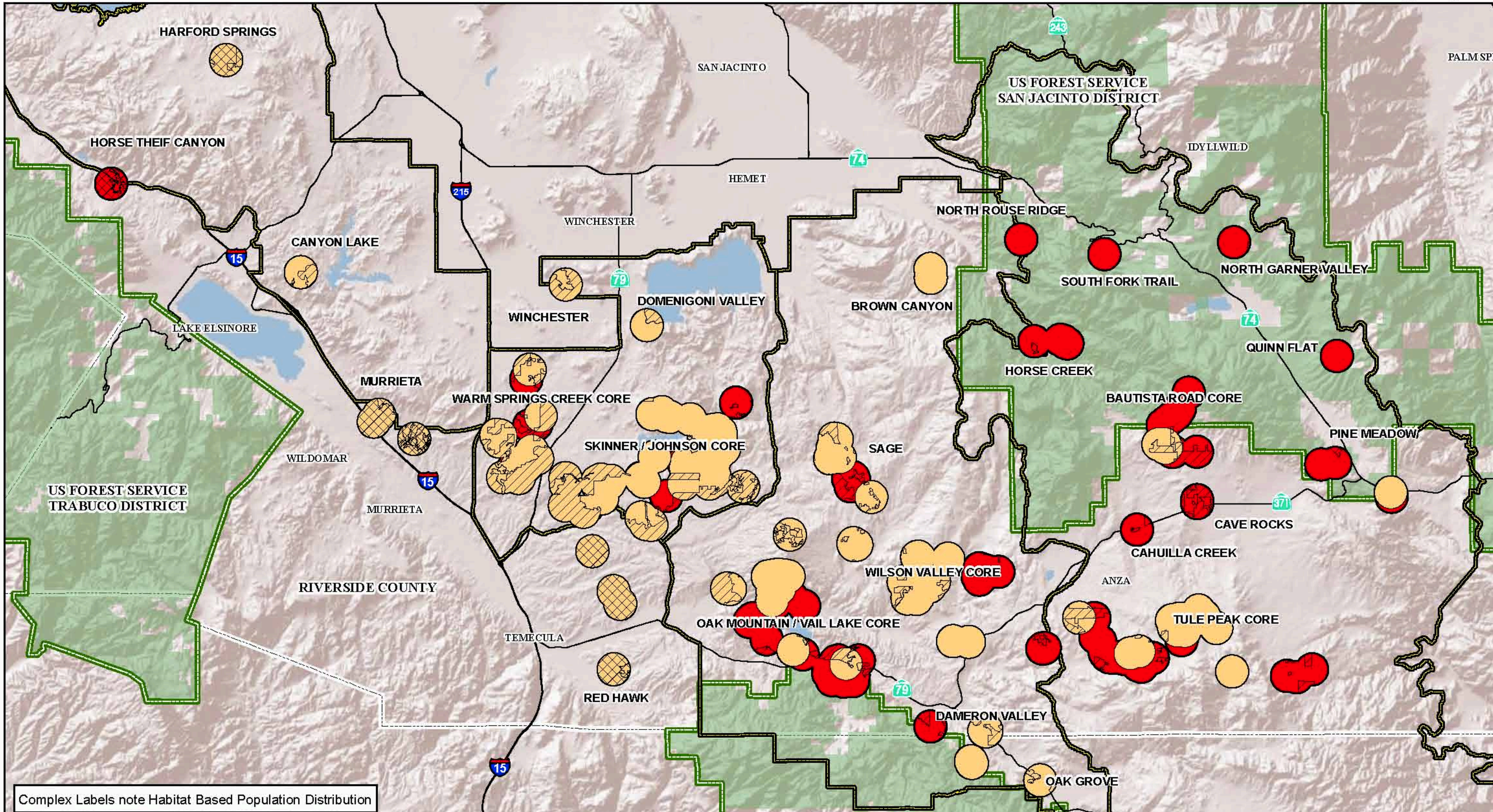
Quino checkerspot butterfly Habitat Complex Map
Riverside County, California



LEGEND
- Quino checkerspot butterfly Occurrence Complexes Pre-recovery Plan 1986 - 2002
- Quino checkerspot butterfly Occurrence Complexes 2003 - Present
- Possible Quino checkerspot butterfly Recovery Units
- US Forest Service Boundary
- Extirpated Complex
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0 2 4 8 Miles
0 1 2 4 6 8 Kilometers