Kern primrose sphinx moth
(Euproserpinus euterpe)

5-Year Review:
Summary and Evaluation

Photo: Paul Johnson

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Sacramento Fish and Wildlife Field Office
Sacramento, California
September 2007

5-YEAR REVIEW

Species reviewed: Kern primrose sphinx moth (*Euproserpinus euterpe*)

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I. GENERAL INFORMATION

I.A. Methodology used to complete the review

This review was conducted by staff in the U.S. Fish and Wildlife Service (USFWS), Sacramento Fish and Wildlife Office, Sacramento, California. The review is based on the following: information from species survey and monitoring reports, the *Recovery Plan for the Kern primrose sphinx moth* (Recovery Plan) (U.S. Fish and Wildlife Service [USFWS] 1984), documents generated as part of section 7 and section 10 consultations, journal articles and unpublished technical reports and grant proposals, discussions with species experts, and the Sacramento Fish and Wildlife Office species files. Survey data, the recovery plan, a published journal article (Jump et al. 2006), and personal communications with entomologists and land managers were our primary sources of information used to update the species status and threats sections of this review.

I.B. Reviewers

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I.C. Background

I.C.1. FR Notice citation announcing initiation of this review:

71 FR 14538 14542 dated 22 March 2006. No information from the public was received in response to the notice.

I.C.2. Listing history

Original Listing
FR notice: 45 FR 24088
Date listed: 08 April 1980
Entity listed: Species
Classification: Threatened

I.C.3. Associated rulemakings: None.

I.C.4. Review History:

No status review has been completed. The Service published the recovery plan for the Kern primrose sphinx moth in 1984.

I.C.5. Species' Recovery Priority Number at start of review: 2.

The Kern primrose sphinx moth is a species confronted with a high degree of threats, and the majority of populations have been found on private land. However, it was originally thought that this species' recovery potential was substantial if the property containing Kern primrose sphinx moth prime habitat at Walker Basin were purchased and the animals were protected. Currently, recovery efforts for the Kern primrose sphinx moth do not have significant conflict with local economic and land development practices.

I.C.6. Recovery Plan or Outline

Name of plan: Kern primrose sphinx moth
Date issued: February 8, 1984
Dates of previous revisions: None

II. REVIEW ANALYSIS

Species Description: The Kern primrose sphinx moth (*Euproserpinus euterpe*) is one of three species within the genus *Euproserpinus*, which are members of the family Sphingidae, commonly called hawk moths or sphinx moths. None of the *Euproserpinus* congeners (species sharing a common genus) occur sympatrically (in the same geographic area) and each species is morphologically distinct both as adults and larvae (Tuskes and Emmel 1981). The Kern primrose sphinx moth is a moderate sized moth with a streamlined yet stout body and elongate forewings which are oblique at the outer margins (Powell and Hogue 1979). The colorful larvae are without hair or spines, and the dorsal part of the eighth abdominal segment contains a horn or spur (Powell and Hogue 1979). The adult Kern primrose sphinx moth is distinctly marked by a broad and contrasting white band on the abdomen, convex costal margins of the hindwing and forewing, and white scaling on the dorsal surface of the antenna (Jump et al. 2006). Flight periods for the adults range from late February to early April; however, pupae are known to diapause (delay metamorphosis to adult form) underground for multiple years during drought periods (Jump et al. 2006).

II.A. Application of the 1996 Distinct Population Segment (DPS) policy

II.A.1. Is the species under review listed as a DPS?

The Endangered Species Act (Act) defines species as including any subspecies of fish or wildlife or plants, and any distinct population segment of any species of

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

II.B. Recovery Criteria

II.B.1. Does the species have a final, approved recovery plan containing objective, measurable criteria?

__X__ ***Yes***
____ ***No***

II.B.2. Adequacy of recovery criteria.

II.B.2.a. Do the recovery criteria reflect the best available and most up-to-date information on the biology of the species and its habitat?

____ ***Yes***
__X__ ***No***

Since the recovery plan was issued in 1984, the known distribution of Kern primrose sphinx moth expanded as a result of the discovery of six confirmed populations of Kern primrose sphinx moth at the Carrizo Plain National Monument (Carrizo Plain) in San Luis Obispo County and of five populations in the Cuyama Valley in Santa Barbara and Ventura Counties (Jump et al. 2006, A. Kuritsubo *in litt*. 2006). In addition, research revealed that, contrary to former belief, Kern primrose sphinx moth larvae are capable of short forays in search of their essential host plant, *Camissonia* sp. (certain primrose and sun cup species) (Longcore and Rich 2002, Osborne 2005). Thus, first instar larvae will not necessarily starve and die if they were oviposited on a non-host plant such as filaree (*Erodium cicutarium*). These findings invalidate significant recovery criteria and actions in the recovery plan.

II.B.2.b. Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria (and is there no new information to consider regarding existing or new threats

____ ***Yes***
__X__ ***No***

II.B.3. List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information. For threats-

related recovery criteria, please note which of the 5 listing factors* are addressed by that criterion. If any of the 5-listing factors are not relevant to this species, please note that here.

The following delisting criteria were included in the recovery plan for the Kern primrose sphinx moth:

Protect the only known colony at Walker Basin and establish three more secure colonies within Walker Basin, with a combined total of 5,000 acres that are secured by easement, long-term agreement or other protective strategy. These colonies must be protected from adverse land use practices, such as agricultural conversion, pesticide use, or residential development, for a minimum of 10 consecutive years (addresses Listing Factors A, D, and E). Protection of the Kern primrose sphinx moth and its habitat also requires enforcement of applicable State and Federal laws (addresses Listing Factor B). This criterion has not yet been met. No land has been purchased at the Walker Basin and protection of the Kern primrose sphinx moth on private land at Walker Basin is difficult to enforce (Osborne 2005; K. Osborne, Osborne Biological Consulting, pers. comm. 2006).

Since this recovery criterion was written, the known distribution of the Kern primrose sphinx moth increased with the discovery, in 2002 through 2005, of six additional confirmed populations at the Carrizo Plain, and in 2004 and 2005, of five additional populations in the Cuyama Valley near New Cuyama and Ventucopa (Jump et al. 2006, A. Kuritsubo *in litt.* 2006), which significantly changes the relevance of this criterion. The distance between the Walker Basin and the Carrizo Plain populations is approximately 120 km (75 miles) as the moth flies, yet no additional colonies of Kern primrose sphinx moth have been found between these two locations. At the Carrizo Plain two populations are on public land (Bureau of Land Management), two populations are on private land, and two populations are within washes that run through both private and public land. In the Cuyama Valley, three populations are on private land and two populations are on public land (U.S. Forest Service) (A. Kuritsubo, BLM, pers. comm. 2007).

Conduct ecological and life history studies of the Kern primrose sphinx moth before establishing new colonies (addresses Listing Factors A, D, and E). There has been a significant advance in the knowledge of the life history and ecology of the Kern primrose sphinx moth since its listing in 1978. The 1981 publication by Paul Tuskes and John Emmel describing the life history and behavior of the Kern primrose sphinx moth provided the basis for drafting the recovery plan (USFWS 1984). Subsequent studies of the Kern primrose sphinx moth include:

* A)Present or threatened destruction, modification or curtailment of its habitat or range;
B) Overutilization for commercial, recreational, scientific, or educational purposes;
C) Disease or predation;
D) Inadqequacy of existing regulatory mechanisms;
E) Other natural or manmade factors affecting its continued existence.

a) Annual surveys of known populations that include incidental observations and discussions of Kern primrose sphinx moth life history and behavior (e.g., Shields 1990; Osborne 1999, 2005; U.S. BLM 2005, 2006, 2007),

b) Research of congeners and closely related moth species that may likewise apply to the Kern primrose sphinx moth (Bagdonas 1981; Osborne 1995, 1999, unpublished observations),

c) One published action plan which directs recovery actions for the Kern primrose sphinx moth populations recently discovered at Carrizo Plains and at Cuyama Valley and describes methods for managing those populations (Longcore and Rich 2002), and

d) One journal article which updates and compiles the current knowledge of Kern primrose sphinx moth distribution, habitat preferences, life history and behavior (Jump et al. 2006).

In spite of these advances in the baseline knowledge of the Kern primrose sphinx moth, this recovery criterion has only partially been met. There are still gaps in the life history and behavior of the Kern primrose sphinx moth that need to be addressed in future research to more effectively manage the species.

Factor C is not relevant to this taxon.

II.C. Updated Information and Current Species Status

II.C.1. Biology and Habitat

A large part of what was known about the life history and ecology of the Kern primrose sphinx moth when it was listed and when the recovery plan was written was based on Tuskes and Emmel (1981). Since 1981 a number of new studies have increased our knowledge and understanding of the Kern primrose sphinx moth.

II.C.1.a. Abundance, population trends (e.g. increasing, decreasing, stable), demographic features (e.g., age structure, sex ratio, family size, birth rate, age at mortality, mortality rate, etc.), or demographic trends:

Population trends and abundance: At the time of listing, the Kern primrose sphinx moth was known from only the northwest portion of the Walker Basin, primarily on 4,000 square meters (43,053 square feet) of a sandy wash (45 FR 24088). Although population surveys have been continuous and ongoing, it is difficult to establish long term trends from this population data (K. Osborne, pers. comm. 2006). Adult populations of Kern primrose sphinx moth vary significantly in size from year to year and the phenology (timing of biological events correlating to climatic factors) of pupation and metamorphosis of the Kern primrose sphinx moth is not yet well known (Osborne 2005). It is known, however, that the extended diapause (period of physiological dormancy between

periods of activity) event in the lifecycle of insects inhabiting arid climates provides a means to avoid the loss of many larvae during drought years when the host plant numbers may be few (Powell 1986). This is accomplished by pupal emergence that is correlated with climatic cues associated with relatively wet and productive years (Powell 1986). Because pupae may spend several years in diapause, buried in loose soil, population abundances will most likely be underestimated.

Relevant to surveying for Kern primrose sphinx moth is its flight season. The flight season of this species was observed to occur earlier in the year at Carrizo Plain (late January through late February) than at Walker Basin (mid-March through early April). This difference is attributed to the seasonally warmer than average temperatures prior to the flight season during this survey event. However, it is believed that the Carrizo Plain, being at a lower elevation, will normally have an earlier flight season than the Walker Basin owing to the higher temperatures earlier in the year (Jump et al. 2006). Staggered flight seasons are common for Lepidopteran species in California, especially where lower altitude or coastal populations of a species often have earlier and longer flight times than higher altitude populations of the same species found further inland (Langston 1974).

Demographic trends: Female Kern primrose sphinx moths fly slower and are easier to capture, which may have led to a serious depletion in females at Walker Basin prior to listing, when large numbers of Kern primrose sphinx moths were captured by collectors (USFWS 1984). No systematic determination of demographic status and trends has been conducted for the Kern primrose sphinx moth during annual surveys.

II.C.1.b. Spatial distribution, trends in spatial distribution (e.g. increasingly fragmented, increased numbers of corridors, etc.), or historic range (e.g. corrections to the historical range, change in distribution of the species' within its historic range, etc.):

From surveys conducted in 2002 and 2003 by entomologists Tom Dimock and Peter Jump, three populations of Kern primrose sphinx moth were discovered for the first time at the Carrizo Plain in San Luis Obispo County, about 120 km (75 miles) west of the Walker Basin population (Jump et al. 2006). Within the Carrizo Plain and in the Cuyama Valley there is a fairly wide distribution of potentially suitable habitat for the Kern primrose sphinx moth based on those habitat characteristics supporting known populations (Jump et al. 2006). Within this surveyed area, Peter Jump found three confirmed populations previously mentioned, three more confirmed populations in later seasons, as well as several unconfirmed Kern primrose sphinx moth sightings (Jump et al. 2006). From surveys conducted in 2004 and 2005 by Peter Jump, five populations of Kern primrose sphinx moth were also discovered in the Cuyama Valley near New Cuyama and Ventucopa (A. Kuritsubo *in litt*. 2006).

II.C.1.c. Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem):

Habitat associations: The recovery plan (USFWS 1984) describes specific habitat associations for the Kern primrose sphinx moth at Walker Basin: sandy washes consisting of coarse to fine textured, decomposed granite soil, and dominant vegetation that includes red-stemmed stork's beak (*Erodium cicutarium*), baby blue-eyes (*Nemophila menziesii*), rabbit brush (*Chyysothamnus nausseosus*), gold fields (*Lasthenia chrysostoma*), and brome grass (*Bromus arenarius*). Essential to the survival of the Kern primrose sphinx moth is the presence of its primary food plant, the sun cup or evening primrose *Camissonia contorta*. The Walker Basin population is found at an altitude of 1,470 meters (4,823 feet).

The population at the Carrizo Plain is associated with sandy washes similar to those in the Walker Basin. The washes at the Carrizo Plain where the Kern primrose sphinx moth was observed flow north from the Caliente Range and along the Elkhorn Scarp (Jump et al. 2006), whereas the washes in the Cuyama Valley with confirmed sightings of the Kern primrose sphinx moth flow west from the Los Padres National Forest into the Cuyama River by Ventucopa and north into the Cuyama River by New Cuyama (A. Kuritsubo *in litt*. 2006).

Topography, especially slope-specific insolation, is known to influence both host plant growth and post-diapause larval growth for some butterfly species (Ehrlich and Hanski 2004) and may be one factor in Kern primrose sphinx moth occurrences in certain washes. Jump et al. (2006) further describe essential habitat elements at both the Carrizo Plain and the Cuyama Valley that include: sandy washes with open soil for morning basking, young alluvial sandy soils that support the food plant *Camissonia campestris* (field primrose or sun cup) and with soil that is loose enough to allow larvae to burrow and construct shallow pupal chambers, and sufficiently dense stands of *C. campestris* that allow Kern primrose sphinx moth larvae to travel from stand to stand as they consume their host plants. According to Jump et al. (2006), washes that have become channelized and eroded into ravines are not as preferable to the Kern primrose sphinx moth as are gently sloping washes. The Kern primrose sphinx moth populations at Walker Basin and those at the Carrizo Plain and in the Cuyama Valley utilize different host plant species.

Distribution: Suitable habitat, in addition to known occupied sites, for the Kern primrose sphinx moth occurs on private, unprotected property at several locations in the northwestern section of the Walker Basin (Johnson 2004, Osborne 2005). About 120 kilometers (75 miles) west of the Walker Basin, there are a fairly large number of alluvial fans supporting *Camissonia campestris* located throughout the Carrizo Plain and the immediate surrounding area (Osborne 2005, Jump et al. 2006). These areas were determined to be suitable habitat for the Kern primrose sphinx moth (Jump et al. 2006). In the Cuyama Valley suitable habitat occurs in the principal drainage systems running west into the Cuyama River near

Ventucopa and along the drainages running north to the Cuyama River near New Cuyama (A. Kuritsubo *in litt*. 2006).

II.C.1.d. Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.):

Currently the phylogenetics of the genus *Euproserpinus* in California is being studied by Dr. Daniel Rubinoff, an entomologist at the University of Hawaii. He has completed one phylogenetic study, in which mitochondrial DNA was evaluated from samples taken from the three *Euproserpinus* species and one undescribed species as follows: *E. wiesti* taken from New Mexico; *E. phaeton* taken from various California locales, populations of undescribed species from San Benito and San Luis Obispo Counties; and *E. euterpe* taken from the Walker Basin as well as from the newly discovered populations at the Carrizo Plain National Monument (Rubinoff 2006). Evidence from his study supports the morphological evidence that the *Euproserpinus* taken from the Carrizo Plain and the Walker Basin are the same species, which is *E. euterpe*. Dr. Rubinoff plans to continue his genetic research to further refine the phylogenetic structure of California *Euproserpinus* using a greater sample size. Ken Osborne, an independent consultant, is performing a separate and broader genetic study of *Euproserpinus* and closely related genera with the goal of enhancing the understanding of the phylogeography of the Kern primrose sphinx moth (K. Osborne, pers. comm. 2006).

II.C.1.e.Taxonomic classification or changes in nomenclature:

There have been no changes to the taxonomy of the Kern primrose sphinx moth since the moth was listed in 1980.

II.C.2. Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)

II.C.2.a. Present or threatened destruction, modification or curtailment of its habitat or range:

At the time of listing, the loss of habitat resulting from conflicting land use was considered the greatest threat to the Kern primrose sphinx moth (45 FR 24088). Currently, this remains a serious threat to the recovery of the Kern primrose sphinx moth for four reasons: 1) there is still no protected land for the management of Kern primrose sphinx moth populations at the Walker Basin; 2) unauthorized land uses at the Carrizo Plain, such as sheep trailing and off-road vehicle (ORV) use negatively impact both Kern primrose sphinx moth populations and their suitable habitat (see II.C.2.e, below); 3) adverse land practices in the Cuyama Valley, such as agricultural disking, modification of washes, ORV use, road maintenance, and sheep bedding negatively impact both populations of Kern primrose sphinx moth and suitable habitat (see also II.C.2.e, below); and 4) much of the Kern primrose sphinx moth habitat on the Carrizo Plain and in the Cuyama Valley is in private ownership and can not be directly

managed for Kern primrose sphinx moth protection (A. Kuritsubo *in litt.* 2006, K. Sharum *in litt.* 2006).

Since listing, the primary threats to the Kern primrose sphinx moth are agricultural land use practices that degrade Kern primrose sphinx moth habitat, particularly cattle grazing, disking, using pesticides and herbicides, and development.

Grazing: Sheep grazing can be both beneficial and harmful to the Kern primrose sphinx moth. Although grazing is used to control invasive weeds (Marty 2004), grazing animals can trample Kern primrose sphinx moth eggs, larvae, and pupae, as well as the Kern primrose sphinx moth host plant. Grazing and trampling can also destroy sensitive cryptogamic crusts, which may alter the native plant community (Mattoni et al. 1997, Osborne 2005). Overgrazed areas can cause serious erosion and destruction of habitat during seasonal rains (Osborne 2005). Jump et al. (2006) describe washes they had observed that were grazed by sheep and became muddy with little forb cover. Two areas in the Carrizo Plain, Old Truck Wash and Scope Moth Wash, were damaged by sheep grazing. This damage occurred from both the reduction of the *Cammissonia* host plant from grazing and the trampling of the area as the sheep moved through the drainage (K. Sharum pers.comm. 2007). Either trampling from trailing sheep (see II.C.2.e below) or actual consumption of the host plants by sheep are equal threats. Sheep grazing and trailing are considered as a threat at this time only to those few Carrizo Plains Kern primrose sphinx moth populations and has not been observed at the Walker Basin or the Cuyama Valley.

Disking: It is not known how deep below the soil surface the Kern primrose sphinx moth constructs its pupal chambers (Osborne 2005). Other sphinx moth species, such as the tobacco hornworm (*Manduca sexta*), form pupal chambers 10 to 15 cm (4 to 6 inches) below the soil surface. Disking may cut deep enough into the ground to disturb or destroy these pupae and be unintentionally timed to destroy large numbers of pupae (Osborne 2005). In addition, disking can destroy host plants and adult moth nectar sources, and the congeners of the host plant that may have attracted oviposition (Shields 1990, Osborne 2005). Tractors pulling the disking apparatus also compact soil and may either prevent the formation of pupal chambers or destroy them. Disking is performed routinely on properties at the Walker Basin, including those where there are known populations of Kern primrose sphinx moths (Osborne 2005). Disking has also seriously degraded potential moth habitat at the Cuyama Valley, specifically at the washes flowing out from the Caliente Range that are converted to agricultural use (Jump et al. 2006).

Herbicide and Pesticide use: Many agricultural pesticides are specifically designed to target insect larvae (caterpillars) as well as adult moths. Some herbicides have also been found to negatively impact a variety of insects (Dewey 1986). Agricultural practices in the Central Valley include spreading thousands of tons of pesticides and herbicides annually, which can be spread beyond the target area by prevailing winds and have been implicated in affecting animals

many miles downwind of applications (Davidson et al. 2002). For example, in New Mexico, pesticide intended to eliminate grasshoppers was inadvertently oversprayed onto a population of *Euproserpinus weisti* owing to wind gusts, which subsequently killed nearly the entire sphinx moth population (Williams and McQueen 1984). All Kern primrose sphinx moth populations are potentially at risk from this effect.

Development: Presently, a 486-hectare (1,202-acre) parcel in the Walker Basin has been targeted for subdivision into small agricultural ranches (USFWS 2006). The parcel is known to have suitable habitat for Kern primrose sphinx moth, including stands of *Camissonia* (evening primrose), is located near known populations of the Kern primrose sphinx moth, and may be occupied by Kern primrose sphinx moths as well (USFWS 2006).

Conservation Areas: The areas that offer some protection for the Kern primrose sphinx moth include two populations at the Carrizo Plain on Bureau of Land Management Land and two populations at the Cuyama Valley on U.S. Forest Service land. This would constitute about one-third of the total populations. The only protective measures offered at these sites include occasional visits by federal agency personnel and the construction of barricades to discourage driving vehicles into the areas (A. Kuritsubo, pers. comm., 2007).

II.C.2.b. Overutilization for commercial, recreational, scientific, or educational purposes:

At the time of listing, collectors had removed a significant number of moths, the majority of which were the slower-flying and, thus, easier-caught females (45 FR 24088). Illegal collection for commercial purposes remains a threat for this moth. This is primarily because small populations of moths and butterflies are vulnerable to harm from collection of adults (Gall 1984). A population may be reduced below sustainable numbers (Allee effect) by removal of females, thus reducing the probability that new colonies will be founded. The Kern primrose sphinx moth is particularly affected by loss of females to collection because females fly slower and often land for oviposition (USFWS 1984). Collectors may not always realize they may be depleting colonies of butterflies or moths to below threshold limits for the survival or recovery of the colony (Collins and Morris 1985). Poachers may also use various methods to escape detection or to evade prosecution (Thelander 1994). An illegal market exists for rare insect species, and private collectors are willing to pay substantial sums for valued specimen of listed species (U.S. Attorneys Office 1994).

Enforcement of section 9 provisions in the Act to protect the Walker Basin population was listed in the recovery plan as a recovery criterion and reflects the serious threat that was posed to the Kern primrose sphinx moth by collectors during the interim between the proposal for listing in 1978 and the final listing of the Kern primrose sphinx moth as a threatened species in 1980. A large number of Kern primrose sphinx moths, particularly the slower flying females, was taken by collectors knowing that collection would soon become illegal (USFWS 1984).

This criterion has not been met in that enforcement is not funded and actively performed by any agency. However, illegal collection of the Kern primrose sphinx moth appears to have significantly abated since listing (K. Osborne, pers. comm. 2006).

II.C.2.c. Disease or predation:

Disease or predation were not considered to be a threat at the time of listing (45 FR 24088). It appears that predation or disease still do not pose a significant threat to the Kern primrose sphinx moth, however, a study of parasitoids is being conducted (Osborne 2005).

II.C.2.d. Inadequacy of existing regulatory mechanisms:

Federal Protection***:*** Until the Kern primrose sphinx moth was federally listed as a threatened species in 1980, no State or Federal laws protected the species or its habitat. The Endangered Species Act of 1973, as amended (Act), is the primary Federal law that provides protection for the Kern primrose sphinx moth. Since the animal's designation as a threatened species in 1980, several projects have undergone review under section 7 and section 10(a)(1)(B) of the Act.

Currently no land at Walker Basin has been acquired to protect that known population of Kern primrose sphinx moth. The population at the Carrizo Plain exists on both public and private land. The public land is managed by BLM and the Kern primrose sphinx moth is afforded some protection. This protection includes fencing installed around known populations and notification of BLM law enforcement when the flight season for the moth starts and unauthorized activities affecting the moth may occur (K. Sharum *in litt*. 2006). Much of the known habitat and large areas of suitable habitat for the Kern primrose sphinx moth are on private lands and remain unprotected (A. Kuritsubo *in litt*. 2006). Only indirect measures can be taken to protect Kern primrose sphinx moth on these private properties, such as educating landowners on what activities are damaging to Kern primrose sphinx moth, and placing barricades to discourage trespassing on private properties near public lands (A. Kuritsubo, pers. comm. 2006).

The Lacey Act***:*** The Kern primrose sphinx moth is also protected by the Lacey Act (P.L. 97-79), as amended in 16 U.S.C. 3371**.** The Lacey Act makes unlawful the import, export, or transport of any wild animals whether alive or dead, and further makes unlawful the selling, receiving, acquisition, or purchasing of any wild animal, alive or dead. The designation of wild animal includes parts, products, eggs, or offspring.

State and Local Protections***:*** The Kern primrose sphinx moth is not specifically protected under any State or local law. The California Endangered Species Act does not provide protection to insects (sections 2062, 2067, and 2068, California Fish and Game Code).

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

II.C.2.e. Other natural or manmade factors affecting its continued existence:

At the time of listing, the non-native, invasive, low-growing weedy plant, filaree (*Erodium* sp.), was thought to negatively impact the Kern primrose sphinx moth at the Walker Basin because it was noted that female Kern primrose sphinx moth oviposit on non-host plants and other objects (45 FR 24088). In addition, laboratory studies revealed that Kern primrose sphinx moth larvae will not eat filaree and will starve in a laboratory setting (45 FR 24088). Since filaree was abundant at the Walker Basin it appeared that females could oviposit on these non-host plants and the larvae would starve and die, thus reducing population viability (45 FR 24088). However, subsequent observations revealed that the first instar (growth period between molts in larval insects) larvae is actually capable of making forays from non-host plants across open ground to find host plants if the individual host plants are of adequate density (Longcore and Rich 2002, Osborne 2005). Thus, Kern primrose sphinx moth oviposition on filaree does not necessarily lead to death of the hatching larvae.

The following are threats to the recovery of the Kern primrose sphinx moth that were brought to light after listing and do not apply to previous categories:

a) Succession on alluvial fans: *Camissonia* grows abundantly within disturbed sandy washes. As the sandy nature of the soil is lost over time due to succession, the abundance and density of *Camissonia* is decreased and appears to be unable to support Kern primrose sphinx moth (Jump et al. 2006). This is likely due to the limited capability of first instar Kern primrose sphinx moth larvae to traverse relatively large distances between plants. If larvae hatch from eggs deposited on a non-food plant, then there must be a sufficient density of *Camissonia* to allow successful forays by larvae to find these food-plants (Jump et al. 2006). It is believed that the Kern primrose sphinx moth is adapted to colonize other disturbed areas containing the food plant as succession renders older washes uninhabitable (Jump et al. 2006)

b) Road kill of basking moths: Adult Kern primrose sphinx moths bask on open, bare, sandy ground. Usually their color renders them indistinguishable from the background and, thus, camouflaged from predators. However, at the Walker Basin, moths using a well traveled, unimproved road for basking have been run over by vehicles (K. Osborne, pers. comm. 2006).

c) Trampling: Grazing sheep have been observed at the Carrizo Plain trampling the Kern primrose sphinx moth food plant while breaking down the cryptogamic crust, which maintains the integrity of the sandy substrate and the plant community (K. Osborne, pers. comm. 2006). Increased fecal and urine deposition by sheep and cattle may alter the composition of the sandy substrate by eventually stabilizing and enriching the nutrient load of the substrate, which encourages

growth of successive plant communities (U.S. BLM 2006). This is particularly problematic when sheep are penned overnight in a confined space. At least a portion of one known Kern primrose sphinx moth population has been lost (U.S. BLM 2006). The Kern primrose sphinx moth larvae burrow into the loose soil at or near the base of their *Camissonia* food plant to make their pupal chamber. If the soil is too compacted then larva may be unable to successfully dig and the animal would be unable to complete its life cycle (Jump et al. 2006).

d) Off-road vehicle use: Off-road vehicles of any type will destroy the *Camissonia* host plant and the cryptogamic crusts, and kill the early stages of the Kern primrose sphinx moth. Repeated vehicle use results in compacted soils. Much of the suitable habitat on private and BLM lands in the Carrizo Plain is not closed to unauthorized off road vehicle use. At the Carrizo Plain, two populations of the sphinx moth occur within washes on BLM land. These washes were found to be used on occasion by ORVs. Barricades were placed at the roadside access to these washes in order to discourage vehicles from driving up the washes and destroying known sphinx moth habitat (A. Kuritsubo in litt. 2006). A more critical situation occurs in the Cuyama Valley where unimproved roads actually occur within three of the washes inhabited by populations of Kern primrose sphinx moths. Not only does use of these roads degrade the habitat, but maintenance of these roads, although not routinely performed, would cause enough habitat damage to impact that local populations (A. Kuritsubo, pers. comm. 2007).

II.D. Synthesis

Since the Kern primrose sphinx moth was listed in 1980 (45 FR 24088), there have been several findings from studies that should significantly alter the direction of recovery actions and clearly demonstrate the need to revise the recovery plan. These new findings include: 1) an expansion in the distribution of the Kern primrose sphinx moth to include the area in and around the Carrizo Plain and Cuyama Valley; 2) the species found at the Carrizo Plain and Cuyama Valley are apparently the same species as the Kern primrose sphinx moth found at Walker Basin (based on the results of both morphological and genetic research); and 3) the Kern primrose sphinx moth larvae can travel small distances between plants and may still survive even if adult Kern primrose sphinx moth lay eggs on non-host plants.

The Kern primrose sphinx moth is a species confronted with a high degree of threats, primarily from land practices that are destructive to the unique Kern primrose sphinx moth habitat. Currently, known populations of Kern primrose sphinx moth are not adequately protected, mainly because the majority of populations at the Carrizo Plain, at the Cuyama Valley, and at Walker Basin exist on private lands. The Kern primrose sphinx moth population at Walker Basin is threatened by residential development, vehicular strikes of basking adult Kern primrose sphinx moth, and agricultural disking practices. The Kern primrose sphinx moth populations at the Carrizo Plain are threatened by habitat degradation due to sheep grazing and by ORV use. The Kern primrose sphinx

moth populations in the Cuyama Valley are threatened by habitat degradation due to agricultural use, sheep penning, road maintenance, and ORV traffic.

The Kern primrose sphinx moth is considered to have a high potential for recovery because there exists suitable habitat on public lands at the Carrizo Plain and Cuyama Valley that have yet to be subjected to a concentrated survey and may reveal new populations of the Kern primrose sphinx moth. Also, owing to the capability of Kern primrose sphinx moth pupae to diapause for several years, this animal has a chance for continued survival under adverse conditions. Thus, if protected from threats, the adaptable characteristics of the Kern primrose sphinx moth appear to make this animal a good candidate for recovery. Currently, recovery efforts for the Kern primrose sphinx moth do not have significant conflict with economical and land development practices within the area of known Kern primrose sphinx moth distribution.

Population trends and densities of the Kern primrose sphinx moth remain elusive and unknown owing to several natural factors which include extended pupal diapause periods during dry years (Powell 1986) and annual population fluctuations. However, despite the discovery of new populations and suitable habitat, the existing threats listed above and the fact that the majority of the Kern primrose sphinx moth populations exist on private land seriously complicate the recovery of the Kern primrose sphinx moth. Therefore, this species still meets the definition of threatened under the Act and we recommend no status change at this time.

III. RESULTS

III.A. Recommended Classification:

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

B. New Recovery Priority Number __No change.

V. RECOMMENDATIONS FOR FUTURE ACTIONS

1. Revise the Kern primrose sphinx moth recovery plan: The 1984 recovery plan does not adequately address the current threats to the Kern primrose sphinx moth and no longer conforms to the best available scientific information. A new recovery plan should be based on the findings summarized in Jump et al. (2006). The most important new findings include an expanded population distribution of Kern primrose sphinx moth and the capability of Kern primrose sphinx moth larvae to traverse small distances to find proper host plants.

2. Protect known Kern primrose sphinx moth populations at Carrizo Plain National Monument and at Cuyama Valley: Currently, known populations that exist at the Carrizo Plain and Cuyama Valley are on private and public land. The public land is managed by BLM (Carrizo Plain) and the U.S. Forest Service (Cuyama Valley). Although measures have been taken to protect these populations through signs and fencing, there exists no means to protect the remaining suitable habitat from being trampled by sheep grazing on private land or from destruction by unauthorized OHV use (A. Kuritsubo *in litt*. 2006, K. Sharum *in litt*. 2006). Possible protective actions for the Kern primrose sphinx moth on these private properties need to be discussed and, if appropriate, implemented.

3. Survey suitable habitat for undiscovered Kern primrose sphinx moth populations: Suitable habitat for the Kern primrose sphinx moth exists in and around the Carrizo Plain and the Cuyama Valley that has not yet been extensively surveyed for the presence of the Kern primrose sphinx moth. These areas should be surveyed coinciding with the Kern primrose sphinx moth flight period to determine presence/absence as a minimum. Potential habitat at Walker Basin should likewise be surveyed.

4. Acquire Kern primrose sphinx moth habitat at Walker Basin and provide protection for Kern primrose sphinx moth: Protection of known populations of the Kern primrose sphinx moth at the Walker Basin is vital for maintaining a third location for the species. Property acquisition should follow after clear indications of sphinx moth presence results from thorough surveys. Once acquired, the property needs to be protected from trespassing and from any practices adverse to the Kern primrose sphinx moth life history.

5. Continue life history, ecology, and genetic studies of Kern primrose sphinx moth: Peter Jump et al. (2006) provide a comprehensive report of the current knowledge of Kern primrose sphinx moth life history. However, there are some gaps in the important baseline of life history knowledge that need to be addressed by future research. One example is that the average depth within the soil that Kern primrose sphinx moth form pupal chambers is not known, so that any reliable recommendations on disking practices are not possible. The phylogenetics of Kern primrose sphinx moth is now better understood as a result of recent genetic work; however, increased sampling is needed to clearly distinguish taxonomic clades, eliminate any doubt as to species lineages, and clarify phylogenetic distributions.

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of Kern primrose sphinx moth/ *Euproserpinus euterpe*

Current Classification: 2
Recommendation resulting from the 5-Year Review

____ **Downlist to Threatened**
____ **Uplist to Endangered**
____ **Delist**
__X__ **No change is needed**

Appropriate Listing/Reclassification Priority Number, if applicable N/A

Review Conducted By Sacramento Fish and Wildlife Office staff.

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve Cay C. Goude Date 1/24/07

REGIONAL OFFICE APPROVAL:

The Regional Director or the Assistant Regional Director, if authority has been delegated to the Assistant Regional Director, must sign all 5-year reviews.

Acting
Regional Director, Fish and Wildlife Service

Approve [signature] Date 9/24/07