5-YEAR REVIEW
Kern Primrose Sphinx Moth (*Euproserpinus euterpe*)

GENERAL INFORMATION:

Species: Kern primrose sphinx moth (*Euproserpinus euterpe*)
Date listed: April 8, 1980
Federal Register (FR) citation: 45 FR 24088 (Service 1980)
Classification: Threatened

State listing: The Kern primrose sphinx moth is not listed by the state of California.

BACKGROUND:

Species overview:

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. The Kern primrose sphinx moth is a small moth with a streamlined yet stout body and elongate forewings which are oblique at the outer margins (Tuskes and Emmel 1981, p. 27). The colorful larvae are without hair or spines, and the dorsal part of the eighth abdominal segment contains a horn or spur (Jump et al. 2006, p. 47; Tuskes and Emmel 1981, pp. 27, 28). 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, p. 43). Flight periods for the adults range from late February to early April, although pupae are known to diapause (delay metamorphosis to adult form) underground for multiple years during drought periods (Jump et al. 2006, p. 41). The Kern primrose sphinx moth is found in sandy washes consisting of coarse to fine textured, decomposed granite soil in Walker Basin (Kern County), Carrizo Plain (San Luis Obispo County), and Cuyama Valley (Santa Barbara and Ventura Counties; Service 1984, p. 3; Service 2007, pp. 3, 7).

Most recent status review:

U.S. Fish and Wildlife Service. 2020. Kern Primrose Sphinx Moth (*Euproserpinus euterpe*). 5-Year Review. Sacramento Fish and Wildlife Office, Sacramento, California. 6 pp.

We did not recommend a status change in the 2020 status review.

FR notice citation announcing this status review:

U.S. Fish and Wildlife Service (Service). 2024. Endangered and Threatened Wildlife and Plants; Initiation of 5-Year Status Reviews for 59 Pacific Southwest Species. Federal Register 84: 83510–83514.

We did not receive information from the public regarding the Kern primrose sphinx moth in response to the notice.

ASSESSMENT:

This 5-year review was conducted by the U.S. Fish and Wildlife Service's (Service) Sacramento Fish and Wildlife Office. Data for this review were solicited from interested parties through a Federal Register notice announcing this review on October 16, 2024 (Service 2024, entire). We did not receive any information for this species from the public in response to the notice. To gather information for this status review, we contacted species experts, performed a literature search, reviewed records in our files, and obtained data from an occurrence search of the California Natural Diversity Database maintained by the California Department of Fish and Wildlife (Department).

Since the previous 5-year review (Service 2020, entire), no surveys have been conducted for the Kern primrose sphinx moth and our understanding of the current distribution and abundance of the species remains as described in the 2020 5-year review (see **Distribution** and **Abundance** sections). However, new information on the life history and threats to the species (see **Life history** and **Threats** sections) provides a starting point for new management recommendations to promote recovery.

Life history:
Methods for captive rearing of the Kern primrose sphinx moth from egg to adult were published following the last 5-year review (Osborne 2023a, entire). This was the first report of successful efforts to rear the species from eggs to adult emergence and provides additional understanding of the species' requirements for development. Previous efforts focused only on rearing larvae from eggs (Osborne 2008, entire) or adults from pupae (Osborne 2009, entire). Osborne (2023a, pp. 90, 91) collected three gravid females from Walker Basin and one gravid female from Carrizo Plain. The eggs that were oviposited in captivity were reared to adult emergence using a combination of artificial pupal cells and buckets filled with soil from the source locations (Osborne 2023a, p. 91). Out of 14 larvae, 12 developed into pupae and 9 adults emerged. Seven of the adults emerged in the spring following oviposition and two adults emerged the following spring (Osborne 2023a, p. 95). Three other pupae remained viable for three years but never eclosed or (emerged) as adults (Osborne 2023a, p. 95).

This study provided additional information on pupal development and requirements for adult emergence. Captively reared larvae were able to pupate in more compacted soil, suggesting greater soil cohesion increases larval burrowing success, supporting previous studies that larvae were unable to burrow in loose soils (Osborne 2023a, p. 97). In addition, when developing pupae were excavated to measure burrow depth, larvae were not found at the surface of the soil, as previously described, but instead were found at depths of 5–11 centimeters (Osborne 2023a, pp. 95, 96). Furthermore, Osborne (2023a, p. 98) found that underground pupal development is initiated by soil humidity (primarily driven in situ by fall and winter precipitation), while adult emergence is triggered by temperatures above 65ºF. The results from this study provide a basis for better understanding of the life history and developmental requirements of the species.

Distribution:
At the time of listing, the Kern primrose sphinx moth was known only from the northwest portion of the Walker Basin in Kern County, primarily on 4,000 square meters (43,053 square feet) of a sandy wash (Service 1980, p. 24088). At the time of the 2020 5-year review the known

species' distribution had expanded to include eight known localities at the Carrizo Plain National Monument in San Luis Obispo County and five known localities in the Cuyama Valley in Santa Barbara and Ventura Counties (Service 2007, p. 3; Service 2020, p. 1). The known distribution of the species remains as described in the 2020 5-year review (Service 2020, pp. 1–2). As we do not have enough information to delineate populations of the species, we refrain from using the term "populations" in this review and refer instead to larger occupied areas (i.e., Walker Basin, Carrizo Plain, and Cuyama Valley) and specific localities within those areas, where Kern primrose sphinx moths have been observed.

At the time of the 2020 5-year review, a genetic analysis of Kern primrose sphinx moth showed that individuals found in the Walker Basin, Carrizo Plain, and Cuyama Valley were genetically related but had no recent genetic contact, suggesting that the species may have once been more widespread across the southern San Joaquin Valley and became genetically isolated due to anthropogenic and environmental factors (Rubinoff et al. 2015, p. 285). This hypothesis is now supported by species distribution modeling (Longcore and MacDonald *Unpublished* 2018, entire), which identified environmental factors including climate, elevation, distance to streams, and slope as the most important predictors of Kern primrose sphinx moth habitat and distribution (Longcore and MacDonald *Unpublished*, pp. 14–15). Longcore and MacDonald found that current Kern primrose sphinx moth distribution is best predicted by low mean annual precipitation (~200–250m), low elevation, and flat ground slope (Longcore and MacDonald *Unpublished* 2018, p. 15).

Abundance:
Annual presence and local abundance surveys for the Kern primrose sphinx moth were conducted up to 2019; however, no abundance estimates or trends have been determined for the species. The latest survey in 2019 found an overall average flight season with moths continuing to be observed in known localities (Bureau of Land Management (Bureau) 2021, entire). No surveys for Kern primrose sphinx moth have been conducted since the 2020 5-year review (Bureau 2021, entire; Bureau 2022, entire; Bureau 2023, entire; Osborne 2022, entire; Osborne 2023b, entire). However, in 2022, 2023, and 2024 individuals were observed and photographed at two of the previously known localities at the Carrizo Plain National Monument (Diversity Database 2025, pp. 2–4). Additionally, during the captive rearing study, Osborne (2023a, p. 97) found that adults do not emerge during drought conditions, but pupae can diapause for up to three years, and due to this, surveys conducted during drought years may underestimate abundance.

Threats:
Threats to the species identified at time of listing included habitat loss due to changes in land management; collection of individuals; inadequacy of existing regulatory mechanisms; and non-native plants (Service 1980, p. 24089). At the time of the 2007 and 2020 5-year reviews, additional threats were identified including grazing, disking, herbicide and pesticide use, development, succession of alluvial fans, road kill of basking moths, trampling from grazing, and off-road vehicle use (Service 2007, p. 8; Service 2020, p. 2). Additionally, at the time of the 2020 5-year review, non-native rabbit bush (*Chyysothamnus nausseosus*) abundance was steadily increasing within the range of Kern primrose sphinx moth, particularly in the Walker Basin, crowding out the species' native host plant (Service 2020, p. 2). Although Kern primrose sphinx

moth are capable of short forays from non-host plants to their host *Camissonia* (sun cup species) (Kniessen *in litt.* 2022), they still rely on an abundance of host plants for suitable habitat.

Currently, there is no evidence that the status of the previously identified threats has changed; however, additional information on the threat of pesticides and discussion of the emerging threat of the effects of climate change is summarized below.

Pesticides
As discussed in our previous 5-year reviews, many agricultural pesticides are specifically designed to target insect larvae as well as adult moths (Service 2007, pp. 9–10; Service 2020, p. 2). Agricultural practices in the Central Valley include spreading thousands of tons of pesticides annually, which can be spread beyond the target area by prevailing winds (Service 2007, pp. 9–10). The Environmental Protection Agency (Agency) recently released final biological evaluations assessing the effects of labeled uses of three neonicotinoid pesticides on listed species (Agency 2022a, entire; Agency 2022b, entire; Agency 2022c, entire). The three pesticides (clothianidin, imidacloprid, and thiamethoxam) are registered for use on a variety of agricultural crops; however, there are also some non-agricultural applications. The three pesticides target insect species by acting on their neurotransmitters to cause excessive nervous stimulation, paralysis, and death. The Agency anticipates releasing amended proposed interim decisions, and a national consultation with the Agency is pending. We cannot speculate as to the outcome of the consultation and final rulemaking, but it could have bearing on the Kern primrose sphinx moth's conservation status.

Climate change:
The Central Coast region of California, which encompasses the Cuyama Valley and Carrizo Plains, is predicted to experience an increase in extreme rainfall variation (atmospheric river events and severe droughts) and an overall increase in temperature throughout the year (Langridge 2018, pp. 12–17, 20). The San Joaquin Valley, which encompasses the Walker Basin, is predicted to experience an increase in climate extremes, with longer and more severe droughts, higher temperatures, less annual rainfall with more intense precipitation and flooding events, increased instability of dams and levees, and an increase in water diversions to agriculture (Santiago Fernandez-Bou et al. 2021, pp. 17–27). Due to the species' reliance on soil humidity for pupal development, which requires a balance of dry conditions and precipitation throughout the year, increased severe drought and extreme precipitation events may impact pupal development of the species. The Kern primrose sphinx moth may be impacted at the population level by the effects of climate change if severe drought periods surpass the maximum diapause period for pupae and adult emergence does not occur for multiple years.

Recovery criteria:
The Kern primrose sphinx moth's single delisting recovery criterion is described in the Recovery Plan for the Kern primrose sphinx moth (Service 1984, p. 14) and is as follows: 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. The Recovery Plan also specifies that each of these colonies must be maintained without threat from agricultural conversion, pesticides, disease, or collection for a period of ten consecutive years before delisting should be considered (Service 1984, p. 14). Attempts to conserve occupied areas in Walker Basin have been unsuccessful and no progress

has been made towards the delisting criterion since the previous 5-year reviews (Service 2007, p. 4; Service 2020, pp. 3, 4).

As discussed in the **Distribution** section, the known distribution of Kern primrose sphinx moth expanded following publication of the Recovery Plan in 1984 due to the discovery of eight localities of the species on the Carrizo Plain and of five localities in the Cuyama Valley (Service 2020, p. 1), which significantly changes the relevance of the delisting criterion. Some of the newly discovered localities fall on public lands that confer some level of protection. At the Carrizo Plain four localities are on public land managed by the Bureau within Carrizo Plain National Monument, two localities are on private land, and two localities are within washes that run through both private and public land. In the Cuyama Valley, three localities are on private lands and two localities are on public land managed by the U.S. Forest Service within Los Padres National Forest. Although the localities on public lands at the Carrizo Plain and Cuyama Valley are protected from land conversion and measures have been taken to protect the localities through signs and fencing, remaining occupied habitat on private lands is at risk from trampling by sheep grazing and destruction by off-highway vehicle use.

Conclusion:
After reviewing the best available scientific information, we conclude that the Kern primrose sphinx moth remains a threatened species. The evaluation of threats affecting the species under the factors in 4(a)(1) of the Endangered Species Act and analysis of the status of the species in our 2020 5-year review (Service 2020, p. 4) remain an accurate reflection of the species' current status.

RECOMMENDATIONS FOR FUTURE ACTIONS:

Here we propose several management, conservation, and research recommendations which will aid in the recovery and conservation of the Kern primrose sphinx moth. Some of these recommendations have already been discussed in previous recovery documents (Service 2007, pp. 14–15; Service 2020, p. 4) and remain valid.

1. *Acquire habitat at Walker Basin and provide protection for Kern primrose sphinx moth*: Protection of known localities of the Kern primrose sphinx moth at Walker Basin is vital for maintaining species redundancy. Property acquisition should follow clear indications of sphinx moth presence results from thorough surveys. Once acquired, property should be protected from trespassing and any practices adverse to the Kern primrose sphinx moth life history.
2. *Protect known Kern primrose sphinx moth localities at Carrizo Plain and Cuyama Valley:* Known localities of the species at the Carrizo Plain and Cuyama Valley occur on both private and public lands. The public lands are managed by the Bureau (Carrizo Plain) and the U.S. Forest Service (Cuyama Valley), and measures have been taken to protect these localities through signs and fencing. However, there exists no means to protect the remaining occupied habitat in these areas that fall on private lands. The Service should work with partners and private land holders to develop conservation measures for the species that can be implemented on private lands. Additionally, the Service should work with partners to acquire private properties with occupied habitat in these areas and secure protection through easements, long-term agreement, or other protective strategies.

3. *Survey suitable habitat for undiscovered Kern primrose sphinx moth localities*: Suitable habitat in and around the Carrizo Plain, Cuyama Valley, and Walker Basin that has not yet been extensively surveyed for the species should by surveyed during the flight season specific to each area to determine presence/absence.
4. *Regular monitoring of known localities:* Regular surveys should be conducted at known localities within all three areas occupied by the species. To determine trends in abundance (stable, increasing, or decreasing), the following actions should be taken:
    a. Flight season surveys of adults should be conducted annually at localities within the three occupied areas (Walker Basin, Carrizo Plain, and Cuyama Valley). Regular, annual monitoring is necessary for estimating abundance and determining trends.
    b. Compare abundances in drought years versus non-drought years to increase understanding of how diapausing pupae may contribute to abundance and trends.
    c. Survey years with high precipitation in the preceding fall and winter should be prioritized over drought years, to increase the probability of detecting individuals.
5. *Continue life history, ecology, and genetic studies*: Future research should build upon the current understanding of species life history (pupal development and survival), genetics, and population ecology.
6. *Delineate colonies or populations of the species to better assess progress towards the recovery criterion.* The Recovery Plan outlines goals for the protection and establishment of a specific number of colonies. Colonies (or populations) of the species have not been defined. Future work should focus on delineating colonies of the species.
7. *Identify conservation needs at Carrizo Plain and Cuyama Valley and clarify how these areas contribute to the overall recovery strategy of the species.* Increased survey efforts following the development of the Recovery Plan have resulted in the discovery of localities in new areas. The recovery strategy outlined in the Recovery Plan does not address these additional occupied areas. Future work should focus on identifying needs for recovery of the species across its range.

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Approve AMBER AGUILERA Digitally signed by AMBER AGUILERA Date: 2025.08.08 09:57:51 -07'00' **Date** _____

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