

*Caulanthus californicus*  
(California jewelflower)

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



Photo by Rosalie Faubion, used with permission.

**U.S. Fish and Wildlife Service  
Sacramento Fish and Wildlife Office  
Sacramento, California**

**August 2013**

## 5-YEAR REVIEW

*Caulanthus californicus* (California jewelflower)

### I. GENERAL INFORMATION

#### **Purpose of 5-Year Reviews:**

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

**Species Overview:** *Caulanthus californicus* is an annual herb belonging to the mustard family (*Brassicaceae*) that can grow from 4 inches to more than 20 inches in height. This California species historically ranged across the San Joaquin Valley floor in Fresno, Kern, Kings, and Tulare Counties. It was also known from the Carrizo Plain in San Luis Obispo County and the Cuyama Valley in Santa Barbara and Ventura Counties. Extant populations of *C. californicus* occur in Nonnative Grasslands, Upper Sonoran Subshrub Scrub, and Cismontane Juniper Woodland and Scrub communities at an elevation range of 230 - 3,280 feet (E. Cypher, unpubl. data 1994).

#### **Methodology Used to Complete This Review:**

This review was prepared by the Sacramento Fish and Wildlife Office (SFWO), following the Region 8 guidance issued in March 2008. We used information from the *Recovery Plan for Upland Species of the San Joaquin Valley, California* (Recovery Plan; Service 1998), survey information from experts who have been monitoring various localities of this species, and the California Natural Diversity Database (CNDDDB) maintained by the California Department of Fish and Wildlife. The Recovery Plan and personal communications with experts were our primary sources of information used to update the species' status and threats. We received no information from the public in response to our Federal Notice initiating this 5-year review. This 5-year review contains updated information on the species' biology and threats, and an assessment of that information compared to that known at the time of listing. 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:**

**Lead Regional Office:** Larry Rabin, Deputy Division Chief for Listing, Recovery, and Environmental Contaminants, Pacific Southwest Region; (916) 414-6464.

**Lead Field Office:** Josh Hull, Recovery Division Chief, SFWO; (916) 414-6600.

**Cooperating Field Office(s):** Ventura Fish and Wildlife Office, Ph: (805) 644-1766

**Federal Register (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 April 3, 2006; 71 FR 16584.

**Listing History:**

**Original Listing**

**FR Notice:** 55 FR 29361

**Date of Final Listing Rule:** July 19, 1990

**Entity Listed:** *Caulanthus californicus*, a plant species

**Classification:** Endangered

**Review History:** No previous 5-Year reviews or other relevant documents have been written for *C. californicus*.

**Species' Recovery Priority Number at Start of 5-Year Review:** The recovery priority number for *C. californicus* is 2 according to the Service's most recent Recovery Data Call for the SFWO, based on a 1-18 ranking system where 1 is the highest-ranked recovery priority and 18 is the lowest (Endangered and Threatened Species Listing and Recovery Priority Guidelines, 48 FR 43098, September 21, 1983). This number indicates that the taxon is a species that faces a high degree of threat and has a high potential for recovery.

**Recovery Plan**

**Name of Plan:** *Recovery Plan for Upland Species of the San Joaquin Valley, California*

**Date Issued:** September 30, 1998

**II. REVIEW ANALYSIS**

**Application of the 1996 Distinct Population Segment (DPS) Policy**

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

## Information on the Species and its Status

**Species Biology and Life History:** *Caulanthus californicus* is a glabrous decumbent to erect often branched annual, with whitish petals and spherical seeds. Leaves are less than 11 millimeters (mm) (0.4 inch (in.)) in length and are shallowly cut to wavy-dentate and tapered. Calyx petals (outer whorl) are generally spreading, 4–10 mm (0.15–0.4 in.) in length, maroon, keeled, and darker in bud stage. Corolla petals (inner whorl) are 6–11 mm (0.2–0.4 in.) long and whitish, with wavy margins (Buck 1993).

Bud emergence and flowering generally begin in early to mid-March and continue through the beginning of May. There appears to be a range of flowering phenology related to plant size. Smaller plants flower earlier in the season; larger plants flower later in the season and continue flowering past the peak for most of the population (Mazer and Hendrickson 1993).

**Spatial Distribution:** The historical distribution of *C. californicus* is known from 40 herbarium specimens, which were collected in 7 counties between 1880 and 1973. Nearly half of the historic collection sites were on the floor of the San Joaquin Valley in Fresno, Kern, and Tulare Counties. Several other collections came from two smaller valleys southwest of the San Joaquin Valley: the Carrizo Plain in San Luis Obispo County, and the Cuyama Valley in Santa Barbara County. Three collections were made from the Sierra Nevada foothills at the eastern margin of the San Joaquin Valley in Kern County. The remainder of the historic sites were in the foothills west of the San Joaquin Valley in Fresno, Kern, and Kings Counties. As of 1986, all natural occurrences of *C. californicus* on the San Joaquin and Cuyama Valley floors had been extirpated (California Department of Fish and Game (CDFG) 2005).

At the time of listing (1990), *C. californicus* was known from three localized areas: the mouth of Santa Barbara Canyon in Santa Barbara County, the southern portion of the Carrizo Plain in San Luis Obispo County, and the Paul Paine Preserve (owned by The Nature Conservancy) in Kern County (Service 1990). Currently, there are 34 presumed extant occurrences: 1 introduced occurrence in Kern County; 7 occurrences in Santa Barbara County; 22 occurrences in San Luis Obispo County; 3 occurrences in Fresno County; and 1 occurrence in Kings County. Two populations were introduced in the Los Padres National Forest in 1995. Although these records still appear in the CNDDDB, both populations have failed and are no longer extant (Lloyd Simpson, USFS pers. comm. 2013). See Appendix A for a table of occurrences.

At the time the Recovery Plan (1998) was issued, the naturally-occurring populations of *C. californicus* were concentrated in three areas: (1) Santa Barbara Canyon area in the Cuyama Valley in Santa Barbara County, (2) Carrizo Plain National Monument in San Luis Obispo County, and (3) Kreyenhagen Hills in Fresno County. The Fresno County and San Luis Obispo County sites are under mostly public ownership. All known occurrences are depicted in Figure 1.

**Abundance:** See Table 1 for monitoring data (total plants observed) from the Santa Barbara Canyon, Cuyama Valley, Carrizo Plain National Monument, and Kreyenhagen Hills populations. These data represent the only populations that are monitored with any regularity.

**Habitat or Ecosystem:** Extant populations of *C. californicus* occur in Nonnative Grasslands, Upper Sonoran Subshrub Scrub, and Cismontane Juniper Woodland and Scrub communities (E. Cypher, unpubl. data 1994). Herbaceous cover has been dense at most *C. californicus* sites studied in 1993

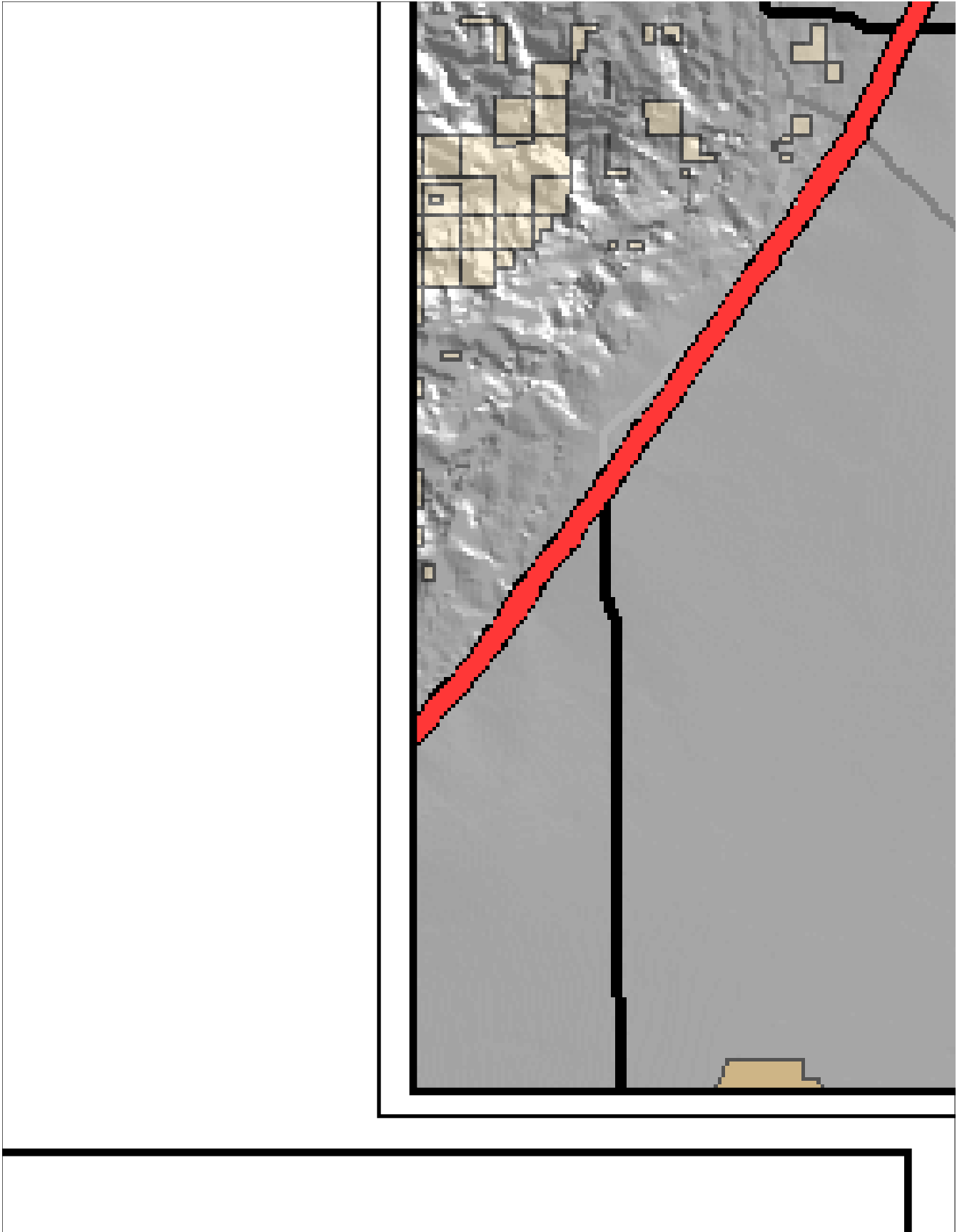


Table 1. Total numbers of individual *Caulanthus californicus* observed in the Carrizo Plain, Cuyama Valley, Kreyenhagen Hills, and Santa Barbara Canyon populations, 1986–2012.

Year	Carrizo Plain	Cuyama Valley	Kreyenhagen Hills	Santa Barbara Canyon
1986				600
1991	200		1,672	
1992	700	80	62	
1993	7,742		272	
1994			1,459	
1999			11	
2000			65	
2003	8,748		68	
2007			0	
2008			31	
2009	150		0	
2010	331	158	86	450
2011	4	43	3	131
2012		0	0	

(Cypher 1994). Native plant species, such as *Vulpia microstachys* (annual fescue), *Trifolium* spp. (clovers), *Calandrinia ciliate* (red maids), and *Lasthenia californica* (goldfields) comprised a high proportion of the vegetation at many of the known locations over several years. The exotic grass red brome (*Bromus madritensis* ssp. *rubens*) was a significant component of the vegetation only at the Carrizo Plain sites (Taylor and Davilla 1986, Cypher 1994). Buck (1993) lists *C. californicus* as occurring on flats, gentle slopes, and generally in non-alkaline grassland, and open-juniper woodland at elevations ranging from 70 to 1000 m (230 to 3280 feet). *Caulanthus californicus* is known to occur on non-saline sandy soils (Taylor and Davilla 1986).

Changes in Taxonomic Classification or Nomenclature: *Caulanthus californicus* was first placed in the genus *Stanfordia*, which was described solely to accommodate this species. Greene (as cited in Taylor and Davilla 1986) placed most of the current species of *Caulanthus* in the genus *Streptanthus* in 1891, however, Payson (1922) published the currently accepted scientific name for California jewelflower, *Caulanthus californicus*.

Species-specific Research and/or Grant-supported Activities: Dr. Suzan Mazer and Beth Hendrickson conducted species specific research which explored the relationship of plant size and reproduction, floral characteristics and reproductive output, factors affecting seed number per fruit, general reproductive patterns, greenhouse pollination studies, and other variables affecting the ecology and reproductive biology of *C. californicus* (Mazer and Hendrickson 1993). However, by cutting the seed coat with a razor to expose the embryo (an event that would occur in nature only after abrasion to the seed coat occurred as a result of changes in temperature and humidity) and adding gibberellic acid Mazer and Hendrickson (1993) were able to force up to 52 percent of the seeds to germinate under greenhouse conditions.

A more recent greenhouse propagation of *C. californicus* found the plants did not do well under experimental conditions. The plants survived for about the first year or so in boxes filled with expanded shale, but later they developed depauperate (stunted or poorly developed) forms and fungal problems. Curators hypothesized *C. californicus* likes heat, low humidity, sterile conditions and restricted watering. Seed germination was poor when planted after about January 1<sup>st</sup>, in contrast to the wild, where germination seems largely opportunistic with the right conditions of rain or disturbance. In 2011 only a few seeds germinated (30 were sown), and seed set was poor (only about 40 seeds) (H. Forbes, pers. comm. 2011).

## **Five-Factor Analysis**

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

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

At the time of listing the primary threats to *C. californicus* were the ongoing and threatened destruction and adverse modification of habitat due to agricultural land conversion and urbanization on the San Joaquin Valley floor (Service 1990). Non-urbanized or non-converted lands, which largely occurred in the neighboring foothills and valleys, were subject to livestock grazing, oil and gas exploration and development, off-road vehicle use, and mining (Service 1990). These threats continue to adversely affect *C. californicus*. Additionally, the proposed siting of solar power facilities in *C. californicus* habitat is an emerging threat that has the potential to adversely affect the species as discussed below. Approximately 10 of the presumed extant occurrences of *C. californicus* are entirely on private land (CDFG 2012) and are not known to be protected, 18 are entirely on public lands, 3 are split on private and public lands, 2 are on lands with unknown ownership, and 1 occurrence is on Center for Natural Lands Management land.

#### Habitat Conversion

The Central Valley Project (CVP) is the largest surface water storage and delivery system in California, with a geographic scope covering 35 of the State's 58 counties. The project includes: 22 reservoirs, with a combined storage capacity of approximately 13.56 teraliters (11 million acre-feet); 8 power plants and 2 pump-generating plants, with a combined generation capacity of approximately 2 million kilowatts; 2 pumping plants; and approximately 805 kilometers (500 miles) of major canals and aqueducts. The CVP supplies water to more than 250 long-term water contractors in the Central Valley, Santa Clara Valley, and eastern San Francisco Bay Area. Agricultural conversions and related operations either directly or indirectly facilitated by the CVP include: conversion of native habitats to agricultural fields; conversion of land use to more water intensive purposes; disposal of agricultural drain water; application of pesticides; and other mowing and harvesting operations. Agricultural conversion and related operations have contributed to the loss and degradation of several habitat types, including grasslands and alkali scrub associated with declines of multiple listed species (Service 1998).

At the time of listing, 96 percent of the native habitat, including *C. californicus* habitat, in the San Joaquin Valley, had been modified to accommodate agriculture and urbanization (Service 1990). Natural lands continue to be converted to agricultural and urban uses. A net loss of some 2,266 hectares

(5,601 acres) of natural lands, with 800 hectares (1,978 acres) lost in the Friant Division and 1,466 hectares (3,623 acres) lost south of the Delta has been reported between 1993 and 2000 (U.S. Bureau of Reclamation 2005).

### Mining

At the time of listing, mining presented a threat to *C. californicus* (Service 1990). On the Carrizo Plain National Monument (Monument), only valid leases, claims and other rights that existed as of the date of the Proclamation, January 17, 2001, may see mineral development on federal lands within the Monument (BLM 2010). However, because these are federally-owned lands, proposed land use activities are reviewed under the National Environmental Protection Act (NEPA) as well as the Endangered Species Act. These reviews provide an opportunity to avoid or minimize adverse effects to *C. californicus*. In the Monument approximately 53,189 hectares (131,434 acres) of mineral rights are privately owned (BLM 2010), including 12,140 hectares (30,000 acres) of privately-held subsurface mineral rights in the center of the monument (BLM 2010). Approximately 53 percent of the mineral estate within the Monument is privately owned; if agency approval is required for mineral development on privately owned minerals, the proposal would be subject to environmental review under the California Environmental Quality Act (CEQA) and/or NEPA, the Act, and applicable state, county, and local laws and ordinances (BLM 2010). The establishment of the Monument was subject to valid existing mineral rights. Accordingly, only those valid leases, claims, and other rights that existed as of the date of the Proclamation, January 17, 2001, may see mineral development on Federal lands within the Monument (BLM 2010).

### Oil and Gas Exploration and Development

At the time of listing, oil and gas exploration and development presented a threat to *C. californicus* (Service 1990). Adverse effects of oil and gas development on *C. californicus* include the loss of habitat, changes in habitat quality, destruction of individuals or populations and their seed bank, habitat fragmentation, and increased competition from nonnative plant species due to habitat degradation.

Exploration and development activities may still occur both on existing Federal leases and on private leases. Seismic exploration, road building, drilling new wells and re-working old wells, laying pipelines, and other activities may occur. The BLM received a request from a private mineral owner in March 2008 to conduct seismic operations on the Carrizo Plain National Monument valley floor (BLM 2010). Additionally, according to a 2001 programmatic biological opinion for oil and gas extraction on BLM property, *C. californicus* populations are flagged and fenced as protection against encroachment. No more than 3 percent of a population or occurrence may be destroyed or the amount of habitat lost must be cumulatively less than 3 percent of the occupied habitat for the impacted population. However, populations of fewer than 50 individuals that are considered “waifs, or an incidental biologically marginal occurrence” may be destroyed (Service 2001).

### Off-road Vehicle Use

At the time of listing, off-road vehicle use presented a threat to *C. californicus* (Service 1990). Off road vehicle use has been reported as a minor threat potentially affecting 7 occurrences on the Carrizo Plain National Monument where no off-road motorized or mechanized travel is legally permitted (BLM 2010). The threat of off road vehicle recreation use on private lands and other public lands where *C. californicus* persists is unknown.



### Solar Power Development

At the time of listing, solar power development did not present a threat to *C. californicus*. Solar power development projects pose potential threats to and may impact large amounts of habitat. These projects can destroy, fragment, or impact *C. californicus* habitat by: altering landscape topography, vegetation, and drainage patterns; and reducing habitat quality through interception of solar energy normally reaching the ground surface, affecting ambient air temperatures through habitat shading, and altering soil moisture regimes (Smith 1984; Smith *et al.* 1987 as cited in J.R. Single 2010). Moreover, recently proposed solar projects tend to be large contiguous blocks of disturbance in undeveloped habitat lands, ranging from hundreds to several thousand acres.

### Conservation Measures

Prior to listing, The Nature Conservancy (TNC) purchased 33,184 hectares (82,000 acres) on the Carrizo Plains. The BLM received funding from Congress to acquire 9,307 hectares (23,000 acres) in 1988 and another 11,533 (28,500 acres) in 1989. The California Wildlife Conservation Board purchased 1,214 hectares (3,000 acres) from TNC in December 1988 and 1,011 hectares (2,500 acres) in 1989 to be managed by the California Department of Fish and Wildlife (CDFW) (formerly CDFG). Currently, the Carrizo Plain National Monument (formerly the Carrizo Plain Natural Area) contains over 80,937 hectares (200,000 acres) of partially protected natural habitat 53,189 hectares (131,434 acres) are still subject to mineral extraction through privately owned leases). The Monument is jointly managed by the BLM, CDFW and TNC (BLM 2010).

### Summary

The severity and magnitude of each of these threats is difficult to assess. Of the threats recorded in the CNDDDB since the time of listing, land conversion to agricultural use is the most common. However, of the extirpated populations listed in the CNDDDB, 12 were solely due to conversion to agriculture, and 24 were jointly due to conversion to agriculture (grazing included) and urbanization (CDFG 2012). Conversion to agriculture and urbanization near the time of listing were a substantial threat on privately owned lands, the current threat of conversion to agriculture and urbanization is lower as four of six remaining populations exist on public lands. The occurrences on public lands are protected from the direct effects from urbanization and agricultural land conversion, but may still be subject to other threats including oil and gas exploration and development, solar power development, off-road vehicle use on private property and some public lands, and mining for minerals. For an up to date list of occurrences, refer to Appendix 1.

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

At the time of listing, overutilization for commercial, recreational, scientific, or education purposes was not known to be a factor and it does not appear to be a threat at this time.

### **FACTOR C: Disease or Predation**

At the time of listing, disease was not known to be a factor (Service 1990) and it does not appear to be a threat at this time. There is no information that the threat from disease has changed since the species was listed.

At the time of listing, domestic livestock predation was thought to have extirpated colonies of *C. californicus* (Service 1990). On the Carrizo Plain, *C. californicus* is known to occur within and around the precincts or burrows of the endangered giant kangaroo rat (*Dipodomys ingens*). Giant kangaroo rats apparently seek out *C. californicus*, because stems of this species were clipped with equal frequency both on precincts (circular areas with a concentration of giant kangaroo rat burrows) and in interspaces of giant kangaroo rat burrows; however, directed research exploring interactions of plant and animal species in the community should be completed (Cypher 1994).

Domestic livestock consumption of *C. californicus* is considered a type of predation. Domestic livestock grazing has been used to reduce grass and forb competitors in endangered plant habitats; however, the use of domestic livestock grazing to benefit native plant species has had mixed results (Vesk and Westoby 2001; Floyd *et al.* 2003; Kimball and Schiffman 2003). Direct effects from cattle grazing are reported to be detrimental because cattle seek out and show preference for eating the plant (Service 1998). The habitat of *C. californicus* in Fresno County is grazed after the dispersal of its seeds in late spring and prior to the new growth of its basal rosettes in late winter. *Caulanthus californicus* colonies in the Carrizo Plain National Monument are fenced and excluded from grazing by cattle (L. Saslaw, BLM, pers. comm. 2011). Currently, there are no known cattle or sheep grazing on private lands in the Monument (K. Sharum, BLM, pers. comm. 2011). The Kreyenhagen Hills populations have greatly declined since the early 1990s, and this may be due to livestock grazing suppression. The BLM is considering reinstating the original grazing regime (R. O'Dell, BLM, pers. comm. 2011). The current grazing regime for the Kreyenhagen allotment is 85 public animal unit months beginning on January 1<sup>st</sup> and ending February 28<sup>th</sup> (BLM 2013).

In summary, grazing occupied habitats may be beneficial to *C. californicus* but associated predation consumption also poses some degree of threat. Insufficient data are available on loss of the plant to domestic herbivores, rodent predation and the trampling and soil compaction associated with livestock grazing to evaluate the degree of threat posed by predation. Disease is not known to currently threaten any occurrences.

#### **FACTOR D: Inadequacy of Existing Regulatory Mechanisms**

At the time of listing, regulatory mechanisms thought to provide some degree of protection for *C. californicus* included: (1) the California Native Plant Protection Act; (2) the California Environmental Quality Act and (3) the California Endangered Species Act.

#### **Federal Laws and Regulations**

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 jeopardy, adverse modification of critical habitat, and take of listed wildlife.

Section 7 requires the Service to make a jeopardy determination 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 wildlife associated with a project.

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the “take” of federally endangered wildlife; however, the take prohibition does not apply to plants. Instead, plants are protected from harm in two particular circumstances. Section 9 prohibits (1) the removal and reduction to possession (i.e., collection) of endangered plants from lands under Federal jurisdiction, and (2) the removal, cutting, digging, damage, or destruction of endangered plants on any other area in knowing violation of a state law or regulation or in the course of any violation of a state criminal trespass law. Federally listed plants may be incidentally protected if they co-occur with federally listed wildlife species and are protected in all instances under the jeopardy standard of section 7(a)(2).

National Environmental Policy Act (NEPA): 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 usually provide some protection for listed species. However, NEPA does not require that adverse impacts be fully mitigated, only that impacts be assessed and the analysis disclosed to the public.

#### California State Laws and Regulations

California Environmental Quality Act (CEQA): 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.

California Endangered Species Act (CESA): In January, 1987, *C. californicus* was listed as endangered under California Endangered Species Act (CESA) (California Fish and Game Code, section 2080 *et seq.*). The CESA requires State agencies to consult with CDFW on activities that may affect a State-listed species and mitigate for any adverse impacts to the species or its habitat. Pursuant to CESA, it is unlawful to import or export, take, possess, purchase, or sell any species or part or product of any species listed as endangered or threatened. The State may authorize permits for scientific, educational, or management purposes, and to allow take that is incidental to otherwise lawful activities.

Native Plant Protection Act (NPPA): The NPPA (Division 2, Chapter 10, section 1908) prohibits the unauthorized take of State-listed threatened or endangered plant species. With regard to prohibitions of unauthorized take under NPPA, landowners are exempt from this prohibition for plants to be taken in the process of habitat modification. Where landowners have been notified by the State that a rare or endangered plant is growing on their land, the landowners are required to notify the CDFW 10 days in advance of changing land use in order to allow salvage of listed plants.

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

The final listing rule (55 FR 29361) discusses the threat of nonnative grasses to *C. californicus* stating that invasive plants have the ability to alter the fire regime of plant communities and to out-compete or continue to compete with native plant communities. *C. californicus* continues to be adversely affected by these human made factors today. Additionally, the effects of soil nitrification, climate change, loss of pollinators, and loss in genetic diversity are emerging as new threats since the time of listing.

### Competition from Nonnative Grasses

The southern San Joaquin Valley of California, as with much of western North America, has been invaded by nonnative plant species during the past 100 to 200 years. These include the following species: *Bromus rubens* (red brome), *Vulpia myuros* (mouse tail fescue), *Schismus arabicus* (Arabian grass), *Hordeum murinum* ssp. *glaucum* (known locally as foxtail and elsewhere as smooth barley), *Bromus diandrus* (ripgut brome), and *Bromus hordeaceus* (soft chess) (Biswell 1956; Germano *et al.* 2001). Individual invasive species could modify ecosystem properties (Gordon 1998). Exotic grasses are established widely and constitute a substantial threat to the survival of many native plants (Schierenbeck 1995 as cited in Germano *et al.* 2001).

Ryan O'Dell (BLM botanist) has been monitoring (conducting plant counts) at most of the *C. californicus* populations the past few years. The Kreyenhagen Hills populations have greatly declined. This may be due to livestock grazing suppression. The grazing regime within the area of the populations was modified shortly after the populations were discovered based on an assumption that cattle grazing was impacting the species. However, the BLM is considering re-instating the original grazing regime to reduce competition from nonnative grasses (R. Dell, BLM pers. comm., 2011).

### Competition from Nonnative Plant Species Due to Fire Retardant Application

Another threat to California jewelflower is invasion and competition from nonnative plant species; this threat could be exacerbated by the application of fire retardant, which can act as a nutrient source for nonnative invasives. California jewelflower habitat includes slightly alkaline sandy loams; the low nitrogen levels of these soil conditions are unfavorable for nonnative, which in turn provides a competitive advantage to species, such as the jewelflower, which have adapted to the nutrient-poor environment. Nitrogen and phosphorus could be increased in the soil through the application of ammonium-based retardants. Increases in nutrients to the soil might encourage the growth of nonnative invasive species and give them a competitive advantage over California jewelflower. While fire retardant could enhance nonnative plants, it could also enhance California jewelflower growth. However, individual and plant community responses from changes in nutrient availability are complex and site specific, and most studies address the potential effects to crop species. In addition, studies on the potential benefits to native plant species from nutrients in fire retardants are limited, and no such studies exist that focus on California jewelflower.

### Nitrogen Deposition

Nitrification of soil was not considered a threat at the time of listing *C. californicus*, but should currently be considered a threat. There is little information regarding *C. californicus* and soil nitrogen levels in which it occurs (B. Delgado, BLM pers. comm. 2011), however some adverse soil conditions (low nutrients, low water holding capacity) exert stress on plant species and can reduce competition,

particularly for species that are not tolerant of the soil stress factors (R. O'Dell pers. comm. 2011). Human activities have increased nitrogen availability throughout terrestrial systems (Suding *et al.* 2005). Three major producers of nitrogen emissions are transportation, agricultural production, and industrial activities including electricity production (Spiegel 2003). Research has documented that local plant species diversity, especially diversity dependent upon soils low in nitrogen, generally declines in response to nutrient enrichment and that rare species are often extirpated because of soil fertilization (Fenn *et al.* 2003). Fenn *et al.* (2003) found that nitrogen deposition levels as low as 3 to 8 kg per ha per year may influence grassland habitats such as those in which *C. californicus* occurs. Nitrogen enrichment and effects to mycorrhizal fungi and diversity may explain the lack of success in re-establishing *C. californicus*; however, these effects in regard to this species are unstudied.

### Pollinators

At the time of listing, the declines in the pollinators of all descriptions were not considered a threat to *C. californicus*. Since that time, the reduction to the population of the non-native honeybee (*Apis mellifera*), often referred to as colony collapse disorder, has been well documented. For example, in 2007 testimony before a subcommittee before the Congressional Committee on Agriculture, U.S. Department of Agriculture scientists and academic researchers described reduction in abundance of honeybees; between 1947 and 2005, colony numbers declined by over 40 percent from almost 6 million to less than 2.5 million (United States 2007).

The non-native honeybee has been observed visiting the flowers of *C. californicus* (R. Lewis pers. comm in Service 1998), but its contribution to pollination is unknown. Native insects may pollinate the *C. californicus*, however a reduction in their abundance has been observed as well (United States 2007). While there is no single known cause for the decline in pollinators, it is known that Malathion is highly toxic to bees (National Pesticide Information Center 2012). Malathion, a broad spectrum insecticide, is increasingly used to kill agricultural pests and mosquitoes, which are documented as vectors of the West Nile Virus. Its application therefore, is not limited to agricultural areas but includes residential and commercial zones thereby increasing the regional areas in which it is used. The increased use of this chemical agent may result in a further reduction of the native and non-native pollinators of *C. californicus*. Additionally, the amount of pesticides applied in the counties where *C. californicus* occurs has increased in recent years according to recent records compiled and released to the public (California Department of Pesticide Regulation 2011). In Fresno County, pesticide use increased from 24,792,033 pounds in 2001 to 27,818,431 pounds in 2009, in Santa Barbara County from 325,257 pounds in 2001 to 3,732,765 pounds in 2009, and in San Luis Obispo County from 684,894 pounds in 2001 to 2,229,885 pounds in 2009 (California Department of Pesticide Regulation 2011).

### Genetic Diversity

Loss of genetic diversity was not considered a threat at the time of listing *C. californicus*. However, considering the reduction of the range of the *C. californicus* and fragmentation of habitat, lack of cross pollination between populations of the remaining localities may be a future threat. This may result in the loss of genetic diversity, which may reduce the adaptability of the plant to current and future environmental conditions and also increases the threat of inbreeding depression. Loss of genetic diversity and adaptability is likely to reduce the long-term survival of plant species (Huenneke 1991).

### Climate Change

Climate change was not considered a threat to *C. californicus* at the time of listing; however, climate change is a potential threat to the species. Projected California temperature rise estimates range from an increase of 1.7° Celcius to 5.8° Celcius (3.0° Fahrenheit to 10.4° Fahrenheit) for years 2000 - 2100 (Cayan *et al.* 2006). Climate change has the potential to alter the timing and synchronicity of ecosystem processes. The interactions between flower production and insect availability for pollination may be altered (Field *et al.* 1999; Cayan *et al.* 2006). Changes in temperature and precipitation likely will alter the structure, composition, and productivity of vegetation communities and wildfire may become more frequent and intense (Lenihan *et al.* 2006). While climate change will likely have broad reaching effects, there is insufficient data available at this time to predict the specific effects of climate change on *C. californicus*.

In summary, the threats attributable to Factor E are competition from nonnative grasses, declines in pollinators, loss of genetic diversity, and the emerging landscape level threats from landscape nitrification and climate change. The imminence of these threats to *C. californicus* is not well understood; however, due to the landscape level of disturbance, effects likely to result from nonnative grasses, nitrification, and climate change should be considered large in magnitude.

### **III. RECOVERY CRITERIA**

Recovery plans provide guidance to the Service, 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.

The Endangered Species Act section 4(a)(1) lists factors for re-classification (i.e., downlisting) or delisting that are to be in recovery plans. These five factors are as follows.

- A. The present or threatened destruction, modification, or curtailment of the species' habitat or range;
- B. Over-utilization for commercial, recreational, scientific or educational purposes;
- C. Disease or predation;
- D. The inadequacy of existing regulatory mechanisms;
- E. Other natural or man-made factors affecting its continued existence.

The *Recovery Plan for Upland Species of the San Joaquin Valley* (Recovery Plan) addresses the recovery goals for 34 plants and animals that occur in the San Joaquin Valley of California including *C. californicus*. The down listing and delisting criteria in the Recovery Plan are presented in tabular form.

Table 4 (page 180) of the Recovery Plan presents the “Generalized Recovery Criteria for Federally-Listed Plants and Animals.” Table 2 summarizes information pertinent to *C. californicus* from that table and applies factors A, C, E to the *generalized* criteria and whether or not they have been achieved.

Table 5 in the Recovery Plan (page 184) presents “Site-Specific Protection Requirements to Meet Delisting Criteria for the Six Federally-Listed Plant and Five Federally-Listed Animal Species”. Table 3 in this document summarizes information pertinent to *C. californicus* reproduced from that Table and applies relevant factors (A, C, E) to the *site-specific* criteria and whether or not they have been achieved.

Four of the five listing factors are relevant to this species. Factor B “overutilization for commercial, recreational, scientific, or educational purposes” was not known to be a factor in the 1990 final rule listing document. Factor B threats do not appear to be adversely affecting the *C. californicus* at this time. The following discussion includes factors A, C, D, and E.

#### Downlisting

*Caulanthus californicus* may be recommended for downlisting with the completion of the following criteria (Service 1998):

1. *Secure and protect specified recovery areas from incompatible uses on ninety-five percent of occupied habitat on public lands; 75 percent of population and occupied habitat in Santa Barbara Canyon.*

Is Criterion Still Valid: Yes.

Listing Factors Addressed: A, C, D, E.

Has Criterion Been Met: No. This criterion has been partially met. Only one known management plan for public lands exists which provides protection for *C. californicus* at this time, of the 34 known extant occurrences (CDFG 2012), 12 or 35 percent are within the Carrizo Plain National Monument Resource Management Plan (Carrizo Plain National Monument RMP) boundaries.

2. *Management Plan approved and implemented for recovery areas that include survival of the species as an objective for all protected areas identified as important to continued survival.*

Is Criterion Still Valid: Yes.

Listing Factors Addressed: A, C, D, E.

Has Criterion Been Met: No. This criterion has been partially met through the Carrizo Plain National Monument RMP.

Table 2. Generalized Recovery Criteria for *Caulanthus californicus* and Status of Generalized Recovery Criteria (From page 180 of the Recovery Plan)

Recovery Step	Secure and protect specified recovery areas from incompatible uses	Management Plan approved and implemented for the recovery areas that included survival of the species as an objective	Population monitoring in specified recovery areas shows:	Recovery Criteria Achieved (Yes/No)	Listing Factors Addressed	Management Plan approved and implemented for the recovery areas that included survival of the species as an objective	Population monitoring in specified recovery areas shows:
Downlist to threatened	Ninety-five percent of occupied habitat on public lands; 75 percent of population and occupied habitat in Santa Barbara Canyon	For all protected areas identified as important to continued survival	Stable or increasing populations through precipitation cycle	No	A, C, E	For all protected areas identified as important to continued survival	Stable or increasing populations through precipitation cycle
Delist	Ninety percent of population and occupied habitat in Santa Barbara Canyon; one population each on the San Joaquin Valley floor and eastern Valley foothills	For all protected areas identified as important to continued survival	No decline after down listing, if declining, determine cause and reverse trend	No	A, C, E	For all protected areas identified as important to continued survival	No decline after down listing, if declining, determine cause and reverse trend



Table 3. Site-Specific Protection Requirements to Meet Delisting Criteria for *Caulanthus californicus* (From page 184 of Recovery Plan).

Site Name	County	Ownership	Protection Level	Listing Factors Addressed	Recovery Criteria Achieved (Yes/No)
Carrizo Plain	San Luis Obispo	BLM/CDFG/ The Nature Conservancy	95 percent of occupied habitat	A, C, E	No
Kreyenhagen Hills	Fresno	BLM	95 percent of occupied habitat	A, C, E	No
San Joaquin Valley 1. valley floor 2. eastern foothills	Any	Any	260 hectares (640 acres) for valley floor and 260 hectares (640 acres) for eastern foothills	A, C, E	No
Santa Barbara Canyon	Santa Barbara	BLM/private	90 percent of plants and occupied habitat	A, C, E	No

3. *Population monitoring for specified recovery areas shows that the populations are stable or increasing through the normal precipitation cycle.*

Is Criterion Still Valid: Yes.

Listing Factors Addressed: A, E.

Has Criterion Been Met: No.

#### IV. SYNTHESIS

When *C. californicus* was listed as endangered 1990 (55 FR 29361), it was known from 3 localized areas, and is currently presumed extant at these three occurrences. Currently 34 occurrences are presumed to be extant (CDFG 2012). Of the occurrences now described as “presumed extant”, there are 19 occurrences entirely on public and Center for Natural Land Management land, 3 occurrences that are on both BLM lands and private lands and 2 occurrences that are unknown. The remaining 10 occur entirely on private land. The occurrences on public lands are protected from the direct effects from urbanization and agricultural land conversion, but may still be subject to other threats including oil and gas exploration and development, competition with nonnative grasses, loss of genetic diversity, solar power development and emerging threats from landscape nitrification and climate change. Approximately 29 percent of the presumed extant occurrence of *C. californicus* are on private land (CDFG 2012) and are not known to be protected.

Surveys for *C. californicus* are not consistently performed throughout its range, and a majority of occurrences have not been surveyed for over 15 years. Currently, the CNDDDB indicates that of the 34 occurrences listed as “presumed extant,” 26 occurrences have not been updated in 15 years. Eight occurrences have been updated during the last 15 years (CDFG 2012). Thus, reliable values for population sizes and trends do not exist for the overall distribution of this species.

The past extirpation of *C. californicus* from most of its historical range and the current threats to the species continue to endanger the survival and recovery of *C. californicus*. The threats today include uncontrolled grazing, oil and gas exploration and development, off road vehicle recreational use and inadequate regulatory mechanisms. Climate change, nitrification of soil, and solar energy development have been identified as potential new threats.

The *C. californicus* populations on the Carrizo Plain National Monument have a management plan implemented that will help to achieve the recovery plan's criteria through constraints on grazing and utilization and implementation of annual monitoring (BLM 2010). The Bakersfield Resource Management Plan Draft Environmental Impact Statement addresses these recovery goals in areas of Cuyama Valley and Santa Barbara Canyon through certain land use objectives which protect *C. californicus* (L. Saslaw, BLM, pers. comm. 2011). Other goals in the recovery plan have not been achieved, and in some instances, not initiated, including range-wide annual population monitoring and protection of plants on private land in Santa Barbara Canyon through fee title acquisition or conservation easements.

When *C. californicus* was listed as endangered in 1990 (55 FR 29361), the major threats to the species included agricultural land conversion and urbanization, overgrazing, and competition with nonnative, annual grasses.

In summary, based on the continuing threats to *C. californicus* from habitat conversion, oil and gas exploration and development, potential solar power development, potential subsurface mineral extraction, loss of pollinators, competition with nonnative grasses, potentially increased risks in areas of fire retardant application; and the lack of current information regarding current species trends or status we conclude that the species continues to meet the Endangered Species Act definition of endangered of extinction throughout a significant portion of its range. No status change is recommended 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*
- No Change

**New Recovery Priority Number and Brief Rationale:** N/A.

## **VI. RECOMMENDATIONS FOR ACTIONS OVER THE NEXT 5 YEARS**

1. Protection of extant populations and reintroductions as described in the 1998 Recovery Plan should be completed. Management on public lands should include provisions for suitable levels of sheep and cattle grazing. Protection of colonies on private lands or those to be re-established on private lands could result from partnering with landowners or offering conservation easements.
2. Regular yearly surveys utilizing a standardized methodology should be conducted over the next five years at the Santa Barbara Canyon area in the Cuyama Valley in Santa Barbara County, at the Carrizo Plain National Monument in San Luis Obispo County, and at the Kreyenhagen Hills in Fresno County so that the determination of what constitutes a sustainable population can be defined and environmental variables affecting abundance, such as precipitation and temperature, can be monitored.
3. Successful re-establishment of populations will require an adequate understanding of the biology of the species and a robust seed collection. Studies should be conducted that advance the understanding of the species' propagation requirements, knowledge of the physical and chemical elements of the soil required for successful re-establishment, the presence and role of mutualistic soil fungi, the species and role of pollinators, genetics, and seed dispersal mechanisms. Seeds should be collected from each of the three sites and banked at an appropriate depository.
4. Threats such as loss and degradation of habitat should be eliminated, reduced, or ameliorated. The potential for habitat degradation due to nitrogen deposition and threats to pollinators from regional pesticide use should be analyzed and appropriate measures to ameliorate these threats should be implemented.

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### **VIII. Personal Communication**

Simpson, Lloyd. 2013. Email from Dr. Lloyd Simpson to Christopher Diel on June 26, 2013 regarding two *Caulanthus californicus* populations introduced in the Los Padres National Forest in 1995

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

*Caulanthus californicus* (California jewelflower)

**Current Classification:** Endangered

**Recommendation Resulting from the 5-Year Review:**

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

**Review Conducted By:** Hunter Kunkel, Sacramento Fish and Wildlife Office

**Date Submitted to Region 8:** \_\_\_\_\_

**FIELD OFFICE APPROVAL:**

**Lead Field Supervisor, U.S. Fish and Wildlife Service, Sacramento Office**

Approve Ray C. Mond Date 8/7/2013



## Appendix A:

### Areas historically and/or currently occupied by *Caulanthus californicus*; prepared for 5-year review, 2013.

CNDDDB #	County	Presence	Record Last Updated	Land Ownership	Year Last Surveyed (# Observed)*
1	Tulare	Extirpated	2005	Private	
4	Tulare/Kern	Extirpated	2005	Private	
9	Fresno	Extirpated	1991	Private/Unknown	
14	Kern	Extirpated	1991	Unknown	
16	Kern	Extirpated	1995	Private	
17	Kern	Extirpated	1996	Private	
19	San Luis Obispo/Kern	Extirpated	2005	Private	
30	Kern	Extirpated	2005	Private	
32	Santa Barbara	Extirpated	2009	Private	
35	Kern	Extirpated	2005	Private	
36	Fresno	Extirpated	2005	Private/USFS	
38	Fresno	Extirpated	2005	Unknown	
40	San Luis Obispo	Extirpated	1989	Private	
41	Kern	Extirpated	2005	Private	
42	Tulare	Extirpated	1989	Private	
43	Kern	Extirpated	2009	Unknown	
52	San Luis Obispo	Extirpated	1993	Unknown	
57	Santa Barbara	Failed Introduction	1995	USFS	1994 (5)
58	Santa Barbara	Failed Introduction	1995	USFS	1994 (3)
3	Tulare	Possibly Extirpated	1997	CNLM	
5	Kings	Possibly Extirpated	1991	Private	
6	Kings/Kern	Possibly Extirpated	1991	Private/BLM	
7	Fresno	Possibly Extirpated	1993	Private	
8	Fresno	Possibly Extirpated	2005	Private	
10	Fresno	Possibly Extirpated	1997	Private	
15	Kern	Possibly Extirpated	2009	Private	
18	Kern	Possibly Extirpated	1991	Private	

<b>CNDDDB #</b>	<b>County</b>	<b>Presence</b>	<b>Record Last Updated</b>	<b>Land Ownership</b>	<b>Year Last Surveyed (# Observed)*</b>
20	Kern	Possibly Extirpated	1996	Private	
28	San Luis Obispo	Possibly Extirpated	1991	Private	
37	Fresno	Possibly Extirpated	2005	Private	
39	Kern	Possibly Extirpated	1995	Unknown	
22	Santa Barbara	Presumed Extant	1995	Private	1991 (50,000+)
31	Kern	Presumed Extant	1989	CNLM	1986 (13)
44	San Luis Obispo	Presumed Extant	1995	Private/BLM	1991 (1200)
45	San Luis Obispo	Presumed Extant	2005	BLM	1991 (978)
49	San Luis Obispo	Presumed Extant	1995	BLM	
50	San Luis Obispo	Presumed Extant	1995	Private	1991 (136)
51	San Luis Obispo	Presumed Extant	1996	Private	1991 (76)
53	Fresno	Presumed Extant	1995	BLM	1992 (50-100)
54	Fresno	Presumed Extant	1995	BLM	1993 (197)
55	Fresno	Presumed Extant	1995	BLM	1993 (225)
56	Santa Barbara	Presumed Extant	1995	Private	1991 (12,000+)
59	Santa Barbara	Presumed Extant	2005	Private/BLM	1991 (6400)
60	Santa Barbara	Presumed Extant	1995	BLM	1991 (240)
61	San Luis Obispo	Presumed Extant	1995	Private	1992 (9)
62	San Luis Obispo	Presumed Extant	1995	Private	1992 (173)
63	San Luis Obispo	Presumed Extant	1995	BLM	1991 (29)
64	San Luis Obispo	Presumed Extant	1995	BLM	
65	San Luis Obispo	Presumed Extant	1995	BLM	
67	San Luis Obispo	Presumed Extant	1995	BLM	1993 (494)
68	San Luis Obispo	Presumed Extant	1995	Private	1991 (1)
69	San Luis Obispo	Presumed Extant	1995	BLM	1992 (166)

<b>CNDDDB #</b>	<b>County</b>	<b>Presence</b>	<b>Record Last Updated</b>	<b>Land Ownership</b>	<b>Year Last Surveyed (# Observed)*</b>
70	San Luis Obispo	Presumed Extant	1995	Private	1992 (178)
71	San Luis Obispo	Presumed Extant	1995	Private	1992 (114)
72	San Luis Obispo	Presumed Extant	1995	BLM/Private	1992 (113)
73	San Luis Obispo	Presumed Extant	1995	Private	1991 (73)
74	San Luis Obispo	Presumed Extant	1998	BLM	1995 (156)
75	San Luis Obispo	Presumed Extant	1998	BLM	1995 (380)
76	San Luis Obispo	Presumed Extant	1998	BLM	1995 (74)
77	San Luis Obispo	Presumed Extant	1998	BLM	1995 (350)
78	Kings	Presumed Extant	2005	Unknown	
79	Santa Barbara	Presumed Extant	2005	Unknown	

**CNDDDB #** = occurrence number assigned by the California Natural Diversity Database (CNDDDB 2012)

BLM = U.S. Bureau of Land Management

CNLM = Center for Natural Lands Management

USFS = U.S. Forest Service

\*Consistent abundance data are not available