

*Brodiaea pallida*  
(Chinese Camp Brodiaea)

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



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

**June 2012**

## **5-YEAR REVIEW**

### *Brodiaea pallida* (Chinese Camp Brodiaea)

#### **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:** *Brodiaea pallida* is an erect, herbaceous perennial plant belonging to the Themidaceae (false onion family). It is known from three populations along limited stretches of intermittent streams in the western Sierra Nevada foothills of northern Tuolumne and southern Calaveras counties in California. This plant species was first discovered in the Town of Chinese Camp in Tuolumne County, and the two other populations are located near the Town of Copperopolis on Sawmill Creek and Black Creek, and on Littlejohns Creek in Calaveras County.

*Brodiaea pallida* grows from underground corms to a height of 10 to 30 centimeters (4 to 12 inches), and has long, narrow, succulent leaves and umbrella-like clusters of lilac or purple flowers. *Brodiaea pallida* grows in overflow channels, seeps, and springs in clays that may be derived from serpentine soils (Safford et al. 2005; Service 2008; California Natural Diversity Database (CNDDB) 2011).

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

This review was prepared by the Sacramento Fish and Wildlife Office, following the Region 8 guidance issued in March 2008. We used information from the December 2007 5-year status review approved on January 10, 2008 (Service 2008), recent biological opinions, reports, and information in our files or obtained from interviews with individuals involved in surveys or research of this plant, survey information from experts who have been monitoring various localities of this species, and the CNDDB maintained by the California Department of Fish and Game. We received no information on this species from the public in response to our Federal Notice initiating this 5-year review that requested information on this species' status. This 5-year review contains updated information on the species' biology and threats, and an assessment

of that information compared to that known at the time of listing or since the last 5-year review. We focus on current threats to the species that are 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, Region 8, Pacific Southwest; (916) 414-6464.

**Lead Field Office:** Josh Hull, Recovery Division Chief; Sacramento Fish and Wildlife Office; (916) 414-6600.

**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 May 25, 2011 (Service 2011). We received no information regarding this species.

**Listing History:**

**Original Listing**

**FR Notice:** 63 FR 49022 (Service 1998)

**Date of Final Listing Rule:** September 14, 1998

**Entity Listed:** *Brodiaea pallida*, a plant species

**Classification:** Threatened

**State Listing**

*Brodiaea pallida* (Chinese Camp brodiaea) was listed by the State of California as endangered in November 1978.

**Associated rulemakings:** None

**Review History:** A 5-year review was conducted for *Brodiaea pallida* dated December 2007 and approved on January 10, 2008 (Service 2008), at which time no change in the species status was recommended.

**Species' Recovery Priority Number at start of review:** The recovery priority for *Brodiaea pallida* is 2C according to the Service's 2011 Recovery Data Call for the Sacramento Fish and Wildlife Office based on a 1-18 ranking system where 1 is the highest-ranked recovery priority and 18 is the lowest (Endangered and Threatened 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 threats and has a high potential for recovery. The "C" indicates conflict with construction or other development projects or other forms of economic activity.

**Recovery Plan or Outline:** No recovery plan or outline has been completed for this species.

## 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 of any species of vertebrate wildlife. This definition of species under the Act limits listing as distinct population segments (DPS) to species of vertebrate fish and 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

*Brodiaea pallida* is an erect, herbaceous perennial plant belonging to the Themidaceae (false onion family). This species grows from underground corms to a height of 10 to 30 centimeters (4 to 12 inches). It has long, narrow, succulent leaves and umbrella-like clusters of lilac or purple flowers. While all *Brodiaea* can form offsets or daughter corms; *B. pallida* forms these in large numbers (Northfork Associates 2000). Daughter corms are the primary reproductive units of *B. pallida* (Hoover 1938; R. Ornduff, University of California, Berkeley, California, *in litt.* 1989; F. Hrusa, California Department of Food and Agriculture, pers. comm. 2000) and are identical genetically to the main (parent) corm.

As perennial plants, *Brodiaea pallida* individuals persist from year to year. The corms, which are located approximately 2 to 5 centimeters (0.8 to 2.0 inches) below the soil surface (Niehaus 1971), produce new growth in favorable years. The leaves appear first, sometimes as early as September (Hoover 1938; Niehaus 1971), but grow slowly until the rainy season. The plants are usually mature by February or March, then begin to wither. The flower stalk begins growing in January and grows slowly for approximately two months. By March, the buds have developed and the flower stalk elongates. However, the flowers do not open until late May or early June, and flowering lasts only 2 to 3 weeks. The seeds are mature by late summer (Hoover 1939, Niehaus 1971) but probably are not dispersed until the capsule ruptures in the autumn, which is typical of other Californian *Brodiaea* species (Schmidt 1980). The rate of deposition and duration of the seeds’ viability in the soil is unknown. However, it is likely that the majority of seeds produced in the capsules are dispersed nearby and as such would be expected to be scattered among the standing plants at any given occurrence. Conditions conducive to triggering natural germination are also unknown. The above-ground parts (leaves, stems, and flowers) die back after flowering and the corm becomes dormant for the rest of the summer (Hoover 1939, Niehaus 1971; Keator 1990). Production of the above-ground parts uses up all of the stored food in the old corm, so a new one forms during the spring months (Niehaus 1971).

The populations of species in the genus *Brodiaea* are stable and do not substantially fluctuate in terms of numbers of individuals or geographic distribution (R. Preston, ICF Jones & Stokes, *in*

*litt.* 2008). *Brodiaea* reproduces both by seed and clonally, by the production of offsets. The seeds are large and do not disperse far from the parent plants. Therefore the rate of dispersal is very low. In addition, members of this genus are closely associated with, or even restricted to certain soil types (Preston, *in litt.* 2008). The geographic spread of populations is limited to the distribution of specific soil types. The population of *B. pallida* on Sawmill Creek does not appear to have spread upstream of its current location since its discovery in 2000 (Preston, *in litt.* 2008).

### Pollination and Pollinators

Members of the genus *Brodiaea* are self-incompatible and cannot sexually reproduce without the aid of insect pollinators (Niehaus 1971; Preston 2011). Therefore, cross-pollination is essential for the survival and recovery of *B. pallida*. A variety of insects are known to cross-pollinate *Brodiaea*, including native bees (Krombein and Hurd; 1979; Michener 2000) and tumbling flower beetles (Preston 2011). Bell and Rey (1991) report several species of native bees were observed pollinating the related endangered *B. filifolia* (thread-leaved brodiaea) in southern California including the California bumblebee, and leaf cutting and anthophorid bees.

Of primary concern to the conservation of *Brodiaea pallida* are solitary bees such as mason bees in the genera *Hoplitis* and *Osmia* because these pollinators have the most specific habitat requirements, such as nest sites, and they are impacted by habitat fragmentation and reduced diversity of natural habitats at a small scale (Gathmann and Tschardt 2002; Steffan-Dewenter 2003). Due to the focused foraging habits of solitary bees, they may be the most important for the successful reproduction of *B. pallida*. Ground-nesting solitary bees appear to have limited dispersal and flight abilities (Thorp and Leong 1995). Studies have shown that as an area becomes fragmented by development, the remaining habitat areas have reduced pollinator diversity (Steffan-Dewenter 2003). Bumblebees, such as the ground-nesting California bumblebee, also may be important to the pollination of *B. pallida*, and these insects are able to travel greater distances and cross fragmented landscapes to pollinate this threatened plant. However, because of their more general pollinating habits, the visits to the listed plant and focused effort of bumblebees may be less frequent than ground-nesting bees.

### Spatial Distribution

At the time of listing, *Brodiaea pallida* was known from only from the Town of Chinese Camp. However, in the spring of 2000 it was discovered on Sawmill Creek and Black Creek in Calaveras County. At the time of the last 5-year review we stated that the Tuolumne County and the more recently discovered Calaveras County occurrences were still extant, although the former has been fragmented before listing by construction that occurred around 1982 (CNDDDB 2006). *Brodiaea pallida* grows along a reach of the stream no more than 1.2 kilometers (0.75 mile) long and does not extend more than 9 meters (30 feet) out from the center of the streambed (P. Stone, Sierra Foothills Chapter of the California Native Plant Society, pers. comm. 2001). In 2005, a third small population was observed on Littlejohns Creek and the identification was verified as *B. pallida* in 2010 (CNDDDB 2011).

In Calaveras County, *Brodiaea pallida* grows in the channels of two converging intermittent streams, Sawmill Creek and Black Creek, in the watershed of the Stanislaus River above the Tullock Reservoir. *Brodiaea pallida* occurs for a total distance of approximately 4.8 kilometers (3 miles) along the two streams.

### Abundance

At the last 5-year review in 2008, *Brodiaea pallida* was known from two populations one in Tuolumne County and one in Calaveras County approximately 24 kilometers (15 miles) north of the originally reported Tuolumne County occurrence (Hrusa, pers. comm. 2000; CNDDDB 2006). Currently, *B. pallida* is known from three populations. Two of the populations occur in southern Calaveras County, near Copperopolis California; the other population occurs near Chinese Camp in northern Tuolumne County.

*Brodiaea pallida* is found within a narrow band along Black Creek and Sawmill Creek delineated by a fringe of meadow (ICF Jones & Stokes 2009). At these two creeks, the highest densities of the plant were present where rock outcrops or gravel bars were present. Individuals were present in the meadow areas, but at low densities. Both of these waterways are intermittent streams; some reaches of the channels were dry during surveys for this species that were conducted on June 3, 2008, and others were ponded with emergent tule marsh. According to ICF Jones & Stokes (2009), few *B. pallida* were present along the channel where tule marsh was present. High moisture levels could cause the corms of the *B. pallida* to rot, killing plants.

The Tuolumne County population of *Brodiaea pallida* grows along a reach of the stream that is no more than 1.2 kilometers (0.75 mile) long and does not extend more than about 9.1 meters (30 feet) out from the center of the streambed (Stone, pers. comm. 2001). At this location, it has been fragmented by construction that occurred around 1982 (CNDDDB 2011). The population was characterized as increasing in 1994 (CNDDDB 2006), stable in 1999 (California Department of Fish and Game 2001), and was not characterized as of 2005 (California Department of Fish and Game 2005). The site was estimated to contain about 5,000 individuals in 1991, the most recent year for which a full count is available (CNDDDB 2011). During annual censuses in a small portion of the population conducted over the years between 1992 and 2001, numbers have fluctuated from approximately 600 to 1,500 plants (Stone, pers. comm. 2001). The Sierra Foothills Chapter of the California Native Plant Society leases approximately one-fourth of the occupied habitat in Chinese Camp in Tuolumne County (Stone, pers. comm. 2001).

The trend of the Calaveras County populations are not well known because the population size for the Sawmill/Black Creek population has been estimated twice and the Littlejohns Creek area has been estimated only once. In 2000, the Sawmill/Black Creek population contained between 5,000 and 10,000 individuals (Hrusa, pers. comm. 2000). The Sawmill Creek/Black Creek population of *B. pallida* was censused in June 2008 over a distance of about 4.4 kilometers (2.7 miles) by counting flowering stalks. The population may have occurred further downstream, but the census was terminated at that point due to terrain that became difficult to navigate (ICF Jones & Stokes 2009). Individual stalks were counted for isolated plants and small groups of plants (up to 30 individuals); for groups of plants larger than 30 individuals, the number of flowering stalks was based on a visual estimate. An estimated 12,250 to 18,376 individuals were counted (ICF Jones & Stokes 2009).

The population at Littlejohns Creek contains approximately 100 individuals (CNDDDB 2011).

### Habitat or Ecosystem

At the time of our last 5-year review we stated that the Calaveras County population occurred on grayish clay derived from nonserpentine rock (Northfork Associates 2000; CNDDDB 2006). This species is restricted to rocky seasonal intermittently wet creek beds (Tuolumne County 1982; Northfork Associates 2000; Service 1998, 2008). The hydrology of the areas where *Brodiaea pallida* grows is rainfall dependent (Preston, *in litt.* 2008). It has been reported that this species grows on soils derived from serpentine rock (Niehaus 1971, 1977; Keator 1993; Tibor 2001; CNDDDB 2011). However, the serpentine soils where the population in the Town of Chinese Camp is located are interspersed with other soils of volcanic origin, and this species may grow only on the nonserpentine soils (Stone, pers. comm. 2001). Some botanists (Niehaus 1977; Stone, pers. comm. 2001) have described the soil at this site as reddish, but Rogers (1990) observed that the plant was growing only on gray or blackish clay and not on the nearby reddish clay. At this time no analysis has been conducted of this species' soil associations. At Black Creek and Sawmill Creek, the soil is clayey, but gray in color and derived from Jurassic metasedimentary parent materials (Northfork Associates 2000; CNDDDB 2011). Although the soil chemical composition at Black Creek and Sawmill Creek is not known, the parent material rocks are not ultrabasic. Preston (2011) mentions that the population along Sawmill Creek in Calaveras County occurs in blue oak-foothill pine woodland on outcrops of amphibolite schist within the stream channel and along the banks.

### Genetics

*Brodiaea pallida* reproduces asexually by corms, which are short, thick underground stems surrounded by the dry bases of leaves. In addition to the main corm, smaller corms called daughter corms are produced throughout the life of the plant via vegetative reproduction (Niehaus 1971). Daughter corms are the primary reproductive units of *B. pallida* (Ornduff, *in litt.* 1989; Hrusa, pers. comm. 2000) and are presumably genetically identical to the main (parent) corm (Ornduff, *in litt.* 1989). *Brodiaea pallida* vegetatively forms large numbers of daughter corms (Hoover 1939; Hrusa, *in litt.* 2001). Vegetative reproduction is the formation of additional plants from structures other than seeds, such as bulbs or corms. Vegetative reproduction results in offspring genetically identical to the parent, unlike sexual reproduction from seed. However, because of the prevalence of vegetative, or asexual, reproduction and because no genetic analysis has been conducted, the number of genetically unique individuals in the three populations is unknown.

### Taxonomy

There have been no species-level taxonomic or nomenclatural changes since the last 5-year review.

### Species-specific Research and/or Grant-supported Activities

There have been no species specific or grant-supported activities since the last 5-year review.

## 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 Habitat or Range**

At the time of listing in 1998 and at the time of the last 5-year review, *Brodiaea pallida* had been impacted by and faced future impacts from residential development (Service 1998, 2008). Currently, *B. pallida* is still threatened by development. Additionally, *B. pallida* is potentially threatened by alteration of site hydrology as a result of development. Development projects upslope and adjacent to *B. pallida* populations may dewater the site. Conversely, water runoff from nearby developments may inundate *B. pallida* occurrences with excessive amounts of water, depositing silt, and drowning plants.

Residential development outside of the populations themselves could indirectly affect the habitat for *B. pallida* in both counties by modifying stream contours during the construction of roads (Hrusa, pers. comm. 2000; Stone, pers. comm. 2001) or firebreaks (CNDDDB 2006), and by altering hydrology in adjacent streams. For example, lawn runoff (Niehaus 1977; Tuolumne County Planning Department 1982; Cox 1983) or damming of a stream (Hrusa, pers. comm. 2000) could lead to perennially wet conditions and prevent required drying of the soils supporting *B. pallida*. Moisture during the summer months causes the corm to rot (Tuolumne County Planning Department 1982). The likelihood of trampling and other incidental destruction by people also increases when houses are built in proximity to streams.

The Oak Canyon Ranch Development Project near the communities of Copperopolis and Copper Cove in Calaveras County was permitted in 2011. It is a mixed use residential resort development that will at full build out in 25 years have 2,275 single family residential units and a mixed use village center on 1,301 hectares (3,215 acres) in Calaveras County, California. Two school sites and other public services including a post office, parks, and libraries are planned. Construction of an internal road system will provide controlled and uncontrolled access to residential and resort areas and links to State Route 4 and Little John Road. There are 607 hectares (1,500 acres) planned for open space along the creek corridors and around wetlands. Some of the open space areas may be developed into orchard or vineyards. Additionally, vineyards and orchards could be planted by homeowners on their properties.

The resort will consist of a maximum of about 27,871 square meters (300,000 square feet) of retail commercial space and include hotel/motel, conference centers, office, restaurant, and residential facilities. A maximum of 1,200 units will be constructed to provide lodging for permanent and transient occupancy. Additionally, construction of two golf courses next to Littlejohns Creek will be part of the resort development.

There are no *Brodiaea pallida* located within the Oak Creek Canyon project. However, the largest population of *B. pallida* is located about 168 meters (550 feet) to the south. Indirect effects likely may affect the population of this species located downstream on Sawmill Creek and Black Creek by: (1) altering water flows, especially the initiation of summer flows



converting seasonal creeks into perennial creeks; (2) having erosion in the creek beds by changing hydrology which could eliminate habitat for the plant; (3) changing the habitat from riparian communities consisting of low lying herbaceous species to woody species that could outcompete or eliminate *B. pallida*; and (4) introducing fertilizers, herbicides, and pesticides that can have adverse effects to its ground-nesting pollinators and to *B. pallida*.

A number of conservation measures will be implemented by the developer to avoid and minimize potential effects on *Brodiaea pallida* including: preparing and implementing an Erosion Control Plan for construction activities and a Storm Water Pollution Prevention Plan; monitoring flow and water quality; and monitoring vegetation including *B. pallida*. The project is phased to allow for baseline monitoring in order to be able to detect changes from implementing the project and take measures. Potential measures could include delaying the next phase of the construction, limiting further construction east of Littlejohns Road through phasing measures, reduction in the amount of impervious surfaces, and reduction of size and/or relocation of remaining lots.

Adjacent to the southeast boundary of the permitted Oak Canyon Ranch project is the proposed Black Creek Ranch development. This project contains the population of *Brodiaea pallida* that is growing on Sawmill Creek and Black Creek that is directly downstream of Sawmill Creek on Oak Canyon Ranch. A residential development is being proposed for Black Creek Ranch that will consist of homes, roads, and associated infrastructure. The project proponent has indicated portions of the area containing the *B. pallida* may be protected, however, the plans for the site are in their preliminary stages.

There are several other projects proposed in the Copperopolis area that likely will affect *Brodiaea pallida*, including Copper Valley Ranch, Sawmill Lake Specific Plan, Vineyard Estates, and the extension of Copper Cove Drive. These projects are earlier on in the planning process (Service Files).

In Tuolumne County, in 2008, Richard Sinclair put forward the Sinclair Ranch project which proposed to develop 93 hectares (230 acres) of the Chinese Camp area into 242 lots, 250 additional multi-family units, and 225 senior housing units. There was no public water or wastewater available, and the project never moved forward. Instead the parcel has been subdivided into 4 smaller parcels. However, to our knowledge, there is nothing to preclude development of this property in the future.

Additionally, in Tuolumne County, a proposed project that would involve the construction of approximately 50 single-family homes, 300 vacation ownership condominiums, a 120 room hotel, 20 affordable housing units, a 557.4 square meter (6,000 square foot) visitors' center, 6 kilometers (3.7 miles) of recreational trails, and an 18-hole championship golf course could adversely impact suitable habitat for *Brodiaea pallida*. The proposed project also includes 101 hectares (249 acres) of preserved open space. Proposed open space is interspersed throughout the project site, primarily in steeper areas and along drainages. Currently, Tuolumne County is working toward developing a draft Environmental Impact Report prepared for this project.

The three populations of *Brodiaea pallida* are located on private property. The Sierra Foothills Chapter of the California Native Plant Society leases approximately one-fourth of the occupied habitat in Chinese Camp in Tuolumne County (Stone, pers. comm. 2001). As of 2010, the Sierra Foothills Chapter of the California Native Plant Society was still leasing land to protect *B. pallida* (California Native Plant Society 2011). The remaining habitat for this species in all known occurrences is unprotected and vulnerable to development impacts.

Although an additional population has been identified since issuance of the last five-year review, it is limited in geographic extent and occurs on private lands where there are no provisions for its protection and management in perpetuity. Currently, residential development is in various stages of planning for all properties.

In summary, the magnitude and imminence of actual, identifiable development threats to *Brodiaea pallida* appear to be moderate to high. Only a small part of the Tuolumne County site receives some level of protection through a temporary lease by an environmental organization, and residential development for another part of the site has been planned in the past and is not precluded for the future. The Calaveras County populations are being designated and considered for residential development. Although the potential for development at both the Tuolumne and Calaveras sites appears high, there are no immediate plans for construction within the next couple of years.

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

At the time of issuance of the most recent 5-year review (Service 2008), we determined this factor was not applicable to *Brodiaea pallida*. We are not aware of any new information that would indicate overutilization for commercial, recreational, scientific, or educational purposes threaten *B. pallida*.

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

In the final listing rule as well as in the last 5-year review, we noted there was no evidence whether grazing is beneficial or detrimental to *Brodiaea pallida* (Service 1998, 2008). The effects on plants from livestock grazing are highly variable and dependent on many factors, including but not limited to the type of livestock, timing, intensity, and duration of livestock use. Additionally, all of the information we had at the time of listing regarding beneficial and adverse livestock grazing effects was anecdotal. We have no current information on the existence or extent of grazing impacts to the species or its habitat in Tuolumne County. Moderate cattle grazing was observed at the largest known occurrence in Calaveras County. No adverse effects of grazing on *B. pallida* was noted (ICF Jones & Stokes 2009).

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

### **State Laws and Regulations**

The State's authority to conserve rare wildlife and plants is comprised of four major pieces of legislation: the California Endangered Species Act, the Native Plant Protection Act, the California Environmental Quality Act, and the Natural Community Conservation Planning Act.

California Endangered Species Act (CESA) and Native Plant Protection Act (NPPA): The CESA (California Fish and Game Code, section 2080 *et seq.*) prohibits the unauthorized take of State-listed threatened or endangered species. The NPPA (Division 2, Chapter 10, section 1908) prohibits the unauthorized take of State-listed rare or endangered plant species. The CESA requires State agencies to consult with the California Department of Fish and Game 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. *Brodiaea pallida* is State listed as endangered.

Furthermore, 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 California Department of Fish and Game 10 days in advance of changing land use in order to allow salvage of listed plants. Salvage of *Brodiaea pallida* is unlikely to be successful.

California Environmental Quality Act (CEQA): The CEQA requires review of any project that is undertaken, funded, or permitted by the State or a local governmental agency. If significant effects are identified, the lead agency has the option of requiring mitigation through changes in the project or to decide that overriding considerations make mitigation infeasible (CEQA section 21002). Protection of listed species through CEQA is, therefore, dependent upon the discretion of the lead agency involved.

Natural Community Conservation Planning Act: The Natural Community Conservation Program is a cooperative effort to protect regional habitats and species. The program helps identify and provide for area wide protection of plants, animals, and their habitats while allowing compatible and appropriate economic activity. Many Natural Community Conservation Plans (NCCPs) are developed in conjunction with Habitat Conservation Plans (HCPs) prepared pursuant to the Federal 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 take. Since listing, the Service has analyzed the potential effects of Federal projects under section 7(a)(2), which requires Federal agencies to consult with the Service prior to authorizing, funding, or carrying out activities that may affect

listed species. A jeopardy determination is made for a project that is reasonably expected, either directly or indirectly, to appreciably reduce the likelihood of both the survival and recovery of a listed species in the wild by reducing its reproduction, numbers, or distribution (50 CFR 402.02). A non-jeopardy opinion may include reasonable and prudent measures that minimize the amount or extent of incidental take of listed species associated with a project.

Section 9 prohibits the taking of any federally listed endangered or threatened species. Section 3(18) defines “take” to mean “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. Service regulations (50 CFR 17.3) define “harm” to include significant habitat modification or degradation which actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering. Harassment is defined by the Service as an intentional or negligent action that creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. The Act provides for civil and criminal penalties for the unlawful taking of listed species. Incidental take refers to taking of listed species that results from, but is not the purpose of, carrying out an otherwise lawful activity by a Federal agency or applicant (50 CFR 402.02). For projects without a Federal nexus that would likely result in incidental take of listed species, the Service may issue incidental take permits to non-Federal applicants pursuant to section 10(a)(1)(B). To qualify for an incidental take permit, applicants must develop, fund, and implement a Service-approved Habitat Conservation Plan (HCP) that details measures to minimize and mitigate the project’s adverse impacts to listed species. Regional HCPs in some areas now provide an additional layer of regulatory protection for covered species, and many of these HCPs are coordinated with California’s related Natural Community Conservation Planning program.

With regard to federally listed plant species, section 7(a)(2) requires Federal agencies to consult with the Service to ensure any project they fund, authorize, or carry out does not jeopardize a listed plant species. 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.

Clean Water Act: Under section 404, the U.S. Army Corps of Engineers (Corps or USACE) regulates the discharge of fill material into waters of the United States, which include navigable and isolated waters, headwaters, and adjacent wetlands (33 U.S.C. 1344). In general, the term “wetland” refers to areas meeting the Corps’ criteria of hydric soils, hydrology (either sufficient annual flooding or water on the soil surface), and hydrophytic vegetation (plants specifically adapted for growing in wetlands). Any action with the potential to impact waters of the United States must be reviewed under the Clean Water Act, National Environmental Policy Act, and Endangered Species Act. These reviews require consideration of impacts to listed species and their habitats, and recommendations for mitigation of significant impacts.

The Corps interprets “the waters of the United States” expansively to include not only traditional navigable waters and wetlands, but also other defined waters that are adjacent or hydrologically connected to traditional navigable waters. However, recent Supreme Court rulings have called into question this definition. On June 19, 2006, the U.S. Supreme Court vacated two district court judgments that upheld this interpretation as it applied to two cases involving “isolated” wetlands. Currently, Corps regulatory oversight of such wetlands (e.g., vernal pools) is in doubt because of their “isolated” nature. In response to the Supreme Court decision, the Corps and the U.S. Environmental Protection Agency (USEPA) have recently released a memorandum providing guidelines for determining jurisdiction under the Clean Water Act. The guidelines provide for a case-by-case determination of a “significant nexus” standard that may protect some, but not all, isolated wetland habitat (USEPA and USACE 2007). The overall effect of the new permit guidelines on loss of isolated wetlands, such as intermittent streams, is not known at this time.

Nationwide permit No. 26, under section 404 of the Clean Water Act, was established by the U.S. Army Corps of Engineers (Corps) to facilitate issuance of permits for discharge of fill into wetlands. Under the regulations at the time of listing, these nationwide permits could be issued for fill of up to 1.2 hectare (3 acres) of wetlands. For wetland fill of less than 0.13 hectare (0.33 acre) only an after-the-fact report was required to be submitted to the Corps. Thus for *Brodiaea pallida*, which sometimes occupies wetlands less than 0.13 hectare (0.33 acre) in size, the *post facto* reporting was considered inadequate to prevent extirpation of the species. In 2000; however, Nationwide Permit No. 26 expired and new replacement Nationwide Permits were issued. Nationwide permit No. 29 covers residential developments and Nationwide permit No. 39 covers commercial and institutional developments (USACE 2008).

In summary, the Endangered Species Act is the primary Federal law that provides protection for this species since its listing as threatened in 1998. Other Federal and State regulatory mechanisms provide discretionary protections for the species based on current management direction, but do not guarantee protection for the species absent its status under the Act. Therefore, we continue to believe other laws and regulations have limited ability to protect the species in absence of listing under the Endangered Species Act.

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

At the time issuance of the last 5-year review, we noted that there had been no significant change since listing due to the imminence of this threat factor as it relates to the small population size of *Brodiaea pallida*. To our knowledge, there still has been little change in this threat as it relates to small population size. We have, however, identified impacts to pollinators, competition with nonnative vegetation, nitrogen deposition, and global climate change as additional threats to *B. pallida* since the last 5-year review

##### Small Population Size and Potential Lack of Genetic Variability

There has been no significant change since listing to the imminence of this threat factor as it relates to the small population size of *Brodiaea pallida*. As discussed in the final listing rule and

the last 5-year review, small population size increases the susceptibility of a population to extirpation from random demographic, environmental, and/or genetic events (Service 1998). The conservation biology literature commonly notes the vulnerability of taxa known from one or very few locations and/or from small populations (e.g., Shaffer 1981, 1987; Primack 1998; Groom et al. 2006). In particular, small population size makes it difficult for this species to persist while sustaining the impacts of various environmental disturbances, as discussed below. The combination of only two populations, small range, and restricted habitat still renders *B. pallida* highly susceptible to extinction from a significant portion of its range due to random events such as flood, drought, disease, or other factors. We have no information on the long-term regeneration potential of underground corms after such an environmental disturbance.

Another concern is the possible lack of genetic diversity in the two *Brodiaea pallida* populations due to the species' tendency toward vegetative reproduction (Ornduff, *in litt.* 1989). Even though thousands of stems have been observed at each site, they may represent only a few genotypes (Hrusa, pers. comm. 2000). A genotype is the specific genetic makeup of an individual, as opposed to its outward appearance, in this case as indicated by stems or corms. If only a few genotypes are represented, random events such as flood, drought, or a disease outbreak could eliminate the majority of individuals and genetic variation within a population (Groom et al. 2006). The preponderance of vegetative reproduction in *B. pallida* may limit the opportunities for production of new genotypes, and the great physical distance (about 24 kilometers [15 miles]) between the two known populations likely precludes the opportunity for natural transfer of pollen, seeds, or corms between them.

#### Nitrogen Deposition and Nonnative Vegetation

Currently, deposition of nitrogen from air pollution emitted from a variety of sources including vehicles and power plants is a significant threat to native habitats in California (Huennneke et al. 1990; Inouye and Tilman 1995; Brooks 2003; Weiss 1999, 2006; Tonnesen et al. 2007). Changes in plant and microbial communities resulting from increased amounts of the airborne deposition of this chemical have been documented to cause cascading negative effects on ecosystem processes and the species that depend upon the native plant community. Increased nitrogen deposition initially causes ecological perturbations by altering microbial and plant communities. One of the primary adverse effects is the enhancement of environmental conditions for the invasion of non-native weeds, which outcompete native plants (Padgett et al. 1999; Allen et al. 2005), particularly star thistle and non-native grasses such as rip-gut brome. These invasive exotic plants “choke out” native plants through extensive proliferation, and significantly reduce the available area for colonization of native plant species and ground-nesting pollinators. Weeds also grow so densely that *Brodiaea pallida* may not easily be found by its pollinators. Nitrogen deposition also affects the natural fire cycle because of greater fuel loads caused by the excess growth of non-native grasses and weeds (D'Antonio and Vitousek 1992). Nonnative vegetation occurs in at least two of the populations (ICF Jones & Stokes 2009; CNDDDB 2011).

### Impacts to Pollinators

A number of the native bee species that pollinate *Brodiaea pallida* could be adversely affected by insecticides and other pesticides associated with the Oak Canyon Ranch or other developments. A number of the solitary, semi-solitary, or colonial bees that pollinate this plant make their nests in the ground, and they could be vulnerable to toxic chemical agents that are the result of runoff from the proposed project. Their ground nests also could be adversely affected by increased seasonal flows, especially summer flows that could flood out the animals, thus eliminating or preventing these insects from inhabiting the area.

### Global Climate Change

The global average temperature has risen by approximately 0.6 degrees Celsius (1 degree Fahrenheit) during the 20th Century (Intergovernmental Panel on Climate Change [IPCC] 2001, 2007; Adger et al. 2007). There is an international scientific consensus that most of the warming observed has been caused by human activities (IPCC 2001, 2007; Adger et al. 2007), and that it is “very likely” that it is largely due to manmade emissions of carbon dioxide and other greenhouse gases (Adger et al. 2007). Ongoing climate change (Inkley et al. 2004; Kerr 2007; Adger et al. 2007; Kanter 2007) likely imperils *Brodiaea pallida* and the resources necessary for its survival. Since climate change threatens to disrupt annual weather patterns, it may result in a loss of its habitat and/or increased numbers of its predators, parasites, and diseases. Where populations are isolated, a changing climate may result in local extinction, with range shifts precluded by lack of habitat, or in the case of plants the inability to disperse at a rate equal to the change in environmental conditions.

### **III. RECOVERY CRITERIA**

No draft or final recovery plan has been published for this species.

### **IV. SYNTHESIS**

The primary threats to *Brodiaea pallida* that led to the listing of the species as threatened in 1998 continue. They are the potential destruction and modification of habitat and the threat to small populations from catastrophic events and possible lack of genetic diversity. Although a third population has been discovered since listing, the three extant populations are limited in extent and occur on private lands where no provisions for protection in perpetuity have been made. Currently none of the three populations occur on lands managed strictly for the protection of *B. pallida*, and residential development is in various stages of planning at locations for all populations. We also lack monitoring data for *B. pallida*. Although small population size remains a serious factor, we determine the current status of a species by carefully weighing all threats to its survival and recovery. In this case, the potential for residential development was noted at the time of listing and at the time of the last 5-year review and continues to be of concern. Development plans in this species’ habitat constitute a potentially high magnitude of threat, but we do not consider that threat to be imminent.

Therefore, based on past and threatened destruction or modification of its habitat, the inadequacy

of existing regulatory mechanisms, and other natural or manmade factors related to small population size that affect its continued existence, we conclude that *Brodiaea pallida* continues to meet the definition of threatened (likely to become endangered in the foreseeable future throughout all or a significant portion of its range).

## 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:** No change needed.

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

1. Work with private landowners to determine the entire extent of the extant populations and monitor the status and trends of *Brodiaea pallida* in order to estimate current population sizes (i.e., number of above-ground stems), the number and distribution of populations, and whether the species is stable, increasing, or declining.
2. *Seed collection and accession.* Collect mature seed during a minimum of two years from the Sawmill Creek and Black Creek population (and if possible from the Littlejohns Creek population). Collect seed from no more than 5 percent of plants at each population in each year and store in at least two locations approved by the Service in the event that the population(s) fails. Eventually reach a goal of 1,000 stored seeds. Seed storage locations should be affiliates of the Center for Plant Conservation.

Collection of seed shall be conducted in a manner that will not significantly harm the reproductive potential of the population for that year and shall be made in a manner that captures the majority of the genetic variation found in the sampled population. Different genotypes or seed from different occurrences shall not be intermingled during collection or storage activities.

3. Continue surveying for *Brodiaea pallida* in suitable habitats on substrates other than serpentine to determine if additional populations exist.



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

***Brodiaea pallida* (Chinese Camp Brodiaea)**

**Current Classification:** Threatened

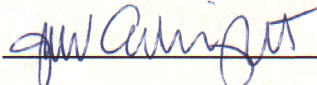
**Recommendation resulting from the 5-Year Review:**

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

**Review Conducted By:** Kirsten Tarp, Sacramento Fish and Wildlife Office

**FIELD OFFICE APPROVAL FOR REGION 8:**

**Lead Field Supervisor, Fish and Wildlife Service**

Approve  Date 20 June 2012