

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

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

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

**December 2007**

**5-YEAR REVIEW**  
**Chinese Camp Brodiaea (*Brodiaea pallida*)**

**I. GENERAL INFORMATION**

**I.A. Methodology used to complete the review:** This review was conducted by staff of the Sacramento Fish and Wildlife Office, U.S. Fish and Wildlife Service (Service), based on peer-reviewed journal articles, California Natural Diversity Database information, personal communications with California Department of Fish and Game and Bureau of Land Management personnel, our log database that tracks Endangered Species Act (ESA) section 7 consultations and other projects, and our files.

**I.B. Contacts**

**Lead Regional or Headquarters Office** – Diane Elam, Deputy Division Chief for Listing, Recovery, and Habitat Conservation Planning, and Jenness McBride, Fish and Wildlife Biologist, Region 8 (California and Nevada), 916-414-6464

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**I.C. Background**

**I.C.1. Federal Register (FR) Notice citation announcing initiation of this review:**

On July 7, 2005, we announced initiation of the 5-year review for *Brodiaea pallida* and asked for information from the public regarding the species' status (FR 70 39327). We published a second notice announcing the 5-year review and extending the request for information on November 3, 2005 (70 FR 66842). We received no response to these requests for information.

**I.C.2. Listing history**

Original Listing

FR notice: 63 FR 49022

Date listed: September 14, 1998

Entity listed: Species – Chinese Camp brodiaea (*Brodiaea pallida*)

Classification: Threatened

**I.C.3. Associated rulemakings:** None

**I.C.4. Review History:** No status reviews have been conducted since the species was listed in 1998.

**I.C.5. Species' Recovery Priority Number at start of review:** The recovery priority is 2C (based on a 1-18 ranking system where 1 is the highest recovery priority and 18 is the lowest), reflecting conflict with construction or other development projects, a high degree of threat, a high potential for recovery, and a taxonomic rank of full species.

**I.C.6. Recovery Plan or Outline**

No draft or final recovery plan has been published for this species. We intend to include it in the *Draft Recovery Plan for Fifteen Plants from Southern Sierra Foothills, California*, which is in development at the Sacramento Fish and Wildlife Office.

**II. REVIEW ANALYSIS**

Species Overview

*Brodiaea pallida* is an erect, herbaceous perennial plant belonging to the lily family (Liliaceae). It was first discovered at Chinese Camp in Tuolumne County, California. *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 (63 FR 49022). This species is a California endemic limited to two small, known populations along limited stretches of intermittent streams in the Sierra Nevada foothills of Tuolumne and Calaveras Counties (63 FR 49022; California Natural Diversity Database 2006).

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

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

     *Yes*  
  X   *No*

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

**II.B. Recovery Criteria**

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

*Yes*  
 *No*

**II.C. Updated Information and Current Species Status**

**II.C.1. Biology and Habitat**

Abundance and trends

At the time of listing in 1998, *Brodiaea pallida* was known from only one population in Tuolumne County. However, the species' known range was extended in the spring of 2000 when it was discovered in Calaveras County approximately 24 kilometers (15 miles) north of the originally reported Tuolumne County occurrence (F. Hrusa, California Department of Food and Agriculture, pers. comm. 2000; California Natural Diversity Database 2006). Therefore, the known distribution of *B. pallida* currently includes two populations, one each from northern Tuolumne and southern Calaveras counties.

The Tuolumne County population of *Brodiaea pallida* was characterized as increasing in 1994 (California Natural Diversity Database 2006) stable in 1999 (California Department of Fish and Game 2001), and was not characterized as of 2005 in *The status of rare, threatened, and endangered animals and plants of California 2000-2004* (California Department of Fish and Game 2005). The Tuolumne County population was estimated to contain about 5,000 individuals in 1991, the most recent year for which a full count is available (California Natural Diversity Database 2006). During annual censuses in a small portion of that population over the years since 1992, numbers have fluctuated from approximately 600 to 1,500 plants (P. Stone, Sierra Foothills Chapter of the California Native Plant Society, pers. comm. 2001). The trend of the Calaveras County population is unknown because the population size has been estimated only once. In 2000, that population contained between 5,000 and 10,000 individuals (F. Hrusa, pers. comm. 2000).

Distribution

*Status of Brodiaea pallida at time of listing:* In 1998, the entire range of *B. pallida* was an area 3 to 6 meters (10 to 20 feet) wide and 0.8 kilometer (0.5 mile) long along a stretch of an intermittent stream channel at an elevation of 385 meters (1,260 feet) in Tuolumne County. The entire population of *B. pallida* was scattered over an estimated 26 hectares (65 acres) (California Natural Diversity Database 1997), all of which was (and still is) privately owned. Because of the complex nature of *B. pallida* reproduction (spreading via vegetative corms, shoots, and suckers), the number of genetically distinct individuals in the

population was (and still is) unknown. Despite purposeful surveys for this species in other nearby areas, at the time of listing the species had been found only at this site. This species is found in association with and may hybridize with *B. elegans ssp. elegans*.

*Current status:* Both the Tuolumne County and the more recently discovered Calaveras County occurrences are still extant, although the former has been fragmented before listing by non-permitted construction that occurred around 1982 (California Natural Diversity Database 2006). The Tuolumne County occurrence is in the watershed of the Tuolumne River, which has been dammed to create the Don Pedro Reservoir. *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, pers. comm. 2001). Species experts disagree as to the type of soil that supports *Brodiaea pallida* at Chinese Camp in Tuolumne County. Most authors (Niehaus 1971, 1977; Keator 1993; Tibor 2001; California Natural Diversity Database 2006) have reported that this species grows on soils derived from serpentine rock. However, the serpentine soils at Chinese Camp are interspersed with other soils of volcanic origin, and *B. pallida* may grow only on the nonserpentine soils (P. Stone, pers. comm. 2001). Some (Niehaus 1977; P. Stone, pers. comm. 2001) have described the soil as reddish, but Rogers (1990) observed that *B. pallida* 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.

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. Potential habitat for the species extends upstream of this location, but the area has not yet been surveyed (F. Hrusa, pers. comm. 2000; California Natural Diversity Database 2006). The Calaveras County occurrence is on grayish clay derived from nonserpentine rock (Hrusa and Glazner 2000, California Natural Diversity Database 2006). The population at Sawmill and Black Creeks appears healthy (Hrusa and Glazner 2000).

### Genetics

*Brodiaea pallida* reproduces by corms, which are short, thick underground stems surrounded by the dry bases of leaves. In addition to the main corm, smaller corms called cormlets are produced throughout the life of the plant via vegetative reproduction (Niehaus 1971). Cormlets are the primary reproductive units of *B. pallida* (R. Ornduff *in litt.* 1989; F. Hrusa, pers. comm. 2000) and are genetically identical to the main (parent) corm (R. Ornduff *in litt.* 1989). No genetic analysis has been done on individual corms or cormlets. *Brodiaea pallida* vegetatively forms large numbers of cormlets (Hoover 1939; F. 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 two populations is unknown.

### Taxonomy

Although there have been no species-level taxonomic or nomenclatural changes since the listing, there are higher level (family) changes that do not affect the species circumscription (Pires and Sytsma 2002).

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

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

At the time of listing in 1998, the threats to *Brodiaea pallida* had been impacted by and faced future impacts from development (63 FR 49022). Currently, *B. pallida* is still threatened by development.

Both the Tuolumne County and Calaveras County occurrences 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 (P. Stone, pers. comm. 2001). The remaining habitat for this species in both occurrences is unprotected and vulnerable to development impacts.

In Calaveras County, *Brodiaea pallida* grows within the community planning area of the small town of Copperopolis. Copperopolis is designated as a growth zone for Calaveras County. Some lands along Black Creek near Copperopolis is slated to be developed, with the environmental documents being written by 2008 (R. Cull, Sustain Environmental, pers. comm. 2006). The proposed future land use designation for lands including *B. pallida* habitat is single family residential (Copperopolis Community Plan Committee 2005).

In Tuolumne County, much of the occupied habitat of *Brodiaea pallida* at Chinese Camp was owned by a person who planned to open a mobile home park after installing roads and wells on the property. Tuolumne County planning staff required that the occupied *B. pallida* habitat be put under a conservation easement as a condition of development. However, the owner died several years ago and the disposition of the property was still in litigation; as of 2001 the development had not occurred, and our analysis with 2005 NAIP imagery does not appear to show that development occurred (P. Stone, pers. comm. 2001; E. Cypher, California Department of Fish and Game, pers. comm. 2006). However, to our

knowledge, there is nothing to preclude development of this property in the future.

Residential development outside of the occurrences themselves could indirectly affect the habitat for *Brodiaea pallida* in both counties by modifying stream contours during the construction of roads (F. Hrusa, pers. comm. 2000; P. Stone, pers. comm. 2001) or firebreaks (California Natural Diversity Database 2006), and by altering hydrology in adjacent streams. For example, lawn runoff (Tuolumne County Planning Department 1982; Cox 1983; Niehaus 1977) or damming of a stream (F. Hrusa, pers. comm. 2000) could lead to perennially wet conditions and prevent required drying of the soils supporting *Brodiaea 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.

In summary, the magnitude and imminence of actual, identifiable development threats to *Brodiaea pallida* appear to be moderate. 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 site is being designated and considered for residential development in current county planning efforts. 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. The development threats to this species appear more imminent in the Calaveras County site (environmental documentation scheduled for 2008-

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

Overutilization is not currently known to be a factor for *Brodiaea pallida*. As mentioned in the final rule, unrestricted collecting for scientific or horticultural purposes, or excessive visits by individuals interested in seeing rare plants, could result from increased publicity as a result of the listing (63 FR 49022). We have no reason to believe these impacts have increased since listing and do not consider them significant threats to this species.

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

In the final listing rule, we noted there was no evidence whether grazing is beneficial or detrimental to *Brodiaea pallida* (63 FR 49022). We have no current information on the existence or extent of grazing impacts to the species or its habitat in Tuolumne County. Grazing is not occurring at the Calaveras County occurrence. 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 concluded that livestock grazing occurred where many of the four plant species (referring to *Brodiaea pallida* and the other three species in the listing rule) were located, and that we were aware of numerous circumstances where, under a specific set of circumstances, livestock grazing had no or little adverse effect on any of the four plant species.

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

As mentioned in the final listing rule, *Brodiaea pallida* is listed as endangered by the State of California Fish and Game Commission. The California Endangered Species Act requires project proponents to obtain a section 2081(b) permit from the California Department of Fish and Game to take a listed species incidental to otherwise lawful activities, and requires that the impacts of the authorized take be minimized and fully mitigated and all required measures be capable of successful implementation. The Federal Endangered Species Act also has provisions under section 10 that allow private landowners to obtain incidental take permits for federally listed species, including State-listed plants on private lands, if required for compliance with State law. We have no information regarding how development planning in Copperopolis, Calaveras County, will ensure compliance with State and Federal endangered species laws.

*Brodiaea pallida* occurs in seeps, springs, and overflow channels, and along intermittent and perennial streams. Such features may be treated as waters of the United States for regulatory purposes by the U.S. Army Corps of Engineers (Corps) under section 404 of the Clean Water Act. However, the Clean Water Act, alone, does not provide adequate protection for *B. pallida*. Nationwide Permit (NWP) No. 26, which regulated discharge of fill into wetlands, no longer exists. Under current regulations, NWP 26 has been superseded, in part, by NWP No. 39. NWP 39 may be issued for fills up to 0.2 hectare (0.5 acre) instead of 0.6 hectare (3 acres). Although General Condition 11 of the NWP states that no activity is authorized under any NWP that is likely to jeopardize the continued existence of a threatened or endangered species, the after-the-fact nature of the reporting requirement is inadequate to ensure the protection of populations that occur in areas smaller than the 0.04 hectare (0.1 acre) reporting requirement threshold. For *B. pallida*, the reporting requirement may be inadequate to prevent destruction of many individual plants and associated habitats. Additionally, recent court cases (*e.g.*, *Rapinos v. U.S.*, *Carabell v. U.S.*) examine changing the definitions regarding what kinds of wetlands are considered under the Corps' jurisdiction. We do not know whether intermittent streams will continue to be covered by section 404 of the Clean Water Act.



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

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, small population size increases the susceptibility of a population to extirpation from random demographic, environmental, and/or genetic events (63 FR 49022). 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 (R. Ornduff, University of California, Berkeley, California, *in litt.* 1989). Even though thousands of stems have been observed at each site, they may represent only a few genotypes (F. 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.

**II.D. 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. Although a second population has been discovered since listing, the two extant populations are limited in extent and occur on private lands where no provisions for protection in perpetuity have been made. Currently neither of the two populations occurs on lands managed strictly for the protection of *B. pallida*, and residential development is in various stages of planning at locations for both populations. We also lack monitoring data for *B. pallida* and are unable to characterize or predict trends in abundance and distribution for either population.

Overall, threats to *Brodiaea pallida* have not changed since listing. 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 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).

### III. RESULTS

#### III.A. Recommended Classification:

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

III.B. New Recovery Priority Number 2C (no change)

III.C. If a reclassification is recommended, indicate the Listing and Reclassification Priority Number:

Reclassification (from Threatened to Endangered) Priority Number: \_\_\_\_\_

Reclassification (from Endangered to Threatened) Priority Number: \_\_\_\_\_

Delisting (Removal from list regardless of current classification) Priority Number: \_\_\_\_\_

### IV. RECOMMENDATIONS FOR FUTURE ACTIONS

- Complete and publish the draft recovery plan, and approve a final recovery plan.
- 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.

- Work with private landowners to protect the extant occurrences of *Brodiaea pallida* through mechanisms such as conservation easements.
- Survey for *Brodiaea pallida* in suitable habitats on substrates other than serpentine to determine if additional populations exist.

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*In Litteris:*

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

Current Classification Threatened  
Recommendation resulting from the 5-Year Review

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

Appropriate Listing/Reclassification Priority Number, if applicable \_\_\_\_\_

Review Conducted By Sacramento Fish and Wildlife Office

**FIELD OFFICE APPROVAL:**

Lead Field Supervisor, Fish and Wildlife Service

ACTH  
Approve  Date 1-8-08

**REGIONAL OFFICE APPROVAL:**

Lead Regional Director, Fish and Wildlife Service

Approve  Date 1/10/08