

*Chorizanthe pungens* var. *hartwegiana*  
(Ben Lomond Spineflower)

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



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

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## **5-YEAR REVIEW**

### ***Chorizanthe pungens* var. *hartwegiana* (Ben Lomond Spineflower)**

#### **I. GENERAL INFORMATION**

##### **Purpose of 5-year Review:**

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:**

As summarized in the recovery plan for this species, Recovery Plan for Insect and Plant Taxa from the Santa Cruz Mountains in California (Service 1998), *Chorizanthe pungens* var. *hartwegiana* is a small annual herb in the buckwheat family (Polygonaceae). *Chorizanthe pungens* var. *hartwegiana* is found on sandy Zayante soils that are the basis for the Zayante sandhill communities in the Santa Cruz Mountains. *Chorizanthe pungens* var. *hartwegiana* is a short-lived annual species whose seeds germinate in late fall after the first substantial rains. The plants mature through the winter and then bolt and produce branches, flower in April and May, and die soon after seed production in June (McGraw and Levin 1994). The plant's entire distribution is within Santa Cruz County, and populations are located on private lands and within State and County parks. Primary threats to the species are conversion of habitat due to fire exclusion and competition with nonnative species.

**Methodology used to complete the review:** This review was carried out by staff of the Ventura Fish and Wildlife Office. The primary source of much of the information used in this review is The Sandhills Conservation and Management Plan, based on the doctoral work of Jodi McGraw (2004a; 2004b). Other information was collected from the species recovery plan, published and unpublished literature, and personal communications with experts in the field. Due to land ownership patterns and the fragmented nature of the sand parkland habitat containing *Chorizanthe pungens* var. *hartwegiana* populations, information was obtained through personal communication with various private and public entities. This 5-year review contains updated information on the taxon's biology and threats, and a re-assessment of the information in 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.

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**Federal Register (FR) Notice citation announcing initiation of this review:**

The initial FR notice was published on May 25, 2011 (76 FR 30377) and initiated a 60-day request for information. No information was received in response to this request.

**Listing history**

**Original Listing**

**FR notice:** 59 FR 5499

**Date listed:** February 4, 1994

**Entity listed:** Subspecies (*Chorizanthe pungens* var. *hartwegiana*)

**Classification:** Endangered

**Associated rulemakings:** None

**Review History:** The previous 5-year review was published in September 2007. The 5-year review resulted in a recommendation for no change to the listing classification of endangered.

**Species' Recovery Priority Number at start of review:**

The recovery priority number for *Chorizanthe pungens* var. *hartwegiana* is 9, according to the Service's 1998 recovery plan for this species and the previous 5-year review. This number is 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). The Recovery Priority 9 denotes a species that faces a moderate degree of threat and has a high potential for recovery.

**Recovery Plan or Outline**

**Name of plan:** *Recovery Plan for Insect and Plant Taxa from the Santa Cruz Mountains in California*

**Date issued:** September 28, 1998

**Dates of previous revisions:** No revisions have been made.

## 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 listings 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.

### Updated Information on Current Species Status, Biology, and Habitat:

#### Description and Taxonomy:

*Chorizanthe pungens* var. *hartwegiana* is an annual herb in the buckwheat family (Polygonaceae). *Chorizanthe pungens* was first described by George Bentham in 1836 based on a specimen collected in Monterey. This taxon was recognized by George Goodman in 1934 as the type species in describing the *Pungentes* section of the genus. *Chorizanthe pungens* var. *hartwegiana* was distinguished from *C. pungens* var. *pungens* by James Reveal and Clare Hardham (1989) based on a distinction between the coastal form (*C. pungens* var. *pungens*) and an inland form (*C. pungens* var. *hartwegiana*) “in the Ben Lomond sandhills area” (Service 1998). The plants grow up to 2.5 decimeters (10 inches) high and have flower clusters and associated structures (inflorescences) that are pink with small distinct heads (Ertter 1996). Whorls of bracts (involucres) below the flowers are 1.5 - 2.5 millimeters (0.6 - 1.0 inch) long and have pink, scarious (thin and dry) margins. Each flower is surrounded by a spiny bract, which encases the fruit, an achene (McGraw 2004b). The achene contains a single seed, which typically falls from the plant, still encased within the involucre, after development in mid-summer (McGraw 2004b). The tepals (undifferentiated petals and sepals) are irregularly toothed at the tips.

#### Genetics, genetic variation, or trends in genetic variation:

A genetic study of the *Pungentes* complex of the genus *Chorizanthe* was recently completed by Brinegar and Baron (2009). The study suggested that there is a closer phylogenetic relationship between the Santa Cruz mountain varieties of the complex (*Chorizanthe robusta* var. *hartwegii* and *Chorizanthe pungens* var. *hartwegiana*) than with either of the coastal varieties (*Chorizanthe pungens* var. *pungens* and *Chorizanthe robusta* var. *robusta*), and the coastal varieties share a closer phylogenetic relationship with each other than with their mountain varieties. Although Brinegar and Baron suggest taxonomic revisions be considered, no such adjustments have been made based on this information.

The population of *Chorizanthe pungens* var. *hartwegiana* that occurs between Gray Whale Ranch State Park and Bonny Doon Ecological Reserve in Bonny Doon has been noted by experts to be morphologically different from other populations, such as those in San Lorenzo and Scotts Valley, California (McGraw, in litt. 2011; McGraw 2004b). Follow-up work needs to be done regarding this observation to determine if this population is genetically different.

### Species biology and life history:

*Chorizanthe pungens* var. *hartwegiana* seeds germinate in the late fall after the first substantial winter rains (Service 1998). The plants remain small through the winter, then grow quickly and begin producing flowers in April (Service 1998). *Chorizanthe pungens* var. *hartwegiana* can be more erect or decumbent depending on competition for light; if it has to compete for light with other species, it is found to be more erect, and if it does not have to compete, it will be more decumbent (McGraw, in litt. 2011; McGraw 2004b). Plants grown in shady conditions or in a competitive environment may only produce 20 flowers per plant (McGraw 2004b). In comparison, plants that do not have any competition and have access to full sun can produce up to 5,000 flowers per plant (McGraw 2004b). On average, however, the number of flowers per plant is 100, which can be attributed to most plants experiencing some competition from other herbaceous plants (McGraw 2004b). The length of the flowering season may persist for several months if the climatic conditions during the spring and early summer are favorable. The life span of the plant ranges from 15 to 21 weeks, with most of the variability coming during the adult stage (Service 1998). Although no conclusive studies have been done on the pollination biology, it is likely pollinated by a variety of insects, including wasps, bees, flies and ants (McGraw 2004b).

*Chorizanthe pungens* var. *hartwegiana* seed set varies with site conditions; in controlled experiments with plants transplanted into grass, manzanita, and pine sites, seed set varied from none to about 60 seeds per plant (Service 1998). Higher seed set was closely tied to the lack of shading; the highest seed sets and survivals were in unshaded or open pine forests and the lowest under silver-leafed manzanita canopies (Kluse 1994 in Service 1998). Seeds are dispersed by mule deer (*Oidocoileus hemionus*), coyotes (*Canis latrans*), rabbits (*Sylvilagus* spp.), and small mammals that come into contact with the plants in late June and July (McGraw 2004b). At that time, the seeds, which are contained in spiny involucres, are easily separated from the flower stems and adhere to the coats of mammals (McGraw 2004b). Insects, including ants, carry out secondary dispersal of those seeds that fall to the soil in late summer (McGraw 2004b). Dense patches of seedlings below the parent plant, however, suggest that many seeds are not widely dispersed (McGraw 2004b). With seeds viable only up to 1 year after production, and with germination less than 0.01 percent, there is little evidence to suggest that *Chorizanthe pungens* var. *hartwegiana* has an extensive seed bank (McGraw 2004b). New information concerning the soil seed bank of the closely related *Chorizanthe pungens* var. *pungens* was published in 2006 (Fox et al. 2006). This 5-year study found that the density of *Chorizanthe pungens* var. *pungens* in a population was directly related to the previous year's seed set, and that the species germinates well under most winter conditions and does not develop an extensive persistent soil seed bank.

### Spatial Distribution:

Below, we define various terms that are used for different assemblages of plants that we use in discussing the status of *Chorizanthe pungens* var. *hartwegiana*. In this 5-year review, we use the term "occurrence" to be consistent with the definition used by the California Department of Fish and Game's California Natural Diversity Database (CNDDB): a grouping of plants within 0.25 mile (0.4 kilometer (km)) of each other (CNDDB 2011). We use the term "population" to refer to a group of interbreeding individuals, in the biological sense of the word. There may be (and usually are) one or more "occurrences" within a single population.

In the Sandhills Conservation and Management Plan, Jodi McGraw describes a methodology for prioritizing sandhills parcels for conservation, using factors such as biology, integrity, and size (McGraw 2004b). In this document, McGraw also includes information about the parcels that support *Chorizanthe pungens* var. *hartwegiana*, which are in addition to the occurrences already documented in CNDDDB. For the purposes of this 5-year review, we have clustered element occurrences listed in the CNDDDB with nearby documented parcels hosting *Chorizanthe pungens* var. *hartwegiana* and will refer to the cluster as a population. We have delineated a separate population if it is over a half mile away from the nearest other occurrence of the species and there are no significant barriers to gene flow and dispersal (please see Figure 1, Table 1, in the Appendix). This distance is based on aggregate *Chorizanthe pungens* var. *hartwegiana* communities that are well within the average foraging distance of bees, which ranges from 500 meters up to 3 kilometers (0.3 to 1.7 miles) (Walther-Hellwig and Frankl 2000; Steffan-Dewenter et al. 2002). These population clusters are dynamic, and may be adjusted as new information about spatial distribution becomes available. Table 1 in the Appendix has a complete listing of all known occurrences and population trends.

The known populations of *Chorizanthe pungens* var. *hartwegiana* are restricted in distribution to a unique edaphic ecosystem referred to as the Zayante Sandhills in Santa Cruz County and found between 90-610 meters (295-2000 feet) in elevation (CNPS 2011). The central range of the species is generally bounded by the communities of Ben Lomond, Glenwood, Scotts Valley, and Felton, with outlying populations located near Bonny Doon, Boulder Creek, Big Basin State Park, and Gray Whale Ranch State Park--all in Santa Cruz County, California. Three new occurrences extending the area of distribution have been documented since the original listing of *Chorizanthe pungens* var. *hartwegiana*; these all occur within the known range of the taxon and were reported in the previous 5-year review (CNDDDB 2011). Many occurrences listed in the CNDDDB are not regularly checked for the continuing presence of the taxon and the spatial extent of older occurrences is unclear. If any of these occurrences have been extirpated, a contraction in range or spatial extent may have occurred.

The newly identified occurrences indicated above and detailed in Table 1 are the only known instances which would alter spatial distribution as understood at the time of listing, and there have been no new occurrences since the publication of the previous 5-year review. Habitat degradation due to fire exclusion, which promotes encroachment of woody species by altering the historical fire regime, non-native annual grasses, landscaping, and recreational use negatively impact remaining populations of this species (McGraw 2004a; McGraw 2004b). Based on habitat conversion and disturbance, as well as an increase in fragmentation of habitat within known occurrences and populations, we would expect the spatial distribution to be somewhat reduced since the time of listing.

#### Habitat or ecosystem conditions:

*Chorizanthe pungens* var. *hartwegiana* is found on sandy Zayante soils that are the basis for the Zayante sandhill communities in the Santa Cruz Mountains. This species is frequently found in association with the federally endangered Ben Lomond wallflower (*Erysimum teretifolium*) and other species restricted to the sandhills habitat (Service 1998). *Chorizanthe pungens* var. *hartwegiana* is not restricted to sandy soils due to any chemical, physical, or biological requirement, but is intolerant of shade and unable to compete for light with other species that

commonly occur on the non-sandy soils (Service 1998). The main threats described for this species are habitat destruction and habitat conversion. Habitat destruction, mainly due to sand mining, has mostly stopped at this time; however, restoration efforts required under the Surface Mine and Reclamation Act of 1975 (SMARA) are unspecific regarding the reclamation of the land. Habitat conversion due to fire exclusion and human disturbance continues to be a major concern when examining suitability of habitat and ecosystem dynamics for continued survival of this species. Habitat conversion from recreation activities and fire exclusion is ongoing and has not been mitigated since the previous 5-year review.

Within the sandhills, *Chorizanthe pungens* var. *hartwegiana* prefers to inhabit areas with unobstructed sunlight, such as sand parkland and the gaps between chaparral shrubs (McGraw 2004b). Sand parkland is characterized by an herb-dominated understory and the presence of ponderosa pine (*Pinus ponderosa*) (T. Hyland, Resource Ecologist, California State Parks pers. comm. 2011). Sand chaparral is dominated by silverleaf manzanita (*Arctostaphylos silvicola*), other shrubs (e.g., *Ceanothus cuneatus*, *Adenostoma fasciculatum*), and oak trees (*Quercus agrifolia*, *Q. wislizenii*) (McGraw 2004b). Within the chaparral community, *Chorizanthe pungens* var. *hartwegiana* grows in the gaps that arise between the larger chaparral shrubs (McGraw 2004b). *Chorizanthe pungens* var. *hartwegiana* is restricted to areas that receive nearly full sun, and can often be found in greater densities on areas of disturbed soil such as trail edges, gopher mounds, and areas of significant soil shifting (i.e., slides) (McGraw 2004b). In the sandhills of Santa Cruz, wildlife trails cover an average of 9 percent of the habitat, gopher mounds 11 percent of the habitat, and slides make up 16 percent (McGraw 2004b).

One critical finding presented in the Sandhills Conservation and Management Plan is the vital role of microhabitat conditions on the larger-scale persistence of the sandhills parkland habitat (McGraw 2004b). In the absence of fire, clearing of accumulated litter on the soil surface is critical to maintaining the open environment required by *Chorizanthe pungens* var. *hartwegiana*. When fire is suppressed for many years, encroachment by woody native species and non-native annual grasses can lead to habitat type conversion (Kluse and Doak 1999; McGraw 2004b). These plants can outcompete *Chorizanthe pungens* var. *hartwegiana* for sunlight and substrate if the buildup of vegetation is not controlled. The 2008 Martin Fire, which burned 520 acres (210 ha) near Bonny Doon and Martin Road, resulted in a rare population expansion of *Chorizanthe pungens* var. *hartwegiana* (T. Hyland, pers. comm. 2011). Given the disturbance ecology of the taxon, this was not unexpected, but simply confirms the post-fire response of *Chorizanthe pungens* var. *hartwegiana* (McGraw, in litt. 2011). In areas where natural fire events present an unacceptable risk to communities, regular efforts to clear the vegetation and understory litter can allow *Chorizanthe pungens* var. *hartwegiana* to establish and persist.

#### Abundance and population trends:

This taxon is a short-lived annual species that undergoes large variations in abundance from year to year depending on climatic conditions and other factors. Ongoing monitoring at multiple historical occurrence sites would be necessary to determine any sort of population trends. We cannot draw any conclusions about population trends for this species because there is very little historical or recent survey data that contains a record of the number of individuals. Currently, monitoring is only taking place at Quail Hollow Quarry, as called for in its Habitat Conservation Plan (HCP), with baseline surveys beginning in May 2006 (B. Davilla, biological consultant, pers. comm. 2006; McGraw 2011a). Spring 2006 surveys found low numbers of individuals,

possibly due to late and heavy precipitation that occurred during winter 2005/2006 (V. Haley, biological consultant, pers. comm. 2006).

The monitoring at Quail Hollow Quarry evaluates percent cover of *Chorizanthe pungens* var. *hartwegiana* by visually assessing the absolute cover of the species in designated plots throughout the quarry (McGraw 2011a). Absolute cover is preferred to counting individuals in the plots because it is more expeditious and more representative of how abundant the population will be in years to come (McGraw 2011a). Due to resource and nutrient limitations within higher plant densities, the fecundity of *Chorizanthe pungens* var. *hartwegiana* decreases with increased competition (McGraw 2011a). By recording the densities of the plants and not the individuals, the population status can be evaluated and trends can be more accurately stated (McGraw 2011a).

In the Quail Hollow survey, McGraw considered two separate habitat types that *Chorizanthe pungens* var. *hartwegiana* prefers: sand parkland and gaps in the chaparral. The 2008 annual report from Quail Hollow Quarry indicated that *Chorizanthe pungens* var. *hartwegiana* density increased in sand parkland by 305 percent from 2006 levels, and that the species did not show any signs of increase or decrease in between the gaps in the chaparral (McGraw 2009b). In 2010, McGraw determined that cover increased in sand parkland by 684 percent and in sand chaparral gaps by 338 percent from the 2006 baseline study (McGraw 2011a). The increase in *Chorizanthe pungens* var. *hartwegiana* density was first observed in 2006, and the trend likely corresponds to increased precipitation in the region from 2007-2010 (McGraw 2011a). Reliable, long-term data should continue to be available from this site where monitoring will continue until 2030 as directed by the current HCP (V. Haley, pers. comm. 2006).

### Land ownership and Management

The Recovery Plan for Insect and Plant Taxa from the Santa Cruz Mountains (Recovery Plan) in California states that in 1998, there were “21 currently known populations” of *Chorizanthe pungens* var. *hartwegiana* (Service 1998). According to CNDDDB records from April 25, 2006, there were 23 “element occurrences” (EO) listed, with 2 of these occurrences (EO 9, 16) listed as being “possibly extirpated,” for a total of 21 occurrences (CNDDDB 2006). For the purpose of this 5-year review, we will consider the Recovery Plan’s original reference to 21 “populations” as meaning 21 “occurrences.” By 2011, the CNDDDB had combined the records for some occurrences (EO 2, 4, 9, 10, 14, 19, 20, 22) and included previously undocumented occurrences (EO 24, 25, 26) for a current total of 18 occurrences. The land ownership for the 18 occurrences now listed in the CNDDDB is detailed in Table 1 and summarized here. This document will only consider the 18 occurrences of *Chorizanthe pungens* var. *hartwegiana* that are currently recognized by the CNDDDB.

Portions of *Chorizanthe pungens* var. *hartwegiana* populations exist on Santa Cruz County and California State Park lands. These lands are managed for the general conservation of natural resources, and species-specific management plans for *Chorizanthe pungens* var. *hartwegiana* do not exist. The California State Parks that support *Chorizanthe pungens* var. *hartwegiana* include Bonny Doon Ecological Reserve, Big Basin Redwood State Park, Wilder Ranch State Park, and Henry Cowell State Park. Additional lands that were slated for development were conserved through the acquisition of the Henry Cowell Foundation Sandhills site by the Save-the-



Redwoods League. This site was transferred to the California Department of Parks and Recreation in June 2007 (McGraw, in litt. 2011). Santa Cruz County manages a portion of the population at Quail Hollow Ranch County Park (CNDDDB 2011).

*Chorizanthe pungens* var. *hartwegiana* also occurs on many parcels of privately owned land, and the ability and willingness of the individual owners to manage occurrences on their land varies significantly. For example, one private landowner, Mount Hermon Association, Inc., has partnered with the Service to carry out restoration on sandhills habitat (Service 2010). Another private land owner, Graniterock, has a long-term HCP that requires the company to manage the sandhills habitat for the continued persistence of endangered sandhills species. Many private parcel owners do not report any land management efforts to the Service. Five of the documented CNDDDB occurrences are on lands whose ownership remains unknown.

#### *Habitat Conservation Plans (HCPs)*

HCPs for lands under county jurisdiction are currently under development. A regional Sandhills HCP was being collaboratively developed by the County of Santa Cruz and the City of Scotts Valley beginning in 2004, but work by the agencies was discontinued in 2005 (McGraw, in litt. 2011). An Interim Programmatic HCP (IPHCP) for the County of Santa Cruz and the City of Scotts Valley was approved by the Service in fall 2011; it is designed to be a temporary measure until the regional plan can be completed. This IPHCP streamlines the permitting process for small development projects in Scotts Valley and Santa Cruz County when private landowners need to apply for incidental take permits (Service 2011). A major development toward the completion of the IPHCP was the approval of the management and monitoring plan for the Ben Lomond Sandhills Preserve by the Zayante Sandhills Conservation Bank. This conservation bank provides an avenue for off-site mitigation of impacts resulting from small-scale residential projects already within highly developed sandhills habitat (McGraw, in litt. 2006).

Project-level HCPs include the Bean Creek 6-year HCP (2009-2015) and the Salvation Army's 3-year HCP (2009-2012). Both of these projects are expected to have little impact on *Chorizanthe pungens* var. *hartwegiana* due to the relatively small project areas (McGraw, in litt. 2011). For example, the Salvation Army's project only impacted 0.101 acre (0.041 ha) of sandhills habitat, of which, 0.012 acre (0.005 ha) is occupied by *Chorizanthe pungens* var. *hartwegiana* (McGraw 2009a). The Bean Creek project impacted 4.15 acres (1.68 ha), of which *Chorizanthe pungens* var. *hartwegiana* was present on 0.002 acre (0.001 ha) (Arnold et al. 2008). As mitigation for the Bean Creek estates, a 14-acre (5.66 ha) sandhills habitat preserve was set aside, and is composed of coast range ponderosa pine forest, mixed evergreen forest, and riparian woodland habitats (Arnold et al. 2008). The site will be managed by the Center for Natural Lands Management to support populations of the Mount Hermon June beetle (*Polyphylla barbata*), Ben Lomond wallflower (*Erysimum teretifolium*), and *Chorizanthe pungens* var. *hartwegiana* (Arnold et al. 2008).

Several recent restoration projects, which are detailed below, have included the removal of non-native plants on private lands.

#### *Hanson Aggregates Felton Plant*

Both the Quail Hollow Quarry and the Hanson Aggregates Felton Plant have conducted revegetation efforts as directed by their HCP and SMARA. The Hanson Plant revegetated their lands by hydroseeding the sandhills habitat with a variety of native plants that included

*Chorizanthe pungens* var. *hartwegiana*. Their stated goal in the 2010 annual report is to recreate a native plant community that is representative of the historical vegetation of the sandhills (NVN 2010). Due to Hanson Aggregate's efforts over the past 15 years, informal monitoring shows that *Chorizanthe pungens* var. *hartwegiana* has experienced a population increase (NVN 2010). In 2010, "carpets of pink" were reported, indicating abundant cover of the species in the transition areas that were the result of hydroseeding efforts (NVN 2010). Neither population numbers nor percent cover of *Chorizanthe pungens* var. *hartwegiana* were recorded for the Hanson Plant, but they have recorded the specific belt transects on their property where the species occurs (NVN 2010). Hanson Aggregates also devotes 15 crew-days per year for the removal of invasive species that could negatively impact the restoration areas (NVN 2010).

#### *Quail Hollow Quarry*

The owner of Quail Hollow Quarry, Graniterock, has a long-term HCP, which requires the company to monitor native plant revegetation efforts and invasive species. In addition, Graniterock is restricting public access to sensitive areas and controlling erosion by developing a self-sustaining cover of native vegetation as directed by SMARA (Greening 2009). The Quail Hollow Quarry annual revegetation report states that *Chorizanthe pungens* var. *hartwegiana* is independently colonizing older revegetated areas and is being incorporated into seeding efforts (Greening 2009). The management plan for Quail Hollow Quarry calls for aggressive control of certain invasive species, such as green wattle (*Acacia decurrens*), jubata grass (*Cortaderia jubata*), and French broom (*Genista monspessulana*), which were not present in the conservation areas in 2008 (McGraw 2009b). Non-native annual grasses and herbs are widespread however, particularly in the sand parkland habitat (McGraw 2009b).

In 2008, there was ongoing evidence of campfires, hikers, and equestrians on the south ridge of the quarry (McGraw 2009b). On the west ridge, McGraw comments that recreational use appears to have leveled off but has not been reduced during the past 10 years and ongoing recreational use continues to remove established plant cover (McGraw 2009b). Paint ball paraphernalia was also observed on the west ridge and motorcycles accessed the area on two occasions. The owners of the quarry, Graniterock, erected fences around the perimeter, posted trespass notices and conducted outreach activities that notified the public about the closure of the quarry to recreational users (McGraw 2009b). McGraw comments that one the greatest benefits to the native plant community at Quail Hollow Quarry is the exclusion of many recreational activities in the conservation easements, including off-highway vehicles (McGraw 2009b).

#### *Metro PCS, Inc. at Mount Hermon*

Metro PCS, Inc. received conditional approval from the County of Santa Cruz to place cellular antenna equipment on top of Mount Hermon (McGraw 2011b). As a condition of approval, since 2008, Metro PCS has conducted habitat restoration in sand parkland habitat that supports *Chorizanthe pungens* var. *hartwegiana* (McGraw 2011b). Restoration measures include: simulating the effects of a ground fire by removing litter, removing both French broom (*Genista monspessulana*) and Portuguese broom (*Cytisus striatus*), and evaluating the success of the project by measuring plant cover and species richness (McGraw 2011b). No results for individual species were reported, including for *Chorizanthe pungens* var. *hartwegiana*. The monitoring report does state, however, that these efforts promoted species richness and have begun a trend towards increased native plant cover (McGraw 2011b).

### *Olympia Wellfield and Geyer Quarry*

In 2009, the Land Trust of Santa Cruz County (Land Trust) entered into a 10-year agreement with the Service to become wildlife cooperators in the Sandhills Exotic Plant Species Eradication Project (Service 2009b). With the costs of the program shared by the Service, the Land Trust, and the San Lorenzo Valley Water District (Water District), the project seeks to remove invasive species on two properties that encompass 54 acres (21.85 ha) of intact sandhills habitat (Service 2009b). In 2002, the Service's Partners for Fish and Wildlife Program provided a grant to the Water District to eradicate acacia (*Acacia* spp.) from 40 acres (16.18 ha) of the Olympia Wellfield. However, ineffective removal methods resulted in a dense infestation of acacia by 2008. Under the new agreement, by 2012, acacia (*A. dealbata* and *A. decurrens*) will be removed from 19 acres (7.68 ha) of the Olympia Wellfield property and 3 acres (1.21 ha) of the Geyer Quarry; French broom (*Genista monspessulana*) and Scotch broom (*Cytisus scoparius*) will be strategically removed from 30 acres (12.14 ha) of the Olympia Wellfield property and 2 acres (0.81 ha) of the Geyer Quarry; and regeneration of *Genista monspessulana* and *Cytisus scoparius* will be controlled on both properties (Service 2009b). Because the invasive species were cleared and competition for light was reduced, *Chorizanthe pungens* var. *hartwegiana* has already started to recover in this area (C. Mitcham, Service biologist, in litt. 2011). In addition, the Water District is working to restrict access to the Wellfield parcel because of problems with equestrian use, mountain biking, motorcycles and social gatherings that can include bonfires (C. Mitcham, in litt. 2011). The Water District's Watershed Management Plan, finalized in November 2010, includes objectives to control invasive plant species and to protect and preserve "special status plant communities" (Water District 2010). The Water District is expected to receive additional funds from the Weed Management Area (administered by the Resource Conservation District of Santa Cruz County) for additional invasive species removal (C. Mitcham, in litt. 2011).

Using Section 6 funds from the Service and additional contributions from outside sources, the Land Trust of Santa Cruz County (Land Trust) purchased the Geyer Quarry in 2008, which they have since renamed the Randy Morgan Preserve (McGraw, in litt. 2011). The Geyer Quarry was identified in the Recovery Plan for this species as having the highest quality of intact sandhills habitat (Service 1998). The Land Trust purchased 189 acres (76.41 ha) of the property, of which approximately 20 acres (8.09 ha) is intact sandhills habitat (McGraw, in litt. 2011). The Land Trust intends to develop an adaptive management plan that will provide long-term protection to the endangered species on this property, including *Chorizanthe pungens* var. *hartwegiana* (Service 2009b).

### *Mount Hermon*

From 2002 to 2004, the Mount Hermon Outdoor Science School participated in the Landowner Incentive Program by removing invasive French broom (*Genista monspessulana*), Scotch broom (*Cytisus scoparius*) and acacia on 15 acres (6.07 ha) of their property to restore sandhills habitat for endemic species (Service 2002). By removing the non-native, invasive trees from the sandhills habitat, greater open space is created for *Chorizanthe pungens* var. *hartwegiana* and other sandhills species to establish (Service 2009a). As a follow-on effort in 2009, the Mount Hermon Outdoor Science School cleared 1.45 acres (0.59 ha) of French broom and Scotch broom through the Partners for Wildlife Program (Service 2010). The school also installed a sign intended to educate visitors about the sensitive nature of the sandhills, and they built a 250 meter (820 feet) long fence along a footpath to decrease intrusion and disturbance of sandhills habitat (Service 2010).

## 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 *Chorizanthe pungens* var. *hartwegiana* was listed, sand quarrying on a large scale was occurring on large holdings of land and was the primary threat to the species. Quarrying is generally no longer a threat to the existing habitat of the species because only one quarry is in operation, and the company, Graniterock, is working under the auspices of an HCP to restore and enhance sandhills habitat. A substantial amount of the species' habitat, however, had already been altered or destroyed by mining operations prior to listing. Recovery of the species will partially depend on habitat restoration of private mining lands, such as is held by Hanson Aggregates, who have ceased mining operations.

Private development was occurring on a limited scale within the habitat of the species at the time of listing, and is still occurring at low levels. Between 1993 and 1998, urban development has resulted in the loss of over 480 hectares (194 ha) of sandhills habitat (Service 1998).

Construction of private homes, roads, and businesses has removed vegetation and modified soils through excavation, compaction, and disruption of soil horizons (Service 1998). Recent private development has had only a limited effect on the overall habitat and range of the species. One of the secondary effects of destruction and fragmentation of habitat by urban development is the introduction, either intentionally or inadvertently, of non-native plants to adjacent remaining habitat.

Recreational threats identified in the Recovery Plan, including hiking, equestrian use, off-road vehicles, mountain biking, and camping, have resulted in habitat degradation and fragmentation (Service 1998; McGraw 2004b). Mountain bikes and off-highway vehicles continue to pose the greatest recreational threats to sensitive habitat, and have caused extensive damage to suitable habitat - specifically at Henry Cowell Redwoods State Park (McGraw, in litt. 2011). These activities crush and remove vegetation, compact soils, promote soil erosion, and can occasionally result in oil and gasoline spills. Equestrian use, mountain biking, motorcycles and social gatherings that can include bonfires remain ongoing impediments to recovery of the species at Olympia Wellfield and Quail Hollow Quarry (C. Mitcham, in litt. 2011; McGraw 2009b). There is also evidence of people accessing Quail Hollow Quarry for games of paintball (McGraw 2009b). These factors continue to threaten the existence of this species and remain relatively unaddressed at this time (McGraw 2004b; McGraw, in litt. 2011).

Increased vegetation cover resulting from fire exclusion was not identified as a major threat at the time of listing, but is one of the most serious ongoing threats to the persistence of *Chorizanthe pungens* var. *hartwegiana* (McGraw 2004b; McGraw, in litt. 2011; T. Hyland, pers. comm. 2011). Encroachment by woody species and litter buildup, in large part stemming from the disruption of natural fire cycles, encourages habitat type conversion (McGraw 2004b). The exclusion of wildfires from sandhill communities results in longer intervals between fire events, and in the sand parkland and northern maritime chaparral communities, this has resulted in

increased vegetation cover and heightened competition for space with other species over time. Increased shading due to abundant vegetation cover also may reduce the quality of the habitat for this species. *Chorizanthe pungens* var. *hartwegiana* has the potential to benefit from fire, but little is known about the fire regime to which it is adapted. Ongoing modifications to the sandhills habitat, including widespread invasive species and non-native annual grasses, may impact how *Chorizanthe pungens* var. *hartwegiana* interacts and responds to fire (McGraw 2009b). Furthermore, fire suppression methods, including application of fire retardant, foam, and large amounts of water, can influence how *Chorizanthe pungens* var. *hartwegiana* will recover after a fire, and they may affect the surrounding community assemblage by fertilizing the sandy soil and perhaps providing a competitive advantage to non-native annual grasses and other invasive species (McGraw 2009b).

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

Overutilization was not identified as a factor at the time of listing, and is not known to currently be a factor.

**FACTOR C: Disease or Predation:**

Disease and predation were not identified as factors at the time of listing, and are not known to currently be factors. Limited herbivory by lepidopteran larvae (caterpillars) on *Chorizanthe pungens* var. *hartwegiana* rosettes and mammalian herbivory on seedlings were personally observed by Jodi McGraw, but do not seem to have a detrimental effect on overall seedling survivorship (McGraw 2004b).

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

At the time of listing, we did not discuss any particular concerns regarding the adequacy of existing regulatory mechanisms for *Chorizanthe pungens* var. *hartwegiana* (Service 1994). Below we discuss the existing regulatory mechanisms at the State, County, and Federal levels, and the extent to which they ameliorate the threats from the other factors.

State Regulations

*Chorizanthe pungens* var. *hartwegiana* is not listed as threatened or endangered by the State of California. Populations on State Park and State Reserve lands are the only ones receiving consideration as a sensitive resource, though these agencies have not completed specific management plans for the species (T. Hyland, pers. comm. 2011).

The California Environmental Quality Act (CEQA) requires review of any project that is undertaken, funded, or permitted by the State or a local governmental agency, and is the primary mechanism for ensuring that impacts to sensitive species on private lands are minimized. If significant effects to sensitive resources (including List 1B taxa<sup>1</sup>) are identified, the lead agency

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<sup>1</sup> According to the California Native Plant Society's ranking system for rare plants, a List 1B plant meets the definitions of Sec. 1901, Chapter 10 of the Native Plant Protection Act, or Secs. 2062 and 2067 of the California Endangered Species Act, and is eligible for State listing (CNPS 2009). *Chorizanthe robusta* var. *robusta* is currently not a State listed taxon.

has the option of requiring mitigation through changes in the project or to decide that overriding considerations make mitigation infeasible (CEQA section 21002). Such plans may involve establishing long-term protection for certain sites by designating them as “reserves,” enhancing degraded sites to improve or extend suitable habitat, transplanting affected species to an off-site location, and/or creating artificial habitat. Therefore, protection of sensitive species through CEQA is dependent upon the discretion of the lead agency involved.

#### County Regulations

The sandhills habitat is protected by the Santa Cruz County Sensitive Habitat Ordinance, which is implemented by the County Planning Department during project development review. Lack of enforcement, however, limits the effectiveness of this ordinance at protecting sandhills habitat on private lands (McGraw, in litt. 2011).

#### Federal Regulations

Under Section 9 of the Act, plants are protected from harm in two particular circumstances: (1) the removal and reduction to possession (i.e., collection) of endangered plants from lands under Federal jurisdiction is prohibited, 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 is prohibited. Where the species occurs on private land, protections afforded by section 7 of the Act are triggered only if there is a Federal nexus (i.e., an action funded, permitted, or carried out by a Federal agency). Some of the populations on private lands have benefited from the implementation of HCPs and management plans involving county and city agencies, but many of these plans are still under development, and others have only provided a portion of the necessary protections. The Service has participated in efforts to develop the HCPs mentioned in the Land Ownership and Management discussion above through section 10 of the Act. Many locations supporting *Chorizanthe pungens* var. *hartwegiana* on private lands have not received protection or conservation efforts.

The 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. In cases where the project analysis reveals significant environmental effects, the Federal agency must propose mitigations that could 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.

Given the existing regulations, we have seen some benefit from the Federal and County regulations to *Chorizanthe pungens* var. *hartwegiana*. Several HCPs have been implemented by private landowners, who are required to mitigate the effects that their actions have on *Chorizanthe pungens* var. *hartwegiana*. The existing regulations can only prevent habitat loss if the HCP requires that landowners avoid habitat or restore degraded habitat.

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

As mentioned in the previous 5-year review, fire exclusion leading to encroachment by native woody species and non-native annual grasses threatens the species via habitat type conversion. The threat of extinction due to a small population size is also exacerbated by fire exclusion

activities. In addition, this 5-year review recognizes for the first time that climate change and nitrogen deposition are potential threats.

#### Fire Exclusion

Although not indicated at the time of listing, fire exclusion in Santa Cruz County was leading to encroachment by native woody species and non-native annual grasses threatening habitat type conversion and loss of suitable habitat for *Chorizanthe pungens* var. *hartwegiana*. Fire exclusion allows for the accumulation of understory litter and the establishment of plants with which *Chorizanthe pungens* var. *hartwegiana* cannot compete for light. The result from fire exclusion is a reduction in sand parkland habitat for the *Chorizanthe pungens* var. *hartwegiana* (McGraw 2004b). *Chorizanthe pungens* var. *hartwegiana* experiences reductions in population size as a result of competition with exotic species for open habitat (McGraw 2004b). Research was completed by McGraw (2004b) on various habitat management strategies, including the use of prescribed fire and manual clearing. Management efforts aimed at restoring *Chorizanthe pungens* var. *hartwegiana* habitat should apply these research findings.

#### Stochastic Extinction

Due to its small population and restricted habitat within a narrow geographic range, *Chorizanthe pungens* var. *hartwegiana* is vulnerable to stochastic extinction (Service 1994; McGraw and Levine 1998). Typically, annuals and other monocarpic plants (individuals that die after flowering and fruiting), such as *Chorizanthe pungens* var. *hartwegiana*, are vulnerable to random fluctuations or variation (stochasticity) in annual weather patterns and other environmental factors (Huenneke et al. 1986). A small population size may make it difficult for a species to persist while sustaining other impacts such as habitat alteration that favors non-native species.

#### Climate Change

Current climate change predictions for terrestrial areas in the northern hemisphere indicate warmer air temperatures, more intense precipitation events, and increased summer continental drying (Field et al. 1999, Cayan et al. 2005, Intergovernmental Panel on Climate Change (IPCC) 2007). *Chorizanthe pungens* var. *hartwegiana*'s small and isolated range increases its vulnerability to random fluctuations in annual weather patterns and environmental disturbances such as can be brought about by climate change. Recently, the potential impacts of climate change on the flora of California were discussed by Loarie et al. (2008). Based on climate modeling, they predicted that species' distributions will shift in response to climate change and that the species will "move" to higher elevations and northward, depending on the ability of each species to do so. In the case of the sandhills ecosystem, which is limited to specific soil types in Santa Cruz County, the opportunities to move to higher elevations or further north are limited. *Chorizanthe pungens* var. *hartwegiana*'s presence at relatively high elevations (90-610 meters (295-2000 feet)) does not make it immediately vulnerable to sea level rise; however, it is susceptible to an altered hydrological regime if changes in the annual precipitation schedule or fog patterns occur. The species requires full access to the sun to survive and reproduce, and an increase in fog cover or too much precipitation can reduce the reproductive capacity of the plant to unsustainably low levels. In general, the scientific community lacks adequate information to make specific and accurate predictions regarding how climate change, in combination with other factors such as limited geographical distribution, will affect species like *Chorizanthe pungens* var. *hartwegiana*. Small-ranged species, such as *Chorizanthe pungens* var. *hartwegiana*, however, are more vulnerable to extinction due to these changing conditions (Loarie et al. 2008).

### Nitrogen Deposition

The coarse nature of Zayante soils contributes to this sandy substrate generally having low moisture and nutrient availability. Traditionally, nitrogen can be one of the limiting nutrients in the sandhills, and increased nitrogen deposition from air pollution and urbanization can threaten the biodiversity of the ecosystem (Weiss 1999). *Chorizanthe pungens* var. *hartwegiana* could be impacted by increased nitrogen deposition, resulting primarily from the combustion of fossil fuels. Nitrogen can fertilize non-native annual grasses, such as rattlesnake grass (*Briza maxima*), rip-gut brome (*Bromus diandrus*), and rattail fescue (*Vulpia myuros*), which exert strong competitive effects on *Chorizanthe pungens* var. *hartwegiana* (McGraw 2004a). Competition with nonnative plants poses the greatest threat to *Chorizanthe pungens* var. *hartwegiana* (Service 1998). At the Bonny Doon Ecological Reserve, the presence of the non-native annual grass *Vulpia myuros* was shown to significantly inhibit the growth and reproductive success of *Chorizanthe pungens* var. *hartwegiana* where they occur together (Pollock 1995).

### **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. We focus our evaluation of species status in this 5-year review on progress that has been made toward recovery since the species was listed (or since the most recent 5-year review) by eliminating or reducing the threats discussed in the five-factor analysis. In that context, progress towards fulfilling recovery criteria serves to indicate the extent to which threat factors have been reduced or eliminated.

The recovery objective for *Chorizanthe pungens* var. *hartwegiana* is delisting through habitat protection and appropriate management actions. Listing Factors B and C are not applicable to this species. The recovery plan indicates that delisting for *Chorizanthe pungens* var. *hartwegiana* can be considered when the following criteria have been achieved:

#### 1. The 21 currently known populations have been secured through fee-title acquisition, conservation easements, or habitat conservation plans (HCP):

This recovery criterion addresses Listing Factors A, D, and E. Although the Recovery Plan describes 21 populations of *Chorizanthe pungens* var. *hartwegiana*, this section will only consider the 18 occurrences of *Chorizanthe pungens* var. *hartwegiana* documented by the CNDDDB for the reasons described under the Land Ownership and Management section of this review.



The company Graniterock has an existing 100-year HCP, which addresses CNDDDB element occurrence (EO) number 1 at Quail Hollow Quarry. This HCP requires that the endangered species under protection must be monitored every other year to determine the status of the species at that site, and the population trends. The results from the monitoring efforts are reported in this document under the Review Analysis: Abundance and Population Trends. EO 1 is also on Quail Hollow County Park lands, which is jointly owned and managed by the State of California and Santa Cruz County. The Bean Creek Estates HCP (affecting EO 11) established a 14-acre (5.7 ha) sandhills habitat preserve and is managed for the persistence of sandhills endemic species, including *Chorizanthe pungens* var. *hartwegiana* (Arnold et al. 2008). HCPs for the County of Santa Cruz and the City of Scotts Valley are under development, but none have been completed at this time. An Interim Programmatic HCP (IPHCP) for the Sandhills was developed by the County of Santa Cruz and the City of Scotts Valley, and has recently been approved by the Service.

Element occurrences 3, 5, and 6 are on private lands whose owners actively maintain native vegetation and restore the lands in cooperation with the Service. EO 3 is partly on Mount Hermon Association lands and partly within Henry Cowell State Park; EO 6 is on the San Lorenzo Valley Water District lands. Both the Mount Hermon Association and the Water District are receiving financial assistance through the Service's Partners for Fish and Wildlife program for invasive species removal. EO 5, at the former Geyer Quarry, is under the control of the Land Trust of Santa Cruz County, who plans to develop an adaptive management strategy for restoration of the habitat. Element occurrences 15, 25, and 26 are on state lands. In sum, 8 out of 18 total CNDDDB-recognized occurrences of *Chorizanthe pungens* var. *hartwegiana* have been secured through fee-title acquisition, conservation easements, or habitat conservation plans. At this time, only a portion of *Chorizanthe pungens* var. *hartwegiana* populations have been secured, and for this reason, the criterion has not been met. Considering that populations vary greatly in size, a more accurate unit of measure would be area of occupied habitat that has been secured, as is being documented by McGraw (2011a) at Quail Hollow Quarry. These data are not clearly known for most of the sites due to the varying level of detail that is used in mapping the populations included in CNDDDB records, and the infrequency of updates to the records. If all known occurrences of *Chorizanthe pungens* var. *hartwegiana* can be accurately updated and mapped, the Service can then evaluate what percentage of these occurrences are on lands that have been secured through fee-title acquisition, conservation easements, or habitat conservation plans. The delisting criterion will be complete when all of the known occurrences are secured in the manner detailed above. We believe the intent of the criterion is appropriate with respect to the recovery of the taxon; however, given updated information regarding the taxon's population distribution, we believe this criterion should be revised to indicate that protections should be secured throughout a large portion of the species' range, instead of language that indicates a particular number of populations should be secured.

2. Conservation measures for this species are included in habitat conservation plans (Graniterock Quarry, Kaiser Sand and Gravel Felton Plant, and the County of Santa Cruz) that have been developed and implemented for the listed insect species [Mount Hermon June beetle and Zayante band-winged grasshopper]:

This recovery criterion addresses Listing Factors A, D, and E. A habitat conservation plan that included *Chorizanthe pungens* var. *hartwegiana* has been developed and implemented for

Graniterock at Quail Hollow Quarry. This species was included in both the Quail Hollow Quarry HCP (short term permit) issued in 1997 and the Quail Hollow Quarry Amendment #1 (long-term permit) issued in 1998. In 1999, Hanson Aggregates Felton Sand Plant (formerly Kaiser Sand and Gravel Felton Plant) was issued a 15-year HCP for the two listed insect species, but *Chorizanthe pungens* var. *hartwegiana* was not included in this HCP. Mining has ceased at the Hanson Aggregates and Olympia Quarry, and the companies are obligated under the Surface Mine and Reclamation Act to perform reclamation in the form of revegetation, which is overseen by Santa Cruz County (McGraw, in litt. 2011; D. Carlson, Project Planner, County of Santa Cruz, pers. comm. 2011). The company submits annual reports to the county regarding the revegetation of the land, which includes records of Hanson Aggregates planting *Chorizanthe pungens* var. *hartwegiana*, and they are in the latter stages of the reclamation process (D. Carlson, pers. comm. 2011).

The County of Santa Cruz HCP will be developed in two versions: the preliminary Interim Programmatic HCP (IPHCP) and the County of Santa Cruz Regional HCP. Both of these plans intend to include both insect species and the *Chorizanthe pungens* var. *hartwegiana*, but only the IPHCP is currently permitted. The Regional HCP for the County of Santa Cruz and the City of Scotts Valley will not be developed for another 3 to 5 years (Service 2011).

In addition, a draft HCP has been submitted to the Service from the owners of the Olympia Quarry in order to perform work for reclamation (D. Carlson, pers. comm. 2011). They are requesting an HCP because they need to revegetate the land, and a Mount Hermon June beetle (*Polyphylla barbata*) was detected on the property (D. Carlson, pers. comm. 2011). There are no plans to begin mining again.

Although *Chorizanthe pungens* var. *hartwegiana* was not initially included in all of HCPs developed for the locally listed insect species, both the Graniterock HCP and the Santa Cruz Regional HCP have included it or have plans to include it. Hanson Aggregates, the only organization to not include *Chorizanthe pungens* var. *hartwegiana*, has ceased mining operations, and their HCP expires in 2014.

As not all the HCPs indicated in this criterion have been implemented, this criterion has not been met. Inclusion of this species in all HCPs that overlap geographically with known *Chorizanthe pungens* var. *hartwegiana* occurrences is appropriate and adequate with respect to the recovery of the taxon. We recommend, however, that the criterion should be revised to indicate that conservation measures for this taxon should be included in any habitat conservation plans that are developed for areas that are within the range where it occurs, and not only for the specific HCPs listed above.

### 3. Management plans for populations on Quail Hollow Ranch County Park and the adjacent State-owned parcel, Bonny Doon Ecological Reserve, Henry Cowell Redwoods State Park, Big Basin State Park, and Gray Whale Ranch State Park are developed and being implemented:

This recovery criterion addresses Listing Factor A. None of the management plans for the areas specifically listed in this criterion have been completed at this time (T. Hyland, pers. comm. 2011; C. Jones, Acting Reserve Manager, California State Parks, pers. comm. 2011). Plans for prescribed burns at Henry Cowell Redwoods State Park have been implemented, with the most recent prescribed burn occurring in 2008 (T. Hyland, pers. comm. 2011; CDPR 2008). Although

this management plan does not specifically address *Chorizanthe pungens* var. *hartwegiana*, the project strives to replicate the historical fire regime of the sandhills, which is essential to the survival of sandhill adapted species, including this taxon. The management plan for the Bonny Doon Ecological Reserve has not been completed (C. Jones, pers. comm. 2011), but significant progress has been made on the plan by the California Department of Fish and Game, and a final draft has been prepared (C. Jones, pers. comm. 2011; McGraw, in litt. 2006).

This criterion has not been met. Even though progress has been made on a few management plans, much work is needed to complete this criterion. We believe this criterion is appropriate and adequate with respect to the recovery of the taxon.

#### 4. Population numbers are stable or increasing:

Since this species was listed, virtually no monitoring has been undertaken to provide data that may be used to examine population trends. Efforts have been made to remove invasive plants from a few areas (e.g., San Lorenzo Valley Water District property), but without monitoring the benefits of these projects to *Chorizanthe pungens* var. *hartwegiana*, if any, cannot be ascertained. Impacts to the species have been noted at many sites, including habitat type conversion due to fire exclusion, secondary impacts of urban development (e.g., landscaping), and recreational use (e.g., mountain bikes, OHVs, equestrian use, hiking) (McGraw 2004b; P. Levine, Environmental Coordinator, County of Santa Cruz, pers. comm. 2006; McGraw, in litt. 2011). Although these observations are anecdotal and do not constitute formal monitoring, their frequency and widespread nature may indicate pressures likely to cause population declines; however, there are no data to confirm this.

There is no information indicating that this criterion has been entirely or partially met. However, we believe this criterion should be modified at some point in the future. Although population numbers are useful as a general guideline, due to the large annual fluctuations in population numbers, we believe it would be more appropriate to redefine the criterion in terms of size, quality, and geographic configuration of conserved habitat that is continually occupied by the species. For an example of a way that this can be set up, the Sandhills Conservation and Management Plan establishes a three-tier classification of habitats differentiated by location that can help determine which lands should be prioritized for preservation.

## **IV. SYNTHESIS**

The primary threat to *Chorizanthe pungens* var. *hartwegiana* at the time of listing was habitat destruction from sand and gravel mining within sandhills parkland habitat. This threat has largely been halted due to the completion of many mining contracts, and in the case of Quail Hollow Quarry, a long-term HCP. A substantial amount of the species' habitat had already been destroyed by mining operations prior to listing, and recovery of the species depends to a great extent on habitat restoration of these private holdings in accordance with HCPs. Some of this restoration work is currently under way and monitoring onsite has begun.

Habitat conversion due to fire exclusion was not a threat described at the time of listing for this species, but it has become one of the greatest threats to *Chorizanthe pungens* var. *hartwegiana*. Prescribed burns and manual clearing of brush and vegetative litter buildup to keep woody native

plants and non-native annual grasses from encroaching on sandhills parkland habitat have been discussed for several areas, and implemented in very few. Removal of litter buildup and non-native plants on some experimental plots, and manual removal of non-native woody shrubs and herbaceous species has been undertaken at several sites (McGraw 2004b; McGraw 2011b). These efforts have so far focused on relatively small areas and no plans for large scale operations have been developed.

Human disturbance on private lands due to recreational use and private landscaping continues to be a threat, as well as some limited, small-scale, private land development. Habitat conservation plans are in place for some quarries. HCPs and general area management plans required from state and county parks and city and county agencies have yet to be completed; implementation of conservation efforts has subsequently been limited. In the absence of a natural fire regime, city, county, and state agencies, and private land conservation organizations need to actively manage sandhills habitat for the persistence of *Chorizanthe pungens* var. *hartwegiana* to address impacts of litter build up and encroachment of non-native species.

While monitoring has been implemented on a limited scale in quarries with HCPs, virtually no monitoring of populations elsewhere has occurred. Lack of monitoring has led to inadequate information on current range extents and population trends. The range of many species occurrences identified by individual conservation entities are not mentioned in the recovery plan or identified in the CNDDB records. These populations are not being afforded adequate consideration for protection.

Because of the ongoing impacts of past and present threats to the species, the lack of monitoring data, and the great deal of additional work needed for recovery, we are not recommending any change to the status of *Chorizanthe pungens* var. *hartwegiana*.

## V. RESULTS

### Recommended Listing Action:

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

### New Recovery Priority Number and Brief Rationale:

No change is recommended. The recovery number will remain a 9, as discussed above.

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

1. Identification and coordination of recovery partners who can consolidate occurrence data is critical to get a better overview of the status of *Chorizanthe pungens* var. *hartwegiana*. The Service should work with the County and the City of Scotts Valley to determine the ownership of the parcels where the species exists on properties whose conservation status is unknown.

2. Increased Service oversight, as time allows, may accelerate completion of the HCP with the County of Santa Cruz and other management plans under development at Big Basin State Park, Henry Cowell Redwoods State Park, Gray Whale Ranch State Park, Quail Hollow Ranch County Park, and Bonny Doon Ecological Reserve. The completion of these plans could facilitate effective implementation of recovery actions.
3. Surveys and ongoing monitoring should be undertaken to ensure that potential populations are identified and reliable demographic information is collected. Monitoring should occur at intervals of 1 to 2 years and include percent cover surveys, habitat condition assessment, and documentation of existing and potential threats. These efforts should focus on sandhills habitats that have been identified as element occurrences to clarify whether and where management actions are necessary. In addition, the CNDDB records should be updated with the most current information available, including the areas listed in McGraw (2004b) as West Lompico, Glen Arbor, El Rancho, Gray Whale Ranch State Park, and Henry Cowell State Park.
4. More detailed knowledge of population occurrences and completion of management plans should allow active management to prevent encroachment of both native and non-native species in fire-excluded areas. Prescribed burns are the most natural way to accomplish the vegetation thinning needed to restore open habitat, but in many areas, proximity to human communities precludes this as an option. Mechanical means of vegetation and leaf litter removal (i.e., raking) have proven effective in reducing the chances of habitat type conversion and increased germination rates in *Chorizanthe pungens* var. *hartwegiana* seeds (McGraw 2004b). This method may be used in places where fire would create unacceptable risk to local communities.
5. Outreach to owners of private holdings with potentially conservable habitat and populations should be attempted. These parties should be provided with information necessary to facilitate management of habitats on these holdings. These private efforts could prevent habitat type conversion due to encroachment by other species in fire suppressed areas, minimize unnecessary impacts, and could aid in maximizing the conservation potential of all suitable habitat and populations.
6. The second criterion for downlisting in the recovery plan should be reworded and not name specific HCPs. The entities listed on HCPs may change name and ownership over time, requirements may change or projects may be altogether abandoned. A general statement reflecting the need for the species to be included in any HCP that covers its geographic area would be more appropriate.
7. Habitat management recommendations within the Sandhills Conservation Management Plan (McGraw 2004b) may be the most prudent to follow in order to maximize conservation of *Chorizanthe pungens* var. *hartwegiana*. In addition to *Chorizanthe pungens* var. *hartwegiana*, this specialized and fragile habitat supports five federally listed endangered species and one species of special concern. Most of the recommended actions in this document favor general sandhills habitat management, which are directly in accordance with the microhabitat needs of *Chorizanthe pungens* var. *hartwegiana*.

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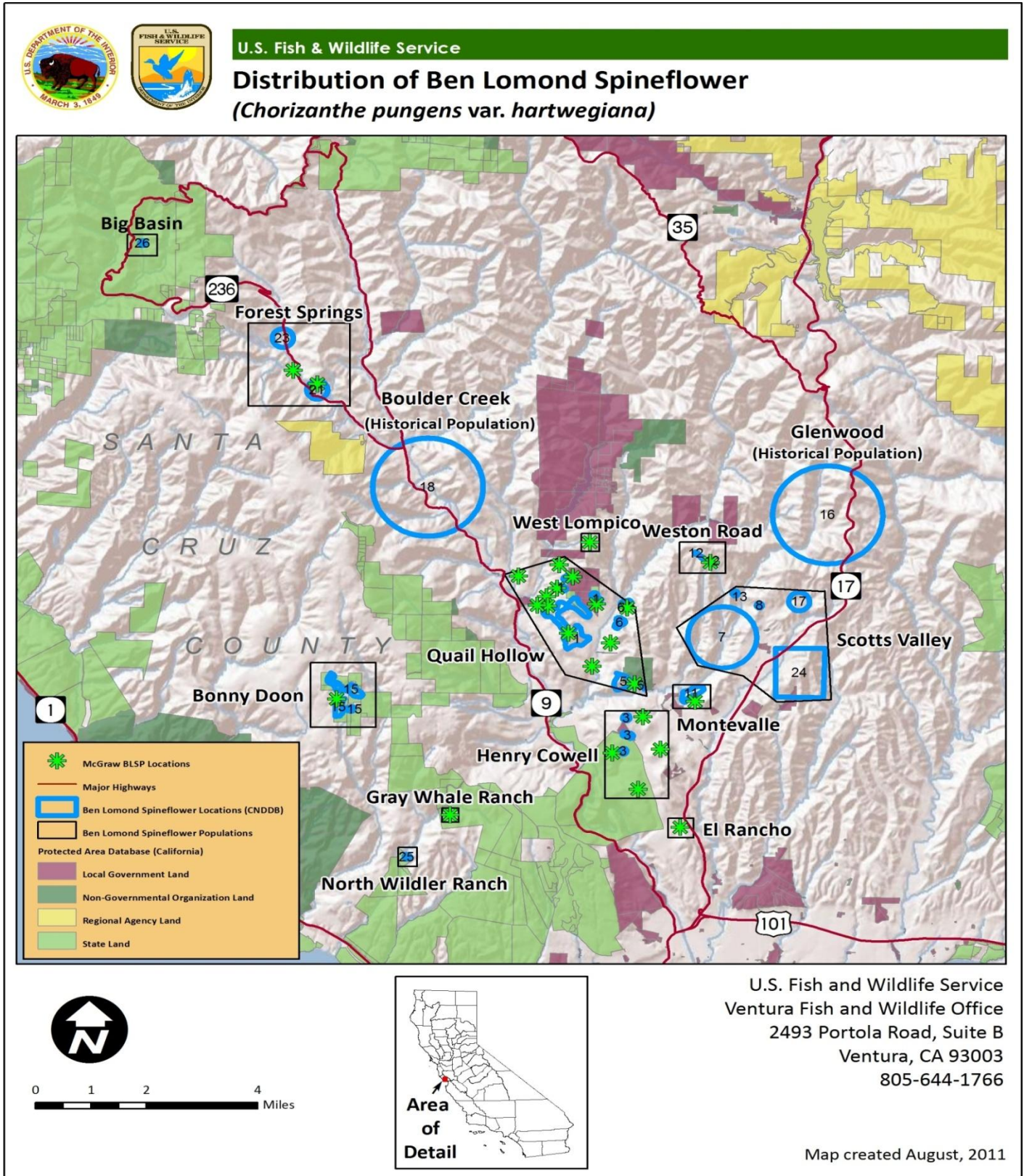
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## APPENDIX

Figure 1: Distribution of Ben Lomond Spineflower



**Table 1:** Population records for *Chorizanthe pungens* var. *hartwegiana*; extracted from CNDDDB 2011, except where indicated that the information has been sourced from the Sandhills Conservation and Management Plan by Jodi McGraw (2004). All published occurrences from the CNDDDB and the Sandhills Conservation and Management Plan have been clustered to form populations. Occurrences from the Sandhills Conservation and Management Plan are ranked into three tiers according to the biology, integrity and size of the parcel, with Tier 1 being the highest. Blank cells indicate that information was not provided at that specific level of detail.

<b>Element occurrence (CNDDDB) or as noted</b>	<b>Location</b>	<b>Trend</b>	<b>Threats</b>	<b>Last observed/ documented</b>	<b>Population size</b>	<b>Reference</b>	<b>Site manager/ owner</b>
<b>Bonny Doon</b>							
15	Bonny Doon Ecological Reserve	Presumed extant	Fire exclusion, exotic plants, recreation (McGraw 2004)	1994	207,000+	CNDDDB 2011	CDFG-Bonny Doon ER
McGraw 50	Martin Road	Unknown (Tier 1)	Fire exclusion, exotic plants, recreation		Moderate population	McGraw 2004	CDFG-Bonny Doon ER; Co. of Santa Cruz; Private
<b>Boulder Creek</b>							
18	Felton	Presumed extant	Unknown	05/07/1939; L. Rose	Unknown	CNDDDB 2011	Unknown
<b>El Rancho</b>							
McGraw 11	Off of Sims Rd, west of Hwy 17	Unknown (Tier 2)				McGraw 2004	
<b>Forest Springs</b>							
21	Northwest of Boulder Creek	Presumed extant; includes former EO 22	Unknown	05/10/1957; Hesse	Unknown	CNDDDB 2011	Private (McGraw 2004)
23	Hilton Airport	Presumed extant	Unknown	06/24/1956; Thomas	Unknown	CNDDDB 2011	Unknown
McGraw 47	Hilton Drive	Unknown (Tier 1)	Unknown			McGraw 2004	Private
McGraw 48	Jamison Creek Road	Unknown (Tier 1)	Unknown			McGraw 2004	Private
<b>Glenwood</b>							
16	Glenwood	Possibly extirpated		Unknown	Unknown	CNDDDB 2011	Unknown
<b>Gray Whale</b>							
McGraw 52	Gray Whale Ranch	Unknown (Tier 1)	Fire exclusion and recreation		Unknown	McGraw 2004	CDPR-Gray Whale Ranch; Private
<b>Henry Cowell</b>							
3	Mount Hermon Outdoor Science School; Henry Cowell State Park	Presumed extant; includes former EO 4, 19	Fire exclusion and recreation including mountain bikes (McGraw 2004)	05/31/1988; J. Reveal; 2009, S. Clark (Service 2010)	Unknown	CNDDDB 2011	Mount Hermon Association, Inc.; Henry Cowell State Park
McGraw 13	Henry Cowell	Unknown (Tier 1)	Fire exclusion and recreation including mountain bikes			McGraw 2004	CDPR – Henry Cowell

McGraw 14	Mount Hermon/Save the Redwoods League	Unknown (Tier 1)	Fire exclusion, exotic plants, and recreation			McGraw 2004	CDPR – Henry Cowell; Private; Co. of Santa Cruz
McGraw 15	Whispering Pines	Unknown (Tier 3)				McGraw 2004	
McGraw 17	Hanson	Unknown (Tier 2)				McGraw 2004	Private
<b>Monteville</b>							
11	Scotts Valley	Presumed extant	Facilities development	Unknown	Unknown	CNDDDB 2011	Private
McGraw 23	Monteville	Unknown (Tier 2)				McGraw 2004	
<b>North Wilder Ranch</b>							
25	Northern edge of Wilder Ranch St. Park, Felton; Santa Cruz	Presumed extant	Fire exclusion and high intensity recreation (McGraw 2004)	05/10/1999; G. Hayes	25,000	CNDDDB 2011	Private; Wilder Ranch St. Park (CDPR)
<b>Quail Hollow</b>							
1	Quail Hollow Rd	Decreasing; presumed extant; includes former EO 2, 10	Fire exclusion, exotic plants, recreation (McGraw 2004)	04/23/2005; A. Schusteff	Unknown	CNDDDB 2011	Private (Graniterock Corp); Quail Hollow Co. Park
5	Geyer Property	Presumed extant; includes former EO 9	Fire exclusion, exotic brooms, recreation (McGraw 2004)	05/06/1995; P. Edwards-Carkeet	10,000+	CNDDDB 2011	Land Trust of Santa Cruz Co. (Service 2009b)
6	Olympia Wellfield	Presumed extant; includes former EO 14	Recreation use and exotic plants (McGraw 2004)	Unknown	Unknown	CNDDDB 2011	SLVWD (McGraw 2004)
McGraw 19	Mount Hermon Road North	Unknown (Tier 1)	Recreation and fire exclusion			McGraw 2004	Private; Co. of Santa Cruz
McGraw 25	Olympia Wellfield	Unknown (Tier 1)	Exotic plants and recreation			McGraw 2004	SLVWD; private
McGraw 26	Zayante School Rd.	Unknown (Tier 1)	Fire exclusion and residential development			McGraw 2004	Private
McGraw 30	Quail Hollow Ranch-East Ridges	Unknown (Tier 1)	Fire exclusion, exotic plants, recreation			McGraw 2004	CDFG
McGraw 33	Sunset Ridge	Unknown (Tier 1)	Fire exclusion			McGraw 2004	Co. of Santa Cruz; Private
McGraw 34	Quail Hollow Ranch-Northwest	Unknown (Tier 1)	Fire exclusion, exotic plants, recreation, agriculture			McGraw 2004	Co. of Santa Cruz; Private
McGraw 35	Vista Robles	Unknown (Tier 1)	Residential development			McGraw 2004	Private
McGraw 36	Marion	Unknown (Tier 1)	Residential development			McGraw 2004	Co. of Santa Cruz; State of

							CA; Private
McGraw 37	Hidden Valley	Unknown (Tier 2)				McGraw 2004	
McGraw 38	Glen Arbor-Quail Hollow	Unknown (Tier 2)				McGraw 2004	
McGraw 39	Quail Hollow Quarry	Unknown (Tier 1)	Fire exclusion, exotic plants, recreation			McGraw 2004	Co. of Santa Cruz; Private
McGraw 41	South Hihn Road	Unknown (Tier 2)				McGraw 2004	
McGraw 42	Glen Arbor Road, East	Unknown (Tier 3)				McGraw 2004	
<b>Scotts Valley</b>							
7	Felton; Santa Cruz	Presumed extant	Unknown	Unknown	Unknown	CNDDDB 2011	Unknown
8	South of Redwood Glen	Presumed extant	Erosion, road maintenance	Unknown	Unknown	CNDDDB 2011	Private (Salvation Army)
13	Redwood Glen Camp	Presumed extant	Houses adjacent	Unknown	Unknown	CNDDDB 2011	Private
17	Canham Rd.	Presumed extant	Private owner currently protecting	in the 1980s	Unknown	CNDDDB 2011	Private
24	South of Scotts Valley	Presumed extant	Unknown	05/25/1936; C. Belshaw	Unknown	CNDDDB 2011	Unknown
<b>West Lompico</b>							
McGraw 32	West Lompico; ridge between Loch Lomond Reservoir and Lompico	Unknown	Fire exclusion and exotic species			McGraw 2004	Private; Co. of Santa Cruz
<b>Weston Road</b>							
12	Weston Rd.	Presumed extant	Residential development	Unknown	Unknown	CNDDDB 2011	Private
McGraw 2	Weston Rd.	Unknown (Tier 1)	Fire exclusion, rural development			McGraw 2004	Private
<b>Big Basin</b>							
26	Big Basin State Park	Stable; Presumed extant	Exotic species; trampling	05/10/2007: R. Martin	500	CNDDDB 2011	CDPR-Big Basin

CNDDDB identification number = element occurrence (EO) number assigned by the California Natural Diversity Database (CNDDDB 2008)

CDPR = California Department of Parks and Recreation

CDFG = California Department of Fish and Game

SLVWD = San Lorenzo Valley Water District

**U.S. FISH AND WILDLIFE SERVICE**  
**5-YEAR REVIEW**  
*Chorizanthe pungens* var. *hartwegiana*  
(Ben Lomond spineflower)

**Current Classification:** Endangered

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

☐ Downlist to Threatened  
☐ Uplist to Endangered  
☐ Delist  
☒ No change is needed

**Appropriate Listing/Reclassification Priority Number:** N/A

**Review Conducted by:** Kirstina Barry

**FIELD OFFICE APPROVAL:**

**Field Supervisor, Fish and Wildlife Service**

Approve Diane K. Noble Date 1/20/12