

Chorizanthe robusta var. *hartwegii*
(Scotts Valley Spineflower)

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



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

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Cover photographs

Chorizanthe robusta var. *hartwegii* (Scotts Valley spineflower). Photographed May 8 and May 15, 2009, on the Glenwood Open Space Preserve in Scotts Valley, Santa Cruz County, California. Photos courtesy of Kathleen Lyons of Biotic Resources Group, Soquel, California.

5-YEAR REVIEW

Chorizanthe robusta var. *hartwegii* (Scotts Valley Spineflower)

I. GENERAL INFORMATION

Purpose of 5-Year Reviews

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

Species Overview

Chorizanthe robusta (robust spineflower) is a small annual plant in the buckwheat family (Polygonaceae). Two varieties are recognized (Reveal and Morgan 1989): *Chorizanthe robusta* var. *robusta* (robust spineflower), and *Chorizanthe robusta* var. *hartwegii* (Scotts Valley spineflower). The species, inclusive of both varieties, was listed as endangered in 1994 (Service 1994).

Chorizanthe robusta var. *hartwegii* is a narrow endemic restricted to Scotts Valley, Santa Cruz County, California (Figures 1, 2). The variety grows in colonies in wildflower fields on patches of exposed bedrock (Santa Cruz mudstone, Purisima sandstone) overlain with a thin layer of soil in fragmented islands of annual grasslands (Reveal and Morgan 1989, Service 1994). For our purposes, we define colony as a cluster of individuals (Service 2002). The geographic range comprises approximately 1.3 square kilometers (0.5 square mile), with three populations on four properties: Salvation Army land, Scotts Valley High School land, the Glenwood Open Space Preserve, and the Polo Ranch. The total occupied area is less than 0.4 hectare (1 acre) (Service 2002). The endangered *Polygonum hickmanii* (Scotts Valley polygonum) also occurs on three of the properties, and the endangered Ohlone tiger beetle (*Cicindela ohlone*) on one (Arnold, *in litt.* 2004).

Methodology Used to Complete This Review

This review was prepared by the Ventura Fish and Wildlife Office, following the Region 8 guidance issued in March, 2008. We used information from our files, the California Natural

Diversity Database maintained by the California Department of Fish and Game, and information from species experts. We received no information from the public in response to our Federal Register Notice initiating this 5-year review. This 5-year review contains updated information on the species' biology and threats, and an assessment of that information compared to that known at the time of listing or since the last 5-year review. We focus on current threats to the species that are attributable to the Act's five listing factors. The review synthesizes all this information to evaluate the listing status of the species and provide an indication of its progress towards recovery. Finally, based on this synthesis and the threats identified in the five-factor analysis, we recommend a prioritized list of conservation actions to be completed or initiated within the next 5 years.

Contact Information

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Federal Register Notice Citation Announcing Initiation of This Review: A notice announcing initiation of the 5-year review of this taxon and the opening of a 60-day period to receive information from the public was published in the Federal Register on March 25, 2009 (Service 2009). No information was received as a result of this request.

Listing History

Original Listing

Federal Register Notice: 59:5499-5511.

Date of Final Listing Rule: The final rule was published on February 4, 1994, and became effective on March 7, 1994.

Entity Listed: "*Chorizanthe robusta* (inclusive of var. *hartwegii* and var. *robusta*) (robust spineflower)."

Classification: Endangered.

Associated Rulemakings: Critical habitat was designated on May 29, 2002, and became effective on June 28, 2002 (Service 2002).

Review History: This is the first review of the taxon since listing in 1994. However, the Service (2007) reported that the species' status in 2006 was "stable" with 0 to 25 percent of the recovery objectives achieved.

Species' Recovery Number at Start of 5-Year Review: The recovery priority number for *Chorizanthe robusta* var. *hartwegii* is 3 according to the Service's 2006 Recovery Data Call for the Ventura Fish and Wildlife Office (Service 2007), based on a 1 to 18 ranking system where 1

is the highest-ranked recovery priority and 18 is the lowest (Service 1983). This number indicates that the taxon is a variety facing a high degree of threat and with high potential for recovery.

Recovery Plan or Outline

Name of Plan or Outline: Recovery Plan for Insect and Plant Taxa from the Santa Cruz Mountains in California.

Date Issued: September 28, 1998.

II. REVIEW ANALYSIS

Application of the 1996 Distinct Population Segment (DPS) Policy

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

Information on the Species and its Status

Description

Chorizanthe robusta var. *hartwegii* is an annual plant, 10 to 30 centimeters tall (4 to 12 inches), in the buckwheat family (Polygonaceae) and is one of two varieties of *Chorizanthe robusta*. It is diagnosed from the nominate variety by its consistently erect habit (not spreading) and rose-pink rather than white involucre lobes (modified leaves subtending the flower; see cover photo). Reveal and Morgan (1989) provide a complete description. *Chorizanthe robusta* var. *hartwegii* is restricted to Scotts Valley, Santa Cruz County, California. The nominate variety is restricted to coastal and near-coastal locations in Santa Cruz County (Brinegar and Baron 2008).

Species Biology and Life History

Very little is known regarding the biology and life history of *Chorizanthe robusta* var. *hartwegii*. In general, the plants germinate during the winter, flower from April to June, dry and turn a rusty hue during the summer, and eventually break apart during the fall. Depending on vigor of individual plants, dozens to possibly hundreds of seeds are produced per plant, with seed maturation by August. The plants occur in full sun (Reveal and Morgan 1989).

Spatial Distribution

Chorizanthe robusta var. *hartwegii* is a narrow endemic. The variety has a very small geographic range, approximately 1.3 square kilometers (0.5 square mile), and is restricted to a specialized habitat in Scotts Valley in the Santa Cruz Mountains. The two most distant colonies

are separated by approximately 1.8 kilometers (1.1 miles). The total occupied area of all colonies combined comprises less than 0.4 hectare (1 acre).

It is likely that the buildout of the city of Scotts Valley and the construction of State Highway 17 (an expressway through the city) removed some occupied areas prior to listing. Since listing, the landscape has become increasingly developed and has resulted in extirpation of some colonies.

Three populations were identified by Reveal and Morgan (1989), all at the northern edge of the city of Scotts Valley. Each population consisted of eight or more colonies. The California Department of Fish and Game (2009) refers to the three populations as three element occurrences. However, the designation of groups of colonies as either populations or element occurrences likely has no biological relevance.

The colonies north of Casa Way (west of Glenwood Drive) comprise element occurrence 1: on Salvation Army land, Scotts Valley High School land, and the western part of the Glenwood Open Space Preserve. The colonies north of Vine Hill School Road (east of Glenwood Drive) on the eastern part of the Glenwood Open Space Preserve comprise element occurrence 2. These two populations are on three adjacent properties and west of State Highway 17. The colonies on the Polo Ranch comprise element occurrence 3. This population is east of State Highway 17 and approximately 0.5 kilometer (0.3 mile) from element occurrence 2.

Habitat

The plants occur only on patches of exposed bedrock (Santa Cruz mudstone, Purisima sandstone) overlain with a thin layer of soil in fragmented islands of annual grasslands (Reveal and Morgan 1989, Service 1994) at Scotts Valley in the Santa Cruz Mountains. In the Scotts Valley area, the grasslands are generally on the middle to lower slopes within the sub-watersheds, while the higher slopes support redwood (*Sequoia sempervirens*) and mixed forest (Service 2003). The species occurs at 213 to 244 meters elevation (700 to 800 feet) (Hinds and Morgan 1995), and approximately 11 kilometers (7 miles) inland from the coast.

The taxon grows in colonies in wildflower fields associated with the following native species: *Arenaria californica* (California sandwort), *Arenaria douglasii* (Douglas' stitchwort), *Calochortus luteus* (yellow mariposa lily), *Clarkia purpurea* (winecup clarkia), *Corethrogyne filaginifolia* (common sandaster), *Gilia clivorum* (purplespot gilia), *Hemizonia corymbosa* (coastal tarweed), *Lasthenia californica* (California goldfields), *Lepidium nitidum* (shining pepperweed), *Lomatium caruifolium* (alkali desertparsley), *Lotus purshianus* (American bird's-foot trefoil), *Lupinus nanus* (sky lupine), *Navarretia atractylodes* (hollyleaf pincushionplant), *Castilleja densiflora* (denseflower Indian paintbrush), *Polygonum hickmanii* (Scotts Valley polygonum), *Trifolium albopurpureum* (rancheria clover), *Trifolium barbigerum* (Andrews' clover), *Trifolium depauperatum* (cowbag clover), and *Trichostema lanceolatum* (vinegarweed) (Reveal and Morgan 1989, Service 2002).

The wildflower fields support a greater number of native plants, whereas the remainder of the annual grassland supports a greater number of invasive (non-native) plants. This results from the

thin and well-drained soil underlying the wildflower fields, while most of the annual grassland is underlain by deeper soil with a greater water-holding capacity (Service 2002).

The Service (2002) identified the following habitat components as essential to conservation of *Chorizanthe robusta* var. *hartwegii*: (1) thin soils in the Bonnydoon series that have developed over outcrops of Santa Cruz mudstone and Purisima sandstone; (2) wildflower field habitat that has developed on these thin-soiled sites; (3) a grassland plant community that supports the wildflower field habitat, that is stable over time and in which non-native species are absent or are at a density with little or no adverse effect on resources available for growth and reproduction; (4) sufficient areas around each population to allow for recolonization to adjacent suitable microhabitat sites in the event of catastrophic events; (5) pollinator activity between existing colonies; (6) seed dispersal mechanisms between existing colonies and other potentially suitable sites; and (7) sufficient integrity of the watershed above the habitat to maintain soil and hydrologic conditions that provide seasonally wet substrate for growth and reproduction. These are the primary constituent elements for its designated critical habitat (Service 2002).

Abundance

Reveal and Morgan (1989) reported the following regarding numbers of individuals: north of Casa Way, several thousand individuals; north of Vine Hill School Road, less than 1,000 individuals; and Polo Ranch, approximately 1,000 individuals. The Service (1994) interpreted this as approximately 6,000 individuals. In 1992, surveys were conducted north of Vine Hill School Road and, in part, north of Casa Way for the proposed Glenwood Estates Development and golf course, which recorded approximately 73,000 individuals (Habitat Restoration Group 1992) (Table 1).

Only one comprehensive survey has been conducted on the Salvation Army property, which reported approximately 32,066 plants in 1992 (Habitat Restoration Group 1992). Lyons (*in litt.* 2009) recorded $\geq 6,336$ individuals on Salvation Army land in 2009, but the survey did not include three colonies with approximately 3,060 individuals in 1992.

Surveys were conducted each year on the Scotts Valley High School land from 1997 to 2003, with approximate numbers of plants ranging from 16,980 in 1997 to 5,000 in 1999 (Lyons, *in litt.* 2009). In 2009, approximately 10,525 plants were recorded in the Scotts Valley High School Preserve (Lyons, *in litt.* 2009).

At the time of listing, approximately 41,141 individuals had been reported on the Glenwood Open Space Preserve in 1992 (Habitat Restoration Group 1992). Since then, surveys were conducted each year from 2004 to 2009, with approximate numbers of plants ranging from 28,118 in 2005 to 9,451 in 2008 (Greer et al. 2009). In 2009, approximately 16,769 plants were recorded (Lyons, *in litt.* 2009).

Since listing, five surveys have been conducted on the Polo Ranch, with approximate numbers ranging from 6,322 in 1998 (Lyons, *in litt.* 1998) to 13,595 in 2003 (Lyons, *in litt.* 2003b). The most recent survey reported approximately 7,799 plants in 2005 (Lyons, *in litt.* 2005). In 1997, the occupied area of 25 colonies comprised 0.17 hectare (0.41 acre) (Lyons, *in litt.* 1997); and in

2005, the occupied area of 22 colonies comprised 0.15 hectare (0.36 acre) (Huffman-Broadway Group 2008).

Since listing, there is no single year when surveys were conducted for all three populations. Although each population is extant, some colonies have been extirpated, in particular 5 of the 38 colonies north of Casa Way (Habitat Restoration Group 1992; Lyons 2004; Greer et al. 2009) and 6 of the 8 colonies north of Vine Hill School Road (Habitat Restoration Group 1992; Wetlands Research Associates et al. 2004; Greer et al. 2009; Lyons, *in litt.* 2009). Up to 11 of 33 colonies may now be extirpated on the Polo Ranch (Lyons, *in litt.* 1997, *in litt.* 2005; Huffman-Broadway Group 2008). Having considered all available information, our best estimates for numbers of extant colonies are the following: north of Casa Way, up to 33 colonies; north of Vine Hill School Road, 2 colonies; and on Polo Ranch, 22 colonies.

In sum, in light of the observed decline in numbers of individuals and the extirpation of some colonies since 1992, the abundance of *Chorizanthe robusta* var. *hartwegii* is decreasing.

Changes in Taxonomic Classification or Nomenclature

The taxonomic arrangement proposed by Reveal and Morgan (1989) was followed by Hickman (1993). There have been no subsequent changes.

Genetics and Species-specific Research

The systematics of the species comprising *Chorizanthe* are difficult and confusing (Reveal and Hardham 1989; Hickman 1993). The Service funded research on the phylogenetic relationships of the *Chorizanthe robusta*/*Chorizanthe pungens* complex. Using molecular techniques, Brinegar and Baron (2008) determined the following: (1) *Chorizanthe robusta* var. *robusta* is more closely related to *Chorizanthe pungens* var. *pungens* (Monterey spineflower, threatened) than to *Chorizanthe robusta* var. *hartwegii*; (2) *Chorizanthe robusta* var. *hartwegii* is more closely related to *Chorizanthe pungens* var. *hartwegiana* (Ben Lomond spineflower, endangered) than to *Chorizanthe robusta* var. *robusta*; and (3) these four taxa comprise a number of geographically-close populations in ecologically-different habitats, and although they are generally morphologically distinct (except in some cases at the extremes of their ranges), the genetic differences are small. In brief, Brinegar and Baron (2008) suggested that systematists consider recognizing *Chorizanthe robusta* (inclusive of *Chorizanthe robusta* var. *robusta* and *Chorizanthe robusta* var. *hartwegii*) and *Chorizanthe pungens* (inclusive of *Chorizanthe pungens* var. *pungens* and *Chorizanthe pungens* var. *hartwegiana*) as a single species while retaining variety designations.

Five-Factor Analysis

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

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

At the time of listing, *Chorizanthe robusta* var. *hartwegii* and its associated habitats were threatened by residential, golf course, and commercial developments. Specifically, for the two populations north of Casa Way and Vine Hill School Road, a residential and golf course development (Glenwood Estates Development) was proposed for construction on two of the three properties. At the Polo Ranch, Borland Software Corporation was intending to establish its global headquarters nearby and “set aside habitat” for *Chorizanthe robusta* var. *hartwegii* (Service 1994).

Salvation Army land

Salvation Army land comprises 83 hectares (206 acres) immediately west of the Scotts Valley High School and the Glenwood Open Space Preserve at the northern edge of the city of Scotts Valley. We are aware of 13 colonies having been recorded on the property: three colonies on the eastern side of Cupcake Hill, approximately 28 meters (91 feet) west of the boundary with Scotts Valley High School; two colonies just southwest of Cupcake Hill, approximately 16 meters (52 feet) downslope of a paved road built in 1999 to access a water tank; three colonies at the southern end of the property near the boundary line; three colonies on the western side of Teacup Hill; and two colonies at the southern end of Teacup Hill, one which extends also onto the Glenwood Open Space Preserve (Habitat Restoration Group 1992; Greer et al. 2009).

Since listing in 1994, a paved road has been built near colonies on the southern part of the property and a high school on an adjacent property to the east. The Salvation Army prepared a draft conservation easement over 1.8 hectares (4.4 acres) inclusive of some colonies on the southern part of the property. However, the California Department of Fish and Game found the terms unacceptable (Gogul-Prokurat 2004). We are not aware of any progress toward resolution of this issue.

Part of the property with *Chorizanthe robusta* var. *hartwegii* is subject to a re-vegetation and management plan, which includes fencing and periodic mowing (Gogul-Prokurat 2004). The most-recent Google Earth image (dated July, 2007) showed signs of mowing in the vicinity of some colonies to reduce invasive grasses, along with numerous trails in the vicinity of the colonies. Trespass by persons with motorbikes and dirt bikes was a problem in 2004. Gogul-Prokurat (2004) reported a dirt bike trail through an area with colonies and observed a person riding a motorbike through it. O'Brien (pers. comm. 2009) stated that paintballing occurs on the property near the water tank, despite a locked gate barring access.

Scotts Valley High School

Construction of a high school north of Casa Way was not envisioned at the time of listing. Scotts Valley High School land comprises 20 acres west of State Highway 17 at the northern edge of the city of Scotts Valley, including a grassland preserve of 3.2 hectares (8 acres). Construction began in 1998, at which time the Scotts Valley High School Preserve was established to protect native wildflowers, including 14 colonies of *Chorizanthe robusta* var.

hartwegii on approximately 0.19 hectare (0.47 acre) (Lyons 1998, 2004). The preserve is bounded by development on three sides: high school facilities to the north (immediate proximity to athletic fields and a parking lot), and residences to the east and south. Salvation Army land is to the west.

Four additional colonies in the high school construction site were salvaged and relocated to the Grassland Scrub and Revegetation Area on the western portion of the property in 1999. The transplanting effort was not successful, possibly because of disturbance from construction activities (Lyons 2004). The Scotts Valley Unified School District (*in litt.* 2009) is now proposing to use the area for solar arrays to generate electricity, which is contrary to the agreement for "long-term management and protection" (Lyons 1998) with the California Department of Fish and Game. The Grassland Scrub and Revegetation Area was established as partial mitigation for impacts to sensitive biological resources by construction of the high school.

The preserve is subject to a habitat mitigation and monitoring plan in perpetuity (Lyons 1998). Mowing to a height of 8 to 10 centimeters (3 to 4 inches) to reduce invasive plants occurred twice in 2003 (late spring and summer), while avoiding *Chorizanthe robusta* var. *hartwegii* (and *Polygonum hickmanii*). The most-recent Google Earth image (dated July, 2007) showed signs of mowing over approximately 80 percent of the preserve. Another 10 percent was covered with what appear to be brush and trees, and another 10 percent showed no signs of mowing. After 5 years of implementing the habitat mitigation and monitoring plan, the mowing regime had not substantially reduced invasive grasses; however, it did control thistle growth and natural colonization by coyotebrush (*Baccharis pilularis*; a competitive native species) (Lyons 2004). Lyons (2004) reported that while invasive grasses grow on and around the rocky outcrops containing the two endangered plants, invasive grasses were not at levels that affected their growth in 2003.

Although the preserve is fenced, Lyons (2004) observed minor disturbance by students traversing to and from the high school in 2003. Gogul-Prokurat (2004) observed a number of golf balls within the preserve. Lyons (2002) previously reported residents using the preserve for golf practice. In addition, Cheap (*in litt.* 2008) reported the dumping of concrete and other waste debris onto the preserve, most likely by an adjacent homeowner. Some debris had been dumped directly on *Chorizanthe robusta* var. *hartwegii*. These observations exemplify types of secondary impacts that can occur to listed species located adjacent to urban areas. The Scotts Valley High School upgraded part of the fencing around the preserve from barbed wire to chain link in 2003.

Glenwood Open Space Preserve

The Glenwood Open Space Preserve comprises 65 hectares (160 acres) of land north, east and northwest of the Scotts Valley High School. In 2003, an agreement was reached between Ponderosa Homes and the City of Scotts Valley for development of Glenwood Estates on Deerfield Drive immediately east of the high school, which included creation of an open space preserve with transfer of ownership to the City of Scotts Valley. The development comprised 45 homes on 14 hectares (35 acres), with construction from 2003 to 2005.

The developer managed and contracted for annual monitoring on the preserve for 5 years (2004 to 2008) (Wetlands Research Associates et al. 2004; Greer et al. 2005, 2006, 2008, 2009). Controlled grazing by horses was implemented on the preserve in 2004 and is ongoing, which appears to be effective in helping to reduce invasive grasses (Greer et al. 2009). As of mid-2009, the City of Scotts Valley and the Land Trust of Santa Cruz County are jointly managing the preserve with an endowment of \$1,070,000. A long-term management plan is being prepared with intention to protect and enhance the natural resources, while accommodating low-intensity recreational use. However, the Scotts Valley Water District may install a well and infrastructure on the preserve (City of Scotts Valley et al. 2009) which could adversely affect *Chorizanthe robusta* var. *hartwegii*.

Habitat Restoration Group (1992) documented 17 colonies on the property in 1992. As of 2009, seven appear to have been extirpated (Greer et al. 2009; Lyons, *in litt.* 2009). Five of these were in the southeastern corner of the property within a narrow strip (113 meters long by 14 meters wide; 372 feet x 45 feet) between the houses on Tabor Road and Vine Hill Elementary School. Apparently this area was disturbed during house construction as evidenced by piles of construction debris and dumped rock (also garden clippings; Wetlands Research Associates et al. 2004).

Polo Ranch

In 1993, Borland Software Corporation established its global headquarters on a portion of the former amusement park known as Santa's Village, which operated from 1957 to 1977. Upon closing of the amusement park, the zoning was changed from commercial to residential for the northeastern portion of the property, which Lennar Communities acquired in 1997 and is now known as Polo Ranch. In 2000, Borland Software Corporation subsequently relocated and sold its headquarters building.

Polo Ranch comprises 46 hectares (114 acres) of grassland and forest east of State Highway 17 at the northern edge of the city of Scotts Valley. The property is situated at the northern terminus of Santa's Village Road, north of the North Navarra Drive residential neighborhood, and northeast of the former Borland Software Corporation campus, with Carbonera Creek forming the western boundary. It has a history of grazing by horses until the early 1990's (Huffman-Broadway Group 2008). The property has been the subject of several residential development proposals since 1990 (Huffman-Broadway Group 2008).

Thirty-three colonies of *Chorizanthe robusta* var. *hartwegii* have been recorded on the Polo Ranch from 1990 to 2005 (Lyons, *in litt.* 2005). Lyons (*in litt.* 1998) reported disturbances by off-highway vehicles to the rock outcrops supporting *Chorizanthe robusta* var. *hartwegii* (and *Polygonum hickmanii*). In 2003, one colony (41 plants) was disturbed by firebreak grading and subsequently had no *Chorizanthe robusta* var. *hartwegii* in 2004 and 2005 (Lyons, *in litt.* 2004, *in litt.* 2005), despite remediation efforts (Lyons, *in litt.* 2003a). Also in 2003, Gogul-Prokurat (2004) reported a number of off-road vehicle and bicycle trails. Although a "No trespassing" sign was posted, the main access gate was not locked. In 2004, Lyons (*in litt.* 2004) reported invasive grasses and coyotebrush had increased. In 2005, Lyons (*in litt.* 2005) reported that increases in "weedy grass/herbaceous growth," off-highway vehicles, and recreational activities

were compromising the existence of *Chorizanthe robusta* var. *hartwegii*. In 2006, much of the area was covered with coyotebrush (Morgan, pers. comm. 2009). In August, 2006, Lennar Communities “...installed fencing around all known populations of listed plant species...” to prevent access (Huffman-Broadway Group 2008).

The U.S. Army Corps of Engineers (*in litt.* 2009) is currently consulting with the Service regarding Lennar Communities’ development proposal and its effects on *Chorizanthe robusta* var. *hartwegii* and *Polygonum hickmanii*. Specifically, Lennar Communities is proposing the following: construct 40 residential units on 5 hectares (12 acres); retain 41 hectares (101 acres) as open space; erect additional fencing; and manage and place a conservation easement over 12 hectares (30 acres), inclusive of the areas with the two endangered plants (Huffman-Broadway Group 2008).

Although Lennar Communities is not proposing to directly destroy any occupied area, development would be within approximately 32 meters (104 feet) of the nearest colony, and fencing would contact one colony. The proposed residential development within such close proximity to the colonies of *Chorizanthe robusta* var. *hartwegii* and its secondary impacts (e.g., increased use of the property for various types of recreation) constitute a serious threat to their survival.

Summary of Factor A

The three populations of *Chorizanthe robusta* var. *hartwegii* occur on four properties that are all near an urban area. On three of the properties (Salvation Army land, Scotts Valley High School land, Glenwood Open Space Preserve), the two populations persist in a fragmented and highly disturbed ecosystem and proximal to development. The numbers of *Chorizanthe robusta* var. *hartwegii* on these properties have decreased substantially through the extirpation of at least 11 colonies. On the Polo Ranch, the ecosystem is impacted by recreational use, and a proposed residential development in close proximity to the colonies constitutes a serious threat to survival of this population. In brief, *Chorizanthe robusta* var. *hartwegii* remains threatened by habitat destruction due to existing and proposed developments, their associated impacts, and invasive and competitive native species. Management of the sites is necessary to maintain the species over the long-term.

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

Overutilization for any purpose was not a factor in the 1994 final listing rule (Service 1994) and is not known to be a threat in 2009.

FACTOR C: Disease or Predation

Disease or predation was not a factor in the 1994 final listing rule (Service 1994) and is not known to be a threat in 2009.

FACTOR D: Inadequacy of Existing Regulatory Mechanisms

This factor was an identified threat at the time of listing (Service 2003). Since then, laws and regulations have not been successful in protecting *Chorizanthe robusta* var. *hartwegii*. In particular, the following projects adversely changed the landscape for the two populations north of Casa Way and Vine Hill School Road: construction of the Scotts Valley High School in 1998; construction of the Scotts Valley Water District's recycled water distribution system in 1999; and construction of Glenwood Estates on Deerfield Drive in 2003. In addition, although the Scotts Valley High School Preserve and the Grassland and Scrub Revegetation Area are subject to a habitat mitigation and monitoring plan in perpetuity (an agreement with the California Department of Fish and Game) (Lyons 1998), they have no long-term legal status (Gogul-Prokurat 2004) and there is no penalty for failing to enact the plan.

The following is a brief summary of the Federal and State laws that apply.

Federal Protections

Clean Water Act

Under section 404, the U.S. Army Corps of Engineers regulates the discharge of fill material into waters of the United States, which include navigable and isolated waters, headwaters, and adjacent wetlands (33 United States Code 1344). In general, the term “wetland” refers to areas meeting the U.S. Army Corps of Engineers’ criteria of hydric soils, hydrology (either sufficient annual flooding or water on the soil surface), and hydrophytic vegetation (plants specifically adapted for growing in wetlands). Any action with the potential to impact waters of the United States must be reviewed under the Clean Water Act, National Environmental Policy Act, and Endangered Species Act. These reviews require consideration of impacts to listed species and their habitats, and recommendations for mitigation of significant impacts. However, the U.S. Army Corps of Engineers, under their limited scope of analysis, issued their permit for Glenwood Estates on Deerfield Drive without consultation under the Endangered Species Act (Service, *in litt.* 2003), even though *Chorizanthe robusta* var. *hartwegii* and its critical habitat (and the Ohlone tiger beetle) occurred on the property prior to subdivision. The U.S. Army Corps of Engineers (*in litt.* 2009) is currently consulting with the Service regarding a development proposal on the Polo Ranch and its effects on *Chorizanthe robusta* var. *hartwegii* (and *Polygonum hickmanii*).

Endangered Species Act of 1973, as Amended (Act)

The Act is the primary Federal law providing protection for this species. The Service’s responsibilities include administering the Act, including sections 7, 9, and 10 that address take. Since listing, the Service has analyzed the potential effects of Federal projects under section 7(a)(2), which requires Federal agencies to consult with the Service prior to authorizing, funding, or carrying out activities that may affect listed species. A jeopardy determination is made for a project that is reasonably expected, either directly or indirectly, to appreciably reduce the likelihood of both the survival and recovery of a listed species in the wild by reducing its reproduction, numbers, or distribution (50 Code of Federal Regulations 402.02). A non-jeopardy

opinion may include reasonable and prudent measures that minimize the amount or extent of incidental take of listed species associated with a project.

With regard to Federally listed plant species, section 7(a)(2) requires Federal agencies to consult with the Service to ensure any project they fund, authorize, or carry out does not jeopardize a listed plant species. Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the “take” of Federally endangered wildlife; however, the take prohibition does not apply to plants. Instead, plants are protected from harm in two particular circumstances. Section 9 prohibits (1) the removal and reduction to possession (i.e., collection) of endangered plants from lands under Federal jurisdiction, and (2) the removal, cutting, digging, damage, or destruction of endangered plants on any other area in knowing violation of a State law or regulation or in the course of any violation of a State criminal trespass law. Federally listed plants may be incidentally protected if they co-occur with Federally listed wildlife species. In brief, this law has only limited ability to protect *Chorizanthe robusta* var. *hartwegii* and other Federally listed plant species on non-Federal land.

State Protections in California

The California Endangered Species Act does not apply to *Chorizanthe robusta* var. *hartwegii* because the taxon is not listed by the State.

California Environmental Quality Act (CEQA)

The CEQA requires review of any project that is undertaken, funded, or permitted by the State or a local governmental agency. In general, if significant effects are identified, the lead agency may require project redesign to avoid impacts, or require development of measures to fully mitigate significant impacts, or make a finding that overriding considerations make full mitigation infeasible. Therefore, protection of Federally listed plant species through CEQA is dependent upon the determination of the lead agency involved.

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

The following factors were identified at the time of listing in 1994: a proposed Glenwood Estates Development and golf course, and stochastic (random) extinction. The proposed Glenwood Estates Development and golf course was never approved, however development projects comprising similar threats have been completed. Stochastic extinction remains a threat, and we identify the following as new threats: invasive and competitive native species, and climate change.

The proposed Glenwood Estates Development and golf course would have destroyed numerous small colonies of *Chorizanthe robusta* var. *hartwegii* while setting aside several reserves for the largest colonies. Completed development projects comprising similar threats to the two populations north of Casa Way and Vine Hill School Road are the following: the Scotts Valley High School, a paved road on the southern portion of the Salvation Army land, housing along Tabor Drive adjacent to the southeastern portion of the Glenwood Open Space Preserve, and Glenwood Estates on Deerfield Drive. In addition to destroying approximately 11 colonies by

direct and secondary impacts, the landscape is now substantially altered by development. Most of the affected colonies now exist in a highly disturbed ecosystem immediately adjacent to development.

Stochastic Extinction

Species with few populations and/or individuals are vulnerable to stochastic extinction. In this situation, naturally occurring events can cause extinction through mechanisms operating at the genetic level (e.g., decrease in genetic variability), the population level (e.g., lack of ability to attract pollinators because of few individuals), or the landscape level (e.g., storms, drought, fire) (Service 2003).

Stochastic extinction is a threat because *Chorizanthe robusta* var. *hartwegii* is an annual plant that is restricted to a habitat of limited distribution within a small geographic area and its populations are small and isolated. No additional populations have been found since listing, and the total occupied area comprises less than 0.4 hectare (1 acre).

Invasive Species and Competitive Native Species

Much of the previously native grassland is now occupied by invasive grasses, which are now a threat to *Chorizanthe robusta* var. *hartwegii* on all four properties. In particular, much of the habitat on the Scotts Valley High School Preserve is now occupied by non-native grasses, which must be mowed to reduce adverse effects to this species and *Polygonum hickmanii*. At Polo Ranch, competitive native species are also threatening *Chorizanthe robusta* var. *hartwegii* and its habitat. See Factor A for additional discussion about invasive species and competitive 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 2007). The potential impacts of climate change on the flora of California were discussed recently by Loarie et al. (2008). Based on modeling, they predicted that species' distributions will shift in response to climate change and that species will move to higher elevations and northward, depending on the ability of each species to do so. Increases in species diversity in higher elevations and northern locations due to climate change have the potential to result "...in new species mixes, with consequent novel patterns of competition and other biotic interactions..." with unknown consequences to the species which currently exist there (Loarie et al. 2008). While we lack adequate information to make specific and accurate predictions regarding how climate change in combination with other factors such as small population size will affect *Chorizanthe robusta* var. *hartwegii*, small-ranged species are more vulnerable to extinction due to these changing conditions (Loarie et al. 2008).

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 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 interim recovery objective for *Chorizanthe robusta* var. *hartwegii* (Service 1998) is to avert extinction by establishing conservation easements, restricting activities to those compatible with the plant, or acquiring the four properties. As of 2009, very little has been accomplished toward achieving the interim recovery objective. However, the interim recovery objective remains appropriate because it addresses Factors A, D, and E. The Service (1998) stated that delisting may not be feasible due to limited range and limited conservation opportunities. However, the interim downlisting criteria (Service 1998) from endangered to threatened are the following.

1. All four properties have been acquired or have permanent conservation easements.

No progress has been achieved regarding acquisition or establishment of permanent conservation easements on Salvation Army land, Scotts Valley High School land, or the Polo Ranch. In addition, these three sites have been impacted by development activities or currently have development proposed. A paved road was constructed on Salvation Army land near some colonies. The Scotts Valley High School was constructed on the Scotts Valley Unified School District's property, with some colonies now persisting in the Scotts Valley High School Preserve (3.2 hectares; 8 acres). On the Polo Ranch, a residential development is proposed, which is currently being reviewed by the Service.

However, the Glenwood Open Space Preserve was created in 2003 with ownership of the land transferred to the City of Scotts Valley. The City of Scotts Valley and the Land Trust of Santa Cruz County are jointly managing the preserve, with an endowment of \$1,070,000. A long-term management plan is being prepared with a stated intention to protect and enhance the natural resources (including *Chorizanthe robusta* var. *hartwegii*), while accommodating low-intensity recreation. In sum, as of 2009, none of the properties have been acquired by a conservation organization or have permanent conservation easements.

2. Conservation measures are included in a habitat conservation plan with the City of Scotts Valley.

No progress has been achieved regarding a habitat conservation plan with the City of Scotts Valley.

3. Population numbers are stable or increasing.

Since listing in 1994 and publication of the recovery plan in 1998, the populations of *Chorizanthe robusta* var. *hartwegii* have declined. In particular, developments have adversely impacted the two populations north of Casa Way and Vine Hill School Road. These developments include construction of the Scotts Valley High School, construction of the Scotts Valley Water District's recycled water distribution system, and construction of Glenwood Estates on Deerfield Drive and other houses. Altogether these developments have substantially reduced and fragmented the annual grassland in the landscape and have extirpated 11 colonies. The ecosystem on the Polo Ranch is impacted by recreational use and is further threatened by a proposed housing development on the property and by invasive and competitive native species. In 1994, the Service considered that *Chorizanthe robusta* var. *hartwegii* had a high potential for recovery. As of 2009, recovery now seems unlikely.

IV. SYNTHESIS

Chorizanthe robusta var. *hartwegii* is a narrow endemic and restricted to Scotts Valley, Santa Cruz County, California. The variety grows in colonies in wildflower fields on patches of exposed bedrock (Santa Cruz mudstone, Purisima sandstone) overlain with a thin layer of soil in fragmented islands of annual grasslands, which is a specialized habitat of very limited distribution. The total occupied area of all colonies combined comprises less than 0.4 hectare (1 acre).

Three populations occur on four properties (Reveal and Morgan 1989, Service 1994) within an area of approximately 1.3 square kilometers (0.5 square mile): Salvation Army land, Scotts Valley High School land, the Glenwood Open Space Preserve, and the Polo Ranch. The entire geographic range is near an urban area. Recovery efforts since listing in 1994 have not been effective.

The three populations are adjacent to existing or proposed developments. The ecosystem north of Casa Way and Vine Hill School Road (Salvation Army land, Scotts Valley High School land, Glenwood Open Space Preserve) is now fragmented and highly disturbed by development and invasive plant species. Developments since listing include the Scotts Valley High School, the Scotts Valley Water District's recycled water distribution system, Glenwood Estates on Deerfield Drive, other houses, and roads. The ecosystem on the Polo Ranch is impacted by recreational use and is further threatened by a proposed housing development on the property and by invasive and competitive native species. In sum, *Chorizanthe robusta* var. *hartwegii* faces a high degree of threat with little potential for recovery. Therefore, it still meets the definition of endangered, and we recommend no status change.

V. RESULTS

Recommended Listing Action

- Downlist to Threatened
 Uplist to Endangered
 Delist (indicate reason for delisting according to 50 Code of Federal Regulations 424.11)
 Extinction
 Recovery
 Original data for classification in error
 No Change

New Recovery Priority Number and Brief Rationale: 6c. We assign a new recovery priority number of 6c (previously 3). Based on a 1 to 18 ranking system where 1 is the highest-ranked recovery priority and 18 is the lowest (Service 1983), this number indicates a variety facing a high degree of threat with low potential for recovery, and in conflict with development.

Three populations occur on four properties (Reveal and Morgan 1989, Service 1994) within an area of approximately 1.3 square kilometers (0.5 square mile). The total occupied area of all colonies combined comprises less than 0.4 hectare (1 acre). The three populations are adjacent to existing or proposed developments in a highly fragmented landscape. The numbers of *Chorizanthe robusta* var. *hartwegii* have decreased substantially since listing in 1994 through the extirpation of at least 11 colonies. Recovery efforts have not been effective, and recovery now seems unlikely.

VI. RECOMMENDATIONS FOR ACTIONS OVER THE NEXT 5 YEARS

- 1. Polo Ranch.** The Polo Ranch contains the only potentially intact ecosystem with *Chorizanthe robusta* var. *hartwegii* (and *Polygonum hickmanii*). Therefore, we recommend pursuing opportunities for acquisition of the Polo Ranch by a conservation organization to appropriately manage it as a preserve for sensitive plant species.
- 2. Salvation Army land.** We recommend pursuing a conservation easement over the area with *Chorizanthe robusta* var. *hartwegii* (and *Polygonum hickmanii*) and that the area be appropriately managed by a conservation organization as a preserve for the plants.
- 3. Scotts Valley High School.** We recommend the preserve and the grassland and revegetation area be protected by a conservation easement with appropriate management by a conservation organization. In addition, we recommend the Scotts Valley High School implement an education program (with assistance from the Ventura Fish and Wildlife Office) for its students and the community that includes conservation of *Chorizanthe robusta* var. *hartwegii* and *Polygonum hickmanii*.
- 4. Glenwood Open Space Preserve.** We recommend the entire property be protected by a conservation easement with appropriate management and prevention of activities that would

adversely affect *Chorizanthe robusta* var. *hartwegii* and other listed species (e.g., Ohlone tiger beetle).

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

Chorizanthe robusta var. *hartwegii* (Scotts Valley Spineflower)

Current Classification: Endangered

Recommendation Resulting from the 5-Year Review:

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

Appropriate Reclassification Priority Number: NA

Review Conducted By: Christopher Kofron

FIELD OFFICE APPROVAL:

Lead Field Supervisor, U.S. Fish and Wildlife Service

Approve Diane K. White Date 11/12/09

Table 1. Approximate numbers reported for *Chorizanthe robusta* var. *hartwegii* (Scotts Valley spineflower) in Scotts Valley, Santa Cruz County, California. [Prepared for 5-year review, 2009.]

Property	1989	1992	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Salvation Army land	5,000 ¹⁰	32,066 ¹													≥ 6,336 ⁹
Scotts Valley High School			16,980 ²	16,500 ²	5,000 ²	15,250 ²	11,500 ²	12,000 ²	13,000 ²						10,525 ⁹
Glenwood Open Space Preserve		41,141 ¹								25,237 ³	28,118 ³	10,642 ³	11,201 ³	9,451 ³	16,769 ⁹
Polo Ranch	1,000 ¹⁰		7,950 ⁴	6,322 ⁵					13,595 ⁶	9,931 ⁷	7,799 ⁸				

¹ June; Habitat Restoration Group 1992. There is an error in the database of the California Department of Fish and Game (2009), which attributes the census data only to east of Glenwood Drive.

² In 1999, four additional colonies were salvaged from the high school construction site, however transplanting was not successful; Lyons 2004.

³ Greer et al. 2009.

⁴ April 29 to May 27; Lyons, *in litt.* 1997.

⁵ July 23; Lyons, *in litt.* 1998.

⁶ May 22 to July 10; Lyons, *in litt.* 2003b.

⁷ May 7 to June 8; Lyons, *in litt.* 2004.

⁸ May 5 to May 20; Lyons, *in litt.* 2005.

⁹ Lyons, *in litt.* 2009.

¹⁰ Reveal and Morgan 1989.

Figure 1. Map showing the three populations of *Chorizanthe robusta* var. *hartwegii* (Scotts Valley spineflower) in Santa Cruz County, California. [Prepared for 5-year review, 2009.]

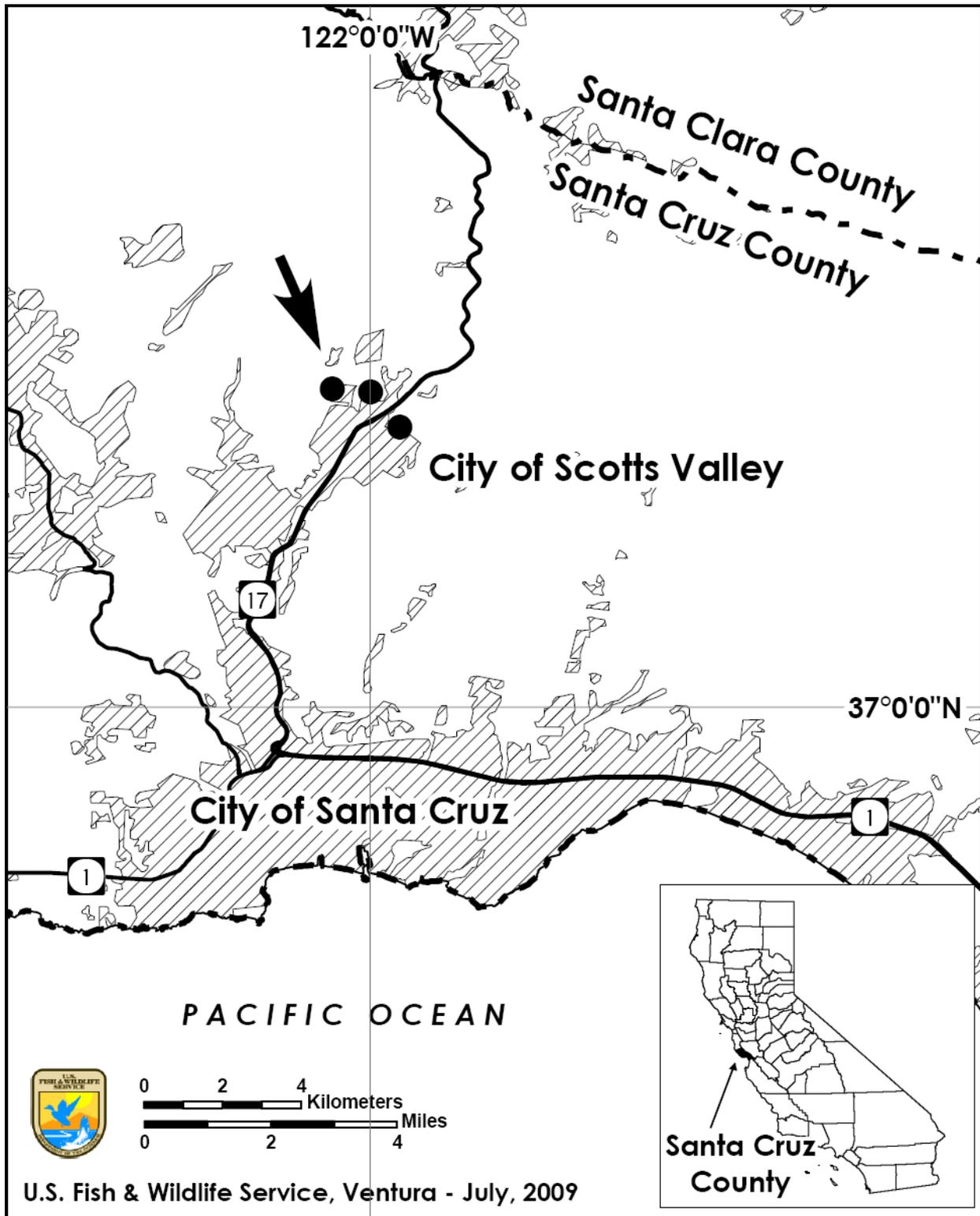


Figure 2. Approximate locations of all known colonies of *Chorizanthe robusta* var. *hartwegii* (Scotts Valley spineflower) in Scotts Valley, Santa Cruz County, California. Multiple colonies are located within the areas depicted by the red ovals, with approximate locations according to Habitat Restoration Group (1992), Lyons (2004), Huffman-Broadway Group (2008), and Greer et al. (2009). The status of every colony is not known in 2009. The Google Earth image is dated July, 2007. [Prepared for 5-year review, 2009.]

