

*Polygonum hickmanii*  
(Scotts Valley Polygonum)

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



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

**November 2009**

### **Cover photographs**

**Upper:** *Polygonum hickmanii* (Scotts Valley polygonum). Photographed July 23, 2003, on the Polo Ranch in Scotts Valley, Santa Cruz County, California. Photo courtesy of Mary Ann Showers of the California Department of Fish and Game, Sacramento, California.

**Lower:** Habitat of *Polygonum hickmanii* (Scotts Valley polygonum). The species inhabits rock outcrops in native grassland in Santa Cruz County, California. Photographed July 23, 2003, on the Polo Ranch in Scotts Valley, Santa Cruz County. Photo courtesy of Mary Ann Showers of the California Department of Fish and Game, Sacramento, California.

## **5-YEAR REVIEW**

### ***Polygonum hickmanii* (Scotts Valley Polygonum)**

#### **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**

As summarized in the final rule for listing (Service 2003), *Polygonum hickmanii* is a small, annual plant, 2 to 5 centimeters tall (1 to 2 inches) in the buckwheat family (Polygonaceae). The leaves are linear and pointed, and the single white flower is in the axil of bracteal leaves (modified leaves near the flower). Germination is in the fall or early winter in response to seasonal rains. The plants grow slowly over the next few months, remaining inconspicuous until flowering begins in May. New flowers are produced until climate or microhabitat conditions are no longer favorable. The species is a narrow endemic and restricted to Scotts Valley, Santa Cruz County, California (Figure 1).

*Polygonum hickmanii* occurs in colonies at two sites (the Polo Ranch, and north of Casa Way) approximately 1.6 kilometers (1 mile) apart at the northern end of Scotts Valley. For our purposes, we define colony as a cluster of individuals (Service 2000). The total inhabited area comprises less than 0.4 hectare (1 acre). The habitat is rock outcrops in annual grassland (Service 2003) at 213 to 244 meters (700 to 800 feet) elevation (Hinds and Morgan 1995). The plants grow on gently-sloping to nearly-level thin soil over outcrops of Santa Cruz mudstone and Purisima sandstone (Hinds and Morgan 1995). The endangered *Chorizanthe robusta* var. *hartwegii* (Scotts Valley spineflower) (Hinds and Morgan 1995) also occurs at the two sites (Service 2003).

## 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 species 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:** 68:16970-16990.

**Date of Final Listing Rule:** The final rule was published on April 8, 2003, and became effective on May 8, 2003.

**Entity Listed:** Species, *Polygonum hickmanii* (Scotts Valley polygonum).

**Classification:** Endangered.

### State of California Listing

**California Regulatory Notice Register:** 2005(17-Z):569.

**Date of Regulatory Action by the California Fish and Game Commission:** The regulation was published on April 29, 2005, and became effective on May 19, 2005.

**Entity Listed:** Scotts Valley polygonum.

**Classification:** Endangered.

**Associated Rulemakings:** Critical habitat was designated at listing, on April 8, 2003, and became effective on May 8, 2003 (Service 2003).

**Review History:** This is the first review of the species since listing in 2003.

**Species' Recovery Priority Number at Start of 5-Year Review:** The recovery priority number for *Polygonum hickmanii* is 5 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 monotypic species facing a high degree of threat and with a low 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

*Polygonum hickmanii* is a small, annual plant, 2 to 5 centimeters tall (1 to 2 inches) in the buckwheat family (Polygonaceae). The leaves are linear and pointed, and the single white flower is in the axil of bracteal leaves (modified leaves near the flower; see cover photo). Hinds and Morgan (1995) provide a complete description.

#### Species Biology and Life History

Very little is known regarding the species' biology, and there is no new information since listing. Germination is in the fall or early winter in response to seasonal rains. The plants grow slowly over the next few months, remaining inconspicuous until flowering begins in May. New flowers are produced until climate or microhabitat conditions are no longer favorable. Consequently, seed production ranges from several dozen in a typical individual to several hundred in a robust

individual (Morgan, pers. comm. 1998b), while depauperate plants produce few or no seeds (Morgan *in* California Department of Fish and Game 2003).

### Spatial Distribution

*Polygonum hickmanii* is a narrow endemic. The species has a very small geographic range and is restricted to a specialized habitat in Scotts Valley, Santa Cruz County, California. The colonies range in area up to 9 meters by 15 meters (30 feet by 50 feet) (Lyons, pers. comm. 1998b). Seventeen colonies have been reported: Polo Ranch (Figure 2), 12 colonies (Huffman-Broadway Group 2008); Salvation Army land (Figures 3, 4), 4 colonies (Lyons, *in litt.* 1998a; Gogul-Prokurat 2004 ); and the Scotts Valley High School Preserve (Figures 3, 5), 1 colony (Lyons 2004). The total area of all colonies combined comprises less than 0.4 hectare (1 acre).

The colonies on the Polo Ranch comprise element occurrence 1 (California Department of Fish and Game 2009). The colonies north of Casa Way (Salvation Army land and the Scotts Valley High School Preserve) are in Glenwood Hills and comprise element occurrence 2 (California Department of Fish and Game 2009). The two element occurrences are approximately 1.6 kilometers (1 mile) apart, with one on each side of State Highway 17. The colonies north of Casa Way are on adjacent properties. For our purposes, we refer to the two groups of colonies as two populations, although neither designation (element occurrence, population) is of likely biological relevance.

Hinds and Morgan (1995) stated the species "...occurs only in very restricted microhabitats within an isolated relictual grassland." Prior to describing the species, they were unable to find any additional specimens in herbarium collections (Jepson, Missouri Botanical Garden, Stanford University, University of California Berkeley) (Hickman, *in litt.* 1991; Hinds, *in litt.* 1993; Morgan, pers. comm. 1998b) or occurrences by extensive surveys in other locations and areas (Morgan, pers. comm. 1998a). The California Department of Fish and Game also searched for specimens in nine herbarium collections (Gogul-Prokurat 2004). It seems likely that the buildout of the city of Scotts Valley and the construction of State Highway 17 (an expressway through the city) removed nearby occupied areas (Hayes *in* California Department of Fish and Game 2003).

### Habitat

The plants grow on gently-sloping to nearly-level ground in patches of thin soil over outcrops of Santa Cruz mudstone and Purisima sandstone in wildflower fields in annual grassland (Hinds and Morgan 1995; Morgan, pers. comm. 1998c). Gogul-Prokurat (2004) referred to the rock outcrops or exposed bedrock as "islands" within the annual grassland. The species occurs at 213 to 244 meters (700 to 800 feet) elevation (Hinds and Morgan 1995) and approximately 11 kilometers (7 miles) inland from the coast. Other important factors appear to be the fine texture of the shallow soil and the absence of fog (Morgan, pers. comm. 1998b). This particular habitat is very specialized and of very limited distribution (Morgan, pers. comm. 1998a). The habitat is shared with the equally narrow endemic and endangered *Chorizanthe robusta* var. *hartwegii* (Scotts Valley spineflower) (Hinds and Morgan 1995). Although the endangered Ohlone tiger beetle (*Cicindela ohlone*) also occurs nearby in Scotts Valley, it has not been documented on a property with *Polygonum hickmanii*.

The wildflower fields comprise a portion of a scattered mosaic throughout the annual grassland. 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 2003).

Within a wildflower field, the outer edge supports the greatest diversity of native plants, likely because the deepest soil underlying the wildflower field is here. The soil is thinnest at the very center of the wildflower field, which is where *Polygonum hickmanii* is generally the densest and other species sparse. Within 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 Service (2003) identified the following habitat components as essential to conservation of *Polygonum hickmanii*: (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 and the pollinator activity and seed dispersal mechanisms typically occurring within the grassland plant community; (4) areas around each colony to allow for recolonization to adjacent suitable microhabitat sites; and (5) habitat within the subwatersheds upslope to the ridgelines to maintain the edaphic and hydrologic conditions and slope stability that provide the seasonally wet substrate for growth and reproduction. These are the primary constituent elements for its designated critical habitat (Service 2003).

### Abundance

Seventeen colonies of *Polygonum hickmanii* have been recorded. Range-wide surveys were conducted in 1991, 1992, 1993, 1998, and 2003 (Table 1). The approximate numbers of observed individuals were the following: 300 in 1991 and 1992,  $\geq 1,000$  in 1993 (Hinds and Morgan 1995), 3,412 in 1998 (Lyons, pers. comm. 1998a, *in litt.* 1998a, b), and 604 in 2003 (Lyons, *in litt.* 2003; Gogul-Prokurat 2004; Lyons 2004).

Twelve colonies of *Polygonum hickmanii* have been recorded on the Polo Ranch, comprising approximately 0.029 hectare (0.072 acre) (Huffman-Broadway Group 2008). The seven surveys from 1990 to 2006 have recorded approximate numbers in the following range: from 2,138 individuals in 1997 (Lyons, *in litt.* 1997) to 0 individuals in 2006 (Morgan, pers. comm. 2009). Since listing, the following approximate numbers have also been recorded: 294 individuals in 2003 (Lyons, *in litt.* 2003), 333 individuals in 2004 (Lyons, *in litt.* 2004), and 254 individuals in 2005 (Lyons, *in litt.* 2005).

Four colonies have been recorded on Salvation Army land (Lyons, *in litt.* 1998a). The nine surveys from 1990 to 2008 have recorded approximate numbers in the following range: from 2,000 individuals in 1998 (Lyons, *in litt.* 1998a) to 50 individuals in 1990 (Morgan 1990b) and "several dozen" individuals in 2008 (Morgan, pers. comm. 2009). Five surveys from 2000 to 2004 recorded from approximately 200 to 267 individuals each year.

One colony has been recorded on Scotts Valley High School land. The eight surveys from 1991 to 2003 recorded approximate numbers in the following range: from 250 individuals in 1997 (Denise Duffy and Associates 1997a), to 88 individuals in 2003 (Lyons 2004).

#### Changes in Taxonomic Classification or Nomenclature

We are not aware of any changes or proposed changes in taxonomic classification or nomenclature since listing. However, prior to listing, the following names were used in unpublished historical documents: a "draft" scientific name, *Polygonum muripes* pro. sp. (Morgan 1990a, b; Habitat Restoration Group 1992 ); and a common name, Hickman's smartweed (Denise Duffy and Associates 1997b). Hinds and Morgan (1995) used the common name Hickman's knotweed.

#### Genetics

The genetic characteristics have not been investigated.

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

We are not aware of any research or grant-supported activities regarding the species.

#### **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**

“Habitat alteration and destruction, including urban development, road construction, and their attendant secondary impacts (including increased trampling from humans, pets, bicycles, and installation and maintenance of landscaped areas)...” were primary threats to the species at the time of listing (Service 2003). Habitat alteration and destruction continue to be the primary threats to *Polygonum hickmanii*. These activities cause soil erosion and compaction, disturbance of the soil crust, changes in soil hydrology and water quality, encroachment by invasive species, and accumulation of thatch (Service 2003).

#### Polo Ranch

The 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 located on a portion of the former amusement park known as “Santa’s Village,” which operated from 1957 to 1977. 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. The property has a history of

grazing by horses until the early 1990's (Huffman-Broadway Group 2008), which was likely beneficial to *Polygonum hickmanii* by reducing invasive and competitive native species (Morgan, pers. comm. 2009). The property has been the subject of several development proposals since 1990 (Huffman-Broadway Group 2008). The Polo Ranch is currently owned by Lennar Communities, which acquired the property in 1997.

Lyons (*in litt.* 1998b) reported disturbances by off-highway vehicles to the rock outcrops supporting *Polygonum hickmanii*. Lyons (*in litt.* 2003) documented disturbance in the form of a path through and near the occupied area from the adjacent residences. 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. Lyons (*in litt.* 2004) reported increased growth of invasive plants in most parts of the occupied area. In 2006, much of the area was covered with *Baccharis pilularis* (coyotebrush, a competitive native species), which was encroaching onto the rock outcrops with *Polygonum hickmanii* (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). This may have included some of the recorded wildflower fields with *Polygonum hickmanii*.

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 *Polygonum hickmanii* and *Chorizanthe robusta* var. *hartwegii*. 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 rock outcrop, development would be within approximately 22, 27 and 29 meters (72, 88 and 96 feet) of three colonies, and fencing would be within approximately 2 and 15 meters (8 and 48 feet) of two colonies. The proposed residential development and its attendant secondary impacts (e.g., increased use of the property for various types of recreation) within such close proximity to the 12 colonies of *Polygonum hickmanii* constitute a serious threat to their survival.

### Salvation Army Land

Salvation Army land comprises 83 hectares (206 acres) immediately west of the Scotts Valley High School at the northern edge of the city of Scotts Valley. The four colonies of *Polygonum hickmanii* on this property are approximately 207 meters (680 feet) west of the single colony in the Scotts Valley High School Preserve (Gogul-Prokurat 2004). The Scotts Valley Water District constructed its recycled water distribution system on this property in 1999. The four colonies of *Polygonum hickmanii* are approximately 16 meters (52 feet) downslope of a paved road built in 1999 to access a water tank to the north (Figure 4).

The Salvation Army prepared a draft conservation easement over 1.8 hectares (4.4 acres) inclusive of the colonies. 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.

The area with *Polygonum hickmanii* is subject to a re-vegetation and property management plan, which includes fencing and periodic mowing (Gogul-Prokurat 2004). The most-recent Google Earth image (dated May, 2009) showed signs of mowing to reduce invasive grasses in the vicinity of the colonies (Figure 4). Trespass by persons with motorbikes and dirt bikes was a problem in 2004. Gogul-Prokurat (2004) reported a dirt bike trail through the habitat 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

The Scotts Valley High School Preserve comprises 3.2 hectares (8 acres) of grassland west of State Highway 17 at the northern edge of the city of Scotts Valley. Salvation Army land is to the west. The high school was constructed in 1998, at which time the preserve was established to protect the single colony of *Polygonum hickmanii* and other State and Federally listed plant species. 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. The colony is approximately 18 meters (60 feet) from the boundary of the preserve (Lyons 2004).

The preserve is subject to a habitat mitigation and monitoring plan in perpetuity (Lyons 1998). In accordance with the plan, 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 *Polygonum hickmanii* (and *Chorizanthe robusta* var. *hartwegii*). 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 coyote brush (Lyons 2004). Lyons (2004) reported that while invasive grasses grow on and around the rock outcrops containing the two endangered plants, the invasive grasses were not at levels that affected their growth in 2003. The most-recent Google Earth image (dated May, 2009) showed signs of mowing over approximately 80 percent of the preserve (Figure 5). Another 10 percent was covered with what appear to be brush and trees, and another 10 percent showed no signs of mowing.

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. While the dumping did not directly impact *Polygonum hickmanii*, 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.

## Summary of Factor A

The two populations of *Polygonum hickmanii* occur on three properties near an urban area. On the Polo Ranch, a proposed residential development in close proximity to 12 colonies constitutes a serious threat to survival of this population, along with invasive species and competitive native species. The habitat and ecosystem are being impacted by recreational use. On Salvation Army land and the Scotts Valley High School Preserve, the five colonies of this population are now being substantially affected by the indirect impacts of development. These five colonies are at risk of extirpation because of the highly disturbed and fragmented nature of the ecosystem, the isolation from other colonies, the proximity to developed areas, and invasive plant species.

In sum, the species remains threatened by habitat destruction due to existing and proposed developments, their associated impacts, and invasive species and competitive native species. Management of these sites is necessary to maintain *Polygonum hickmanii* over the long-term.

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

Overutilization for any purpose was not a factor in the 2003 final listing rule (Service 2003) nor a threat in 2004 (Gogul-Prokurat 2004), and is not known to be a threat in 2009.

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

Disease or predation was not a factor in the 2003 final listing rule (Service 2003) nor a threat in 2004 (Gogul-Prokurat 2004), 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). In particular, the Scotts Valley Unified School District and Scotts Valley Water District were exempt from local permitting requirements during construction of the high school and the recycled water distribution system in 1998 and 1999, respectively (Service 2003). Both projects have critically impacted the species. In addition, although the Scotts Valley High School Preserve is subject to a habitat mitigation and monitoring plan in perpetuity (an agreement with the California Department of Fish and Game; Lyons 1998), the preserve has no long-term legal status (Gogul-Prokurat 2004) and there is no penalty for failing to enact the plan.

Since listing under the Endangered Species Act (May 8, 2003), *Polygonum hickmanii* has become listed under the California Endangered Species Act (May 19, 2005). 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. 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 *Polygonum hickmanii* (and *Chorizanthe robusta* var. *hartwegii*).

### *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 *Polygonum hickmanii* and other Federally listed plant species on non-Federal land.

## State Protections in California

### *California Endangered Species Act (CESA) and Native Plant Protection Act (NPPA)*

The CESA (California Fish and Game Code, section 2080 *et seq.*) prohibits the unauthorized take of State-listed threatened or endangered species. The NPPA (Division 2, Chapter 10, section 1908) prohibits the unauthorized take of State-listed threatened or endangered plant species.

The CESA requires consultation with the California Department of Fish and Game for activities that may affect a State-listed species and mitigation for any adverse impacts to the species or its habitat. Pursuant to CESA, it is unlawful to import or export, take, possess, purchase, or sell any species or part or product of any species listed as endangered or threatened. The State may authorize permits for scientific, educational, or management purposes, and to allow take that is incidental to otherwise lawful activities. This species was State-listed under the S1.2 (rare) ranking of 1979, indicating there are less than 6 occurrences of the species. However, because *Polygonum hickmanii* became State-listed in 2005, protections did not apply to earlier projects. Furthermore, with regard to prohibitions of unauthorized take under NPPA, landowners are exempt from this prohibition for plants that will be taken in the process of habitat modification. Where landowners have been notified by the State that a rare or endangered plant is growing on their land, the landowners are required to notify the California Department of Fish and Game 10 days in advance of changing land use in order to allow salvage of listed plants. In sum, these two laws have only limited ability to protect *Polygonum hickmanii*.

### *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.

### Summary of Factor D

Since listing under the Endangered Species Act, *Polygonum hickmanii* has become listed under the California Endangered Species Act. However, because none of the colonies are on Federal or State lands, the combination of all Federal and State laws has only limited ability to protect this plant species. The inadequacy of existing regulatory mechanisms remains a threat in 2009.

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

The following factors were identified at listing in 2003: inadequate preserve design (particularly fragmentation and small size) and random extinction. Inadequate preserve design pertained to the Scotts Valley High School Preserve, and random extinction pertained to *Polygonum hickmanii* as a species with few populations and individuals of a limited distribution. These

factors continue to threaten the species in 2009. In addition, we identify invasive species and competitive native species, and climate change as new factors in this category.

### Inadequate Preserve Design

A preserve should be large enough to maintain the ecological functions upon which the target species depends, and it should have a ratio of edge to total area that minimizes edge effects and fragmentation. To increase the certainty that the target species will persist over the long term, land uses adjacent to a preserve should be compatible with maintaining the integrity of the preserve (Service 2003).

The Scotts Valley High School Preserve (3.2 hectares; 8 acres) is not large enough to maintain the ecosystem supporting *Polygonum hickmanii*, and edge effects are present because the single colony is near the preserve boundary (within approximately 18 meters; 60 feet). In addition, adjacent land uses to the immediate north (in particular, athletic fields and parking lot), and east and south of the preserve (residences) are not compatible with maintaining its integrity. Because of this, the preserve has been used for non-compatible purposes, including recreation (Lyons 2002, Gogul-Prokurat 2004), a walking short-cut to and from the school (Lyons 2004), and disposal of waste (Cheap, *in litt.* 2008).

Prior to construction of the high school and the recycled water distribution system, the California Department of Fish and Game (*in litt.* 1991) recommended the two areas with *Polygonum hickmanii* be designated as one larger preserve. They stated "Our experiences with small plant preserves have demonstrated that high density residential developments next to small preserves result in significant declines in preserve quality and effectiveness from incompatible land uses if buffer areas between the preserve boundary and the rare plant habitats are too narrow. A 100-foot wide buffer between the plant populations and adjacent development is considered to be the minimum required." See Factor A for additional discussion about alteration and loss of habitat due to proximity to urban areas.

### Random Extinction

Species with few populations and/or individuals are vulnerable to random 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).

*Polygonum hickmanii* is at high risk of random extinction. The species is known from only two populations approximately 1.6 kilometers (1 mile) apart. The total occupied area comprises less than 0.4 hectare (1 acre). The most-recent surveys reported 0 individuals on the Polo Ranch in 2006 (Morgan, pers. comm. 2009), "several dozen" individuals on Salvation Army land in 2008 (Morgan, pers. comm. 2009), and 88 individuals on the Scotts Valley High School Preserve in 2003 (Lyons 2004).

## Invasive Species and Competitive Native Species

Non-native annual grasses are now a threat to *Polygonum hickmanii* on all three properties. In particular, much of the habitat on the Scotts Valley High School Preserve and adjacent Salvation Army land is now occupied by non-native grasses, which must be mowed to reduce adverse effects to this species and *Chorizanthe robusta* var. *hartwegii*. On the Polo Ranch, competitive native species are also threatening *Polygonum hickmanii* 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 *Polygonum hickmanii*, 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 (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.

*Polygonum hickmanii* was not yet listed when the Recovery Plan for Insect and Plant Taxa from the Santa Cruz Mountains in California (Service 1998) was issued. However, the species was included along with others comprising a suite of sensitive species occurring in the same small geographic region of the central coast of California, and because the species was under consideration for Federal listing. Further, measurable recovery criteria were not stated because the species' status was so tenuous. Rather, we provided an "interim recovery objective" (Service 1998), that is, to avert extinction by establishing conservation easements, restricting activities to compatible land uses, or acquiring all parcels of land supporting this species. As of 2009, very little has been accomplished toward achieving the interim recovery objective. However, it remains appropriate because it addresses Factors A, D, and E.

Recovery actions identified in the recovery plan include (1) establishing permanent conservation easements over or acquisition of the three properties in Scotts Valley, and (2) addressing conservation measures for this species in a habitat conservation plan with the City of Scotts Valley. The following primary recovery tasks were recommended in the recovery plan, and we evaluate the progress that has been made toward completing each.

**1. Protect habitat for Santa Cruz Mountains species on private land through habitat conservation plans and landowner agreements.**

Little to no progress has been achieved. Because the habitat on Salvation Army land and the Scotts Valley High School Preserve is now highly degraded, the Polo Ranch is the only property where the ecosystem may be intact.

**2. Manage habitat for Santa Cruz Mountains species.**

Little progress has been achieved regarding this recommended recovery action as it pertains to *Polygonum hickmanii*. The only beneficial actions we are aware of is the mowing of invasive grasses in the vicinity of the colonies on Salvation Army land and the Scotts Valley High School Preserve, and possibly the placing of a fence around colonies on the Polo Ranch (Huffman-Broadway Group 2008).

**3. Conduct research on the life history, ecology, and population dynamics of these species that will contribute to appropriate management strategies.**

No research has been conducted on *Polygonum hickmanii*. Monitoring has been conducted only on an irregular basis, and the data have not been used to modify management actions.

**4. Locate additional habitat/populations within the historic range of the species.**

Gogul-Prokurat (2004) reported the following. "Surveys of most remaining potentially suitable habitat throughout Scotts Valley and surrounding areas have been conducted by local botanists, and to date, no additional populations...have been discovered. Because the rock outcrop areas in which Scotts Valley polygonum occurs are also home to two other Federally-listed endangered species, the Scotts Valley spineflower...and the Ohlone tiger beetle..., these areas have been thoroughly surveyed. Although the individual Scotts Valley polygonum plants are small and

only visible during the growing season, populations should be relatively easy to locate because the rock outcrops on which they grow are...readily identifiable in the field. It is possible that some privately-owned areas of potentially suitable habitat have not been surveyed.... However, Mr. Randall Morgan, a long-time resident ecologist who is intimately familiar with the area, has thoroughly searched for suitable areas based on topographic maps and on-the-ground surveys. According to Mr. Morgan, most of the habitat likely to support Scotts Valley polygonum in this area has been developed, and it is highly unlikely that additional undeveloped areas with the potential to support the species exist.... The Department searched nine U.S. herbaria for historical records.... A literature search was also conducted. To date, no references to any...populations other than the known localities in Scotts Valley have been located." In sum, no additional habitat or populations have been located, and it now seems unlikely that any more exist.

#### **5. Develop and implement a public outreach program.**

A public outreach program has not been developed. The only beneficial action is Hayes and Taylor (2007) producing a fact sheet with color photos in 2006, which the Elkhorn Slough National Estuarine Research Reserve has posted on its website.

#### **6. Evaluate progress of recovery effectiveness of management and recovery actions and revise management plans.**

The efforts to date for *Polygonum hickmanii* have not been effective, and management plans have not been appropriately revised.

### **IV. SYNTHESIS**

*Polygonum hickmanii* is a narrow endemic and restricted to Scotts Valley, Santa Cruz County, California. Its habitat is very specialized and of very limited distribution (Morgan, pers. comm. 1998a). The species occurs in colonies at only two sites (the Polo Ranch, and north of Casa Way) approximately 1.6 kilometers (1 mile) apart at the northern end of Scotts Valley. The total area of all colonies combined comprises less than 0.4 hectare (1 acre). The two populations are on three properties, and recovery efforts to date have not been effective. The most-recent census data for each property are the following: Polo Ranch, 0 individuals observed in 2006 (Morgan, pers. comm. 2009); Salvation Army land, "several dozen" individuals observed in 2008 (Morgan, pers. comm. 2009); and the Scotts Valley High School Preserve, approximately 88 individuals observed in 2003 (Lyons, *in litt.* 2009). On the Polo Ranch, both invasive species and competitive native species are threatening the habitat of *Polygonum hickmanii*, along with recreational users of the property. In addition, a proposed residential development would be in close proximity to the 12 colonies. On Salvation Army land, three or four colonies persist in a highly disturbed ecosystem, isolated from other colonies and in close proximity to development. On the Scotts Valley High School Preserve, one colony persists in a highly disturbed ecosystem, isolated from other colonies and in close proximity to development. The direct and indirect impacts resulting from human activities further exacerbate the risk of stochastic extinction due to the small numbers and sizes of the remaining colonies. In sum, *Polygonum hickmanii* is facing a

high degree of threat with little potential for recovery. Therefore, *Polygonum hickmanii* 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:** Not applicable.

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

- 1. Polo Ranch.** The Polo Ranch contains the only potentially intact ecosystem with *Polygonum hickmanii* (and *Chorizanthe robusta* var. *hartwegii*). 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 *Polygonum hickmanii* (and *Chorizanthe robusta* var. *hartwegii*) and that the area be appropriately managed by a conservation organization as a preserve for the plants.
- 3. Scotts Valley High School Preserve.** 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 *Polygonum hickmanii* and *Chorizanthe robusta* var. *hartwegii*.
- 4.** Because of the high degree of threat and low potential for recovery in the wild, a botanical seed bank for *Polygonum hickmanii* should be established, with the collections stored at several institutions allied with the Center for Plant Conservation. This would provide for a genetic representation of the species in case of extinction in the wild and also a subsequent source for future re-introductions.
- 5.** Because of the high degree of threat and low potential for recovery in the wild, living colonies of *Polygonum hickmanii* should be established at several botanical gardens allied with the Center for Plant Conservation. This would insure that living specimens of the species could be seen somewhere and also insure there is a living population through time.

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

*Polygonum hickmanii* (Scotts Valley Polygonum)

**Current Classification:** Endangered

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

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

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

**Review Conducted By:** Christopher Kofron

**FIELD OFFICE APPROVAL:**

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

Approve Diane K. Moore Date 11/12/09

**Table 1.** Approximate numbers reported for *Polygonum hickmanii* (Scotts Valley polygonum) in Scotts Valley, Santa Cruz County, California. [Prepared for 5-year review, 2009.]

Occurrence	1990	1991	1992	1993	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2008
1. Polo Ranch	300 <sup>10</sup>				2,138 <sup>1</sup>	1,259 <sup>2</sup>					294 <sup>3</sup>	333 <sup>4</sup>	254 <sup>5</sup>	0 <sup>18</sup>	
2. North of Casa Way															
a. Salvation Army land	50 <sup>11</sup>		79 <sup>16</sup>			2000 <sup>14</sup>		200 <sup>12</sup>	225 <sup>12</sup>	200 <sup>12</sup>	222 <sup>17</sup>	267 <sup>20</sup>			“several dozen” <sup>19</sup>
b. Scotts Valley High School		100 <sup>15</sup>			250 <sup>9</sup>	153 <sup>13</sup>	100 <sup>7A</sup>	120 <sup>12</sup>	150 <sup>8</sup>	140 <sup>8</sup>	88 <sup>7</sup>				
Occurrences 1 and 2		300 <sup>6</sup>	300 <sup>6</sup>	≥ 1000 <sup>6</sup>		3412					604				

<sup>1</sup> April 29 to May 27; Lyons, *in litt.* 1997.

<sup>2</sup> July 23; Lyons, *in litt.* 1998b.

<sup>3</sup> May 22 to July 1; Lyons, *in litt.* 2003.

<sup>4</sup> May 7 to June 8; Lyons, *in litt.* 2004.

<sup>5</sup> May; Lyons, *in litt.* 2005.

<sup>6</sup> late May to August; Hinds and Morgan 1995.

<sup>7</sup> May 22 to July 1; Lyons 2004.

<sup>7A</sup> Lyons 2004.

<sup>8</sup> August, 2001; September, 2002; Lyons 2002.

<sup>9</sup> January; Denise Duffy and Associates 1997a.

<sup>10</sup> April 8 to July 7; Morgan 1990a.

<sup>11</sup> July 13; Morgan 1990b.

<sup>12</sup> Lyons, *in litt.* 2002.

<sup>13</sup> June 18; Lyons, pers. comm. 1998a.

<sup>14</sup> Lyons, *in litt.* 1998a.

<sup>15</sup> City of Scotts Valley *in* Denise Duffy and Associates 1997b.

<sup>16</sup> July 1 to July 7; Habitat Restoration Group 1992.

<sup>17</sup> Gogul-Prokurat 2004.

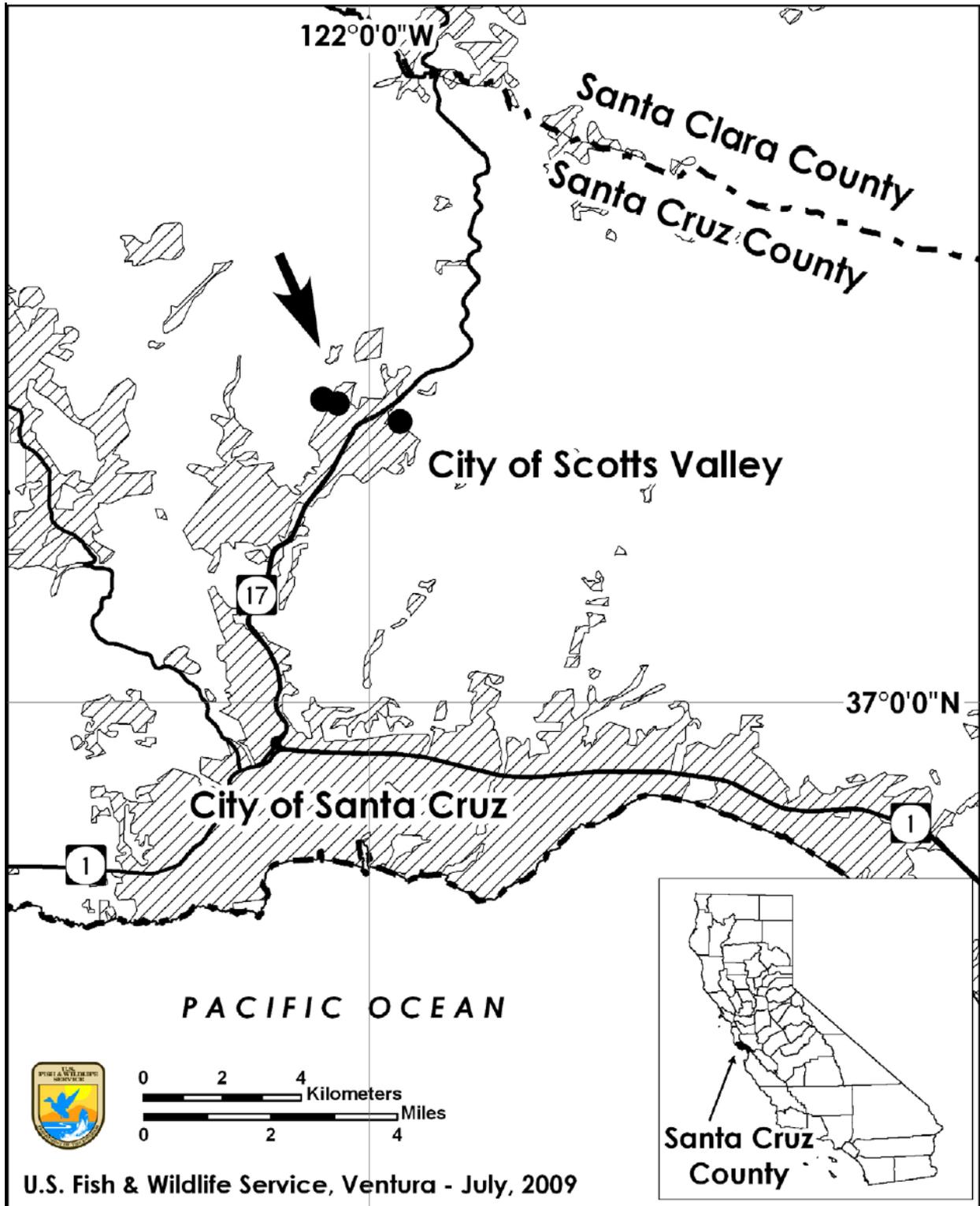
<sup>18</sup> May; Morgan, pers. comm. 2009.

<sup>19</sup> February 23; Morgan, pers. comm. 2009.

<sup>20</sup> Lyons, *in litt.* 2009.

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**Figure 1.** Occurrence records for *Polygonum hickmanii* (Scotts Valley polygonum) in Santa Cruz County, California. [Prepared for 5-year review, 2009.]



**Figure 2.** *Polygonum hickmanii* (Scotts Valley polygonum) on the Polo Ranch in Scotts Valley, Santa Cruz County, California (element occurrence 1). Ten colonies occur within the area depicted by the red oval, with approximate locations according to Huffman-Broadway Group (2008). The Google Earth image is dated July, 2007. [Prepared for 5-year review, 2009.]



**Figure 3.** *Polygonum hickmanii* (Scotts Valley polygonum) on Salvation Army land and the Scotts Valley High School Preserve in Scotts Valley, Santa Cruz County, California (element occurrence 2). Three colonies in the left-hand portion of area depicted by the red oval occur on Salvation Army land (Wissler 1998). One colony in the right-hand portion of the area depicted by the red oval occur on the Scotts Valley High School Preserve (Lyons 2004). The Google Earth image is dated May, 2009. [Prepared for 5-year review, 2009.]



**Figure 4.** *Polygonum hickmanii* (Scotts Valley polygonum) on Salvation Army land in Scotts Valley, Santa Cruz County California. Three colonies occur within the area depicted by the red oval, with approximate locations according to Wissler (1998). The paved road was constructed in 1999 along with other facilities for the Scotts Valley Water District's recycled water distribution system. The development in the upper right is part of the athletic fields of Scotts Valley High School, which was constructed in 1998. A portion of the Scotts Valley High School Preserve is visible in the lower right. The Google Earth image is dated May, 2009. [Prepared for 5-year review, 2009.]



**Figure 5.** *Polygonum hickmanii* (Scotts Valley polygonum) on the Scotts Valley High School Preserve in Scotts Valley, Santa Cruz County, California. A single colony occurs within the area depicted by the red oval, with approximate location according to Lyons (2004). The preserve (3.2 hectares; 8 acres) was established in 1998 when the high school was constructed. The preserve is bounded by development on three sides: high school (in particular athletic fields and parking lot) to the north; and residences to the east and south. The streak pattern in the preserve was produced by mowing invasive grasses. The Google Earth image is dated May, 2009. [Prepared for 5-year review, 2009.]

