Scotts Valley polygonum (*Polygonum hickmanii*)

5-Year Review: Summary and Evaluation

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5-YEAR REVIEW
Scotts Valley polygonum (*Polygonum hickmanii*)

GENERAL INFORMATION:

Species: Scotts Valley polygonum (*Polygonum hickmanii*)
Date listed: 8 April 2003
FR citation(s): 68 FR 16979–16990
Classification: Endangered

Critical Habitat Designation

The U.S. Fish and Wildlife Service (Service) designated Critical habitat for Scotts Valley polygonum (*Polygonum hickmanii*) in 2003 across two critical habitat units totaling 287 acres (ac): 1. Glenwood (214 ac); and 2. Polo Ranch (73 ac) (Service 2003, 68 FR 16982–16989). We identified the following primary constituent elements (i.e., principal biological features today) of critical habitat for Scotts Valley polygonum (Service 2003, 68 FR 16980):

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 that supports the pollinator activity and seed dispersal mechanisms that typically occur within the grassland plant community;

4. Areas around each colony to allow for recolonization to adjacent suitable microhabitat sites;

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 of Scotts Valley polygonum.

Wildflower field habitat is defined in the listing rule as patches of land that support a higher number of native herbaceous species relative to adjacent annual grasslands that are characterized by nonnative species. The wildflower field habitat is underlain by shallow, well-draining soils, in contrast to the deeper soils with a greater water-holding capacity of the annual grasslands (Service 2003, 68 FR 16971)

State Listing:

Endangered, 2004 (CNDDB 2024, p. 17)

BACKGROUND:

Species overview:
Scotts Valley polygonum (*Polygonum hickmanii*) is a small annual plant, 1–2 inches (in) tall, with single flowers appearing axially along stems. The species is restricted to thinly vegetated areas with shallow soil on rock outcrops. Scotts Valley polygonum is restricted to three properties in Scotts Valley, California, in Santa Cruz County.

Most recent status review:
[Service] U.S. Fish and Wildlife Service. 2020. Scotts Valley Polygonum (*Polygonum hickmanii*) 5-Year Review: Summary and Evaluation. Ventura, California. 13 pages.

We recommended no status change to Scotts Valley polygonum in the 2020 5-Year review.

FR Notice citation announcing this status review:
[Service] U.S. Fish and Wildlife Service. 2023. Endangered and Threatened Wildlife and Plants; Initiation of 5-Year Status Reviews of 47 Species in California, Nevada, and Oregon. Federal Register 88:56042–56044.

ASSESSMENT:

Information acquired since the last status review:
We, the Service's Ventura Fish and Wildlife Office, conducted this 5-year review. We solicited data for this review from interested parties through a Federal Register notice announcing this review on August 17, 2023 (Service 2023). We did not receive any information from the public in response to our Federal Register Notice announcing this 5-year review. However, we conducted a literature review and contacted local botanists, consultants, land trusts, and private landowners. In 2018, the Service convened a Recovery Team to provide input and guidance on recovery of Scotts Valley polygonum. In 2022, the Service funded a reintroduction study at Polo Ranch, building upon a seed collection effort that began in 2014. We present the available results of this ongoing study in this status review. Threats to Scotts Valley polygonum populations remain similar to the previous 5-year review with slight changes in land-use threats because of increased beneficial management at Polo Ranch.

Distribution and habitat:
Scotts Valley polygonum remains a narrow endemic to the wildflower field habitat within undeveloped grasslands in Scotts Valley, Santa Cruz County, California (Figure 1). The species occurs on three properties all within 1.0 mile (mi) of each other. The three properties are referred to as the Salvation Army property, Scotts Valley High School Ecological Preserve (High School Preserve), and Polo Ranch. Salvation Army and the High School Preserve are adjacent to one another and contiguous with the Glenwood Open Space Preserve. The Glenwood Open Space Preserve has never been occupied by Scotts Valley polygonum, but suitable habitat is present onsite, and critical habitat was designated there as well (Figure 1). The Glenwood Open Space Preserve presents the best opportunity for potential introduction to increase the number of populations on protected lands. Polo Ranch is held in a conservation easement established as a result of an adjacent housing development; the easement is managed by the Wildlife Heritage Foundation (LSA 2022, p. 1; Marty 2021, entire). Each of the three properties are managed

differently, which has resulted in different observed trends in population abundance. Historically, we considered the Salvation Army and High School Preserve a single population due to their proximity, and considered Polo Ranch to be a separate population because it is located on the opposite side of Highway 17 (Service 1998, pp. 35–37; Service 2003, 68 FR 16970–16972; Service 2009, p. 6).

On each of the properties, Scotts Valley polygonum occurs on shallow soil on rock outcrops of mudstone and sandstone interspersed throughout annual grassland (Service 1998, pp. 35–37, Service 2009, p. 6). Within each property, Scotts Valley polygonum exists in small "colonies" where the soil is shallow and separated from one another by deeper soil typically associated with annual grasses (e.g., *Avena* spp.). The total area occupied by Scotts Valley polygonum when all colonies were occupied was approximately 1.0 ac.

Abundance:
No individuals of Scotts Valley polygonum have been observed at the Salvation Army or High School Preserve properties since 2011 and 2015, respectively (Service 2020, p. 5; Table 1). Polo Ranch continues to support the species at 3 of 12 historical colonies, and at four experimental locations where partners conducted reintroductions by seeding in experimental plots (Marty et al. 2023, pp. 9–10; Marty 2023, entire). The abundance of plants at the historical colonies has declined from 637 in 2020 to 139 in 2023. Weed-removal efforts have remained stable over this time despite change in management from LSA Associates, Inc. to the Wildlife Heritage Foundation.

In December 2022, under a cooperative agreement with the Service, one of our partners reintroduced seed to experimental plots that had not been occupied for a minimum of 5 years at Polo Ranch. They scattered seed over suitable habitat in areas of shallow soil and deeper soil and weeded in the same manner as the historical colonies; as of spring 2023, treatment types did not yield appreciable differences in plant growth (n=1,884 plants across all plots)(Marty 2023, entire).

The continued absence of the species at the Salvation Army and High School Preserve properties suggests that reintroduction efforts may be necessary to restore the species to its historical distribution and advance recovery.

Table 1. Scotts Valley Polygonum Abundance from 2020 to 2023.

	2020	2021	2022	2023
Polo Ranch	637	265	217	139
Polo Ranch Reintroduction[1]	NA	NA	NA	1,884
Scott's Valley High School Preserve[2]	0	0	0	0
Salvation Army[3]	0	0	0	0

[1]Seed reintroduced in December 2022; [2]Last observed in 2015 with 5 plants; [3]Last observed in 2011 with 3 plants

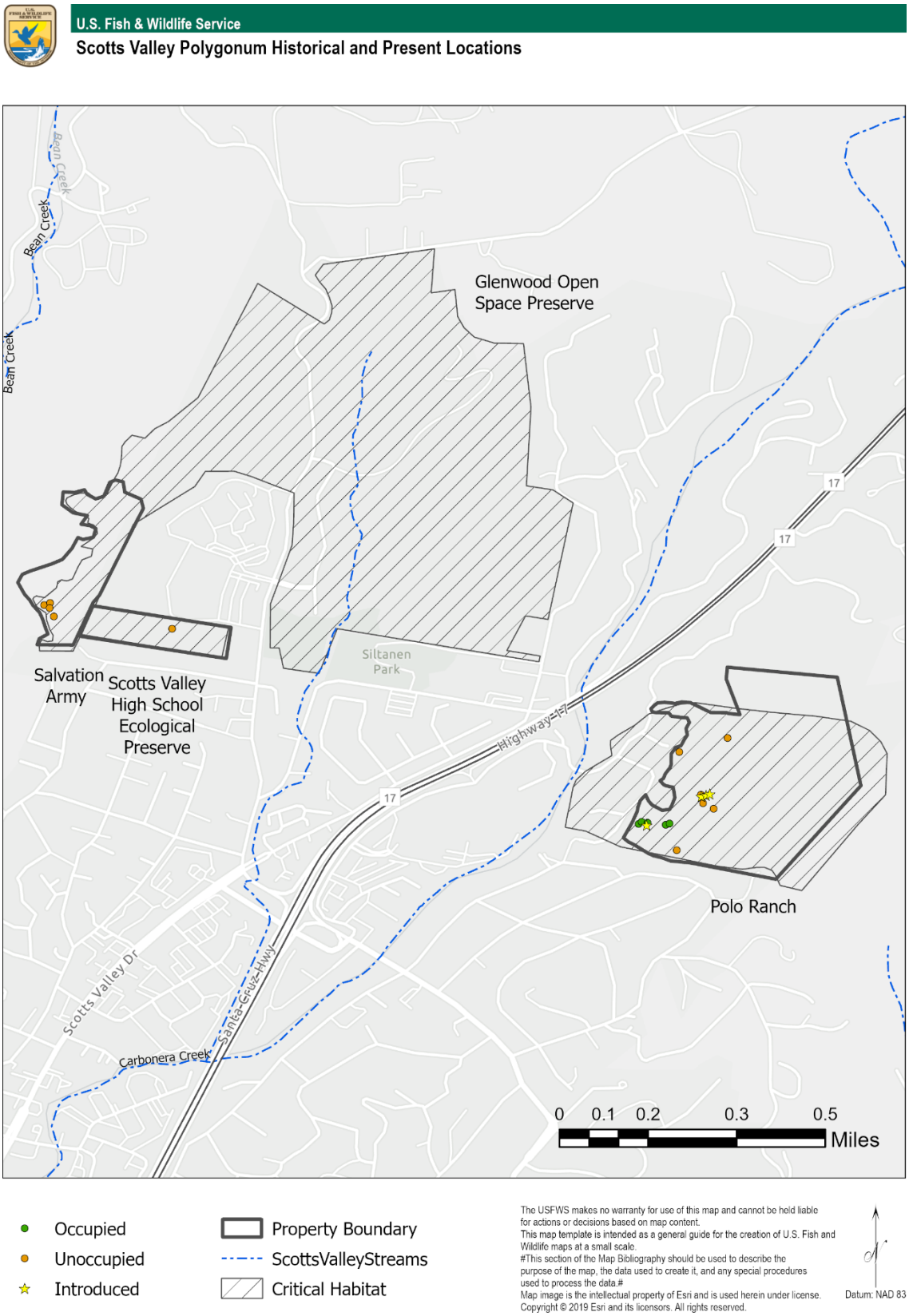

Figure 1. Location of unoccupied, occupied, and reintroduced colonies of Scotts Valley polygonum, land ownership boundaries, nearby streams, and critical habitat.

Seed collection and germination testing:

Seed collections efforts between 1990 and 1997 from both natural and greenhouse populations resulted in 1,150 seeds collected. In response to a declining population, the Service in partnership with the UC Botanical Garden, Randall Morgan, Greening Associates, and UC Santa Cruz Arboretum restarted seed collection efforts in 2013 (Service 2022, entire). Between 2013 and 2020, partners collected approximately 400 seeds from plants at Polo Ranch.

Germination trials and tetrazolium testing in 2018 and 2019 found that seed collected in the 1990s was non-viable (Velzy 2018, pers comm; Ransom Seed Lab 2019, p. 1). However, seed bulking in November 2020 indicated that properly stored seeds can remain viable for at least 7 years; 82% of seeds germinated, with comparable rates across collection years (125 seeds from 2013, 2017, 2019, and 2020 sown). This resulted in 93,000 seeds produced. Of these, experimental reintroduction at Polo Ranch used 16,000 of the seeds (see next section), and the remaining seed from the original collections and bulking effort are stored at the UC Botanic Garden at Berkeley.

Seed reintroduction at Polo Ranch:
Under a cooperative agreement with the Service, partners established 16 seed-reintroduction plots at Polo Ranch in areas that had previously been occupied by Scotts Valley polygonum, but where no plants had been observed for a minimum of five years in December 2022 (Marty 2023, pp. 1–3). They cleared thatch and existing vegetation from plots using hand tools, and broadcast 1,000 seeds into each of the 16 plots. Partners covered plots with wire mesh cages to reduce herbivory to mimic the management of the naturally occupied colonies.

Activities included weeding and monitoring in January, March, April, May, and June 2023, with a count of1,884 plants in June 2023. Plants produced an average of 13 seeds per plant, suggesting a total of approximately 24,586 seeds (more than were broadcast for the experiment) (Marty 2023, pp. 3–6). We currently consider this reintroduction to be successful, but attribute success to favorable growing season conditions and regular weeding. The long-term persistence of these plants is likely dependent on future climatic patterns and successful management. Monitoring will continue through 2024.

Threats:
At the time of listing, we considered habitat alteration and destruction, inadequacy of existing regulatory mechanisms, competition from invasive species, inadequate preserve design, and random (stochastic) extinction as threats to Scotts Valley polygonum (Service 2003, 68 FR 16975–16978). The 2009 5-Year Review affirmed these threats and identified climate change as a new threat to the species. We reviewed these threats again in 2020, finding that the threats persisted. Since the 2020 5-Year Review, there have been changes in management at Polo Ranch and new information regarding reintroduction from seed that update the threat analysis for Scotts Valley polygonum.

Habitat alteration and destruction

As required by the Final Environmental Impact Report, mitigation for an adjacent residential development led to establishment of a conservation easement over the areas occupied by Scotts

Valley polygonum at Polo Ranch occurred in 2021 (Marty et al. 2023, p. 1). Wildlife Heritage Foundation assumed management of the property and is guided by an open-space management plan and grazing management plan (Marty et al. 2023, p. 1; LSA 2021, entire; Ford and Rao 2010, entire). With the conservation easement established, habitat alteration and destruction due to development is no longer a threat to the species at Polo Ranch. However, a recurring landslide area within the conservation easement highlights that habitat may still be lost or altered in the absence of development (Marty et al. 2023, p. 12). The landslide area is not the location of historically occupied areas and does not offer potential areas for outplanting, but it likely has negative consequences for habitat management by decreasing the amount of grazable land and making it more difficult to establish a grazing partnership to control weeds.

The High School Preserve does not have a conservation easement but comprises land set aside to be managed in perpetuity based on the management plan included within a Final Environmental Impact Report (DDA 1998, pp. 4–25, 4–159, Appendix B). As a result, habitat alteration and destruction due to development likely no longer pose a threat. However, no Scotts Valley polygonum have been observed at the High School Preserve since 2015, indicating that habitat has been degraded, that past management was inadequate for maintaining the species at this location, and that current management has not been successful in stimulating the seed bank if one exists, which is a remaining unknown. Reintroduction efforts are, therefore, needed at the High School Preserve.

Habitat alteration and destruction due to development is still a possibility at the Salvation Army property. There is no known plan to develop this area, but nearby residential development projects suggest that land not held in a conservation easement is subject to changes in ownership and potential development. Although no Scotts Valley polygonum have been observed at the Salvation Army property since 2011, suitable habitat is present. Reintroduction to this area and subsequent management is needed to recover the species.

Inadequacy of existing regulatory mechanisms

Existing regulatory mechanisms have resulted in preserves for Scotts Valley polygonum at Polo Ranch and the High School Preserve. However, abundance at the High School Preserve has declined to zero despite some effort to manage the area for Scotts Valley polygonum using horses to reduce competing biomass in conjunction with hand-pulling weeds. At Polo Ranch, there is more funding, a management plan, and a grazing plan guiding the recovery of the species, and there has been more success in maintaining the population. The discrepancy between the two preserves highlights the inadequacy of existing regulatory mechanisms: simple land preservation without adequate funding and management planning can lead to loss of individuals. The existing regulatory mechanisms do not require additional funding or expenditure if there is a loss of individuals.

The population on the Salvation Army property has also declined to zero. The Salvation Army property has no structured management for Scotts Valley polygonum and is privately owned. There is currently no regulatory mechanism that would encourage the proactive management and reintroduction of the Salvation Army property, which has no conservation designation.

Invasive species

Invasive species continue to be a persistent threat at each of the three properties. Competition from annual grasses is likely responsible for the loss of Scotts Valley polygonum at the High School Preserve and Salvation Army property as well as contributing to the decline observed at Polo Ranch. This is supported by an increase in the number of individuals at Polo Ranch following the implementation of direct weeding of occupied habitat and subsequent increases in abundance observed at such locations. Increased weeding efforts at the High School Preserve have failed to stimulate a seed bank (if a seed bank is present), suggesting that once abundance declines to zero for several consecutive years, invasive species management alone will likely not result in a reappearance of Scotts Valley polygonum. Currently, across the three properties, the most abundant invasive species are annual grasses such as *Festuca perennis*., *Avena* spp., *Bromus hordeaceus*, *Bromus diandrus*, *Hordeum murinum*, and annual forbs such as *Hypochaeris glabra*, *Erodium botrys*, *Anthemis cotula*, *Dittrichia graveolens*, and *Dipsacus* sp. (Lyons 2023, pp. 1, 6; Marty et al. 2023, Appendix 1). Both the direct competition for resources from invasive species and the accumulation of thatch represent appreciable management problems for Scotts Valley polygonum.

Inadequate preserve design

A preserve for Scotts Valley polygonum must be large enough to protect both the species as well as the ecological processes that the species has evolved with (Service 2003, 68 FR 16978). We are unable to say with certainty that the High School Preserve or Polo Ranch are too small. However, we can identify problems with the preserves as a result of their size as well as their location within an urbanized area. Such a spatial context has increased fragmentation of the surrounding habitat, exacerbating edge effects such as the new or repeated introduction of invasive weeds. Ecological processes by which weeds were naturally kept low are likely inhibited by the preserves' small sizes as well as their urbanized setting (e.g., fences disrupt natural browsing of deer on invasive plants). Introducing grazing is a desired solution. However, determining an appropriate grazing regime as well as installing and maintaining adequate infrastructure are difficult and costly. Interagency coordination and cost-share are thus required. Furthermore, finding grazing operators for small parcels is challenging and can be expensive because the lands may not be able to support services of enough livestock to reach economic feasibility for a lease. Finally, excluding or concentrating animals in a particular location for a particular goal requires additional staff, enforcement, and infrastructure, which all adds to the difficulty and cost.

Random (Stochastic) Extinction

Scotts Valley polygonum has an extremely limited range and occupies a very specific habitat niche within the broader wildflower field or coastal prairie. The specificity of habitat and the fragmentation of the areas where the species does occur make Scotts Valley polygonum highly susceptible to random (stochastic) events (e.g., catastrophic disturbance, demographic collapse). The threat of stochastic variation in demography and the environment has likely increased proportionately to the decrease in the amount of occupied habitat by the species (85 to 90 percent decrease since the time of listing).

Climate Change

Climate change may affect Scotts Valley polygonum most directly through changes in precipitation patterns, changes in seasonal average temperatures, and changes in minimum and maximum temperatures. Changes to these environmental conditions may decrease the suitability of existing habitat for Scotts Valley polygonum germination, survival, and reproduction, or increase the ability of non-native invasive species to colonize and outcompete Scotts Valley polygonum in areas where the species occurs or had occurred (Sandel and Dangremond 2012, p. 281; Thorne et al 2017, p. 6).

Evaluation of Recovery Criteria:
We have not published a final recovery plan to address the recovery needs of Scotts Valley polygonum to date, although we included the species as a species of concern in the 1998 Recovery Plan for Insect and Plant Taxa from the Santa Cruz Mountains in California (Recovery Plan) (Service 1998, pp. 35–37). The Recovery Plan suggested a recovery objective of preventing extinction and the need to include Scotts Valley polygonum in proposed acquisitions of property to establish conservation easements where the species historically occurred. We listed Scotts Valley polygonum as an endangered species in 2003 (Service 2003, entire), and the final listing rule stated that the conservation recommendations described in the Recovery Plan would serve as the recovery recommendations for the species upon listing (Service 2003, 68 FR 16973).

The recovery recommendations are to:

1. Establish permanent conservation easements over, or acquisition of, the three historically occupied properties in Scotts Valley, and;

2. Create a habitat conservation plan with the City of Scotts Valley (Service 1998, pp. v, 37, 47–48).

The conservation easement at Polo Ranch recorded in 2021 has Wildlife Heritage Foundation as the Grantee and Lennar Homes as the Grantor. The Scotts Valley High School Ecological Preserve is managed for the benefit of federal and state listed plant species but is not held in a conservation easement. There are currently no plans for a conservation easement or acquisition of the Salvation Army property, although there is an informal agreement in place that allows a volunteer to infrequently manage invasive species. There is currently no plan to create a habitat conservation plan with the City of Scotts Valley. The recovery criteria for Scotts Valley polygonum have thus not been met.

The loss of Scotts Valley polygonum at the Salvation Army site and Scotts Valley High School Ecological Preserve, when compared with the severe decline and then rebound of individuals at Polo Ranch, illustrates the need for appropriate long-term monitoring and management. Recovery of the species depends upon successful reintroduction of Scotts Valley polygonum to the Salvation Army site and Scotts Valley High School Ecological Preserve as well as subsequent securing of funding for long-term monitoring and management. Experimental reintroductions at Polo Ranch suggest that reintroduction is feasible and can be successful. The

reintroduction methods and management at Polo Ranch may also be successful at formerly occupied areas on other properties.

Summary
All threats identified at the time of listing (Service 2003, entire) and in the 2009 and 2020 5-Year Reviews (Service 2009, entire; Service 2020, entire) remain. The threat of habitat alteration and destruction has been appreciably reduced, though not eliminated. Only the Salvation Army property remains susceptible to the threat of habitat alteration and destruction via urban development. The Salvation Army property, Scotts Valley High School Ecological Preserve, and Polo Ranch property are each subject to edge effects as small preserves located within an urbanized setting. Scotts Valley polygonum also remains absent from the Salvation Army property and Scotts Valley High School Ecological Preserve. Abundance of Scotts Valley polygonum at Polo Ranch has decreased: 637 plants were observed in 2020 while 139 were observed in 2023 at occupied colonies. Reintroduction to unoccupied areas at Polo Ranch has been successful in the first year following seeding, which may inform potential management on other properties and future conservation easements. Still, the size of the remaining population of Scotts Valley polygonum makes it extremely susceptible to random (stochastic) variation in demography and the environment, which can exacerbate risk of extinction. The expected response of the species to climate change is not currently understood, but any changes to precipitation patterns, seasonal average temperatures, and minimum and maximum temperatures may have negative effects on the suitability of the current and historical habitat for Scotts Valley polygonum. A secondary effect of climate change may be an increased ability of invasive species to colonize and outcompete Scotts Valley polygonum where it occurs or had occurred. The persistence of the above threats combined with reduced population redundancy and resiliency increase Scotts Valley polygonum's risk of extinction.

Conclusion:
After reviewing the best available scientific and commercial information, we conclude that Scotts Valley polygonum (*Polygonum hickmanii*) remains an endangered species. The evaluation of threats affecting the species under the factors in 4(a)(1) of the Act and analysis of the status of the species in our 2009 5-year review (Service 2009, entire) remains an accurate reflection of the species' current status.

RECOMMENDATIONS FOR FUTURE ACTIONS:

The following actions are recommended based on the current 5-year review:

- Reintroduction should be expanded within Polo Ranch.
- Reintroduction should be implemented at the Scotts Valley High School Ecological Preserve and Salvation Army property.
- The Glenwood Preserve, adjacent to both the Salvation Army property and the Scotts Valley High School Ecological Preserve, should also be considered as a novel introduction location. The Glenwood Preserve is already managed for the presence of other federally listed plant species and has a similar suite of associated species and environmental conditions.

- In order to address the inadequacy of the current preserve designs and associated management, the creation of a single large management unit that brings together the Salvation Army property, Scotts Valley High School Ecological Preserve, Polo Ranch property, and Glenwood Preserve should be explored.

Field Supervisor, Ventura Fish and Wildlife Office, U.S. Fish and Wildlife Service

Approved STEPHEN HENRY Digitally signed by STEPHEN HENRY Date: 2024.06.05 11:56:29 -07'00'

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