

Castilleja affinis spp. *neglecta*
(Tiburon paintbrush)

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



Photo credit: Ben Solvesky, USFWS

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

June 2012

5-YEAR REVIEW

Castilleja affinis spp. *neglecta* (Tiburon paintbrush)

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:

Castilleja affinis spp. *neglecta* (Tiburon paintbrush) is a semi-woody perennial in the Scrophulariaceae (snapdragon or figwort) family with erect, branched stems 30 to 60 cm (1 to 2 ft) tall and a sparse covering of soft, spreading hairs. The lance-shaped leaves have one or two pairs of narrow lobes. The conspicuous floral bracts are yellowish and sometimes red-tipped; the flowers are light yellow to red and 18 to 20 mm (0.7 to 0.8 in) long. The simple (unbranched) hairs and the lack of glands below the inflorescence distinguish *C. affinis* spp. *neglecta* from other species of the genus *Castilleja* on the Tiburon Peninsula (*C. latifolia* var. *rubra* and *C. foliosa*) (Howell 1970). The type specimen of *C. affinis* spp. *neglecta* was collected by Katherine Brandegee in the early 1900s. The plant was described by Zeile in 1925 in Willis Jepson's Manual of the Flowering Plants of California (Jepson 1925).

Castilleja affinis spp. *neglecta* is a root parasite on other angiosperm (flowering) plant species. The primary advantage of the parasitic attachment in *Castilleja* and related plants in the figwort family is reportedly an increased water and mineral supply. Though the parasitic relationship is not obligate, benefits to species of *Castilleja* from the parasitic habit are manifested in increased vigor with more branching, greater height, and earlier flowering (Heckard 1962). Heckard (1962) showed that a host plant is beneficial to *C. affinis* spp. *neglecta* and increases the species' chance for survival. Experiments (Heckard 1962) and field data (Martin 1989) suggest that *C. affinis* spp. *neglecta* may utilize a variety of host species.

Castilleja affinis spp. *neglecta* occurs in serpentine bunchgrass communities typically on north to west facing slopes. At the time of listing, this species was known from five occurrences in Marin County, three of which are on the Tiburon Peninsula, one occurrence in Napa County, and

one occurrence in Santa Clara County. The range of this plant is approximately 50 km (30 miles) from east to west and 112 km (70 miles) from north to south. A total of approximately 1,500 plants were known to exist at the time of listing with populations ranging from 13 plants in Santa Clara County to 600 plants at Ring Mountain Preserve on the Tiburon Peninsula (Service 1995). Since the listing of this species, a second occurrence of *C. affinis* spp. *neglecta* was discovered in Santa Clara County near the first occurrence (S. Weiss personal communication 2011). Results of surveys conducted since 2000 have shown high fluctuations in numbers of plants within each of these populations.

Methodology Used to Complete This Review:

This review was prepared by the Sacramento Fish and Wildlife Office (SFWO), following the Region 8 guidance issued in March 2008. We used information from the Recovery Plan for Serpentine Soil Species of the San Francisco Bay (September 30, 1998), survey information from experts who have been monitoring various localities of this species, and the California Natural Diversity Database (CNDDDB) maintained by the California Department of Fish and Game. The Recovery Plan and personal communications with experts were our primary sources of information used to update the species' status and threats. We received one letter in response to our Federal 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. 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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Lead Field Office: Josh Hull, Recovery Division Chief, Sacramento Fish and Wildlife Office (SFWO), (916) 414-6600.

Federal Register (FR) 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 5, 2008 (73FR11945). We received one response from the California Attorney General's Office to this request for information.

Listing History:

Original Listing

FR Notice: 60 FR 6671-6685

Date of Final Listing Rule: February 3, 1995

Entity Listed: Species: *Castilleja affinis* ssp. *neglecta*, a plant subspecies
Classification: Endangered

State Listing

Castilleja affinis ssp. *neglecta* (Tiburon paintbrush) was listed by the State of California as threatened in January 1990.

Review History: No status reviews or other relevant reviews have been conducted since the 1995 listing.

Species' Recovery Priority Number at Start of 5-Year Review:

The recovery priority number for *Castilleja affinis* ssp. *neglecta* is 9C according to the Service's 2011 Recovery Data Call for the SFWO, based on a 1-18 ranking system where 1 is the highest-ranked recovery priority and 18 is the lowest (Endangered and Threatened Species Listing and Recovery Priority Guidelines, 48 FR 43098, September 21, 1983). This number indicates that *C. affinis* ssp. *neglecta* is a subspecies that faces moderate degree of threat and has a high potential for recovery. The "C" indicates conflict with construction or other development projects or other forms of economic activity.

Recovery Plan or Outline

Name of Plan or Outline: Recovery Plan for Serpentine Soil Species of the San Francisco Bay Area

Date Issued: September 30, 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

Species Biology and Life History

Castilleja affinis ssp. *neglecta* (Tiburon paintbrush) is a semi-woody perennial of the Scrophulariaceae (snapdragon or figwort) family with erect, branched stems 30 to 60 cm (1 to 2 ft) tall and a sparse covering of soft, spreading hairs. The lance-shaped leaves have one or two pairs of narrow lobes. The conspicuous floral bracts are yellowish and sometimes red-tipped; the flowers are yellow to red and 18 to 20 mm (0.7 to 0.8 in) long. The simple (unbranched) hairs and the lack of glands below the inflorescence distinguish *C. affinis* ssp. *neglecta* from other

species of the genus *Castilleja* on the Tiburon Peninsula (*C. latifolia* var. *rubra* and *C. foliosa*) (Howell 1970, Service 1998). The type specimen of *C. affinis* ssp. *neglecta* was collected by Katherine Brandegee in the early 1900s.

The yellow flowers of *Castilleja affinis* ssp. *neglecta* are pollinated by hummingbirds (County of Santa Clara et al. 2010). Seed dispersal occurs from June to October. The plant dies back to its woody base after seed dispersal and new growth occurs after the first winter rain. Seeds remain dormant in the soil until appropriate conditions occur, which can take several years (Martin 1989, Service 1998). Germination may be induced by water (disintegrates the netted seed coat) and low temperatures (5 -15 degrees Celsius or 45 - 49 degrees Fahrenheit) (Service 1998). Seed establishment may be negatively affected by slow root growth, although the establishment and success of this plant is likely the result of several factors such as local climate, soils, and the amount of herbivory (Martin 1989, Service 1998).

Castilleja affinis ssp. *neglecta* is a root parasite on other angiosperm (flowering) plant species. The primary advantage of the parasitic attachment in *Castilleja* and related plants in the figwort family is reportedly an increased water and mineral supply. Though the parasitic relationship is not obligate, benefits to species of *Castilleja* from the parasitic habit are manifested in increased vigor with more branching, greater height, and earlier flowering (Heckard 1962). Heckard (1962) showed that a host plant is beneficial to *C. affinis* ssp. *neglecta* and increases the species' chance for survival. Experiments (Heckard 1968) and field data (Martin 1989) suggest that *C. affinis* ssp. *neglecta* species may utilize a variety of host species.

Spatial Distribution

Castilleja affinis ssp. *neglecta* occurs in serpentine bunchgrass communities typically on north to west facing slopes. The distribution of *C. affinis* ssp. *neglecta* has never been widespread. The Recovery Plan describes seven occurrences; five in Marin County (three of which occur on the Tiburon Peninsula), one near American Canyon in Napa County, and one in Santa Clara County (Service 1998, CDFG 2010). The CNDDDB reports one additional occurrence (occurrence 9) in Santa Clara County (CDFG 2010). The CNDDDB also reports one occurrence from Stinson Beach in Marin County that was last observed at 1965 with the exact location and number of plants listed as unknown (CDFG 2010). The range of *C. affinis* ssp. *neglecta* is approximately 50 kilometers (30 miles) from east to west, and 112 kilometers (70 miles) from north to south (Service 1995).

Marin County

Three of the occurrences of *Castilleja affinis* ssp. *neglecta* in Marin County occur on the Tiburon peninsula. These include: (1) an occurrence comprised of scattered colonies on the Middle Ridge of the Tiburon Peninsula that falls on both Town of Tiburon Open Space and private land (S. Anderson and E. Buxton personal communication 2009; CDFG 2010); (2) an occurrence near Old St. Hilary's church above the Town of Tiburon on land managed by Marin County Open Space District (CDFG 2010); and (3) an occurrence comprised of scattered colonies on the west-central portion of the Ring Mountain Preserve managed by Marin County Open Space District (LSA 2007, 2008, and CDFG 2010). Approximately 50 percent of the Ring Mountain Preserve occurrence extends onto Corte Madera Open Space land adjacent to the Ring Mountain Preserve to the west (LSA 2007). The other two occurrences of *C. affinis* ssp. *neglecta* in Marin County

occur approximately 0.5 mile apart on land owned by the National Park Service in the Golden Gate National Recreation Area (GGNRA) west of Sir Francis Drake Blvd (CDFG 2010).

Napa County

The *Castilleja affinis* ssp. *neglecta* occurrence in Napa County is located near the City of American Canyon, west of Interstate 80, approximately two miles southeast of Napa Junction, southwest of Cordelia (CDFG 2010). The population occurs primarily on private land associated with a quarry operation but extends onto approximately twelve acres of the Newell Open Space Preserve near its southern boundary (C. Cromer personal communication 2009). The Land Trust of Napa County holds a conservation easement on the open space land which is estimated to support 5 to 10 percent of this population (C. Cromer and J. Ruygt personal communication 2009).

Santa Clara County

There are two occurrences of *Castilleja affinis* ssp. *neglecta* in Santa Clara County located on private land along Coyote Ridge north of Morgan Hill in the Kirby Canyon area (County of Santa Clara et al. 2010). The southern occurrence is located on the top and northeast-facing slope of Paintbrush Hill (County of Santa Clara et al. 2010 and CDFG 2010). The northern occurrence is located in North Canyon (also called Paintbrush Canyon) on the steep north-facing slope of a ravine (County of Santa Clara et al. 2010). Occurrence 7 in the CNDDDB represents both the Paintbrush Hill and North Canyon occurrences. Occurrence 9 in the CNDDDB refers to the North Canyon occurrence alone (County of Santa Clara et al. 2010).

Abundance

Marin County

There are no recent population estimates for Middle Ridge and St. Hilary's church occurrences of *Castilleja affinis* ssp. *neglecta* on the Tiburon peninsula (Table 1). Although recent surveys conducted for the Town of Tiburon's Open Space Resources Management Plan found *C. affinis* ssp. *Neglecta* present in four areas on the Middle Ridge, no estimates of abundance were provided (LSA 2010). The most recent estimate for the Middle Ridge occurrence is from 1997 when approximately 228 plants were counted (CDFG 2010). It is thought that the Saint Hilary's church occurrence may be in decline (D. Herlocker personal communication as cited in County of Santa Clara et al. 2010); the most recent survey from 1997 found 13 plants down from a high of 101 reported in 1988 (Table 1) (CDFG 2010).

The occurrence of *Castilleja affinis* ssp. *neglecta* within the Ring Mountain Preserve on the Tiburon peninsula has been monitored periodically since 1988. The occurrence is located in the far western-central portion of the preserve and extends onto Corte Madera Open Space where approximately 50 percent of the population is estimated to occur (LSA 2007). Monitoring conducted at Ring Mountain Preserve has not included plants that fall on the Corte Madera property. Monitoring was conducted by The Nature Conservancy until 1995 when the Ring Mountain Preserve was transferred to the Marin County Open Space District (LSA 2007). LSA conducted monitoring for the Open Space District in 2007 and 2008 (LSA 2008). In 2007, a total of 494 plants were counted on the preserve which is consistent with numbers in the past (Table 1). Also in 2007, 24 colonies of *C. affinis* ssp. *neglecta* were selected for annual

monitoring (LSA 2007). Since 2007, the number of plants, number of inflorescent branches, and level of herbivory observed within these 24 colonies has remained relatively stable. It has not yet been determined whether this data can be extrapolated to describe a population trend (S. Abercrombie personal communication 2011). In 2011, *C. affinis* ssp. *Neglecta* had a strong bloom with a large number of plants setting seeds and with two individuals observed far from the source population, indicating the potential for other areas of suitable habitat on the preserve (S. Abercrombie personal communication 2011).

Two occurrences of *Castilleja affinis* ssp. *neglecta* fall within the GGNRA in areas managed by the Point Reyes National Seashore (Service 1998). The Nicasio Ridge occurrence extends onto private land. The number of plants in the Nicasio Ridge occurrence has fluctuated from year to year (Table 1). Starting in 2003, only plants within the GGNRA boundary were counted during annual surveys and since then, the number of plants has increased from four to 55 (M. Chasse personal communication 2011). The second occurrence within the GGNRA (occurrence 6 in the CNDDDB) has only been surveyed once in 1991, when 50 individuals were counted (CDFG 2010).

Napa County

Surveys of the Napa County occurrence counted more than 186 plants in 1986 and 588 plants in 1988 (Table 1) (CDFG 2010). In 2001, a survey of the 5 to 10 percent of the population that occurs on Newell Preserve counted 35 individuals (C. Cromer and J. Ruygt personal communication 2009). Comprehensive surveys have not been conducted on the Newell Preserve since 2001, however, in 2009, 38 plants were observed during a site visit (J. Ruygt personal communication 2011). No recent surveys for the portion of the population on the quarry property have been reported. Rare plant surveys conducted in 2007 and 2008 on a 50-acre portion of the quarry property south of the mapped *Castilleja affinis* ssp. *neglecta* population found suitable habitat present but no Tiburon paintbrush were observed (Ohlson 2008).

Santa Clara County

At the Paintbrush Hill site, the most recent survey conducted in 2009 counted 103 plants down slightly from surveys in 2006 that found 135 plants (C. Niederer personal communication 2009) (Table 1). At the North Canyon site, the number of plants counted increased from 17 in 1993 to approximately 1,000 plants within an approximately 0.25 hectare area in 2006 (CDFG 2010); in 2009 the population was estimated at 1,100 plants (C. Niederer personal communication 2009). This is by far the largest occurrence in all three counties (County of Santa Clara et al. 2010). Although a 2002 survey reported only 5 plants in this population (CDFG 2010), it is likely that the entire area was not included in the survey (C. Niederer personal communication 2009).

Habitat or Ecosystem

Castilleja affinis ssp. *neglecta* grows on open, rocky, serpentine slopes within the serpentine grassland communities, between about 75 and 400 meters (250 and 1,300 feet) in elevation in Napa, Marin, and Santa Clara Counties (Service 1998, Safford et al. 2005, LSA 2007, CDFG 2010). The habitat is serpentine bunchgrass community with associated native, non-native and invasive plant species such as: *Gilia achilleifolia* ssp. *multicaulis* (California gilia), *Eschscholzia californica* (California poppy), *Plantago erecta* (dwarf plantain), *Nassella pulchra* (purple needlegrass), *Dudleya setchellii* (Santa Clara Valley dudleya), *Calamagrostis ophitidus*

(serpentine reedgrass), *Eriogonum caninum* = *Eriogonum leuteolum* var. *caninum* (Tiburon buckwheat), *Calochortus tiburonensis* (Tiburon mariposa lily), *Hesperolinon congestum* (Marin dwarf-flax), *Carduus pycnocephalus* (Italian thistle), *Centaurea solstitialis* (yellow starthistle), and *Centaurea melitensis* (tocolote) (Service 1998, LSA 2007, C. Niederer personal communication 2009).

Changes in Taxonomic Classification or Nomenclature

This species was first collected in 1925 by Katherine Brandege and described as *Castilleja neglecta* by Zeile at that time (Jepson 1925). In the updated Jepson manual (Hickman 1993), the species was reduced to subspecific status, *C. affinis* ssp. *neglecta*, by Chuang and Heckard. Common names include Tiburon paintbrush and Tiburon Indian paintbrush. There have been no changes in taxonomic classification or nomenclature for this species since the time of listing.

Genetics

Studies regarding genetic variation or trends in variation have not been produced for any of the *Castilleja affinis* ssp. *neglecta* populations in Marin, Napa, or Santa Clara Counties since the species was listed. In 1968, Heckard studied chromosome numbers and polyploidy in 54 taxa of *Castilleja*. Chromosome numbers in this genus varies from twelve to 72. Two subspecies of *Castilleja affinis* were sampled, *C. affinis* ssp. *affinis* (Orange and Santa Cruz Counties) and *C. affinis* ssp. *contentiosa* (San Luis Obispo and Monterey Counties) for this study. Heckard (1968) observed evidence that polyploidy leads to patterns of variation that can lead to hybridization while plants maintain differences in their appearance. Hybridization, therefore, indicates that inbreeding is possible not only between species with the same number of chromosomes, but also between different species with varying ploidy levels (Heckard 1968).

Species-specific Research and/or Grant-supported Activities

At the time of this review, we are not aware of any scientific research studies being conducted on *Castilleja affinis* ssp. *neglecta*. In March 2011, The Nature Conservancy awarded a \$75,000 grant to the Marin County Open Space District to fund year one of a multi-year stewardship and habitat restoration program at the Ring Mountain Preserve which will include assessing and treating invasive plant infestations, developing a database to track restoration actions, monitoring *C. affinis* ssp. *neglecta* and *Calochortus tiburonensis* (Tiburon mariposa lily) populations, and increasing volunteer opportunities. GGNRA conducts annual monitoring of the portion of the Nicasio ridge population that falls within park boundaries as their funding allows (M. Chasse personal communication 2011). Monitoring for both Santa Clara County populations has been conducted periodically by the Kirby Canyon Butterfly Trust (County of Santa Clara et al. 2010) and it is anticipated that a grant proposal will be submitted to the Central Valley Conservation Program for funding to support future monitoring and management of these populations as well as additional seed collection (S. Weiss and C. Niederer personal communication 2011).

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

Residential Development: When *Castilleja affinis* ssp. *neglecta* was listed as endangered in 1995, residential development was identified as a primary threat to Marin County populations. It remains a significant threat today. At the time of listing, the St. Hilary's church occurrence on the Tiburon peninsula was threatened by a proposed residential development. A portion of the land supporting this population was purchased by the Marin County Open Space District and Town of Tiburon in 1997 as an open space preserve (the Old St. Hilary's Open Space Preserve), however, a portion of the population remains on private land where residential development has been proposed on multiple occasions. In 2001, a draft Environmental Impact Report (EIR) was released for the Easton Point residential development but was not certified by the Town of Tiburon. However, in 2009, following a court decision to uphold the development of the property, the Town of Tiburon and the Easton Point project applicant (the Martha Company) signed a Memorandum of Understanding regarding a 32-unit lower density alternative for the project site, and in March 2011 the Easton Point Residential Development Draft Environmental Impact Report was released. Although the Draft EIR states that no *C. affinis* ssp. *neglecta* plants were found during surveys of the project area and no individuals will be directly impacted by the proposed development, *C. affinis* ssp. *neglecta* plants within Old St. Hilary's Open Space Preserve are within 100 feet of the development and are likely to experience excess irrigation run-off and downdrift of non-serpentine fill/top soils, herbicides, and fertilizers from landscaped areas resulting in non-native invasive plants within the serpentine bunchgrass habitat on Old St. Hilary's Open Space.

The Middle Ridge occurrence of *Castilleja affinis* ssp. *neglecta* on the Tiburon Peninsula falls partially on Town of Tiburon Open Space lands and partially on private lands that could be developed. At this time, the Service is not aware of any pending residential development projects proposed for parcels supporting *C. affinis* ssp. *neglecta* zoned for development. However, residential development on the Middle Ridge adjacent to Tiburon paintbrush habitat is anticipated to occur in the near future (S. Anderson personal communication 2009).

Mining/Landfill: Both Santa Clara County occurrences of *Castilleja affinis* ssp. *neglecta* occur on private land associated with the Kirby Canyon Landfill. However, both are located in areas currently managed as mitigation sites for landfill impacts. Both occurrences are monitored and managed by the Kirby Canyon Butterfly Trust, but neither site is permanently protected (County of Santa Clara et al. 2010). The Paintbrush Hill occurrence is located within a 250 acre reserve for the Bay checkerspot butterfly (*Euphydryas editha* ssp. *bayensis*) established under a 1985 conservation plan that was required by the City of San Jose as part of the development permit for the Kirby Canyon Landfill (T. Peterson personal communication 2011). Santa Clara Waste Management leases the checkerspot reserve land from a private landowner under the terms of a conservation agreement with the Service executed in 1986. The reserve must be maintained for the life of the landfill. Following the issuance of a 2003 biological opinion addressing the landfill's effects to California red-legged frog, and in compliance with state and other federal agency requirements (Clean Water Act and Fish and Game Code), Santa Clara Waste Management purchased the land supporting the North Canyon *C. affinis* ssp. *neglecta* occurrence

as mitigation. A conservation easement has been placed on creek and wetland habitat on this site, but not on the remainder of the property (T. Peterson personal communication 2011). Grazing management currently occurs in this area, but it is not controlled under a specific agreement (T. Peterson personal communication 2011).

At the time of listing, the Napa County occurrence was threatened by the potential expansion of the American Canyon Quarry. In 1999 private landowners donated land supporting 5 to 10 percent of the *Castilleja affinis* ssp. *neglecta* occurrence to the City of American Canyon in order to create the Newell Preserve; the Land Trust of Napa County holds a conservation easement on the preserve land (Napa County Land Trust website). Currently, there are no active plans for quarry expansion on the land that supports the majority of this occurrence and quarry reclamation which was initiated in 2007 is not anticipated to affect this occurrence (D. Barrella personal communication 2011). However, the quarry property is in an area zoned for agriculture and low density residential and could potentially be developed in the future.

Recreation: At the time *Castilleja affinis* ssp. *neglecta* was listed, we cited pedestrian traffic associated with recreation activities as a Factor A threat for the Middle Ridge and Ring Mountain populations of *C. affinis* ssp. *neglecta* on the Tiburon peninsula. Currently, wayward trails continue to crisscross Ring Mountain Preserve resulting in a small reduction in available habitat. *C. affinis* ssp. *neglecta* is most likely to be negatively affected by hikers, cyclists, and equestrians if they stray from designated and social trails and trample plants or if new trails are established. *C. affinis* ssp. *neglecta* plants on the Middle Ridge of the Town of Tiburon faces threats from hikers and their dogs that trample plants and habitat despite posted signs warning sensitive plant habitat (E. Buxton personal communication 2009).

Currently, visitors are only allowed to visit Newell Preserve in Napa County during docent-led tours. Therefore, trampling and habitat destruction from recreational hikers, dogs, cyclists, and equestrians is currently not a threat to this *Castilleja affinis* ssp. *neglecta* occurrence. However, a master plan is being developed for the preserve that will likely include allowing public access without docent supervision. It is anticipated the plan will avoid impacts to *C. affinis* ssp. *neglecta* by either avoiding the area supporting the occurrence or by using existing paths and roads in sensitive areas (S. Cleisz and S. Trippi personal communication 2009).

Landslide/Erosion: At the time of listing, soil slumping was identified as a threat to the *Castilleja affinis* ssp. *neglecta* occurrence at Ring Mountain Preserve (Service 1995). The toe of the slope that supports the population was removed to accommodate residential development in Corte Madera in the 1960s and soil from the slope slips onto the street below. It appears that soil slumping at this location remains a threat. Some Town of Tiburon Open space parcels are mapped as being prone to landslides and erosion occurs along some trails and watercourses on open space parcels, but neither appears to be a major threat to *C. affinis* ssp. *neglecta* at this time (LSA 2010).

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

Overutilization for commercial, scientific and or educational purposes was not known to be a threat to *Castilleja affinis* ssp. *neglecta* at the time of listing and does not appear to be a threat at this time.

FACTOR C: Disease or Predation

Cattle grazing was cited as a factor C threat to *Castilleja affinis* ssp. *neglecta* at the time of listing. Improper grazing may remain a potential threat to the species, however, grazing can also be used as a management tool to reduce biomass of non-native vegetation and may actually be beneficial to the species if managed appropriately (County of Santa Clara et al. 2010). Since listing, mammalian herbivory has also been identified as a threat to *C. affinis* ssp. *neglecta*.

Grazing: Disturbance associated with cattle grazing has been noted at the Paintbrush Hill occurrence in Santa Clara County (CDFG 2010) and the consumption of *Castilleja affinis* ssp. *neglecta* flowers and fruit by cattle could potentially negatively impact reproduction (C. Niederer personal communication 2009). However, it appears that cattle grazing is instrumental in maintaining the site by keeping invasive grass low and that limited grazing provides an overall benefit to the species at this site (C. Niederer personal communication 2009, County of Santa Clara et al. 2010). The North Canyon occurrence in Santa Clara County is located on slopes too steep for all but light cattle grazing (C. Niederer personal communication 2009). Nicasio Ridge in the GGNRA is grazed by cattle, but due to the rocky nature of the area where *C. affinis* ssp. *neglecta* plants occur, use of the area by cattle is low and the plants don't appear to be negatively affected by the current grazing regime (M. Chasse, personal communication 2011). More intensive grazing could pose a threat to this population.

Herbivory: Mammal herbivory by mule deer (*Odocoileus hemionus*) and black-tailed jackrabbits (*Lepus californicus*) may pose a threat to *Castilleja affinis* ssp. *neglecta* on the Ring Mountain Preserve. Results from 2007 monitoring showed that approximately 25 percent of the inflorescence branches in the 53 plants evaluated were removed by herbivory (LSA 2007). However, side branches developed when tips of branches were removed, so this type of herbivory may not pose a substantial threat. Disturbance from feral pig (*Sus scrofa*) rooting poses a threat to the Paintbrush Hill occurrence in Santa Clara County (County of Santa Clara et al. 2010). Cameras placed at the Santa Clara occurrences have documented rabbits and deer in the area and sharp incisions on the plants suggest that rabbits may be eating some *C. affinis* ssp. *neglecta* flowers and fruit at this location (C. Niederer personal communication 2011). It is not known whether any diseases threaten the species.

FACTOR D: Inadequacy of Existing Regulatory Mechanisms

At the time of listing, regulatory mechanisms thought to have some potential to protect *Castilleja affinis* ssp. *neglecta* were the Native Plant Protection Act, the California Endangered Species Act, the California Environmental Quality Act, and the Clean Water Act. It was determined that

these regulatory mechanisms did not adequately protect *C. affinis* ssp. *neglecta* from threats to the species. The following is a summary of the regulatory mechanisms that are most likely to afford protection to *C. affinis* ssp. *neglecta*.

Federal Laws

The Endangered Species Act: The Endangered Species Act of 1973, as amended (Act), is the primary Federal law that provides protection for *Castilleja affinis* ssp. *neglecta*. 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 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, plants are not protected against take. 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. The protection of section 9 afforded to endangered species is extended to threatened wildlife and plants by regulation. Federally listed plants may be incidentally protected if they co-occur with federally listed wildlife species.

Under the terms of section 7(b)(4) and section 7(o)(2) of the Act, taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of an incidental take statement. Sections 7(b)(4) and 7(o)(2) of the Act generally do not apply to listed plant species because take of plants is not prohibited. However, limited protection of listed plants from take is provided to the extent that the Act and the implementing regulations prohibit the removal and reduction to possession of federally listed threatened or endangered plants or the malicious damage of endangered plants on areas under Federal jurisdiction, or the destruction of endangered plants on non-Federal areas when in violation of state law or regulation or in the course of any violation of a State criminal trespass law

Currently there are no completed final regional or county-wide Habitat Conservation Plans (HCPs) authorized under section 10 of the Act, or Natural Community Conservation Plans (NCCPs) authorized under the California Natural Community Conservation Plan Act, in Marin or Napa County, thereby leaving populations on private land in these counties without protection under these laws. In Santa Clara County, a draft HCP/NCCP (the Draft Santa Clara Valley Habitat Plan), Draft EIR/EIS, and Draft Implementing Agreement were released in December, 2010. The public comment period closed on April 18, 2011. The Santa Clara HCP/NCCP will only cover temporary effects to *C. affinis* ssp. *neglecta* resulting from implementation of the HCP conservation strategy (e.g. prescribed burning and livestock grazing) and will not cover any loss of occurrences of this species (County of Santa Clara et al. 2010).

California State Laws

California Endangered Species Act (CESA) and Native Plant Protection Act (NPPA): CESA (California Fish and Game Code, section 2080 *et seq.*) prohibits the unauthorized take of State-listed threatened or endangered species. NPPA (Division 2, Chapter 10, section 1908) prohibits

the unauthorized take of State-listed threatened or endangered plant species. CESA requires State agencies to consult with the CDFG on activities that may affect a State-listed species and mitigate 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.

California Environmental Quality Act (CEQA): *Castilleja affinis* ssp. *neglecta* is listed under CESA as threatened and it must be considered under CEQA as a rare species (Section 15380, Public Resources Code). CEQA (chapter 2, section 21050 *et seq.* of the California Public Resources Code) requires government agencies to consider and disclose environmental impacts of projects and to avoid or mitigate for impacts where possible. Under CEQA, public agencies must prepare environmental documents to disclose environmental impacts of a project and to identify conservation measures and project alternatives. Through this process, the public can review proposed project plans and influence the process through public comment. However, CEQA does not guarantee that such conservation measures will be implemented

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

At the time of listing (Service 1995), we cited restricted habitats/range, small population size, and competition with non-native plants as threats to *Castilleja affinis* ssp. *neglecta*.

Non-native Invasive Plant Species: Competition from non-native invasive plant species continues to pose a serious threat to *Castilleja affinis* ssp. *neglecta* on the Tiburon peninsula. At the Ring Mountain Preserve, the Marin County Open Space District has been working to eradicate or control non-native invasive species for several years. The Ring Mountain Preserve Sensitive Resource Monitoring Plan (LSA Associates, Inc. 2007) provides a list of non-native invasive species that currently occur on Ring Mountain and describes treatment recommendations. Similarly, the Town of Tiburon has an Open Space Resource Management Plan (LSA 2010) that addresses invasive species that affect the Middle Ridge occurrence of *C. affinis* ssp. *neglecta*. Bull thistle (*Cirsium vulgare*), French broom (*Genista monspessulana*), and wild oats (*Avena* spp.), are problematic on parcels supporting *C. affinis* ssp. *neglecta*. Weed abatement is an ongoing activity that will likely need to occur in perpetuity at these locations.

Non-native invasive plant species occur to some extent in association with occurrences of *Castilleja affinis* ssp. *neglecta* outside the Tiburon peninsula as well. Point Reyes National Seashore is working to control an invasion of distaff thistle (*Carthamus lanatus*) in the vicinity of the Nicasio Ridge occurrence of *C. affinis* ssp. *neglecta* within the GGNRA and hand removal of tocolote (*Centaurea melitensis*) is conducted on Nicasio Ridge once or twice a year as funding allows. At this time, however, these non-native species do not appear to pose a serious threat to the Nicasio Ridge *C. affinis* ssp. *neglecta* occurrence (M. Chasse personal communication 2011). Treatments for barbed goatgrass (*Aegilops triuncialis*) have taken place on the Kirby Canyon Butterfly Preserve that supports Paintbrush Hill occurrence of *C. affinis* ssp. *neglecta* in Santa Clara County (Niederer 2008) and a number of non-native species occur in low densities within the North Canyon occurrence in Santa Clara County (C. Niederer personal communication 2009). At these two locations, efforts to control non-native plant species are necessary to keep them in control, but at this

time cattle grazing and current efforts appear to have prevented severe encroachment of non-native species (C. Niederer personal communication 2009).

Nitrogen Deposition: Air pollution and the resultant deposition of reactive airborne nitrogen has become a significant threat to many native California plants, in particular to those that occur in nutrient poor soils such those in serpentine areas (Weiss 1999). Increased nitrogen deposition allows nutrient-poor serpentine soils to be invaded by non-native annual grasses that displace the native forbs (Weiss 1999). Nitrogen deposition is especially high near urban areas where combustion sources produce substantial concentrations of nitrogen oxides (Weiss 1999). All occurrences of *Castilleja affinis* ssp. *neglecta* occur within or adjacent to urban areas with elevated levels of nitrogen deposition with particularly high nitrogen deposition levels occurring in Santa Clara County near San Jose (Weiss 2006).

Stochasticity: The limited number and small sizes of *Castilleja affinis* ssp. *neglecta* occurrences increase this species vulnerability to chance events such as fire, flood, drought, disease, and other natural and human-caused disasters (Brook et al. 2002). The occurrences of *C. affinis* ssp. *neglecta* on the Tiburon peninsula in particular are located in close proximity to dense, residential development placing them at risk of catastrophic events associated with human activity such as fire or vandalism. In addition, small populations are subject to inbreeding (mating between closely related individuals) resulting in a subsequent loss of genetic diversity (Spielman et al. 2004). Small populations are also more likely to experience extinction as a result of “stochastic” demographic fluctuations or other density-dependent effects (Avice 2004).

Climate Change/Drought: 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, IPCC 2007). However, climatic conditions for smaller sub-regions such as California remain uncertain (Pyke 2005). It is unknown at this time if climate change in California will result in a localized, relatively small cooling and drying trend, or a warmer trend with higher precipitation events (Pyke 2005). A modeling study completed by Loarie et al. (2008) provides an evaluation of potential trends to California’s floristic communities under climate change scenarios. The models suggest that shifts in species ranges may break up local floras, resulting in new species combinations, with new patterns of competition and biotic interactions (Loarie et al. 2008).

While it appears reasonable to assume that *Castilleja affinis* ssp. *neglecta* will be affected by climate change, we lack sufficient certainty regarding how and how soon climate change will affect the species. Because *C. affinis* ssp. *neglecta* is restricted to limited and patchily distributed serpentine soils, however, the species will likely have difficulty shifting its range to adjust to changing conditions. If California enters into a drying trend, the resulting droughts could adversely affect *C. affinis* ssp. *neglecta* and compounded by other factors such as human trampling, invasive plant species, and other unforeseen circumstances, could contribute to the local extirpation of this species.

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.

The recovery plan for *Castilleja affinis* ssp. *neglecta* (Recovery Plan for Serpentine Species of the San Francisco Bay Area) provides recovery criteria for *C. affinis* ssp. *neglecta* and 27 other listed plants and animals (Service 1998). The recovery plan takes a community-level approach since many of the listed species and species of concern co-occur in the same natural community and share the same threats. The over-arching recovery strategy for *C. affinis* ssp. *neglecta* is habitat protection and management. The key elements that comprise this ecosystem-level recovery and conservation strategy are: (1) habitat protection; (2) habitat management and restoration, including removal of invasive non-native species; (3) surveying and monitoring; (4) ex-situ conservation measures such as artificial rearing; (5) research; and (6) public participation, education, and outreach.

According to the recovery plan (Service 1998); the following are the downlisting criteria for *Castilleja affinis* ssp. *neglecta*:

1. *Occupied habitat along with adjacent habitat and a 150-meter buffer is secured and protected from incompatible uses at 6 known sites.*

Is criterion still valid: Yes.

Listing factors addressed: Present or threatened destruction, modification or curtailment of habitat or range (Factor A).

Has criterion been met: No. Of the eight *Castilleja affinis* ssp. *neglecta* occurrences, four are adequately protected from incompatible uses. The *C. affinis* ssp. *neglecta* occurrences on the Ring Mountain Preserve and Town of Tiburon Open Space in Marin County fall primarily on lands permanently protected by conservation easements. However, the implementation of a 150-meter buffer is not possible at these two locations due to the presence of housing developments in close proximity. The two occurrences on GGNRA land can also be considered protected based on their location on NPS land.

The remaining four occurrences of *Castilleja affinis* ssp. *neglecta* are not permanently protected. Although some of the St. Hilary's church occurrence falls on Town of Tiburon Open space, a residential development being proposed in this area could negatively affect this occurrence. The majority of the occurrence near American Canyon in Napa County is located on private land zoned for single family residential or agriculture with only a small portion (5-10 percent) of the population extending onto open space land protected by a conservation easement. The two Santa Clara occurrences are currently protected from incompatible uses by virtue of their location on private lands serving as mitigation for Bay checkerspot butterfly. However, these areas are not permanently protected under conservation easements. The pending Santa Clara Valley Habitat Conservation Plan is anticipated to include permanent protection for these occurrences, however, the mechanism and timing of this protection is unknown at this time.

2. *A management plan, including survival of the species as an objective, has been approved and implemented for all sites and any adjacent occupied or unoccupied habitat identified as essential to continued survival.* ("all sites" is interpreted here as referring to the 6 sites in downlisting criteria 1).

Is criterion still valid: Yes.

Listing factors addressed: Present or threatened destruction, modification or curtailment of habitat or range (Factor A); Disease or predation (Factor C); Other natural or manmade factors affecting its continued existence (e.g. non-native invasive plant species) (Factor E).

Has criterion been met: No. Two *Castilleja affinis* ssp. *neglecta* occurrences are located on sites managed according to approved management plans with species survival as an objective. The approved 2007 Ring Mountain Preserve Sensitive Resources Monitoring and Enhancement Strategy is being implemented by Marin County Open Space District (LSA 2007) and the Town of Tiburon Open Space Resource Management Plan was recently published and will be used to guide management on Town of Tiburon lands (LSA 2010). The Service is not aware of approved management plans for lands supporting the other *C. affinis* ssp. *neglecta* occurrences; however, the occurrences in Santa Clara County fall within areas managed for Bay checkerspot butterfly and management for Bay checkerspot may also benefit *C. affinis* ssp. *neglecta*.

3. *Population monitoring shows populations are stable or increasing over 20 years that include the normal precipitation cycle (or longer if suggested by the results of demographic monitoring).* (this criteria is interpreted here as referring to the 6 sites in downlisting criteria 1)

Is criterion still valid: Yes.

Listing factors addressed: Present or threatened destruction, modification or curtailment of habitat or range (Factor A); Disease or predation (Factor C); Other natural or manmade factors affecting its continued existence (e.g., non-native invasive plant species) (Factor E).

Has criterion been met: No. The population monitoring that has occurred is not adequate to establish long-term population trends for any of the eight *Castilleja affinis* ssp. *neglecta* occurrences in order to determine whether this criterion has been met.

4. *Seeds are stored in at least 2 Center for Plant Conservation certified facilities and seed germination and propagation techniques are understood.*

Is criterion still valid: Yes.

Listing factors addressed: Present or threatened destruction, modification or curtailment of habitat or range (Factor A); Disease or predation (Factor C); Inadequacy of existing regulatory mechanisms (Factor D); Other natural or manmade factors affecting its continued existence (e.g., stochasticity) (Factor E).

Has criterion been met: No. Seed was collected from the two Santa Clara County occurrences in 2007 and is being held at the U.C. Berkeley Botanical Garden (C. Niederer personal communications 2009 and 2011), a Center for Plant Conservation certified facility. Experimental propagation has not yet been attempted.

According to the recovery plan (Service 1998); the following are the delisting criteria for *Castilleja affinis* ssp. *neglecta*:

1. *Secure and protect 10 populations, including 2 in Santa Clara County, from incompatible uses.*

Is criterion still valid: Yes.

Listing factors addressed: Present or threatened destruction, modification or curtailment of habitat or range (Factor A).

Has criterion been met: No. Currently, there are only eight known occurrences of *Castilleja affinis* ssp. *neglecta* and only four of these are adequately protected. A second occurrence *C. affinis* ssp. *neglecta* was discovered in Santa Clara County in close proximity to the population described in the recovery plan. However, because the term population was not clearly defined in the recovery plan, it is unclear whether this occurrence meets the definition of a second population. Neither of the Santa Clara occurrences of *C. affinis* ssp. *neglecta* is adequately protected.

2. *A management plan, including survival of the species as an objective, has been approved and implemented for all sites and any adjacent occupied or unoccupied habitat identified as essential to continued survival.* (“all sites” is interpreted here as referring to the 10 populations in delisting criteria 1).

Is criterion still valid: Yes.

Listing factors addressed: Present or threatened destruction, modification or curtailment of habitat or range (Factor A); Disease or predation (Factor C); Other natural or manmade factors affecting its continued existence (e.g., non-native invasive plant species) (Factor E).

Has criterion been met: No. See downlisting criteria number 2 above.

3. *Population monitoring shows no decline after downlisting; if declining, determine cause and reverse trend.* (this criteria is interpreted here as referring to the 6 sites in downlisting criteria 1)

Is criterion still valid: Yes.

Listing factors addressed: Present or threatened destruction, modification or curtailment of habitat or range (Factor A); Disease or predation (Factor C); Other natural or manmade factors affecting its continued existence (e.g. non-native invasive plant species) (Factor E).

Has criterion been met: Not applicable.

IV. SYNTHESIS

When *Castilleja affinis* ssp. *neglecta* was listed as endangered in 1995, the primary threats to its survival and recovery were urban development, mining, recreational activities, non-native invasive plant species, and stochastic events. We have no new information to suggest that these threats have substantially changed since the time of listing. However, new information regarding nitrogen deposition and climate change indicate that these phenomena may exacerbate threats by facilitating invasions of non-native plant species and by increasing the frequency of stochastic events such as drought or fire. The Ring Mountain and Town of Tiburon Middle Ridge occurrences of *C. affinis* ssp. *neglecta* have current management plans and actions are taken annually to control non-native invasive plant species at these locations. Some management for non-native invasive plants also occurs at the GGNRA Nicasio ridge occurrences and at the Santa Clara occurrences when funding and staff are available. However, long-term funding for management and monitoring at these locations is not reliable and the need for non-native invasive plant control will continue and will likely worsen in the foreseeable future. Because only four *C. affinis* ssp. *neglecta* occurrences are adequately protected from incompatible uses and due to the continued threats of habitat loss from non-native invasive plant species, recreational activities, and stochastic events, we believe *C. affinis* ssp. *neglecta* still meets the definition of endangered under the ESA. No status change is recommended at this time.

V. RESULTS

Recommended Listing Action:

- Downlist to Threatened
- Uplist to Endangered
- Delist (indicate reason for delisting according to 50 CFR 424.11):
 - Extinction*
 - Recovery*
 - Original data for classification in error*
 - No Change*

VI. RECOMMENDATIONS FOR ACTIONS OVER THE NEXT 5 YEARS

1. Control and eradicate non-native, invasive plant species:
 - a. Continue to control non-native plant species at Ring Mountain Preserve and Town of Tiburon Open Space parcels according to existing management plans. Amend the Town of Tiburon Open Space Management Plan to include the Old Saint Hilary's Church Open Space parcel.
 - b. Develop and implement management plans for controlling non-native invasive plant species in the area supporting the two *Castilleja affinis* ssp. *neglecta* occurrences on GGNRA land in Marin County, on the Newell Preserve in Napa County, and for the mitigation lands supporting the two *C. affinis* ssp. *neglecta* occurrences in Santa Clara County.
2. Locations that should be targeted for protection in cooperation with willing landowners:
 - a. In Santa Clara County, establish a conservation easement on the 250 acre Bay checkerspot butterfly reserve that supports the Paintbrush Hill *C. affinis* ssp. *neglecta* occurrence and on the entire mitigation parcel that supports the North Canyon occurrence.
 - b. In Napa County, pursue opportunities to acquire or incorporate land supporting *C. affinis* ssp. *neglecta* in the former quarry area into Newell Open Space Preserve.
 - c. In Marin County, establish a conservation easement on all remaining undeveloped serpentine habitat in the Old St. Hilary's Church area as mitigation for any development that takes place on private parcels in this location.
3. Monitoring
 - a. Continue to monitor *Castilleja affinis* ssp. *neglecta* on the Ring Mountain Preserve using the 24 established 1m² monitoring plots for three years using

- the same parameters as those used in 2007 thereafter, every two years as recommended by the 1998 Recovery Plan (Service 1998).
- b. Add a monitoring protocol for *Castilleja affinis* ssp. *neglecta* to the Town of Tiburon Open Space Management Plan.
 - c. In Marin County on GGNRA land, continue monitoring *Castilleja affinis* ssp. *neglecta* at Nicasio Ridge and initiate monitoring at CNDDDB occurrence 6. Include monitoring of grazing effects at these locations.
4. Seeds from *Castilleja affinis* ssp. *neglecta* should be collected from populations throughout the range and banked in Center for Plant Conservation certified gardens.
 5. Other serpentine habitats with the potential to support *Castilleja affinis* ssp. *neglecta* should be surveyed to determine whether undiscovered populations exist. New populations should be noted with the appropriate County, California Department of Fish and Game, the Service and the California Native Plant Society.

VII. REFERENCES CITED

- Avise, J.C. 2004. Molecular Markers, Natural History, and Evolution. Sinauer Associates, Publisher, Sunderland, Massachusetts. 684 pp.
- Brook, B. W., Tonkyn, D. W., O’Grady, J. J. and R. Frankham. 2002. Contribution of Inbreeding to Extinction Risk in Threatened Species. *Conservation Ecology* 6: 16
<<http://www.consecol.org/voll6/iss1/art16>>
- California Department of Fish and Game, Natural Diversity Data Base. 2010. Element Occurrence Reports for *Castilleja affinis* ssp. *neglecta*. Unpublished cumulative data current to May 1, 2009. Accessed February 13, 2009, version 3.1.1
- Cayan, D., M. Dettinger, I. Stewart, and N. Knowles. 2005. Recent changes towards earlier springs: early signs of climate warming in western north America? U.S. Geological Survey, Scripps Institution of Oceanography, La Jolla, California.
- County of Santa Clara, City of San Jose, City of Morgan Hill, City of Gilroy, Santa Clara Valley Water District, Santa Clara Valley Transportation Authority. December 2010. Draft Santa Clara Valley Habitat Plan, Santa Clara County, California.
- Field, C.B., G.C. Daily, F.W. Davis, S. Gaines, P.A. Matson, J. Melack, and N.L. Miller. 1999. Confronting climate change in California: ecological impacts on the golden state. A Report of the Union of Concerned Scientists and the Ecological Society of America. 62 pages.
- Intergovernmental Panel on Climate Change (IPCC). 2007. Climate change 2007: the physical science basis. Summary for policymakers. IPCC Secretariat, World Meteorological Organization and United Nations Environmental Programme, Paris, France.

- Hickman, J.C. 1993. The Jepson Manual: Higher Plants of California. University of California Press, Berkeley. Pp. 1183-87.
- Heckard, L.R. 1962. Root parasitism in *Castilleja*. Botany Gazette, 124: 21-29
- Heckard, L.R. 1968. Chromosome numbers and polyploidy in *Castilleja* (Scrophulariaceae). Brittonia 20: 212-226. Jul.-Sept.
- Howell, J. T. 1970. *Marin Flora*. University of California Press, Berkeley.
- Jepson, W. 1925. Manual of the Flowering Plants of California. Berkeley, CA: University of California Press.
- Loarie, S.R., Carter, B.E., Hayhoe, K., McMahon, S., Moe, R., Knight, C.A., and D.D. Ackerly. June 2008. Climate change and the future of California's endemic flora. PLOS One 3, e2502:1-10.
- LSA Associates, Inc. 2007. Ring mountain preserve sensitive resource monitoring and enhancement strategy, County of Marin, California. Pp. 15, 20-23. LSA Associates, Point Richmond, California.
- LSA Associates, Inc. 2008. Ring mountain monitoring report, Tiburon paintbrush and Tiburon mariposa lily, 2007 and 2008. LSA Associates, Point Richmond, California. LSA Project No. MCO0602, June 30, 2008.
- LSA Associates, Inc. 2010. Open Space Resource Management Plan, Town of Tiburon, Marin County. LSA Associates, Point Richmond, California. Adopted by Tiburon Town Council November 17, 2010.
- Martin, K.F. 1989. The characteristics of seed germination and seedling establishment of *Castilleja neglecta*. M.A. thesis, San Francisco State University.
- Napa Land Trust. 2011. Properties protected by conservation easement. Available online at <<http://napalandtrust.org/pdfs/CE-Protected-Properties-2010-2.pdf>>
- Niederer, Christal. 2008. Barbed goatgrass (*Aegilops triuncialis*) at Coyote Ridge Management Report June 2008. Creekside Center for Earth Observation, Menlo Park, California.
- Ohlson, D. 2008. Results of rare plant surveys conducted for the American Canyon quarry in American Canyon, California (PN 1129-01). Unpublished report submitted to the Napa County Conservation, Development and Planning Department by Live Oak Associates, Inc. September 15, 2008.
- Pyke, C.R. 2005. Assessing climate change impacts on vernal pool ecosystems and endemic branchiopods. Ecosystems 8: 95-105.

Safford, H. D., J. H. Viers, and S. P. Harrison. 2005. Serpentine endemism in the California flora: a database of serpentine affinity. *Madroño* 52:222–257.

U.S. Fish and Wildlife Service. 1995. Endangered and threatened wildlife and plants; determination of endangered status for ten plants and threatened status for two plants from serpentine habitats in the San Francisco Bay region of California. *Federal Register* 60(23):6671-6685.

U.S. Fish and Wildlife Service. 1998. Recovery plan for serpentine soil species of the San Francisco bay area. California/Nevada Operations Office, Region 1. September 30, 1998.

Weiss, S.B. 1999. Cars, cows, and checkerspot butterflies: nitrogen deposition and management of nutrient-poor grasslands for a threatened species. *Conservation Biology*. 13: 1476-1486.

Weiss, Stuart. 2006. Impacts of Nitrogen Deposition on California Ecosystems and Biodiversity. California Energy Commission, PIER Energy-Related Research. CEC-500-2005-165.

Personal Communications

Abercrombie, Sam. 2011. Stewardship Coordinator, Ring Mountain Preserve, Marin County Department of Parks and Open Space. Emails to Stephanie Jentsch, U.S. Fish and Wildlife Service, Sacramento Fish and Wildlife Office.

Anderson, Scott. 2009. Director, Community Development Town of Tiburon. Telephone conversation with Maral Kasparian, U.S. Fish and Wildlife Service, Sacramento Fish and Wildlife Office.

Barrella, Don. 2011. Planner, Napa County. E-mail and telephone conversation with Stephanie Jentsch, U.S. Fish and Wildlife Service, Sacramento Fish and Wildlife Office.

Buxton, Eva. 2009. Botanist (retired), LSA Associates. E-mail and telephone conversation with Maral Kasparian, U.S. Fish and Wildlife Service, Sacramento Fish and Wildlife Office.

Chasse, Michael. 2011. Biologist, National Park Service, San Francisco, California. E-mail and telephone call with Stephanie Jentsch, U.S. Fish and Wildlife Service, Sacramento Fish and Wildlife Office.

Cliesz, Sandra. 2009. Senior Planner, City of American Canyon Planning Department. Telephone conversation with Maral Kasparian, U.S. Fish and Wildlife Service, Sacramento Fish and Wildlife Office.

Cromer, Carolyn. 2009. Ecologist, Land Trust of Napa County. Telephone conversation with Maral Kasparian, U.S. Fish and Wildlife Service, Sacramento Fish and Wildlife Office.

- Niederer, Christal. 2009. Biologist, Creekside Center for Earth Observation. E-mail to Maral Kasparian, U.S. Fish and Wildlife Service, Sacramento Fish and Wildlife Office.
- Niederer, Christal. 2011. Biologist, Creekside Center for Earth Observation. E-mail to Stephanie Jentsch, U.S. Fish and Wildlife Service, Sacramento Fish and Wildlife Office.
- Peterson Tay. 2011. Senior Project Manager, TRA Environmental Sciences, Inc. Telephone conversation with Stephanie Jentsch, U.S. Fish and Wildlife Service, Sacramento Fish and Wildlife Office.
- Ruygt, Jake. 2009. Botanist, J. Ruygt Consulting. E-mail to Maral Kasparian, U.S. Fish and Wildlife Service, Sacramento Fish and Wildlife Office.
- Ruygt, Jake. 2011. Botanist, J. Ruygt Consulting. E-mail to Stephanie Jentsch, U.S. Fish and Wildlife Service, Sacramento Fish and Wildlife Office.
- Spielman, D., B.W. Brook, R. Frankham. 2004. Most species are not driven to extinction before genetic factors impact them. *Proceedings from the National Academy of Sciences* 101(42): 15261-15264.
- Trippi, Sean. 2009. Principal planner. County of Napa, as discussed with Maral Kasparian U.S. Fish and Wildlife Service, Sacramento Fish and Wildlife Office,.
- Weiss, Stuart. 2011. Senior Biologist. Creekside Center for Earth Observation. Telephone conversation with Stephanie Jentsch, U.S. Fish and Wildlife Service, Sacramento Fish and Wildlife Office.

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

Castilleja affinis ssp. *neglecta* (Tiburon paintbrush)

Current Classification: Endangered

Recommendation Resulting from the 5-Year Review:

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

Review Conducted By: Stephanie Jentsch, Sacramento Fish and Wildlife Office

FIELD OFFICE APPROVAL:

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

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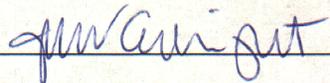
Approve  Date 20 June 2012

Table 1. Survey results for *Castilleja affinis* spp. *neglecta* compiled for 2011 5-year review.

Population	County	Year Surveyed	Number of Plants
Ring Mountain Preserve	Marin	1983	<100
		1986	>50
		1987	454
		1988	661
		1989	821
		1996	50-100
		1997	63
		2007	494
Middle Ridge Tiburon Peninsula	Marin	1983	100
		1986	25
		1988	191
		1997	228
St Hilary's Church	Marin	1961	3
		1981	10
		1986	25
		1988	101
		1996	0
		1997	13
Nicasio Ridge, GGNRA	Marin	1994	28
		1995	25
		2000	84
		2001	68
		2003	4*
		2004	4
		2008	18
		2009	39
		2010	56
		2011	55
CNDDB Occurrence 6, GGNRA	Marin	1991	50
American Canyon	Napa	1986	>186
		1988	588
		2001	35**

North Canyon	Santa Clara	1993	17
		1994	9
		1996	27
		1999	80
		2002	5**
		2006	1000
		2009	1100
Paintbrush Hill	Santa Clara	1996	0
		1999	0
		2004	>140
		2006	135
		2009	103

*starting in 2003 only plants within the GGNRA boundaries were counted

** surveys did not include entire population