Castilleja cinerea
(Ash-gray Paintbrush)

5-Year Review:
Summary and Evaluation

Castilleja cinerea (Ash-gray paintbrush). Inset photo shows both the red and yellow forms of *Castilleja cinerea*
Photos by USFWS.

U.S. Fish and Wildlife Service
Carlsbad Fish and Wildlife Office
Carlsbad, California

March 27, 2013

5-YEAR REVIEW
Castilleja cinerea (Ash-gray Paintbrush)

I. GENERAL INFORMATION

Purpose of 5-year Review:

The U.S. Fish and Wildlife Service (Service) is required by section 4(c)(2) of the Endangered Species Act (Act) to conduct a status review of each listed species at least once every 5 years. The purpose of a 5-year review is to evaluate whether or not the species' status has changed since it was listed. 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 listing of a species as endangered or threatened is based on an assessment of threats attributable to one or more of the five threat factors described in section 4(a)(1) of the Act. We must consider these same five factors in any subsequent consideration of reclassification or delisting of a species. In a 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 as defined in section 4 of the Act which includes provisions for public review and comment.

Species Overview:

Castilleja cinerea (Ash-gray paintbrush) is a perennial hemiparasitic plant restricted to San Bernardino County, California. It is generally found within pebble plain habitats, but can also be found in forest meadows, mixed coniferous forests, and pinyon/juniper woodlands.

At the time of listing, *Castilleja cinerea* was known from fewer than 20 localities at the eastern end of the San Bernardino Mountains. In our last 5-year review, we reported several new occurrences within pebble plain habitat, and grouped localities supporting *C. cinerea* into 11 pebble plain complexes. All currently known occurrences of *C. cinerea* are within the same general geographical area as that known at the time of listing, and its current spatial distribution has not changed. *Castilleja cinerea* is currently presumed to be extant, at a minimum at 56 localities in 13 pebble plain complexes within the San Bernardino Mountains.

The primary threats identified at the time of listing were associated with habitat loss, fragmentation, and degradation due to urban development; off-road vehicle traffic; nonnative plants; trampling; and grazing or browsing. Fuel wood harvesting, mining activities, and altered hydrological regime were also identified as additional threats within pebble plains habitat occupied by *Castilleja cinerea*. Current threats include effects related to urban development on private lands, roads, and trails; mining and fire suppression activities; nonnative species; and climate change.

Castilleja cinerea was federally listed as threatened under the Act in 1998. This taxon is not listed by the State of California under the California Endangered Species Act.

Based on our assessment of the current threats to *Castilleja cinerea*, we recommend no change in its listing status.

Methodology Used to Complete This Review:

This review was conducted by Betty Grizzle and staff at the Carlsbad Fish and Wildlife Office, following the Region 8 guidance issued in March 2008. We used information in the 1998 listing rule, the 2007 final critical habitat rule, available literature, reports and information in our files, and information provided by experts familiar with the species (Scott Eliason, U.S. Forest Service; Timothy Krantz, University of Redlands), its habitat, and the associated processes. We received no information from the public in response to our notice in the Federal Register 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 any of 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 recommended to be completed or initiated within the next 5 years.

Contact Information:

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Lead Field Office: Betty Grizzle and Bradd Baskerville-Bridges, Carlsbad Fish and Wildlife Office, Region 8; 760–431–9440.

Federal Register Notice Citation Announcing Initiation of This Review:

A notice announcing initiation of the 5-year review of this taxon and the opening of a 60-day period to receive information was published in the Federal Register on May 25, 2011 (USFWS 2011, pp. 30377–30382). No information relevant to *Castilleja cinerea* was received.

Listing History:

Federal Listing
FR Notice: 63 FR 49006–49022 (USFWS 1998)
Date of Final Rule: September 14, 1998
Entity Listed: *Castilleja cinerea* (Ash-gray paintbrush), a plant species.
Classification: Threatened
Critical Habitat: 72 FR 73092–73178 (USFWS 2007b).

State Listing
Castilleja cinerea (Ash-gray paintbrush) is not listed by the State of California as endangered or threatened.

Associated Rulemakings:

Critical habitat was designated on December 26, 2007 (72 FR 73092), for *Castilleja cinerea* (Ash-gray paintbrush), along with *Eremogone ursina* (*Arenaria u.*) (Bear Valley sandwort) and *Eriogonum kennedyi* var. *austromontanum* (southern mountain wild-buckwheat). These taxa are collectively referred to here as ‘‘pebble plains plants’’ because of their shared occupation of pebble plain habitat. For *C. cinerea*, 1,769 acres (ac) (722 hectares (ha)) within 24 units, primarily within the San Bernardino National Forest (SBNF), of critical habitat were designated in San Bernardino County (USFWS 2007b, p. 73103).

Review History:

The Service initiated a status review for *Castilleja cinerea* on February 14, 2007 (USFWS 2007a). We completed a 5-year review on March 31, 2008, which recommended no change in status (USFWS 2008, p. 10).

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

The recovery priority number (RPN) for *Castilleja cinerea* is 8 according to the Service's 2012 Data Recovery Call, based on a 1–18 ranking system where 1 is the highest-ranked recovery priority and 18 is the lowest (USFWS 1983a, pp. 43098–43105; USFWS 1983b, p. 51985). An RPN assignment of 8 indicates that the species faces a moderate degree of threat and a high potential for recovery.

Recovery Plan or Recovery Outline:

A recovery outline or recovery plan has not been completed for this species.

II. REVIEW ANALYSIS

Application of the 1996 Distinct Population Segment (DPS) Policy:

The 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:

<u>Species Description</u>

Castilleja cinerea is a hemiparasitic, perennial herb with several ascending to decumbent (trailing) grayish stems sprouting from the rootcrown. The stems are 1 to 2 decimeters (4 to 8 inches (in) tall (Munz 1974, p. 795). As described by Wetherwax *et al.* (2012, p. 960), the inflorescence (flower stalk) is greenish yellow (occasionally reddish-orange tinged) with

distinctive yellowish hairs on the lower bracts. This inflorescence color has been described as highly variable, both within and among sites in the San Bernardino Mountains pebble plain occurrences, with a general trend of yellow to yellow-green in the northwest to more frequent red inflorescences in the south to southeast (U.S. Department of Agriculture, Forest Service [USFS] 2005d, no page number). The calyx (united sepals) is nearly equally divided into linear lobes and the corolla is yellowish. It flowers from June through August (California Native Plant Society [CNPS] 2012). *Castilleja cinerea* is distinguished from other species of *Castilleja* within its range by its perennial nature, ashy-puberulent (covered with short hairs) stems and leaves, yellowish flowers, with calyx lobes of equal length (Wetherwax *et al.* 2012, p. 957).

Species Biology and Life History

Castilleja cinerea is an herbaceous perennial with bisexual flowers (Wetherwax *et al.* 2012, pp. 956–957). As a hemiparasitic plant, *C. cinerea* produces haustoria (modified structures on the plant's roots that penetrate the root tissues of a host plant) to obtain nutrients and water. Host plants include *Eriogonum kennedyi* var. *austromontanum*, *Eriogonum kennedyi* var. *kennedyi* (Kennedy's wild-buckwheat), *Eriogonum wrightii* var. *subscaposum* (short-stemmed bastard-sage), *Artemisia tridentata* ssp. *tridentata* (big sagebrush), *Artemisia nova* (black sagebrush), and other *Artemisia* taxa (USFS 2005d, no page number). Because plants also possess photosynthetic green leaves that are capable of producing sugars, it is termed hemiparasitic. *Castilleja cinerea* does not require a host plant species for its survival; however, as noted in one greenhouse study, important benefits have been observed for other *Castilleja* species when placed in a parasitic environment, including increased vigor with more branching, increased height, and earlier flowering (Heckard 1962, p. 25).

There is very limited information available regarding seed dispersal, seed production, and germination for *Castilleja cinerea*. Germination results at Rancho Santa Ana Botanic Garden found seeds of *C. cinerea* to be deeply dormant and, with one exception, no plants were successfully brought to reproductive maturity (M. Wall, Curator and Seed Conservation Program Manager Rancho Santa Ana Botanic Garden, 2012, pers. comm.). These results have suggested that some cues from the host plant may be required for the seed to germinate and additional literature research and trials are needed for successful cultivation (Wall 2012, pers. comm.).

Seed dispersal for *Castilleja cinerea* has not been directly observed. Plants develop a rosette arrangement of slender, sprawling to upright, basal branches, with each usually terminating in an inflorescence supporting loosely arranged flowers. New aerial stems are likely produced each year. All of the other flower parts fall away when the capsules are mature. The capsules are erect and open at the distal ends exposing the seeds and creating, in effect, a saltshaker-type of seed dispersal mechanism. Each seed is encased in a delicate, loose honeycomb patterned membrane and may play a role in the dispersal of the seeds. It is likely that seeds are shaken loose from the erect seed capsules and drop short distances from the parent plant, and then dispersed short distances by the wind as observed in *C. levisecta* (golden paintbrush), a prairie species from the Pacific Northwest (USFWS 2010, p. II–34).

O'Brien has determined that *Castilleja cinerea* is outcrossing; covered flowers produced no seeds (O'Brien 1979, p. 69). She also saw a bee touch three flowers on one occasion and a

hummingbird fly by on another, but indicated that neither stayed long enough nor close enough to get pollen or nectar (O'Brien 1979, p. 69). In her published study of insect visitation as compared with flower morphology, she noted that *C. cinerea* was occasionally visited by insects or possibly hummingbirds (O'Brien 1980, p. 217). Freas and Murphy (1990) assessed the transfer of pollen by insect pollinators for *C. cinerea* (and three other pebble plain plants) in a 1988 gene flow study using a pollen analog (fluorescent dye powder). They found no pollen analog movement for *C. cinerea* within and between four pebble plain plant communities in the Big Bear Preserve System (Mojave View, Sugarloaf, Arrastre Flat, and Lower Holcomb) (Freas and Murphy 1990, pp. 4, 6). In this study, they also observed only one potential pollinator, an unidentified beetle, visiting *C. cinerea* (Freas and Murphy 1990, p. 6).

The limited gene flow observed in these studies of pollination visitation patterns and pollen transfer for *Castilleja cinerea* and other pebble plain plants may be important in the context of both the natural and artificially fragmented locations where this species is found. However, no evaluation of this relationship has been conducted (USFS 2002, p. 16).

Habitat or Ecosystem

Castilleja cinerea is found in the San Bernardino Mountains at elevations between 1,800 and 3,300 meters (m) (5,905 to 10,827 feet (ft)) (Wetherwax *et al.* 2012, p. 960). Within the San Bernardino Mountains, *C. cinerea* occurs on various benches and on all mountain slope aspects including both south-facing and north-facing slopes (CNDDB 2012; USFWS 2012). Derby and Wilson measured density and frequency distributions for *C. cinerea* within microhabitats in the Sawmill pebble plain complex and found it to be more common on northwest exposures and absent from southwest exposures (Derby and Wilson 1979, p. 468).

Castilleja cinerea occupies the meadow/forest ecotone (transitional area of vegetation between two different plant communities) of the San Bernardino Mountains and has been recorded in the following ecological communities: pebble plains, dry and wet forest meadows, mixed conifer forests, open pine forests, and pinyon-juniper woodlands (CNDDB 2012). Vegetation associations include *Pinus monophylla* Woodland Alliance, *Quercus kelloggii* Forest Alliance, and *Artemisia nova* Shrubland Alliance (USFS 2002, pp. 23–24; Sawyer *et al.* 2009, pp. 182–184, 261–264, 397–398).

These communities are found within upper montane coniferous forest, pinyon juniper woodlands or Great Basin sagebrush, on seasonally wet clay, or sandy clay soils, generally containing quartzite pebbles (USFWS 2007b, p. 73100). The high clay content of this soil makes pebble plain habitat particularly vulnerable to persisting damage from ground disturbance; once disturbed, native vegetation recovery is very slow providing opportunities for the establishment of nonnative species (USFS 2005b, p. 100). Habitat supporting *Castilleja cinerea* also supports one or more of the known host plants listed above in Species Biology and Life History.

The primary habitat for *Castilleja cinerea* is pebble plains, so described because of the layer of orange quartzite pebbles that are pushed to the clay soil surface by frost heaving and thawing (Krantz 1983, p. 10). Pebble plains are treeless, open patches within pine forests and pinyon-juniper woodlands (USFS 2002, pp. 12, 15). They contain unique plant associations and soil

characteristics, associated with climatic features (Derby and Wilson 1979, p. 463; USFS 2002, pp. 12, 22–23). These plains, once called pavement plains, are centered around the Bear and Holcomb Valleys of the northeastern San Bernardino Mountain Range (Derby and Wilson 1978, p. 374). Pebble plains support a unique assemblage of plant taxa, some of which are endemic to the Big Bear area or the San Bernardino Mountains, while others represent disjunct occurrences of species more common elsewhere (USFWS 1998, p. 49007). *Eremogone ursina* (*Arenaria u.*), *Eriogonum kennedyi* var. *austromontanum*, and *Ivesia argyrocoma* (silver-haired ivesia) are considered the three indicator species defining a pebble plain (USFS 2002, p. 14).

Floristic surveys conducted in the late 1970s within pebble plains habitats in the San Bernardino Mountains recorded 33 plant taxa (Derby and Wilson 1978, p. 376; Derby and Wilson 1979, p. 465). Botanical surveys conducted in 2001 produced a total of 73 different plant taxa associated with pebble plain habitats (USFS 2002, p. 12; Table 2). Species commonly associated with *Castilleja cinerea* on pebble plain habitat include *Artemisia nova*, *Eriogonum kennedyi* var. *austromontanum*, *Erigeron aphanactis* (fleabane daisy), and *Poa secunda* subsp. *secunda* (one-sided bluegrass) (USFS 2002, p. 17).

Montane coniferous forest plants associated with *Castilleja cinerea* include *Calocedrus decurrens* (incense cedar), *Pinus jeffreyi* (Jeffrey pine), *Pinus ponderosa* (Ponderosa pine), *Juniperus occidentalis* subsp. *australis* (Sierra juniper), *Abies concolor* (white fir), *Quercus kelloggii* (California black oak), and *Quercus chrysolepis* (canyon live oak) (Sclafani 2006, p. 3). Within juniper-pine woodlands, *C. cinerea* is associated with predominantly singleleaf pinyon pine mixed with *Juniperus occidentalis* subsp. *australis*, *Juniperus osteosperma* (Utah juniper) and oaks (*Quercus* spp.) (Sclafani 2006, p. 3).

Castilleja cinerea is also found within dry and wet montane meadows and within meadow/forest ecotones in the San Bernardino Mountains (USFS 2005d, no page number; CNDDB 2012). Representative associated species for these meadow areas include *Ericameria nauseosa* (rubber rabbitbrush), *Artemisia ludoviciana* (silver wormwood), *Cirsium scariosum* (dwarf thistle), *Achillea millefolium* (common yarrow) (Element Occurrence (EO) 50; CNDDB 2012, p. 36); *Potentilla anserina* (silver weed cinquefoil) *Potentilla gracilis* (slender cinquefoil), *Sisyrinchium bellum* (western blue eyed grass) (EO 51; CNDDB 2012, p. 37); *Leymus triticoides* (beardless wild rye), *Carex praegracilis* (field sedge), *Poa secunda* (pine bluegrass) (EO 55; CNDDB 2012, p. 41). Occupied habitat in these meadow margins consist of fine silty soils or silty-clay soils with an open vegetation structure (USFS 2012c, p. 32).

It is unclear to what extent fire has affected pebble plain communities (USFS 2005b, p. 100). For well-conserved pebble plain habitats, the interior of the plain is highly resistant from high intensity burning because of the large percentage of bare ground, rock cover, and limited and discontinuous fuel (USFS 2005b, p. 100). Pebble plain habitats may therefore function as a natural fuelbreak with fire moving around the margins of the plain through tree litter and shrubs (USFS 2005b, pp. 100–101). However, the presence of *Bromus tectorum* (cheatgrass) within pebble plain habitat can provide a continuous “flashy” fuel load and the potential to increase the fire return interval; thus, its presence represents an increasing concern for fire management (USFS 2005b, p. 101).

The Big Bear area of the San Bernardino Mountains receives an average of 21.95 in (56 centimeters (cm)) of rain and 62.1 in (158 cm) of snow per year (Western Regional Climate Center 2012; website at *http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?cabibe+sca*). The winter freezing and thawing of the wet, clay soils is responsible for the frost heaving that maintains the pebble plains free from deep-rooted perennial plants. Water released by the periodic thawing of the winter snow pack and spring thaws generally percolates slowly into the soft, fragile soils. Considerable erosion of the clay soils can occur with heavy rains when the ground is not covered by protective snow or held together as a frozen matrix of clay, pebbles, and water. Local erosion can expose the roots of the small pebble plain plants to desiccation and lead to the death of the plants. These weather-related erosion events seldom occurred historically. Alterations of precipitation patterns due to climate change such that more precipitation falls in the form of rain, especially heavy rains, rather than snow would result in severe impacts to the pebble plain habitats that support *Castilleja cinerea*.

Spatial Distribution and Abundance

Castilleja cinerea is endemic to the San Bernardino Mountains, in San Bernardino County, California. At the time of listing, 33 EOs were reported for *C. cinerea* within 12 pebble plain complexes (CNDDB 1997). In our 1998 listing rule we stated that *C. cinerea* was known from fewer than 20 "localities," and generally encompassed within nine pebble plain complexes and other habitats (USFWS 1998, p. 49007–49008). Its known geographical range, at the time of listing, extended from Snow Valley eastward to Onyx Peak, and from South Fork Meadows northward to Holcomb Valley (CNDDB 1997, pp. 1–33). In our previous 5-year review, we indicated that *C. cinerea* was found within 11 pebble plain complexes, stating that we were unable to determine whether the occurrence at Grinnell Ridge complex was currently occupied (USFWS 2008, p. 4). We also noted that *C. cinerea* was found in non-pebble plain habitat (near pine forests) near the Snow Forest Ski Area, along Sugarloaf Ridge, and in the vicinity of Lost Creek (USFWS 2008, p. 4).

Since the time of listing and our previous 5-year review, *Castilleja cinerea* has been confirmed at Grinnell Ridge (EO 16; CNDDB 2012, p. 12), which now includes former EO 34, and a new occurrence has been located within a cirque northwest of the Dollar Lake area, in the southern portion of the San Bernardino Mountains (Scott Eliason, Mountaintop District Botanist, USFS, San Bernardino National Forest, 2012a, pers. comm.; USFS 2012d, p. 87; no CNDDB number). The CNDDB currently describes 49 EOs for *C. cinerea* (CNDDB 2012), all located within the geographical range depicted in our previous 5-year review (USFWS 2008, p. 13).

In this 5-year review, we are using the previous spatial delineations (pebble plain complexes and montane meadows) to define the locations of observations of *Castilleja cinerea* using the CNDDB EO dataset for the species (CNDDB 2012), survey reports, and herbarium collections (CCH 2012). Specifically, we are defining 13 pebble plain complexes within the San Bernardino Mountains to represent the current spatial distribution for *C. cinerea* (Appendix 1). These complexes can contain pebble plain, forest, meadow, or ecotones found between any or all of these community types. The EOs described in the CNDDB for *C. cinerea* all fall within our defined pebble plain complexes, with the exception of Dollar Lake, which does not yet have an assigned EO (CNDDB 2012). Of the 49 EOs described in the CNDDB database for *C. cinerea*

(CNDDB 2012), we believe that two of these (EOs 42, 64), located just south of Big Bear Lake, are now extirpated (USFWS 2012). In addition, several historical specimens in the Consortium of California Herbaria Accession Records (CCH) (CCH 2012) were reported to be collected in locations that are now under portions of Big Bear Lake, which was formed after completion of an improved dam in 1911 that subsequently flooded a larger portion of the Bear Valley.

We have estimated that, as of 2012, approximately 84 percent of the pebble plain habitat occupied by *Castilleja cinerea* within the San Bernardino Mountains is located on USFS lands (USFWS 2012). The remaining pebble plain habitat is located on State, local agencies (e.g., County, City), private, or non-profit (conservation and non-conservation) lands.

Comprehensive surveys of *Castilleja cinerea* have not been completed within all of the 13 pebble plain complexes. Many of descriptions from CNDDB EOs, CCH Accession Records, or other surveys describe unknown numbers of plants or small patches (generally less than 100); however, a few locations have recorded individual plant populations in the thousands (USFS 2005d, no page number; EO 35; CNDDB 2012; Wildhorse Meadows). The Snow Valley pebble plain complex is one of the largest documented occurrences of *C. cinerea* within the SBNF with over 10,500 plants observed in 1999 (CNDDB EO 35; USFS 2005b, p. 46). On private lands, approximately 5,500 individual plants were recorded on one parcel in 2011 (Fawnskin pebble plain complex), which was described as the highest densities and robust anthesis (flower bloom) the observer has ever seen for *C. cinerea* (T. Krantz, Professor, University of Redlands, 2012, pers. comm.).

Changes in Taxonomic Classification or Nomenclature

At the time of listing, the genus *Castilleja* including *Castilleja cinerea* was included in Scrophulariaceae (figwort family). Evidence from systematic studies have shown the genus *Castilleja* and other related genera, formerly in the Scrophulariaceae, to be in the Orobanchaceae (broomrape) family (Olmstead *et al.* 2001, p. 352; Wetherwax *et al.* 2012, p. 956).

Genetics

Gene flow for *Castilleja cinerea* and other pebble plain plants was evaluated by Freas and Murphy (1990) using a pollen analog movement study design. As discussed above, this pollen transfer study found no movement within or between four pebble plain plant communities for *C. cinerea* (Freas and Murphy 1990, p. 6).

We are unaware of any other completed or proposed studies focusing on the genetics of *Castilleja cinerea*.

Species-specific Research and/or Grant-supported Activities

None.

Vulnerability Factors

Rare species are generally considered more vulnerable to extinction than common species (Sodhi *et al.* 2009, p. 517). Three criteria of rarity—narrow geographic range, specific habitat requirements, and small population size—can be used to evaluate a species vulnerability when applied to its entire geographic range *or* to its distribution and abundance in a specific area, although within a limited geographical range, a rare species may be locally abundant (Primack 2006, pp. 155–156). In general, species that have a narrow geographic range, specific habitat requirements, and always found in small populations have a high conservation priority in order to maintain their limited populations (Primack 2006, p. 156). Related to the concept of rarity, endemism, or the natural restriction of a species to a single geographic area, is also a factor in a species' risk of extinction (Primack 2006, p. 157).

Consideration of elements of rarity and endemism along with life history traits can provide an extinction vulnerability profile for *Castilleja cinerea*. This species exhibits several attributes that might limit its distribution and population growth. These attributes include:

1) Restriction of the species to specific habitats (i.e., specialized niche) found within a narrow range of the San Bernardino Mountains.

2) Dependence on undisturbed surface water flows and associated physical features that are easily and permanently altered by human activities.

3) Low levels of gene transfer between obligate outcrossing populations within geographic areas (i.e., pebble plain complexes) that are subject to additional fragmentation.

4) Dependence on a relatively few host plant taxa.

All of these attributes, but particularly habitat specificity and host plant requirements, represent significant vulnerabilities for *Castilleja cinerea.* These vulnerabilities may separately, or together, exacerbate any of the threats described below in our **Five-factor Analysis**.

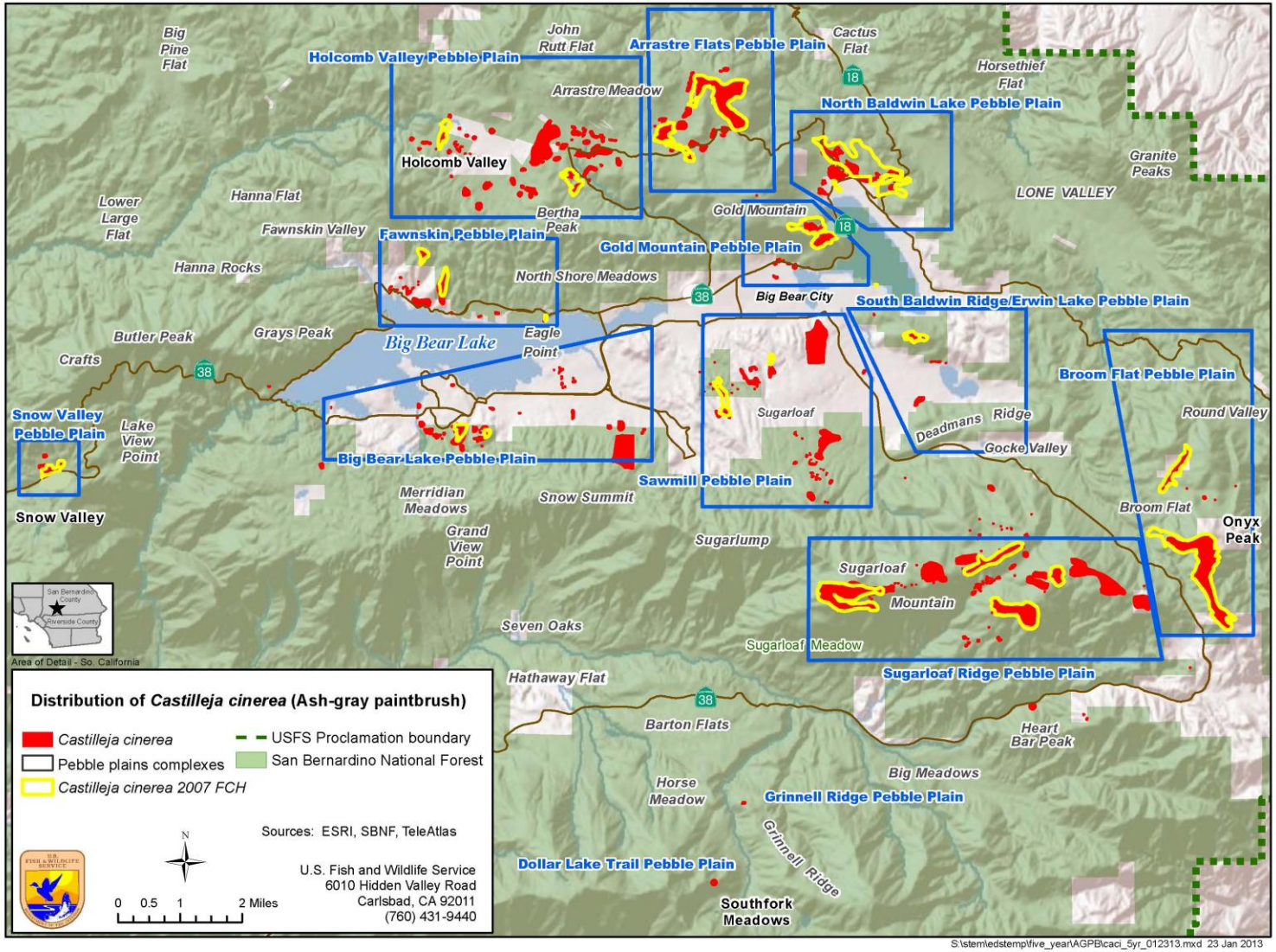

Figure 1: Distribution of *Castilleja cinerea* (Ash-gray paintbrush); prepared for 2013 5-year Review.

Five-factor Analysis:

The listing rule for *Castilleja cinerea* described ongoing and threatened destruction and modification of habitat by urban and recreational development and possible overutilization due collection of specimens (USFWS 1998, pp. 49012–49014). Additional threats described in the final rule included exotic plants (now termed nonnative plants), off-road vehicle (ORV) activity, grazing or browsing, and trampling of plants and their habitat (USFWS 1998, pp. 49012–49018). Since listing and our previous 5-year review, the effects of climate change has been identified as an additional threat to *C. cinerea*. The threats identified at the time of listing, changes in those threats since our previous 5-year review of the species, as well as the description and status of newly identified threats are discussed below; threats attributed to each occurrence are identified in Appendix 1.

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

Threats to *Castilleja cinerea* attributable to Factor A at the time of listing were urbanization, ORV activity, alteration of hydrological conditions, fuel-wood harvesting, and mining resulting in habitat modification, destruction, degradation, and fragmentation (USFWS 1998, p. 49012). The listing rule also mentioned one act of vandalism as a threat under Factor A, due to activities from a commercial vehicle in one pebble plain complex (USFWS 1998, p. 49014). We do not believe vandalism is a current threat (Eliason 2013a, pers. comm.) and this is not discussed further in this 5-year review. Creation of fuelbreaks and fire suppression activities were identified as new threats in our 2008 5-year review (USFWS 2008, p. 5) and, along with nonnative plants, are discussed here as threats to habitat. Threats associated with trampling of habitat and to individual plants (previously discussed under Factor E) are discussed here under **FACTOR A**. Fuel-wood harvesting is discussed under the Roads and Trails section of **FACTOR A**. Current threats attributable to Factor A are described below under the following general headings: <u>Urban Development</u>, <u>Roads and Trails</u>, <u>Alteration of Hydrology</u>, <u>Trampling</u>, <u>Nonnative Plants</u>, <u>Mining</u>, and <u>Fire Suppression</u>.

<u>Urban Development</u>

Much of the habitat of *Castilleja cinerea* historically found on private lands has been lost to residential and commercial development (USFS 2012c, p. 32). At the time of listing, we indicated that relatively unrestricted development of privately owned parcels of land was a threat to *C. cinerea* and other pebble plain plants, and we specifically described losses due to urbanization in the Big Bear Lake pebble plain complex (USFWS 1998, p. 49013). In our 2008 5-year review, we indicated that development continued to be an ongoing threat at several pebble plain complexes including North Baldwin Lake, South Baldwin Ridge/Erwin Lake, Big Bear Lake, Fawnskin, Sawmill, and Gold Mountain complexes (USFWS 2008, p. 5). This determination was based, in part, on the summary assessment outlined in the 2002 Pebble Plain Habitat Management Guide (USFS 2002).

Urban development (primarily residences) and related recreational development on city, county or private lands within the Big Bear Lake and Baldwin Lake areas continue to represent an

ongoing threat to *Castilleja cinerea* at seven of the pebble plain complexes. Threats and their effects on *C. cinerea* and other pebble plain and meadow plants were recently described in a biological assessment for ongoing activities within the SBNF (USFS 2012d, pp. 61–63, 76–78).

The Big Bear Lake area includes many localities that support *Castilleja cinerea*, including the Big Bear Lake and Fawnskin pebble plain complexes. Much of the occupied habitat of *C. cinerea* in the Big Bear Lake area is on private lands, on small lots located within residential neighborhoods under the jurisdiction of San Bernardino County. Non-Federal activities on these lands do not provide the protections or management of those occurrences located within Forest Service lands (USFS 2012d, pp. 57, 63). Urban development threats to *C. cinerea* within portions of the Big Bear Lake and Fawnskin pebble plain complexes result from the effects of residential improvements (e.g., landscaping) and services provided by local entities (e.g., drainage structures), as well as new, proposed residential developments (USFS 2012d, pp. 63–64).

Use and maintenance of access roads to tract cabins located in the Snow Valley pebble plains complex has resulted in disturbance to pebble plain habitat as well as crushing, uprooting, and burial of *Castilleja cinerea* plants (USFS 2012d, p. 55).

Examples of urban development actions identified for the future include two development proposals by the City of Big Bear Lake near the Castle Rock Trail and Talbot Road (Shadow Mountain) and another near Talmadge Road and Mill Creek Road (all within the Big Bear Lake pebble plain complex) (USFS 2012c, p. 20). Other proposals being evaluated for development by the County of San Bernardino include two parcels on the north shore of Big Bear Lake (Marina Point and Moon Camp) (Fawnskin pebble plain complex), and in the Moonridge area (High Timber Ranch Phase 2) (Sawmill pebble plain complex) (USFS 2012c, p. 20). The north shore parcels represent the largest remaining area of undeveloped private land along the shoreline of Big Bear Lake, collectively encompassing about 200 ac (81 ha) of pine, fir, and juniper habitats, and some pebble plains habitats (USFS 2012c, p. 20).

Several *Castilleja cinerea* occurrences located in the eastern half of the Bear Valley, which includes the Sawmill, North Baldwin Lake, South Baldwin Ridge/Erwin Lake, and Gold Mountain pebble plain complexes, are located on non-USFS lands (approximately 170 ac (68.8 ha) total). Where *C. cinerea* is found on the small lots and private lands in residential neighborhoods within these complexes, threats include those related to home improvements, maintaining defensible space, or County services (USFS 2012d, pp. 75, 80).

Threats resulting from urban development or associated infrastructure to private inholdings within lands managed by San Bernardino County within the Holcomb Valley and Arrastre Pebble Plain complexes are unknown.

Several utilities operating within the San Bernardino Mountains provide either direct services to urbanized areas in the region or related infrastructure, and their operation and maintenance activities can affect populations of *Castilleja cinerea* or its critical habitat. Examples of these include: (1) Snow Valley transmission and distribution lines that feed the main transmission line (Snow Valley pebble plain complex); (2) the Bear Valley transmission and distribution lines

(Gold Mountain, North Baldwin Lake, South Baldwin Ridge/Erwin Lake, Big Bear Lake, and Fawnskin complexes); (3) transmission lines within Holcomb Valley and Arrastre Flat complexes; and (4) sewer outfall line and co-located telecommunication lines (Gold Mountain and North Baldwin Lake pebble plain complexes) (USFS 2012d, pp. 55, 62–63, 73–74, 78). The primary threats to *C. cinerea* from these utilities include ground disturbance and localized trampling of habitat related to operation and maintenance activities, such as pole replacements. In addition, the Forest Service radio repeater facility on Onyx Peak is within mapped occupied and critical habitat for *C. cinerea* within the Broom Flat pebble plain complex. Soil disturbance or trampling resulting from operation and maintenance activities of the facility on both Forest Service lands and adjacent private lands may affect the primary constituent elements identified for this species (USFS 2012d, pp. 85–86).

In summary, we believe that the effects of urban development remain a widespread threat to *Castilleja cinerea*. Urban development and related infrastructure is currently a threat within 8 of the 13 complexes where *C. cinerea* is found. However, the highest level of threat (loss of habitat) is likely to be limited to the remaining private lands in the San Bernardino Mountains (approximately 353 ac (143 ha)) that are not owned and managed by the Forest Service.

Roads and Trails

In our final listing rule, we described impacts from this threat under the category of ORV activity, citing over 7 miles (mi) (11 kilometers (km)) of Forest Service roads and 10 mi (16 km) of unauthorized routes that directly impact pebble plain sites (USFWS 1998, p. 49013, citing Odell 1988, p. 4). Impacts to *Castilleja cinerea* habitat from unauthorized ORV use, and road use and maintenance were also discussed together in our previous 5-year review (USFWS 2008, p. 5). In this 5-year review, we evaluate impacts from roads and trails (primarily their use, maintenance, and development) as well their use for recreational activities (ORV, mountain biking, and hiking) under separate headings below.

Approximately 2.5 percent of the SBNF acreage consists of roads (USFS 2005e, Vol. 1, p. 114). The SBNF implements a Roads and Trails Management Program that incorporates roads, motorized trails, motorized interpretive trails, and non-motorized trails found within the SBNF (USFS 2012d, pp. 9–10). Of the current programs implemented within the SBNF, activities under this program affect the largest spatial extent of occupied and critical habitat for federally listed species and can result in the most frequent severe and lasting effects (USFS 2012d, p. 92). An estimated 10.7 mi (17.2 km) or 258 ac (104 ha) (using 100 ft (30 m) of centerline) of roads and trails affect *Castilleja cinerea* occurrences within an estimated 1,931 ac (781 ha) of *C. cinerea* occupied habitat located on lands owned and managed by the Forest Service (USFS 2012d, p. 22).

Road Construction, Use, and Maintenance

Threats to *Castilleja cinerea* from roads and trails include both direct effects, such as habitat alteration, and indirect effects, including alteration of water flow and drainage patterns, sedimentation, deposition of particulates (dust), and effects related to wildfire (USFS 2012d, pp. 21–24). Roads, road construction, and road maintenance can also facilitate the introduction

and establishment of nonnative plants by creating open, continually disturbed habitat as well as disrupt hydrological processes within pebble plains habitats. Nonnative plants can be transported along these road corridors by equipment and vehicles, and are often more easily established on exposed cut-and-fill slopes of roads than native plants (USFS 2005e, Vol. 1, p. 114).

Open Forest Service roads present ongoing threats in the Baldwin Lake area (Sawmill pebble plain complex) and the Wildhorse Meadow area (Sugarloaf Ridge pebble plain complex) where *Castilleja cinerea* occurs, and the SBNF has installed fencing and signage to minimize impacts to the habitat, including effects related to crushing, uprooting, or burial of plants (USFS 2012d, pp. 77, 82). The SBNF has also closed unauthorized routes that originate from Forest Service roads in the Baldwin Lake area and, following these closures, has implemented habitat restoration activities (USFS 2012d, p. 77).

Under section 7 of the Act, the SBNF consults with the Service on potential effects to habitat and plants from proposed trails to ensure adverse effects to listed species are avoided or minimized. As an example, the SBNF recently completed a biological assessment for the South Big Bear Bike Trails project, which identified potential threats to *Castilleja cinerea* habitat including the re-routing and restoration of portions of the Pineknot trail (USFS 2012c, p. 30). The SBNF determined that, after closure and restoration of the section of trail that currently travels through pebble plain habitat, this project would produce beneficial effects to *C. cinerea* and other listed species with the potential for re-colonization of the currently disturbed areas (USFS 2012c, pp. 30–31).

Recreational Use of Roads and Trails

The high frequency of ORV activity was described as the most significant and persistent threat in the final listing rule for *Castilleja cinerea* and other pebble plain plants and was reiterated as such in our 2008 5-year review (USFWS 1998, p. 49013; USFWS 2008, p. 5). Threats also result from the effects of non-motorized trails and mountain biking due to the proximity of *C. cinerea* and its habitat to urban areas (USFS 2012d, pp. 60–61).

The Holcomb Valley area (Holcomb Valley, Arrastre Flats pebble plain complexes) experiences intensive recreational use, both on Forest Service lands and private inholdings (USFS 2012d, p. 68). For example, unauthorized roads and trails are created each year by users in the heavily used Holcomb Valley area and represent a particular challenge for protection of pebble plains species (USFS 2012d, p. 69). Even with the blocking in 2010 of more than 60 unauthorized routes in this area, including the use of large boulders (USFS 2012d, p. 69), impacts from this threat are expected to continue into the near future due to budget and staffing constraints (USFS 2012d, pp. 69, 74). Other impacts to *C. cinerea* related to effects of recreational activities at private summer camps in the Holcomb Valley are not known (USFS 2012d, p. 74).

Associated with ORV activity is unauthorized collection of wood for fuel including removal of downed vegetation or trees. The SBNF has an active, personal use fuel-wood program in which the public can purchase permits for cutting wood from marked, downed logs in designated areas (USFS 2012d, p. 30). However, *unauthorized* collection of fuel-wood is a current threat in some

areas within the SBNF and on private lands (e.g., Sawmill Creek area (Eliason 2012b, pers. comm.)). This activity reduces natural barriers to sensitive areas and creates additional access for unauthorized ORV activities (Eliason 2012a, pers. comm.). The Sawmill, North Baldwin, South Baldwin Ridge/Erwin Lake, and Gold Mountain pebble plain complexes continue to experience a high intensity of these activities as well as a high frequency of use (USFS 2012d, pp. 77–78).

The SBNF is implementing an ongoing habitat restoration program that is linked to its ORV road and trail network to minimize the effects of recreational use to sensitive habitats (USFS 2012d, p. 10). However, the Forest Service's recent assessment of recreational activities identifies several areas that require active management in order to maintain control and restrict access to pebble plain complexes where *Castilleja cinerea* is found. These include abundant unauthorized non-motorized trails created and used by mountain bike riders (south Big Bear Lake), motorized vehicle traffic on open Forest Roads and unauthorized routes in the Holcomb Valley (Holcomb Valley pebble plain), unauthorized user-created roads and trails in the Baldwin Lake area (North Baldwin Lake and South Baldwin Ridge/Erwin Lake pebble plains), and open Forest Roads and unauthorized routes (especially trails) in the Sugarloaf-Onyx area (Sugarloaf and Broom Flat pebble plains) (USFS 2012d, pp. 61, 69–72, 77–78, 82–85).

Given these assessments, we believe that ORV and other recreational activities are threats to the continued survival and recovery of *Castilleja cinerea*. However, unauthorized routes, or those roads and trails that are not part of the National Forest or otherwise authorized for public use, likely represent the more significant threat because they are unplanned and unmanaged and may pass through pebble plain areas where *C. cinerea* and other federally listed or sensitive plants occur (USFS 2012d, p. 24).

A recent summary of potential effects of roads and trails to San Bernardino Mountain plant species, including federally listed species such as *Castilleja cinerea*, indicates that these threats continue to affect the species and its critical habitat (USFS 2012d). This assessment describes the direct and indirect effects of the use, maintenance, and development of roads and trails and those related to recreational use. These effects pose a threat to at least eight pebble plain complexes that support *C. cinerea*.

<u>Alteration of Hydrology</u>

The listing rule identified alteration of hydrological conditions as a threat to *Castilleja cinerea* habitat, noting that the majority of pebble plain complexes are directly impacted by vehicle routes that may lead to alterations in the surface hydrology (USFWS 1998, p, 49013). This threat is often the result of unauthorized ORV activities and direct and indirect impacts from urbanization (USFS 2002, p. 25). Vehicle traffic within pebble plains habitats during the wet season is of particular concern because this activity creates deep ruts that change the hydrological patterns over the pebble plain (USFS 2002, p. 20). Alteration of hydrology can also result from land disturbance due to mining and fire suppression activities, which are discussed as separate threats to *C. cinerea* below.

Our listing rule also highlighted activation or installation of wells within lower Holcomb Valley, Baldwin Lake (within the North Baldwin Lake complex) as a potential threat to pebble plains habitat through the alteration of hydrology in these areas (USFWS 1998, p. 49014). However, the Forest Service acquired privately-owned property at the North Baldwin Lake complex; thus, installation or activation of wells is no longer considered a threat at this location. A well immediately north of lower Holcomb Valley pebble plains within the Holcomb Valley complex was proposed for activation in 1987 (USFS 2002, p. 42). Because activation of the well was in conflict with the use of this site as mitigation for a previous project, the activation was discouraged at that time.

In an undisturbed condition, water generally flows evenly over the surface of pebble plains (Odell 1988, p. 19). However, disturbances to their surface can change hydrological patterns across these surfaces and can alter their soil composition through the erosion of clay sediments during rainfall events, leaving only large cobbles and pebbles (Neel and Chaney 1992, p. 1). These potential changes to soil morphology and composition can alter the vegetation structure and composition of the pebble plain, by creating favorable conditions for the invasion of both native and nonnative plant species that then out-compete *Castilleja cinerea* for space and resources, and further altering the soil composition by increasing the amount of organic debris (Derby 1979, pp. 72–73; USFS 2002, p. 15).

In summary, we believe alternation of hydrology represents an indirect, but potentially threat to those occurrences in which recreational use and other vehicular traffic activities are found. As noted in our discussion of Roads and Trails and Urban Development threats above, these include Big Bear Lake, Holcomb Valley, Arrastre Flats, Sawmill, North Baldwin, South Baldwin Ridge/Erwin Lake, Gold Mountain, Sugarloaf, and Broom Flat pebble plain complexes. The threat of hydrological alteration from the installation or activation of wells within two pebble plains complexes is believed to be much reduced since the time of listing and is not considered a threat at this time.

Trampling of Habitat

In our listing rule, we described prior moderate to heavy degradation of certain sites occupied by *Castilleja cinerea* from trampling by cattle and indicated that some pebble plains and meadow complexes continued to be impacted by cattle, horses, and feral burros (USFWS 1998, p. 49016). However, we anticipated this threat would be reduced with the removal of feral burros from several pebble plain complexes under the provisions of the Big Bear Wild Burro Territory Management Plan (USFWS 1998, p. 49017). We also reported occasional trampling of *C. cinerea* from construction activities and trails near the Snow Valley Ski Area (USFWS 1998, p. 49016).

In our 2008 5-year review, we stated that burros were removed from the Big Bear City area in 1998, which includes the North Baldwin Lake, Sawmill, and Gold Mountain pebble plain complexes, but they remained at the Broom Flat pebble plain complexes (USFWS 2008, p. 9, citing USFS 2005a). We concluded that the threat from feral burro trampling had been addressed at all impacted complexes except for the Broom Flat pebble plain complex.

At present, the threat of trampling to pebble plain habitat and to individual plants, including *Castilleja cinerea* due to burro activity is estimated to be very minor and the threat of trampling from cattle no longer exists for *C. cinerea* (Eliason, 2012a, pers. comm.). However, if soils within pebble plain habitats are wet, trampling effects may be more significant to both habitat and individual plants (Eliason 2013b, pers. comm.). Burros are still found in the SBNF under an authorized prescription of the Wild, Free-Roaming Horses and Burro Act of 1971 (16 U.S.C. § 1331–1340). Two Herd Management Areas (HMA) are designated within designated Wild Burro Territory of the SBNF—one in the Bear Valley area (HMA2) managed toward a desired condition of no burros, and one east of Bear Valley (HMA1) (within the Broom Flat pebble plain complex, Eliason 2012a, pers. comm.). Herd Management Area 1 is managed to maintain small herd of 50 burros on approximately 21,500 ac (8,700 ha) (USFS 2012d, p. 29). Burros occasionally move to and congregate in HMA2 (e.g., Shay Meadow, South Baldwin Ridge (both located in the South Baldwin Ridge/Erwin Lake pebble plain complex) and Wildhorse Meadow (Sugarloaf Ridge pebble plain complex)), but effects to pebble plan habitats in both HMAs have been low in severity, frequency, and duration, and, if necessary, burros can be removed from HMAs as staff and resources allow (USFS 2012d, p. 29). Therefore, we believe that the threat of trampling from domestic cattle or burros is not a substantial threat to *C. cinerea*.

In addition to potential impacts from burros, the Hitchcock Ranch, a private inholding in the Holcomb Valley area, graze approximately 30 to 40 horses in the Hitchcock Meadow (located within the Holcomb Valley pebble plain complex), which is occupied by *Castilleja cinerea* and other federally listed plants (USFS 2012d, p. 74). The extent and severity of effects of trampling by horses in this portion of the Holcomb Valley occurrence to *C. cinerea* habitat and individual plants is currently unknown.

Nonnative Plants

In our final listing rule, we identified exotic (nonnative) plants as a threat to *Castilleja cinerea* in the context of disturbances related to grazing, urban and rural development, and various recreational activities (USFWS 1998, p. 49017). These activities can threaten native plants by facilitating the establishment of nonnative species and resulting in the alteration of habitat through crowding or competition for resources (USFWS 1998, p. 49017).

In our 2008 5-year review, we used the assessments provided in the 2002 Pebble Plain Habitat Management Guide (USFS 2002) in determining that nonnative plants, including grasses and forbs, continued to impact *Castilleja cinerea* habitat, potentially displacing the taxon through competition for nutrients, water, light, and space (USFWS 2008, p. 9). Treatment activities for nonnative plants under the SBNF's Invasive Species Management program may also threaten *C. cinerea* through trampling and crushing, but these effects are considered incidental and localized relative to the larger beneficial effects to these and other native species (USFS 2012d, p. 92). In addition, ground disturbance from mining (discussed below) and recreational activities (discussed above) can disturb soils and create the potential for the introduction and spread of nonnative plants.

The 2002 Pebble Plain Habitat Management Guide described nonnative plants as a threat to the unique plant communities for the following pebble plain complexes where *Castilleja cinerea*

occurs: (1) Arrastre Flats, (2) Broom Flat, (3) Fawnskin, (4) Gold Mountain, (5) North Baldwin Lake, (6) Sawmill, and (7) South Baldwin Ridge/Erwin Lake (USFS 2002, pp. 46, 48, 51, 53, 57, 62, 65). *Bromus tectorum* represents the primary species of concern for these pebble plain areas. This taxon, as well as *Erodium cicutarium* (filaree), represent very old invasions for the San Bernardino Mountains and are persistent threats within these complexes (Eliason 2012a, pers. comm.). More recent invasions of nonnative plant species within some of these pebble plain complexes include *Linaria dalmatica* (dalmatian toadflax), *Ranunculus testiculatus* (bur buttercup), and *Lepidium perfoliatum* (clasping pepperweeed) (Eliason 2012a, pers. comm.).

As noted above, *Castilleja cinerea* is also found in montane meadow habitat (e.g., EOs 19, 31, 35, 50, 51, 55; CNDDB 2012). As with pebble plain habitat, ground disturbances by hikers, mountain bicyclists, and ORVs can create conditions favorable for the establishment and spread of nonnative plants into these areas. The Baldwin Lake Ecological Reserve, which is located within the North Baldwin Lake pebble plain complex, provides several public recreational opportunities; control and monitoring of *Ranunculus testiculatus* and *Lepidium perfoliatum* represent ongoing efforts to improve habitat for *C. cinerea* and other federally listed plants in this area (USFS 2012d, pp. 76–77).

In general, Forest Service biologists believe that the threat from nonnative plants does not appear to be significantly expanding (Eliason 2012a, pers. comm.). Therefore, while impacts from nonnatives are present at 7 of the 13 complexes, we believe that the effects of nonnative plants currently represent a moderate threat to the conservation of *Castilleja cinerea*.

Mining

National Forest System (NFS) lands are open to location and mineral claiming under the General Mining Law of 1872 (as amended) and the Mineral Leasing Act unless withdrawn from mineral entry or otherwise restricted by National Forest orders or closures (USFS 2005e, Vol. 1, p. 294). The Forest Service can only propose lands for withdrawal when necessary to protect capital investments, natural resources, and unique natural features; however, the authority to withdraw National Forest System lands from locatable mineral entry rests with the Department of the Interior (through the Bureau of Land Management) and U.S. Congress (USFS 2005e, Vol. 1, p 294). In addition, withdrawals do not guarantee that mining will not occur since NFS lands are subject to valid existing rights at the time of a withdrawal (USFS 2005e, Vol. 1, p. 294). Within the SBNF, 147,430 ac (59,663 ha) have been withdrawn from mineral entry as of 2003 (USFS 2005e, Vol. 1, p. 294).

In our listing rule, we indicated that mining activities had contributed to the decline of *Castilleja cinerea* due to effects from habitat destruction, degradation, and fragmentation of pebble plain habitats (USFWS 1998, p. 49013). We described mining as a secondary threat to habitat degradation in our 2008 5-year review (USFWS 2008, p. 5) based on expected implementation of avoidance measures by the Forest Service for regulated mining activities (USFWS 2005, p. 245).

The Forest Service has the responsibility for the management of surface resources on claims that are unpatented, but has no authority on patented claims, which are held in private ownership

(USFS 2005e, Vol. 1, p. 293). Plans of Operation for mining for the patented claims on the SBNF have the potential to affect pebble plain plant habitat due to surface disturbance and loss of habitat (USFS 2005e, Vol. 1, p. 107). The number of unpatented claims on NFS lands changes annually; individual prospectors or major mining companies own most mining claims (USFS 2005e, Vol. 1, p. 293). Although the scale of gold mining has been much reduced in the Holcomb Valley area since the late 1800s (USFS 2005e, Vol. 1, p. 107), small-scale gold mining activities continue to occur in several pebble plain complexes (e.g., Fawnskin, Gold Mountain, and Holcomb Valley; USFS 2005b, pp. 10, 54). Prospecting has also become more dispersed, and is of concern because of the lack of restrictions governing this activity (USFS 2005e, Vol. 1, p. 107).

Mining claims on Forest Service lands were previously reported for five pebble plain complexes occupied by *Castilleja cinerea*: (1) Holcomb Valley (83 ac (33.6 ha), (2) Fawnskin (24 ac (9.7 ha)), (3) Arrastre Flats (69 ac (28 ha)), (4) North Baldwin Lake (62 ac (25 ha)), and (5) Broom Flat (0.2 ac (0.08 ha)) (USFS 2002, pp. 42, 46, 48, 57, 65). These claims continue to represent a potential threat of ground disturbance for *C. cinerea*, specifically, gold prospecting activities or mining operations related to the ownership of mineral rights. Mining activities that fall under the Notice of Intent submission exceptions of 36 CFR 228, regulations that govern locatable minerals on NFS lands, specifically, 36 CFR § 228.4 (Plan of operations–notice of intent–requirements), can also result in the uprooting, burying, or crushing of pebble plain plants (USFS 2012d, p. 33). The Holcomb Valley area, including the Holcomb Valley and Arrastre Flats pebble plain complexes, is a particularly active area for small-scale mining activities (e.g., prospecting by clubs and individuals) and represents an area of concern for pebble plain plants and their habitats (USFS 2012d, p. 74).

The level of threat to *Castilleja cinerea* habitat from unpatented mining activities is difficult to estimate, even from active areas such as within the Holcomb Valley pebble plain complex, given the changes in the number of claims from year-to-year. However, we believe the effects of mining currently impact five complexes and represent a threat to *C. cinerea* given the economic drivers occurring at a national scale that may encourage the development of existing and future claims, and the magnitude of ground disturbance to *C. cinerea* habitat that can result from active claims.

Fire Suppression

Activities related to management of fire and fuels can also threaten *Castilleja cinerea* and its habitat. Though not recognized as a threat at the time of listing, fire suppression was known to impact one occurrence in 2008 when the previous status review was developed. However, fuelbreaks and vegetation treatment units are very rarely located in pebble plain habitat due to the scarcity of fuels (USFS 2005a, p. 255). Fire suppression activities typically include fire line construction; fire retardant and water drops; establishment of temporary fire camps, staging areas, parking sites, safety zones, and helipads; and post-fire rehabilitation (USFWS 2005, p. 27). Each of these activities can have negative impacts to *C. cinerea* and its habitat. For example, safety zone and fire line construction can involve using bulldozers to clear vegetation and parking areas, and fire camps result in heavy trampling and soil compaction from equipment

and vehicles; fire lines that cut through habitat can alter hydrological patterns as well as destroy individual plants or encourage the establishment of nonnative species (USFWS 2005, p. 27).

Under section 7 of the Act, the SBNF consults with the Service for proposed fuel breaks and fuels reductions projects. Emergency consultations were prepared for impacts due to contingency fuel breaks (dozer lines) that were constructed during the Heart Incident in 2006 within the Broom Flat pebble plain complex and 2003 within the Fawnskin pebble plain complex (Eliason 2006, pp. 3–4). The lines were successfully rehabilitated and recovery of the habitat is expected; however, the existence of these fuel breaks makes them more likely to be re-opened in future wildfire suppression efforts (Eliason 2006, pp. 3–4). In addition, the ridgeline in the Sugarloaf Ridge pebble plain complex is considered at risk for future fuel break construction for wildfire suppression responses (Eliason 2006, p. 5).

In general, the effects of this fuels reduction project effects from mechanical treatments to known occurrences of *Castilleja cinerea* and its designated critical habitat would be avoided through application of design features (USFS 2012e, Appendix C); however, prescribed fire is not expected to directly affect *C. cinerea* due to the sparse fuel conditions typical of pebble plain habitat (USFS 2012e, p. 56). In addition, the assessment indicates that this lack of vegetation cover would not warrant mechanical treatment to meet fuels objectives and, therefore, effects would be incidental to treatment in adjacent areas (USFS 2012e, p. 57). These effects would be reduced by application of design features that include prohibiting operations during wet soil conditions (USFS 2012e, p. 57 and Appendix C). Other similar fuels reduction projects projected in the future with possible effects to *C. cinerea* include the Baldwin and Upper Santa Ana fuels projects, which would incorporate similar design features to avoid impacts to federally listed plants and designated critical habitat (USFS 2012e, p. 57).

Given the protective mechanisms being implemented to avoid impacts from fire suppression actions to listed species and the limited fuel and vegetation treatment units in pebble plain habitat, we believe that threats to *Castilleja cinerea* and its habitat from these fire suppression activities will be localized, only occasional, and do not constitute a widespread threat to the species or its habitat.

Summary of Factor A

Habitat destruction and disturbance from land management activities, such as road construction, operation, and maintenance; recreational activities; and threats resulting from mining and fire suppression activities represent current threats to at least 10 of the 13 occurrences of *Castilleja cinerea* as well as other federally listed plants that occupy pebble plain habitats within the San Bernardino Mountains. Of these threats, the combined effects of road use, maintenance, and development with ORV and other recreational activities represent a widespread threat to *C. cinerea*. Urban development remains an important threat to *C. cinerea* on the remaining private lands in the Big Bear Lake and Baldwin Lake areas (within three pebble plain complexes). However, the effects of urban development is not a widespread threat to the species given that a large percentage (84 percent) of *C. cinerea* habitat is found on Forest Service lands where conservation measures have been defined and implemented for this taxon. The threat of alteration of hydrological conditions remains a threat for at least nine pebble plain occurrences,

primarily from the direct and indirect effects of urbanization and recreational use of roads and trails. The threat of trampling to pebble plain habitat due to burros and horses is of a low level and very localized. The Forest Service is managing two Herd Management Areas in the SBNF to control any future threat from trampling from burros; however, reductions in resources (funding and staff) are likely to affect future management efforts to control burros in these and other areas. The survival and recovery of *C. cinerea* continues to be threatened from nonnative plants, but this threat does not appear to be expanding in scope. The potential effects of ground disturbance to *C. cinerea* from both patented and unpatented mining claims is still of concern, particularly gold prospecting in the Holcomb Valley and Arrastre Flats occurrences. In summary, we believe that these habitat threats continue to significantly affect the recovery of *C. cinerea* in 11 of the 13 pebble plains complexes (see Appendix 1).

Protective regulatory mechanisms (discussed below in **FACTOR D**) that have changed since listing include a revision of the Forest Service planning rule, the development of revised land and resource management plans, and the designation of critical habitat. These mechanisms provide a more comprehensive level of conservation planning that is likely reducing the magnitude of threat within occurrences of *Castilleja cinerea* located on Forest Service lands (84 percent of the mapped habitat). For example, two designated Special Interest Areas (SIA), the North Baldwin-Holcomb Valley SIA, and the Arrastre Creek SIA, which include portions of North Baldwin Lake, Holcomb Valley, and Arrastre Creek pebble plain complexes, provide additional management protections from these threats described in **FACTOR A**; however, these areas and their zoological and biological values are still subject to compatible uses.

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

In our listing rule, we indicated that one major herbarium in the region had a significant increase in its collection of pebble plains taxa following a publication highlighting the uniqueness of pebble plain habitat (USFWS 1998, p. 49014). We also indicated that additional attention provided to *Castilleja cinerea* and other pebble plains taxa in the final listing rule could result in new efforts to collect specimens (USFWS 1998, p. 49014).

In our 2008 5-year review, we stated we had no new information on collection of *Castilleja cinerea*. We do not believe that overutilization for commercial, recreational, scientific, or educational purposes poses a threat to *C. cinerea* at this time.

FACTOR C: Disease or Predation

<u>Disease</u>

Disease was not known to be a threat to *Castilleja cinerea* at the time of listing (USFWS 1998, p. 49014) or at the time of our 2008 5-year review (USFWS 2008, p. 7). We do not believe that disease poses a current threat to the species.

Predation

At the time of listing, predation was not described as a threat to *Castilleja cinerea* (USFWS 1998, p. 49014). The 2002 Pebble Plain Management Guide evaluated potential grazing threats to pebble plain vegetation from burros (see **FACTOR E** for related discussion on trampling threats) (USFS 2002, p. 62). The report stated that because pebble plain vegetation is typically low growing and because burros have prehensile lips that interfere with the ability to graze close to the ground, that there was little threat to pebble plain vegetation from burro grazing activity.

There are no current cattle grazing allotments in the SBNF (Eliason 2012a, pers. comm.). Horses have been reported on private lands (Hitchcock Ranch; approximately 488 ac (197 ha)) in Hitchcock Meadow (Holcomb Valley pebble plain complex), but the effect on *Castilleja cinerea* from grazing from the reported small number (30–40) of horses in this area is unknown.

Summary of Factor C

Disease does not currently pose a threat to *Castilleja cinerea*. Predation threats from wild burros or other livestock (cattle and horses) are believed to be minimal or insignificant at this time.

FACTOR D: Inadequacy of Existing Regulatory Mechanisms

At the time of listing, regulatory mechanisms considered to provide some protection for *Castilleja cinerea* included: (1) California Environmental Quality Act (CEQA) and (2) National Forest Management Act. Land management by various Federal, State, or local government agencies, or by private conservation organizations was also evaluated in the listing rule. We concluded that the primary planning management process evaluated for this region (the Coordinated Resource Management Plan for the Big Bear Valley region) would not guarantee protection for *C. cinerea* and other co-occurring pebble plain plants (USFWS 1998, p. 49016). In our 2008 5-year review, we identified the National Environmental Policy Act (NEPA) and the Act itself as additional existing regulatory mechanisms (USFWS 2008, p. 8).

State Regulatory Mechanisms

Castilleja cinerea is not listed by the State of California as rare, threatened, or endangered and therefore receives no protection under the the California Endangered Species Act or the Native Plant Protection Act. However, CEQA may provide some protective benefit to *C. cinerea* as discussed below.

California Environmental Quality Act (CEQA)

CEQA (California Public Resources Code 21000–21177) is the principal statute mandating environmental assessment of projects in California. The purpose of CEQA is to evaluate whether a proposed project may have an adverse effect on the environment and, if so, to determine whether that effect can be reduced or eliminated by pursuing an alternative course of action or through mitigation. CEQA applies to projects proposed to be undertaken or requiring approval by State and local public agencies and requires disclosure of potential environmental

impacts and a determination of "significant" if a project has the potential to reduce the number or restrict the range of a rare or endangered plant. However, projects may move forward if there is a statement of overriding consideration. If significant effects are identified, the lead agency has the option of requiring mitigation through changes in the project or to decide that overriding considerations make mitigation infeasible (Public Resources Code 21000; CEQA Guidelines at California Code of Regulations, Title 14, Division 6, Chapter 3, Sections 15000–15387).

Castilleja cinerea is listed by the California Native Plant Society (CNPS) as **1.B.2** or rare, threatened, or endangered in California and elsewhere and fairly endangered in California (CNPS 2012). The California Department of Fish and Wildlife (CDFW; previously known as California Department of Fish and Game) works in collaboration with CNPS and with botanical experts throughout the State to maintain an *Inventory of Rare and Endangered Plants*, and the similar *Special Vascular Plants, Bryophytes, and Lichens List*. All CNPS List 1 and 2 and some List 3 and 4 plants (now known as California Rare Plant Ranks 1, 1A, 1B, 2, 3, and 4) may fall under Section 15380 of CEQA (CDFG 2012, p. ii). In addition, the CDFW is the trustee agency for the wildlife of California under CEQA (Section 15386), including the plants, ecological communities, and the habitat upon which they depend, and the agency provides expertise in reviewing and commenting on environmental documents during the CEQA process regarding potential negative impacts to these resources (CDFG 2012, p. vii).

Although enforcement provisions under CEQA have the potential for providing some level of protection to *Castilleja cinerea*, this State law is not a comprehensive regulatory mechanism for this taxon.

Federal Regulatory Mechanisms

National Environmental Policy Act

All Federal agencies are required to adhere to the National Environmental Policy Act (NEPA) of 1970 (42 U.S.C. 4321 *et seq.*) for projects they fund, authorize, or carry out. Prior to implementation of such projects with a Federal nexus, NEPA requires the agency to analyze the project for potential impacts to the human environment, including natural resources. The Council on Environmental Quality's (CEQ) regulations for implementing NEPA state that agencies shall include a discussion on the environmental impacts of the various project alternatives (including the proposed action), any adverse environmental effects that cannot be avoided, and any irreversible or irretrievable commitments of resources involved (40 CFR part 1502). Its public notice provisions provide an opportunity for the Service and others to review proposed actions and provide recommendations to the implementing agency. The NEPA does not impose substantive environmental obligations on Federal agencies—it merely prohibits an uninformed agency action. However, if an Environmental Impact Statement is prepared for an agency action, the agency must take a "hard look" at the consequences of this action and must consider all potentially significant environmental impacts. Effects on threatened and endangered species is an important element for determining the significance of an impact of an agency action (40 CFR § 1508.27). Thus, although NEPA does not itself regulate activities that might affect *Castilleja cinerea*, it does require full evaluation and disclosure of information regarding the effects of contemplated Federal actions on sensitive species and their habitats. As an example,

activities that impact special status plant species that are found on *non*-pebble plain habitat within the SBNF are evaluated, as necessary, through the NEPA process and other Forest Service policy (e.g., Forest Service manual 2670) (USFS 2002, p. 11). Federal agencies may also include mitigation measures in the final Environmental Impact Statement as a result of the NEPA process that help to conserve *C. cinerea* and its habitat and these may include measures that are different than those required through the section 7 consultation process.

Organic Administration Act of 1897 and the Multiple-Use, Sustained-Yield Act of 1960

The Organic Act of 1897 (16 U.S.C. § 475–482) established general guidelines for administration of timber on Forest Service lands, which was followed by the Multiple-Use, Sustained-Yield Act (MUSY) of 1960 (16 U.S.C. § 528–531), which broadened the management of Forest Service lands to include outdoor recreation, range, watershed, and wildlife and fish purposes. Under general provisions of the Organic Act (16 U.S.C. § 472) and MUSY (16 U.S.C. § 551), the Forest Service can also designate Special Areas for protection based on their unique or outstanding physical features, environmental values or social significance (USFS 2005e, Vol. 1, p. 13). Special Areas also include administrative designations, such as Research Natural Areas and Special Interest Areas (USFS 2005e, Vol. 1, p. 13).

Areas within the North Baldwin Lake-Holcomb Valley and the Arrastre Creek pebble plain complexes have been designated as SIA. Management objectives for SIAs are defined by their designation, but compatible uses are retained within an SIA, to the maximum extent possible (USFS 2005e, Vol. 1 p. 13). The North Baldwin-Holcomb Valley SIA is designated for historical, zoological, and botanical values, and the Arrastre Creek SIA is designated for botanical and zoological values (USFS 2005b, p. 49). Program management plans developed for these two SIAs provide more specific guidance than the larger SBNF Land Management Plan, which is discussed below.

Within the SBNF, the Forest Service has also recommended two Research Natural Areas (RNA), Arrastre Flat (within the Arrastre Flat pebble plain complex) and Wildhorse Meadow (within the Sugarloaf Ridge pebble plain complex) (USFS 2005b, pp. 112–113). These areas overlap with 469 ac (189.8 ha) of *Castilleja cinerea* occupied habitat (USFS 2005a, p. 256). If designated, these RNAs will fall under Forest Manual Directive 4063 (RNAs), and will be subject to use only for research and development, study, observation, monitoring, and educational activities that maintain unmodified conditions.

National Forest Management Act

The National Forest Management Act (NFMA) (16 U.S.C. § 1600 *et seq*.) requires the Forest Service to develop a planning rule under the principles of MUSY. The NFMA outlines the process for the development and revision of the land management plans and their guidelines and standards (16 U.S.C. § 1604(g)).

A new NFS land management planning rule (planning rule) was recently adopted by the Forest Service (effective May 9, 2012) (77 FR 21162–21276; April 9, 2012). The new planning rule guides the development, amendment, and revision of land management plans for all units of the

NFS to maintain and restore NFS land and water ecosystems while providing for ecosystem services and multiple uses (77 FR 21162; April 9, 2012). Land management plans (also called Forest Plans) are to be designed so as to (1) provide for the sustainability of ecosystems and resources; (2) meet the need for forest restoration and conservation, watershed protection, and species diversity and conservation; and (3) assist the Forest Service in providing a sustainable flow of benefits, services, and uses of NFS lands that provide jobs and contribute to the economic and social sustainability of communities (77 FR 21162). A land management plan does not authorize projects or activities, but projects and activities must be consistent with the plan (USFS 2012b, p. 21261). The plan must provide for the diversity of plant and animal communities including species-specific plan components in which a determination is made as to whether the plan provides the "ecological conditions necessary to: contribute to the recovery of federally listed species…" (USFS 2012b, p. 21265).

The decision of record for the final planning rule was based on the analyses presented in the *Final Programmatic Environmental Impact Statement, National Forest System Land Management Planning* (USFS, 2012a), which was prepared in accordance with the requirements of NEPA. In addition, the NFMA requires land management plans to be developed in accordance with the procedural requirements of NEPA, with a similar effect as zoning requirements or regulations as these plans control activities on the national forests and are judicially enforceable until properly revised (Coggins *et al.* 2001, p. 720).

The most recent Land Management Plan for the SBNF was prepared in 2005 in conjunction with a final Environmental Impact Statement for four Southern California National Forests (USFS 2005b; USFS 2005e). The San Bernardino Land Management Plan contains specific design criteria including place specific standards related to *Castilleja cinerea* and pebble plain habitats. These include: (1) avoid or minimize any activity that causes long-term damage to *C. cinerea* host plants or host plant habitat in occupied *C. cinerea* habitats (Arrowhead, Big Bear, Big Bear Back Country, Desert Rim, and San Gorgonio Places) and (2) avoid or minimize new ground disturbing activities that cause long-term damage to pebble plain habitat (Arrowhead, Big Bear, Big Bear Back Country, Desert Rim, and San Gorgonio Places) (USFS 2005b, p. 99). In addition, the Forest Plan identifies pebble plain habitat guidance, which states, in part, that (1) the desired condition is for pebble plain habitat to be conserved over the long-term; (2) incompatible uses are minimized; (3) pebble plain habitat degraded by past use is restored; and (4) federally listed threatened species are recovered and delisted (USFS 2005b, pp. 100–101).

In addition to the 2005 SBNF Land Management Plan, the Forest Service prepared the 2002 Pebble Plain Habitat Management Guide (Guide) (USFS 2002) to assist in the conservation of pebble plain habitat in the SBNF, which updated the previous Guide and Action Plan (Neel and Barrows 1990). The SBNF Land Management Plan incorporates the Guide for implementation of management programs for pebble plains plant species (USFS 2012d, p. 7). The 2002 Guide provides specific information on pebble plains habitat and the sensitive species it supports, site status summaries, and management direction and implementation schedules to aid in the recovery of three federally listed plants (*Eremogone ursina*, *Castilleja cinerea*, and *Eriogonum kennedyi* var. *austromontanum*) (USFS 2002, p. 1).

Finally, under general provisions of the Organic Administration Act of 1897 (16 U.S.C. 551), the Forest Service has proposed the Arrastre Flat and Wildhorse Meadow Research Areas, which overlap with 469 ac (189.8 ha) of *Castilleja cinerea* occupied habitat (USFS 2005a, p. 256). If designated, these areas will fall under Forest Manual Directive 4063 (RNAs), and subject to use only for research and development, study, observation, monitoring, and educational activities that maintain unmodified conditions.

Other Federal Regulations

Other Federal laws and regulations set forth rules and procedures by which uses of the surface of NFS lands are conducted in order to minimize adverse environmental impacts to surface resources, including habitat for *Castilleja cinerea*. Protections that govern mining operations on Federal lands can be found in 36 CFR 228 (Title 36 Parks, Forests, Public Property, Subpart A–Locatable Minerals) and are applied at the site-specific level. Related regulations are also implemented in connection with operations authorized by the U.S. mining laws, 30 U.S.C. § 21–54, which confer a statutory right to enter public lands to search for minerals. The effects of mining can be avoided or mitigated by Forest Plan Standards, where needed and feasible, as conditions of approval for mining Plans of Operation (USFS 2005e, Vol. 1, p. 374). As an example, Forest Plan Standard S44 requires surface use determinations for proposed locatable mining operations that are likely to cause significant surface disturbance to federally listed, candidate, and sensitive species habitats, and requires measures to protect these species and their habitats (USFS 2012d, p. 32).

In addition, the Forest Service Directive System codifies the agency's policy, practice, and procedures under various Federal laws and regulations under which the Forest Service operates, including the Act. The Directive System is the primary basis for the internal management and control of all programs as well as the primary source of administrative direction to Forest Service employees. This system includes the Forest Service Manual and Forest Service Handbooks that outline land and resource management planning and other conservation directives (*http://www.fs.fed.us/im/directives/dughtml/serv_fsm.html*). As an example, the Forest Service uses standards, guidelines, and best management practices to avoid or reduce fire suppression impacts (USFS 2005a, p. 256; USFS 2005c, Appendices B and F) and staff are trained to identify pebble plain habitat and are instructed to use suppression techniques that reduce or prevent soil disturbance (USFWS 2008, p. 6). The potential for impacts from fire suppression is also reduced by implementation of Forest Plan Standard 38 that avoids establishment of staging areas, helibases, base camps, fuelbreaks, or other areas of human concentration and equipment use within listed, proposed, and candidate species habitats, where practicable (USFWS 2005, p. 27).

Endangered Species Act of 1973, as amended (Act)

Since listing, the Act is the primary Federal law providing protection for *Castilleja cinerea*. The Service's responsibilities for administering the Act include sections 6, 7, 9, and 10. Section 7(a)(1) of the Act requires all Federal agencies to utilize their authorities in furtherance of the purposes of the Act by carrying out programs for the conservation of endangered and threatened species. Section 7(a)(2) of the Act requires Federal agencies, including the Service, to satisfy two standards in carrying out their program. Federal agencies must ensure that actions they

fund, authorize, or carry out are not likely to (1) jeopardize the continued existence of any listed species or (2) result in the destruction or adverse modification of designated critical habitat. A jeopardy determination is made for a project that is reasonably expected, either directly or indirectly, to appreciably reduce the likelihood of both the survival and recovery of a listed species in the wild by reducing its reproduction, numbers, or distribution (50 C.F.R. § 402.02). Critical habitat has been designated for this taxon and incorporates 1,662 ac (672.6 ha) (or 94 percent) of Forest Service lands (USFWS 2007b, pp. 73092–73178).

The section 7(a)(2) prohibition against jeopardy applies to plants as well as animals, but other protections of the Act are more limited for plant species. There is no prohibition against the taking of a protected plant under section 7(a)(2), thus no incidental take statement is prepared in the analysis of effects associated with a project. A non-jeopardy opinion for plants therefore would not include reasonable and prudent measures to minimize incidental take. However, voluntary conservation recommendations may be included, which are discretionary actions the action agency can implement relevant to the proposed action and consistent with their section 7(a)(1) authority to minimize or avoid adverse effects of an action on listed species or critical habitat, to help implement recovery plans, or develop information; however, they are not a precondition for a finding of no jeopardy (or adverse modification).

Under the taking prohibitions of section 9(a)(2) of the Act, it is unlawful to remove and reduce to possession (i.e., collect) any endangered species of plant from areas under Federal jurisdiction; maliciously damage or destroy any such taxon on any such area; or remove, cut, dig up, or damage or destroy such species. For areas outside Federal jurisdiction, there are no restrictions on killing, damaging, or removing plants or plant parts unless State law prohibits these acts and it can be shown that there was a knowing violation of any law or regulation of any State or in the course of any violation of a State criminal trespass law. The protection of section 9 afforded to endangered species is extended to threatened wildlife and plants by regulation. Additionally, federally listed plants may be incidentally protected if they co-occur with federally listed wildlife species.

Other protections for plants in the Act include restrictions against the import into or export from the United States any endangered plant and to deliver, receive, carry, transport, or ship or sell or offer for sale in interstate or foreign commerce any such species.

The Service has an extensive section 7(a)(2) consultation history with the Forest Service in southern California, including the Mountaintop District of the SBNF. Most recently, the Forest Service submitted a biological assessment to review the effects of ongoing management activities of SBNF (USFS 2012d). This assessment is intended to tier to and update the Service's consultation on the 2005 revision of the Land and Resource Management Plans for the Four Southern California Forests, including the SBNF Land Management Plan (USFS 2005b). The biological assessment provides updated site-specific information on existing conditions and effects of Forest Service management within the SBNF for *Castilleja cinerea* and other federally listed plants and their critical habitat; it also outlines features to minimize effects to listed species and critical habitat that may result from activities implemented under several Forest Service management programs (USFS 2012d, p. 5).

Summary of Factor D

Existing State regulatory mechanisms do not provide a comprehensive level of protection for ameliorating impacts to *Castilleja cinerea* from current threats. There has been some loss of *C. cinerea* and its habitat since listing, primarily on private lands. Federal regulatory mechanisms have reduced the overall loss and degradation of habitat of *C. cinerea* by virtue of its occurrence on Forest Service lands. Thus, under section 7 of the Act, this will generally result in a preparation of a biological assessment by the Forest Service for a proposed action to the species and the preparation of a consultation by the Service to analyze the effects of the action to the species and its designated critical habitat on Forest Service lands. Therefore, we believe that the Act continues to remain the primary regulatory mechanism providing for the conservation of *C. cinerea*. However, the NFMA in conjunction with the requirements of NEPA provides important guidance and policy for maintaining ecosystem and species-specific biodiversity via the development and implementation of land management plans (and environmental impact statements). This includes amendments or revisions to the SBNF Management Plan (USFS 2005b), as well as conservation recommendations provided in the Pebble Plain Habitat Management Guide (USFS 2002). Other Forest Service legislation provides opportunities for additional protections for pebble plain habitats; however, recommendations for RNAs within the SBNF have not been finalized.

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

At the time of listing, we identified the following Factor E threats to *Castilleja cinerea*: (1) trampling by livestock and humans; (2) indirect effects of grazing and browsing; (3) competition with other plant species (i.e., nonnative plants); and (4) habitat fragmentation (USFWS 1998, p. 49016). Threats related to trampling by humans are addressed under several threats described in **FACTOR A**. Trampling threats to habitat (i.e., indirect effects of grazing or browsing) and trampling of individual plants from animals are addressed together under **FACTOR A**. Threats associated with nonnative plants and habitat fragmentation-associated threats are now addressed under **FACTOR A**. Impacts associated with climate change, a threat that was not identified at the time of listing, are included here under **FACTOR E**.

<u>Climate Change</u>

Our analyses under the Act include consideration of ongoing and projected changes in climate. The terms “climate” and “climate change” are defined by the Intergovernmental Panel on Climate Change (IPCC). The term “climate” refers to the mean and variability of different types of weather conditions over time, with 30 years being a typical period for such measurements, although shorter or longer periods also may be used (IPCC 2007a, p. 78). The term “climate change” thus refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2007a, p. 78).

Scientific measurements spanning several decades demonstrate that changes in climate are occurring, and that the rate of change has been faster since the 1950s. Examples include warming of the global climate system, and substantial increases in precipitation in some regions of the world and decreases in other regions. (For these and other examples, see IPCC 2007a, p. 30; and Solomon *et al.* 2007, pp. 35–54, 82–85). Results of scientific analyses presented by the IPCC show that most of the observed increase in global average temperature since the mid-20th century cannot be explained by natural variability in climate, and is "very likely" (defined by the IPCC as 90 percent or higher probability) due to the observed increase in greenhouse gas (GHG) concentrations in the atmosphere as a result of human activities, particularly carbon dioxide emissions from use of fossil fuels (IPCC 2007a, pp. 5–6 and figures SPM.3 and SPM.4; Solomon *et al.* 2007, pp. 21–35). Further confirmation of the role of GHGs comes from analyses by Huber and Knutti (2011, p. 4), who concluded it is extremely likely that approximately 75 percent of global warming since 1950 has been caused by human activities.

Scientists use a variety of climate models, which include consideration of natural processes and variability, as well as various scenarios of potential levels and timing of GHG emissions, to evaluate the causes of changes already observed and to project future changes in temperature and other climate conditions (e.g., Meehl *et al.* 2007, entire; Ganguly *et al.* 2009, pp. 11555, 15558; Prinn *et al.* 2011, pp. 527, 529). All combinations of models and emissions scenarios yield very similar projections of increases in the most common measure of climate change, average global surface temperature (commonly known as global warming), until about 2030. Although projections of the magnitude and rate of warming differ after about 2030, the overall trajectory of all the projections is one of increased global warming through the end of this century, even for the projections based on scenarios that assume that GHG emissions will stabilize or decline. Thus, there is strong scientific support for projections that warming will continue through the 21st century, and that the magnitude and rate of change will be influenced substantially by the extent of GHG emissions (IPCC 2007a, pp. 44–45; Meehl *et al.* 2007, pp. 760–764 and 797–811; Ganguly *et al.* 2009, pp. 15555–15558; Prinn *et al.* 2011, pp. 527, 529). (See IPCC 2007b, p. 8, for a summary of other global projections of climate-related changes, such as frequency of heat waves and changes in precipitation. Also see IPCC 2011(entire) for a summary of observations and projections of extreme climate events).

Various changes in climate may have direct or indirect effects on species. These effects may be positive, neutral, or negative, and they may change over time, depending on the species and other relevant considerations, such as interactions of climate with other variables (e.g., habitat fragmentation) (IPCC 2007a, pp. 8–14, 18–19). Identifying likely effects often involves aspects of climate change vulnerability analysis. Vulnerability refers to the degree to which a species (or system) is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the type, magnitude, and rate of climate change and variation to which a species is exposed, its sensitivity, and its adaptive capacity (IPCC 2007a, p. 89; see also Glick *et al.* 2011, pp. 19–22). There is no single method for conducting such analyses that applies to all situations (Glick *et al.* 2011, p. 3). We use our expert judgment and appropriate analytical approaches to weigh relevant information, including uncertainty, in our consideration of various aspects of climate change.

Although many species already listed as endangered or threatened may be particularly vulnerable to negative effects related to changes in climate, we also recognize that, for some listed species, the likely effects may be positive or neutral. In any case, the identification of effective recovery strategies and actions for recovery plans, as well as assessment of their results in 5-year reviews, should include consideration of climate-related changes and interactions of climate and other variables. These analyses also may contribute to evaluating whether an endangered species can be reclassified as threatened, or whether a threatened species can be delisted.

Global climate projections are informative, and, in some cases, the only or the best scientific information available for us to use. However, projected changes in climate and related impacts can vary substantially across and within different regions of the world (e.g., IPCC 2007a, pp. 8–12). Therefore, we use "downscaled" projections when they are available and have been developed through appropriate scientific procedures, because such projections provide higher resolution information that is more relevant to spatial scales used for analyses of a given species (see Glick *et al.* 2011, pp. 58–61, for a discussion of downscaling).

We reviewed predictions from Cal-Adapt, a web-based, climate adaptation planning tool that synthesizes existing downscaled climate change scenarios and climate impact research, and presents it in an interactive, graphical layout (*http://cal-adapt.org*/; California Energy Commission 2011). Projected changes in April snow water equivalence across the Fawnskin, Holcomb Valley, and parts of Arrastre Flats pebble plains, under a low carbon emissions scenario (B1), indicate an 84 percent reduction in snow moisture; and a 92 percent reduction in snow moisture under a high emissions scenario (A2), between a baseline time period (1961 to 1990) and an end of century period (2070 to 2090). Similar reductions in snowpack are projected for the Bear Valley region and other parts of the SBNF. Projected changes in annual average in temperature for this region using the Cal-Adapt tool under the B1 scenario indicate a 3.9^{o}F (2.1^{o}C) increase in temperature, and 6.9^{o}F (3.8^{o}C) increase under the A2 scenario, between the baseline time period (1961 to 1990) and an end of century period (2070 to 2090). Although there is uncertainty in predictions of downscaled climate change models, these projected climate change effects could significantly alter the hydrology and vegetation that sustain and characterize pebble plain and other habitats occupied by *Castilleja cinerea*.

Summary of Factor E

Based on the best available information contained in model predictions for this general region of California, changes in temperature and hydrological conditions resulting from climate change are considered a significant threat to *Castilleja cinerea* throughout its range.

III. RECOVERY CRITERIA

A recovery plan has not been completed for *Castilleja cinerea*.

IV. SYNTHESIS

At the time of listing, *Castilleja cinerea* was described from fewer than 20 localities at the eastern end of the San Bernardino Mountains. There are currently an estimated 47 extant

localities of *C. cinerea* within 13 geographical areas, identified as pebble plain complexes. These complexes contain several habitats occupied by *C. cinerea* including pebble plains, forest, and mountain meadows, or ecotone areas between these community types. The distribution of *C. cinerea* largely remain as identified at the time of listing although the detection of this species at Grinnell Ridge and Dollar Lake in the southern San Bernardino Mountains region represents an expansion of the species' range to the south. We currently have no comprehensive abundance estimate of *C. cinerea*; however, we believe that, since listing, the numbers of individuals has remained largely the same in most areas.

The primary threats identified at the time of listing were associated with habitat loss, fragmentation, and degradation due to urban development, ORV traffic, nonnative plants, trampling, and grazing or browsing. Fuel wood harvesting, mining activities, and altered hydrological regime were also identified as additional threats within pebble plains habitat occupied by *Castilleja cinerea*. Subsequent to listing, fuelbreaks and fire suppression activities were identified and discussed in the 2008 5-year review.

Currently, the effects of roads and trails in conjunction with ORV and other recreational activities represent the most important threats rangewide to *Castilleja cinerea*. Unauthorized routes, or roads and trails that are not part of the SBNF or otherwise authorized for public use, likely represent the more significant impact from this threat to *C. cinerea* since they are generally unplanned and unmanaged. Taken together, authorized and unauthorized roads and trails can have significant direct and indirect impacts to *C. cinerea* including destruction of habitat and plants, facilitation of the introduction and establishment of nonnative plants, and alteration of hydrology (water flow and drainage patterns) that sustain pebble plain and montane meadows habitats.

The second most important threat to *Castilleja cinerea* is the effects of urbanization. Two geographical areas that encompass six occurrences of *C. cinerea* are threatened by encroachment of existing residences and proposed new residences into pebble plains habitat along with related infrastructure to support these urbanized areas. The highest level of threat (loss of habitat) is limited to the remaining private lands in the San Bernardino Mountains that are not owned and managed by the Forest Service (about 16 percent of mapped *C. cinerea* habitat).

Mining activities continue to remain a threat for *Castilleja cinerea* within five occurrences within the SBNF, though the level of threat is dependent on the annual activities of claims. The Forest Service has some level of control over mining operations and the impacts of these activities through Federal regulations and Forest Plan Standards such as the control of proposed locatable mining operations that might cause significant surface disturbance. Impacts from nonnative plants have largely remained the same since listing throughout the range of *C. cinerea* and the Forest Service is actively implementing a nonnative plant treatment program. Fire suppression practices represent threats in several pebble plain complexes; however, the Forest Service is implementing design features, best management practices, and other protective measures to minimize the direct and indirect effects to federally listed plants and designated critical habitat.

Trampling from cattle and feral burros was described as an important threat to *Castilleja cinerea* at the time of listing; however, our previous 5-year review indicated that this threat had been much reduced. Trampling from feral burros is now considered a localized and minor threat within 3 of the 13 occurrences and the Forest Service is managing the designated HMAs in the SBNF to control any future threats. The effects of climate change, which was not considered at the time of listing, particularly an increase in temperature and altered precipitation patterns, are likely an important rangewide threat to the species.

The Act continues to remain the primary regulatory mechanism providing for the conservation of *Castilleja cinerea*. However, additional Federal regulatory mechanisms have reduced the overall loss and degradation of habitat of *C. cinerea* by virtue of the majority of its occurrences (84 percent of mapped *C. cinerea* habitat) located on Forest Service lands. The Organic Act has allowed the Forest Service to designated two SIAs (North Baldwin Lake-Holcomb Valley and Arrastre Creek) within pebble plains habitat that contain populations of *C. cinerea*. The Organic Act has also authorized the Forest Service to recommend RNAs; two of which have been defined for the SBNF, and which contain portions of the Arrastre Flat and Sugarloaf Ridge pebble plain complexes. The NFMA in conjunction with the requirements of NEPA can also provide important guidance and policy for assisting in the conservation of *C. cinerea* through the development and implementation of comprehensive land management plans. These measures provide additional protections to *C. cinerea* and its habitat where located on lands within the SBNF.

In recognition of the magnitude of the ongoing threats, we recommend no change in the threatened status of *Castilleja cinerea* 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*
__X__ No Change

New Recovery Priority Number and Brief Rationale: No Change

VI. RECOMMENDATIONS FOR FUTURE ACTIONS

The actions listed below are recommendations to be completed over the next 5 years. These will help guide recovery of *Castilleja cinerea* by controlling access to its habitat on pebble plains and montane meadows. Conservation of *C. cinerea* is dependent on continued cooperation with our partners (i.e., Federal, State, and local agencies). We will work with Service programs, such as the Service's Partners for Fish and Wildlife Program, to identify opportunities for conservation

on private lands. Property easements or purchases of parcels could also be made through the Act's section 6 funding. We recognize that the conservation of *C. cinerea* will require continued cooperation and coordination with partners to minimize impacts from current threats and aid future restoration.

1) Work with biologists at the SBNF to reduce impacts from recreational use of roads and trails through uncontrolled access to pebble plain habitat occupied by *Castilleja cinerea*. Prioritize protective measures being implemented (or planned) for controlling access to areas occupied by *Castilleja cinerea*.

2) Reduce current and future impacts to *Castilleja cinerea* (and other federally listed pebble plain plants) from roads and trails through coordination with staff at SBNF. Identify and implement a priority strategy to identify roads and trails for decommissioning within pebble plain habitats.

3) Conserve or preserve *Castilleja cinerea* occurrences on private lands. Continue to work with the State and local groups to purchase *C. cinerea* habitat from willing sellers, particularly within the Sawmill pebble plain complex.

4) Develop a monitoring plan to provide early detection of downward trends in the populations of pebble plain plants, such as *Castilleja cinerea*, and quality of pebble plain and montane meadows habitats (adapted from USFS 2005b, p. 125). This monitoring plan should identify and prioritize surveys of plant populations, including abundance, and habitat conditions, in those areas most vulnerable to threats (e.g., pebble plain complexes with high levels of recreational activity) and should include remote sensing and mapping of unauthorized ORV trails.

5) In an effort to generate interest for research opportunities for this taxon, post the following research needs on the Carlsbad Fish and Wildlife Office website (*http://www.fws.gov/carlsbad*):
    - Evaluate reproductive life history characteristics such as seed germination requirements, mechanism of seed dispersal, and seed viability.
    - Determine the distribution of genetic diversity in the species occurrences and identify the most appropriate means to preserve the diversity.

VII. REFERENCES CITED

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Appendix 1. Occurrences* of *Castilleja cinerea* (Ash-gray paintbrush): Current status, threats, and conservation. Prepared for the 2013 5-year Review.

PEBBLE PLAIN COMPLEX[1]	OCCURRENCES: includes Elemental Occurrences (EOs) (CNDDB 2012), survey points, and herbarium collections[2] (CCH 2012)	STATUS AT LISTING[3]	CURRENT STATUS	CURRENT THREATS[4]	CURRENT PRIMARY CONSERVATION MECHANISM
Arrastre Flats (including Cactus Flats)	EOs 27; Davidson 4476 (RSA#400528)	Presumed extant	Presumed extant	A: Roads and Trails; Alteration of Hydrology; Nonnative Plants; Mining E: Climate change	USFS-SBNF Land Management Plan
Big Bear Lake	EOs 17, 18, 19, 20, 26, 33, 41, 53, 63, 65; Wood 2164 (RSA#768236)	Presumed extant	Presumed extant	A: Urban Development; Roads and Trails; Alteration of Hydrology E: Climate change	USFS-SBNF Land Management Plan (in some areas)
Broom Flat (including Onyx Peak)	EOs 3, 52, 56, 57, 58	Presumed extant	Presumed extant	A: Roads and Trails; Alteration of Hydrology; Nonnative Plants E: Climate change	The Wildlands Conservancy: USFS-SBNF Land Management Plan
Dollar Lake	[No EO assigned]	Unknown	Extant (located in 2012; USFS 2012d)	E: Climate change	
Fawnskin	EOs 24, 25, 49, 50, 54	Presumed extant	Presumed extant	A: Urban Development; Roads and Trails; Nonnative Plants E: Climate change	USFS-SBNF Land Management Plan
Gold Mountain	EOs 30, 31, 51, 55	Presumed extant	Presumed extant	A: Urban Development; Roads and Trails, Alteration of Hydrology; Nonnative Plants E: Climate change	USFS-SBNF Land Management Plan

PEBBLE PLAIN COMPLEX[1]	OCCURRENCES: includes Elemental Occurrences (EOs) (CNDDB 2012), survey points, and herbarium collections[2] (CCH 2012)	STATUS AT LISTING[3]	CURRENT STATUS	CURRENT THREATS[4]	CURRENT PRIMARY CONSERVATION MECHANISM
Grinnell Ridge	EO 16	Presumed extant	Presumed extant	E: Climate change	
Holcomb Valley	EOs 22, 23, 44	Presumed extant	Presumed extant	A: Roads and Trails; Alteration of Hydrology; Mining E: Climate change	USFS-SBNF Land Management Plan
North Baldwin	EO 1, 28, 66; Gale s.n. (CHSC#26330), Davidson 7335(HSC#46470), Peirson 13548 (RSA#78646)	Presumed extant	Presumed extant	A: Urban Development; Roads and Trails; Alteration of Hydrology; Nonnative Plants; Mining E: Climate change	State of California; USFS-SBNF Land Management Plan
Sawmill	EOs 7, 8, 38, 39; Thorne *et al.* 47645 (RSA#371324), Thorne 47331 (RSA#380472), Sanders 00985 (UCR#14721)	Presumed extant	Presumed extant	A: Urban Development; Roads and Trails; Alteration of Hydrology; Nonnative Plants E: Climate change	USFS-SBNF Land Management Plan
Snow Valley	EO 35	Presumed extant	Presumed extant	A: Urban Development E: Climate change	USFS-SBNF Land Management Plan
South Baldwin Ridge/Erwin Lake	EOs 10, 11, 67, 68	Presumed extant	Presumed extant	A: Urban Development; Roads and Trails; Alteration of Hydrology; Nonnative Plants E: Climate change	USFS-SBNF Land Management Plan
Sugarloaf Ridge (including Wildhorse Meadow)	EOs 2, 4, 59, 60, 61, 62; Peirson 3128 (RSA#79993)	Presumed extant	Presumed extant	A: Roads and Trails; Alteration of Hydrology E: Climate change	USFS-SBNF Land Management Plan

Abbreviations: EO = CNDDB Element Occurrence; USFS = U.S. Forest Service; SBNF = San Bernardino National Forest; CCH = Consortium of California Herbaria (see references cited).
*Identifications are based on USFS descriptions and location information, USFWS critical habitat unit determinations and other location information.
1. Name of pebble plain complex defined by USFS and USFWS (*i.e.*, Dollar Lake), listed in alphabetical order. Complex can include pebble plain, forest, and mountain meadows, or ecotone areas between these community types.
2. Note: Accession records listed in this column are those **not** listed in CNDDB database for Element Occurrences.
3. The final listing rule identified 20 "localities" within the pebble plain complexes listed in this Table, all of which were presumed extant.
4. Current threats to the occurrence segregated by listing threat **Factor** (see analysis in text).

U.S. FISH AND WILDLIFE SERVICE

5-YEAR REVIEW

***Castilleja cinerea* (Ash-gray Paintbrush)**

Current Classification: Threatened

Recommendation Resulting from the 5-Year Review:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
__X__ No change needed

Review Conducted By: Carlsbad Fish and Wildlife Office

FIELD OFFICE APPROVAL:

ACTING

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

Approve _____ Date MAR 27 2013