

Eremogone ursina
(Bear Valley Sandwort)

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



Pebble plain habitat and *Eremogone ursina* (Bear Valley sandwort).
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**U.S. Fish and Wildlife Service
Carlsbad Fish and Wildlife Office
Carlsbad, CA**

August 14, 2015

5-YEAR REVIEW
Eremogone ursina
(Bear Valley Sandwort)

I. GENERAL INFORMATION

Purpose of 5-year Reviews:

The U.S. Fish and Wildlife Service (Service) is required by section 4(c)(2) of the Endangered Species Act of 1973, as amended (Act), to conduct a status review of each listed species at least once every 5 years. The purpose of a 5-year review is to evaluate whether or not the species' status has changed since it was listed (or since the most recent 5-year review). Based on the 5-year review, we recommend whether the species should be removed from the list of endangered and threatened species, be changed in status from endangered to threatened, or be changed in status from threatened to endangered. Our original listing of a species as endangered or threatened is based on the existence of threats attributable to one or more of the five threat factors described in section 4(a)(1) of the Act, and we must consider these same five factors in any subsequent consideration of reclassification or delisting of a species. In the 5-year review, we consider the best available scientific and commercial data on the species, and focus on new information available since the species was listed or last reviewed. If we recommend a change in listing status based on the results of the 5-year review, we must propose to do so through a separate rule-making process defined in the Act that includes public review and comment.

Species Overview:

Eremogone ursina (Bear Valley sandwort) is a low, tufted perennial herb in the pink family (Caryophyllaceae). Individual plants are green, with white flowers arranged in open clusters. This species is restricted to pebble plain habitat in the San Bernardino Mountains at elevations from 1,950 to 2,100 meters (6,393 to 6,885 feet) in San Bernardino County, California.

According to the final listing rule, *Eremogone ursina* was known from eight pebble plain complexes in the vicinity of Big Bear and Baldwin lakes. Although two other complexes were not identified in the final listing rule, we consider them to be occupied based on pre-listing occupancy records, and therefore, *E. ursina* occurred in 10 pebble plain complexes at the time of listing. All currently known occurrences of *E. ursina* are within the same general geographical area as that known at the time of listing, and its current spatial distribution has not changed.

The primary threats identified at the time of listing were associated with habitat loss, fragmentation, and degradation due to urbanization, off-road vehicle traffic, nonnative plants, and trampling by livestock. Fuel-wood harvesting, mining activities, and alteration of hydrological conditions were also identified as threats within pebble plains habitat occupied by *Eremogone ursina*. Current threats include effects related to urbanization on private lands, roads and trails, alteration of hydrology, trampling of habitat, nonnative plants, mining, fire suppression activities, and climate change.

Eremogone ursina 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 *Eremogone ursina*, we recommend no change in its listing status.

Methodology Used to Complete This Review:

This review was prepared by Stacey Love at the Carlsbad Fish and Wildlife Office (CFO), following the Region 8 guidance issued in March 2013. 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 (S. Eliason, U.S. Forest Service), its habitat, and the associated processes.

We received no comments from the public in response to our **Federal Register** notice initiating this 5-year review. This 5-year review contains updated information on threats to the species and an assessment of that information compared to that known at the time of listing and from our previous 5-year review in 2008. We focus on current threats to the species that are attributable to the Act's five listing factors. The review synthesizes all this information to evaluate the listing status of the species and provide an indication of its progress towards recovery. Finally, based on this synthesis and the threats identified in the five-factor analysis, we recommend a prioritized list of conservation actions to be completed or initiated within the next 5 years.

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Federal Register Notice Citation Announcing Initiation of This Review:

A notice announcing initiation of the 5-year review of this taxon and the opening of a 60-day period to receive information from the public was published in the **Federal Register** on May 25, 2011 (USFWS 2011, pp. 30378). No information relative to *Eremogone ursina* was received.

Listing History:

Federal Listing

FR Notice: 63 FR 49006–49022 (USFWS 1998)

Date of Final Rule: September 14, 1998

Entity Listed: *Eremogone ursina* (Bear Valley sandwort), a plant species

Classification: Threatened

State Listing:

Eremogone ursina is not listed under the California Endangered Species Act.

Associated Rulemakings:

Critical habitat was designated on December 26, 2007 (USFWS 2007a) for *Eremogone ursina* (formerly *Areneria ursina*) (Bear Valley sandwort), along with *Castilleja cinerea* (Ash-gray paintbrush) 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. A total of 1,412 acres (ac) (571 hectares (ha)) were designated as critical habitat for *E. ursina*, within 17 units, primarily within the San Bernardino National Forest (SBNF) in San Bernardino County (USFWS 2007a, p. 73103).

Review History:

The Service initiated a status review of *Eremogone ursina* on February 14, 2007 (USFWS 2007b, p. 7065). We completed a 5-year review in 2008 (USFWS 2008, entire) and published a notice of the results of the review in the **Federal Register** on March 25, 2009 (USFWS 2009, p. 12882). We recommended no change in status in our 2008 5-year review (USFWS 2008, p.11).

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

The recovery priority number for *Eremogone ursina* is 8, 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). This number indicates that the taxon is a species that faces a moderate degree of threat and has a high potential for recovery.

Recovery Plan or Outline:

A Recovery Plan has not been completed for *Eremogone ursina*.

II. REVIEW ANALYSIS

Application of the 1996 Distinct Population Segment Policy:

The Endangered Species Act defines “species” as including any subspecies of fish or wildlife or plants, and any distinct population segment (DPS) of any species of vertebrate wildlife. This

definition of species under the Act limits listing as distinct population segments to species of vertebrate fish or wildlife. Because the species under review is a plant, the DPS policy is not applicable, and the application of the DPS policy to the species' listing is not addressed further in this review.

Information on the Species and its Status:

The following sections on the habitat requirements, biology and life history, distribution, abundance, and genetics of *Eremogone ursina* include information available at the time of listing as well as more recent information.

Species Description

Eremogone ursina is a low, tufted perennial herb in the pink family (Caryophyllaceae). Individual plants are green, with stems from 10 to 18 centimeters (cm) (3.9 to 7.1 inches (in)) long. The leaves are opposite and 0.5 to 1 cm (0.2 to 0.39 in) long. The flowers are white, five-petaled, and arranged in open cymes (clusters). The petals are 0.2 to 0.45 cm (0.1 to 0.18 in) long. Plants flower between May and June. *Eremogone ursina* is distinguished from other members of the genus within its range by rounded 0.18 to 0.3 cm (0.07 to 0.12 in) long sepals and leaves that are less than 1 cm (0.39 in) long (Robinson 1894, p. 294; Munz and Keck 1959, p. 278; Hartman and Rabeler 2012, pp. 602, 607–608). The seeds of *E. ursina* are flat, reticulate, measure 2 millimeters (mm) (0.079 in) long, remain in open erect capsules for up to 2 months, and can bounce out of the capsule in a strong wind (O'Brien 1979, pp. 81–82).

Habitat

Eremogone ursina is restricted to pebble plain habitat (USFS 2002, p. 17), 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). The deep clay deposits support an assemblage of small cushion-forming plants, tiny annuals, grasses, and succulents that are low growing, sun tolerant, and well-spaced (USFS 2005a, p. 100). The surface of undisturbed pebble plain habitat is about 31 to 38 percent vegetation, 9 to 15 percent litter, 46 to 48 percent rock pavement, and 0.89 to 12 percent bare soil (Derby and Wilson 1979, pp. 463–465).

Pebble plain endemic plants seem to have a specific competitive advantage for their particular specialized habitat, but lack that advantage in adjacent forest and woodland habitat (Derby and Wilson 1979, p. 472). Derby and Wilson (1979, pp. 470–471, 473) found that densities of endemics at one study site were inversely correlated with litter buildup and light intensity under tree canopies. Likewise, soil characteristics of pebble plains appear to prevent trees and shrubs from becoming easily established due to one or a combination of the following factors: (1) the action of frost heaving and thawing; (2) timing and duration of available soil moisture; (3) soil temperature; (4) presence or absence of mycorrhizal fungi; and (5) available soil nutrients (Derby and Wilson 1979, pp. 472–473).

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). Botanical surveys conducted in 2001 produced a total of 73 different plant taxa associated with pebble plain habitats (USFS 2002, p. 12). *Eremogone ursina*, *Eriogonum kennedyi* var. *austromontanum* (southern mountain wild buckwheat), and *Ivesia argyrocoma* var. *argyrocoma* (silver-haired ivesia) are considered the three indicator plants defining a pebble plain (USFS 2002, p. 14). *Eremogone ursina* exhibits a patchy distribution within pebble plains and occurs in areas with low levels of shade and leaf litter accumulation (Derby and Wilson 1979, p. 471). Species commonly associated with *E. ursina* include *E. k.* var. *austromontanum*, *Antennaria dimorpha* (low pussytoes), *Boechera parishii* (Parish's rock cress), *Dudleya abramsii* subsp. *affinis* (San Bernardino Mountains dudleya), and *I. a.* var. *argyrocoma* (USFS 2002, p. 17).

Species Biology and Life History

Eremogone ursina produces seeds by selfing (self-pollinating) and entomophilous (insect-mediated) outcrossing (O'Brien 1979, p. 80). Small syrphid flies, sphecid wasps, and bees appear to be the primary insect pollinators for this species (O'Brien 1979, p. 82; Freas and Murphy 1990, p. 6). O'Brien (1980, p. 217) observed that *E. ursina* flowers with their open cup morphology were heavily visited by insects, in contrast to pebble plain plants with specialized flower morphology. Additionally, this species was dependent on insects for maximum seed set, as bagged individuals had approximately half of the seed production of those that were not bagged (O'Brien 1980, p. 214).

Freas and Murphy (1990) assessed the transfer of pollen by insect pollinators for *Eremogone ursina* (and three other pebble plain plants) in a 1988 gene flow study using a pollen analog (fluorescent dye powder). Pollen analog transfer was not detected greater than 4 meters (13.1 feet) from marked plants, with more than 90 percent of dye transfer occurring within 1 meter (3.3 feet) of each plant (Freas and Murphy 1990, p. 6). An earlier study found low rates of pollen carryover from offsite plant taxa (O'Brien 1980, p. 216). As pollinators moved short distances and were frequently observed to visit two or more plant taxa growing in close proximity in their study, Freas and Murphy (1990, pp. 6, 8) theorized that this further reduced the potential for pollen carryover across distances separating pebble plains and thus makes the potential for regular gene flow between sites very low. Finally, there was no evidence indicating that wind-mediated dispersal plays a role in gene flow between pebble plain sites (Freas and Murphy 1990, p. 8). Therefore, it appears that internal processes regulate species persistence in each pebble plain.

Spatial Distribution and Abundance

Eremogone ursina is found in pebble plain habitat in the northeastern San Bernardino Mountains of southwest San Bernardino County at elevations between 1,950 and 2,100 meters (6,393 to 6,885 feet) (USFS 2002, p. 17; Hartman and Rabeler 2012, p. 608).

Pebble plain complexes were first described and delineated by Neel and Barrows (1990, p. 11) who grouped pebble plains that were clearly clustered and isolated from other complexes and presumed to have comparable origins. According to the final listing rule, *Eremogone ursina* was known from eight pebble plain complexes in the vicinity of Big Bear and Baldwin lakes (USFWS 1998, p. 49007). *Eremogone ursina* was also known to occur in the 1970s, prior to the time of listing, on two pebble plain complexes within the area now referred to as the Fawnskin and Sugarloaf Ridge pebble plain complexes (CNDDDB 1997, Occurrence Number 23; Eliason 2006, p. 6). While these complexes were not identified in the final listing rule, we consider them to be occupied based on pre-listing occupancy records, and therefore, *E. ursina* occurred in 10 pebble plain complexes at the time of listing.

Currently, *Eremogone ursina* is still known to occur in 10 pebble plain complexes, which include Arrastre/Union Flat, Big Bear Lake, Broom Flat, Fawnskin, Gold Mountain, Holcomb Valley, North Baldwin Lake, Sawmill, South Baldwin Ridge/Erwin Lake, and Sugarloaf Ridge (Appendix 1, Figure 1).

In the final listing rule, we cited Krantz's (1987, *in litt.*, p. 5) estimate of historical pebble plain habitat at approximately 700 ac (283 ha), although this number was thought to be low because two pebble plains were not included in the estimate (USFWS 1998, p. 49013). We later stated that there were 545 ac (221 ha) of pebble plains habitat remaining based on estimates by Neel and Barrows (1990, p. 5 cited in USFWS 1998, p. 49013).

The 2002 Pebble Plain Habitat Management Guide (USFS 2002) uses more recent work by the U.S. Forest Service (USFS) to define pebble plain habitat using a point system based on plant indicator species and soils. Based on this system, the National Forest supports about 3,473 ac (1,402 ha) of pebble plain habitat and private land supports about 736 ac (297 ha), for an estimated total of 4,209 ac (1,699 ha) (USFS 2002, p. 15). Data specific to *Eremogone ursina* as of 2007 indicates that there are about 1,939 ac (785 ha) of *E. ursina* occupied habitat, with 1,508 ac (610 ha), or about 78 percent, on National Forest lands; 341 ac (138 ha), or about 18 percent, on private lands; 79 ac (32 ha), or about 4 percent, on municipal lands and special districts; and 11 ac (4 ha), or less than 1 percent, on State lands (J. Bill, USFS, 2007, pers. comm.). However, we are unable to compare current trends and estimates of occupied habitat to that known at the time of listing, due to differences in the way pebble plain habitat was characterized.

Comprehensive surveys of *Eremogone ursina* have not been completed within all 10 pebble plain complexes. Many descriptions from surveys describe unknown numbers of plants; however, three pebble plain complexes have recorded individual plant numbers greater than 1,000, and two locations have plant counts in the hundreds (Appendix 1).

Changes in Taxonomic Classification or Nomenclature

We made a technical correction to the List of Endangered and Threatened Plants at 50 CFR 17.12(h) to reflect our acceptance of the change in scientific name for Bear Valley sandwort to *Eremogone ursina* (B.L. Rob.) Ikonn. (Ikonnikov 1973, p. 140) from *Arenaria ursina* B.L.

Rob. (Robinson 1894, p. 294). We listed Bear Valley sandwort as threatened under the name *Arenaria ursina* (USFWS 1998, pp. 49006–49002).

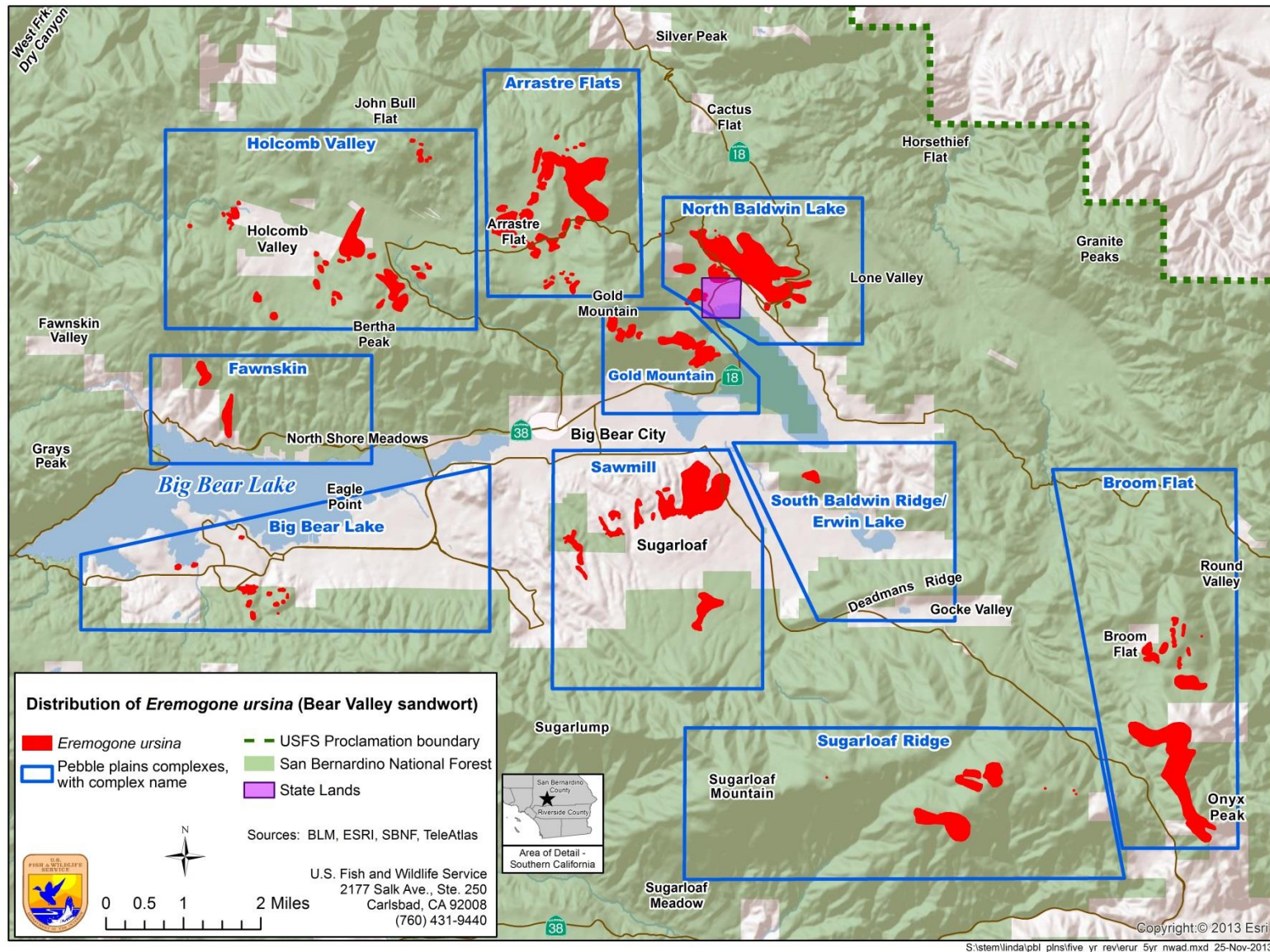


Figure 1. Distribution of *Eremogone ursina* (Bear Valley sandwort); prepared for the 2015 5-year Review.

Recent phylogenetic analysis of three chloroplast gene regions has confirmed the polyphyletic nature of *Arenaria*, and supports recognition of *Eremogone* as a separate genus (Harbaugh *et al.* 2010, p. 195). *Eremogone* has previously been recognized as a separate genus or a subgenus of *Arenaria* (McNeill 1962). Prior to the Harbaugh *et al.* 2010 paper, earlier work precipitated recognition of *Eremogone* as a separate genus in the treatment of the Caryophyllaceae for the *Flora of North America* (Hartman *et al.* 2005, p. 56). *Eremogone* is treated as a separate genus that includes *E. ursina*, in the *Jepson Manual* second edition (Hartman and Rabeler 2012, pp. 607–608) as well as in the California Native Plant Society’s Inventory (CNPS 2011). We concur with these taxonomic and nomenclatural changes. The technical correction of the scientific name to *Eremogone ursina* does not alter the description, distribution, or listing status of the species.

Genetics

As discussed above, gene flow for *Eremogone ursina* and other pebble plain plants was evaluated by Freas and Murphy (1990) using a pollen analog movement study design. The potential for regular gene flow between pebble plains appears to be very low.

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

Species-specific Research and/or Grant-supported Activities

Rancho Santa Ana Botanic Garden (RSABG) currently has four seed collections of *Eremogone ursina* (N. Fraga, RSABG, 2013, pers. comm.). Germination tests were conducted on two of these collections in 2011. Seed development was healthy, and test results indicated that there is no dormancy in fresh seed (E. Meyer, RSABG, 2013, pers. comm.).

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 *Eremogone ursina*. This species exhibits several attributes that can 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.

All of these attributes represent significant vulnerabilities for *Eremogone ursina*. These vulnerabilities may separately, or together, exacerbate any of the threats described below in our five-factor analysis.

Five-factor Analysis:

The listing rule for *Eremogone ursina* described ongoing and threatened destruction, and modification of habitat by urbanization, off-road vehicle activity, fuel-wood harvesting, mining activities, alteration of hydrological regimes, and possible overutilization due to collection of specimens (USFWS 1998, pp. 49012–49014). Additional threats described in the final rule included exotic plants (now termed nonnative plants) and trampling of plants and their habitat (USFWS 1998, pp. 49012–49018). Since our 2008 5-year review, the effects of climate change has been identified as an additional threat to *E. ursina*. Threats identified at the time of listing, changes in those threats since our 2008 5-year review of the taxon, as well as the description and status of newly identified threats are discussed below; threats attributed to each pebble plain complex are identified in Appendix 1.

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

Threats to *Eremogone ursina* attributable to Factor A at the time of listing were urbanization, off-road vehicle activity, alteration of hydrological conditions, fuel-wood harvesting, and mining resulting in habitat modification, destruction, degradation, and fragmentation (USFWS 1998, p. 49013). 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). However, 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. 6) 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: Urbanization, Roads and Trails, Alteration of Hydrology, Trampling of Habitat, Nonnative Plants, Mining, and Fire Suppression.

Urbanization

Much of the habitat historically occupied by *Eremogone ursina* on private lands was lost to residential and commercial development (USFS 2012a, p. 31). At the time of listing, we

indicated that relatively unrestricted development of privately owned parcels of land was a threat to *E. ursina* 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 (USFWS 2008, p. 6). This determination was based, in part, on the summary assessment outlined in the 2002 Pebble Plain Habitat Management Guide (USFS 2002, pp. 25–26, 30–69).

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 *Eremogone ursina* at six of the pebble plain complexes. Threats and their effects on *E. ursina* and other pebble plain plants were recently described in a biological assessment for ongoing activities within the SBNF (USFS 2012b, pp. 61–64, 76–78, 80).

Big Bear Lake area

The Big Bear Lake area includes many localities that support *Eremogone ursina*, including the Big Bear Lake and Fawnskin pebble plain complexes. Much of the occupied habitat of *E. ursina* in the Big Bear Lake area is on private lands, on small lots located within residential neighborhoods under the jurisdiction of the City of Big Bear Lake and San Bernardino County; thus, future non-Federal actions may affect *E. ursina* in these areas (USFS 2012b, pp. 57, 63). Residential improvements (e.g., landscaping) and services provided by local entities (e.g., drainage structures), as well as new, proposed residential developments impact *E. ursina* habitat within portions of the Big Bear Lake and Fawnskin pebble plain complexes (USFS 2012b, pp. 63–64).

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 2012a, 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 2012a, 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 habitat (USFS 2012a, p. 20).

Baldwin Lake area

Large areas of non-Federal land are also found within the eastern half of Bear Valley, which includes *Eremogone ursina* occurrences found within the Sawmill, North Baldwin Lake, South Baldwin Ridge/Erwin Lake, and Gold Mountain pebble plain complexes. Where *E. ursina* is found on the small lots and private lands in residential neighborhoods within these complexes, potential impacts include those related to home improvements, maintaining defensible space, or administration of County services (USFS 2012b, pp. 75, 80).

Holcomb Valley area

Threats resulting from development or associated infrastructure within private inholdings managed by San Bernardino County within the Holcomb Valley and Arrastre Pebble Plain complexes are possible, but unknown (USFS 2012b, p. 74).

Utilities

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 *Eremogone ursina* or its critical habitat. Examples of these include: (1) Bear Valley Electric and Southern California Edison transmission and distribution lines (Big Bear Lake, Fawnskin, Gold Mountain, North Baldwin Lake, South Baldwin Ridge/Erwin Lake, Holcomb Valley, and Arrastre Flat pebble plain complexes); and (2) a sewer outfall line and co-located telecommunication lines (Gold Mountain and North Baldwin Lake pebble plain complexes) (USFS 2012b, pp. 62–63, 73–74, 78). The primary threats to *E. ursina* from these utilities include ground disturbance and localized trampling of habitat related to operation and maintenance activities, such as pole replacements. In addition, the USFS radio repeater facility on Onyx Peak is within mapped occupied and critical habitat for *E. ursina* within the Broom Flat pebble plain complex. Soil disturbance or trampling resulting from operation and maintenance activities of the facility on both USFS lands and adjacent private lands may affect the primary constituent elements identified for this taxon (USFS 2012b, pp. 85–86).

Summary

We believe that the effects of urbanization remain a widespread threat to *Eremogone ursina*. Urban development and related infrastructure is currently a threat within 6 of the 10 complexes where *E. ursina* 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 341 ac (138 ha)) that are not owned and managed by the USFS.

Roads and Trails

In our final listing rule, we described impacts from Roads and Trails under the category of off-road vehicle activity, citing over 7 miles (mi) (11 kilometers (km)) of USFS roads and 10 mi (16 km) of unauthorized routes that directly impact pebble plain sites (Odell 1988, p. 4). Impacts to *Eremogone ursina* habitat from unauthorized off-road vehicle use, and road use and maintenance were also discussed together in our 2008 5-year review (USFWS 2008, p. 6). In this 5-year review, we use the currently accepted term off-*highway* vehicle (OHV) in place of off-*road* activity. We evaluate impacts from roads and trails (primarily their use, maintenance, and development) as well their use for recreational activities (OHV, mountain biking, and hiking) under separate headings below.

Approximately 2.5 percent of SBNF land consists of roads (USFS 2005b, 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 2012b, 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 2012b, p. 92). An estimated 9.6 mi (15.4 km) or 223 ac (90 ha) (using 100 foot (30 meters) of centerline) of roads and trails affect *Eremogone ursina* occurrences within an estimated 1,591 ac (642 ha) of *E. ursina* occupied habitat located on lands owned and managed by the USFS (USFS 2012b, p. 22).

Road and Trail Construction, Use, and Maintenance

Threats to *Eremogone ursina* 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 2012b, 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 2005b, Vol. 1, p. 114).

USFS roads present ongoing threats in the Holcomb Valley area (Holcomb Valley, Arrastre Flat pebble plain complexes), Baldwin Lake area (Gold Mountain pebble plain complex) and the Sugarloaf–Onyx area (Broom Flat pebble plain complex) where *Eremogone ursina* occurs. The SBNF installed fencing, rock barriers, and signage at the most disturbed locations to minimize impacts to the habitat, including effects related to crushing, uprooting, or burial of plants (USFS 2012b, pp. 71–72, 77, 82–84). The SBNF also closed unauthorized routes that originate from USFS roads in the Baldwin Lake area (Sawmill pebble plain complex) and, following these closures, has implemented habitat restoration activities (USFS 2012b, p. 77). Periodic maintenance work on State Routes 18 and 38, and County roads (Holcomb Valley Road) has the potential to impact *E. ursina* and its habitat in the Baldwin Lake area (North Baldwin Lake, Sawmill pebble plain complexes) (USFS 2012b, p. 79).

Ongoing use and maintenance of USFS trails likely subjects *Eremogone ursina* to occasional localized crushing, uprooting, or burial of habitat and individuals in the Big Bear Lake, Baldwin Lake, and Sugarloaf–Onyx areas (USFS 2012b, pp. 59, 76–77, 82). In their biological assessment for the South Big Bear Bike Trails project, the SBNF identified potential threats to *E. ursina* habitat, including the re-routing and restoration of portions of the Pine Knot trail (USFS 2012a, 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 *E. ursina* and other listed species with the potential for re-colonization of the currently disturbed areas (USFS 2012a, pp. 30–32).

Recreational Use of Roads and Trails

The high frequency of OHV activity was described as the most significant and persistent threat in the final listing rule for *Eremogone ursina* and other pebble plain plants and was reiterated as such in our 2008 5-year review (USFWS 1998, p. 49013; USFWS 2008, p. 6). Unauthorized OHV use has impacted all pebble plain complexes to varying degrees (USFS 2002, p. 25). Impacts also result from the effects of non-motorized trails and mountain biking due to the proximity of *E. ursina* and its habitat to urban areas (USFS 2012b, pp. 60–61).

Along with soil compaction, soil erosion resulting from OHV use could significantly alter *Eremogone ursina* habitat. Vehicle traffic during the wet season is of particular concern, as this activity directly disturbs or destroys vegetation and creates deep ruts that change the hydrological patterns over the pebble plain (USFS 2002, p. 20). (Threats from alteration of hydrological conditions is discussed below). Vehicle traffic also increases breakdown in natural soil aggregates (structure) (Sadler 1989, pers. comm., cited in USFS 2002, p. 23).

Associated with OHV 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 2012b, 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 2012a, pers. comm.)). This activity reduces natural barriers to sensitive areas and creates additional access for unauthorized OHV activities (Eliason 2012b, pers. comm.). The Baldwin Lake area (Sawmill, North Baldwin, South Baldwin Ridge/Erwin Lake, and Gold Mountain pebble plain complexes) continues to experience a high intensity of these activities as well as a high frequency of use (USFS 2012b, pp. 77–78).

The SBNF is implementing an ongoing habitat restoration program that is linked to its OHV road and trail network to minimize the effects of recreational use to sensitive habitats (USFS 2012b, p. 10). However, the USFS'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 *Eremogone ursina* occurs. These include abundant unauthorized non-motorized trails created and used by mountain bike riders in the southern Big Bear Lake area (Big Bear Lake pebble plain complex), motorized vehicle traffic on open Forest Roads and unauthorized routes in the Holcomb Valley (Holcomb Valley, Arrastre Flats pebble plain complexes), unauthorized user-created roads and trails in the Baldwin Lake area (Sawmill, North Baldwin Lake, and South Baldwin Ridge/Erwin Lake pebble plain complexes), and open Forest Roads and unauthorized routes (especially trails) in the Sugarloaf–Onyx area (Sugarloaf Ridge, Broom Flat pebble plain complexes) (USFS 2012b, pp. 61, 69–72, 77–78, 82–85). For additional description of OHV impacts at specific pebble plains, see Appendix 2.

Given these assessments, we believe that OHV and other recreational activities are important threats that need to be addressed for the continued survival and recovery of *Eremogone ursina*. However, 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 *E. ursina* and other federally listed or sensitive plants occur (USFS 2012b, p. 24).

Summary

A recent summary of potential effects of roads and trails to San Bernardino Mountain plant species, including federally listed species such as *Eremogone ursina*, indicates that these threats continue to affect the taxon and its critical habitat (USFS 2012b). 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 all 10 pebble plain complexes that support *E. ursina*.

Alteration of Hydrology

The listing rule identified alteration of hydrological conditions as a threat to *Eremogone ursina* 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 OHV activities and direct and indirect impacts from urbanization (USFS 2002, p. 25). As discussed above, vehicle traffic within pebble plains habitats during the wet season is of particular concern because this activity creates deep ruts that change hydrological patterns within pebble plains. Alteration of hydrology can also result from land disturbance due to mining and fire suppression activities, which are discussed as separate threats to *E. ursina* below.

Normally, surface water flows evenly across the relatively impervious pebble plains (Odell 1988, p. 19). However, changes in the hydrological pattern associated with a disturbed pebble plain could alter the soil composition by allowing for 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 could theoretically result in invasion of both native and nonnative plant species that then out-compete *Eremogone ursina* for space and resources. Once established, native trees and shrubs alter the surrounding microhabitat by shading, increasing leaf litter, and probably by reducing temperature extremes (Derby 1979, pp. 72–73; USFS 2002, p. 15). Threats from nonnative plant species are discussed further under Nonnative Plants below.

Our listing rule also highlighted activation or installation of wells within lower Holcomb Valley and near Baldwin Lake (Holcomb Valley and North Baldwin Lake pebble plain complexes) as a potential threat to pebble plains habitat through the alteration of hydrology in these areas (USFWS 1998, p. 49014). However, the USFS acquired privately owned property at the North Baldwin Lake complex since listing; thus, activation or installation 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; any future activation would be subject to the requirements of the National Environmental Policy Act (discussed in **FACTOR D** below) (USFS 2002, p. 42).

In summary, we believe alteration of hydrology represents an indirect, but important rangewide threat to *Eremogone ursina* habitat 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 impacts to all 10 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 listing and is not considered an important threat at this time.

Trampling of Habitat

In our listing rule, we described prior moderate-to-heavy degradation of certain sites occupied by *Eremogone ursina* from trampling by cattle and indicated that some pebble plains 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).

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 complex (USFWS 2008, p. 10, citing USFS 2005c). 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 *Eremogone ursina*, due to burro activity is estimated to be very minor and the threat of trampling from cattle no longer exists for *E. ursina* (Eliason 2012b, 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 2012b, pers. comm.)). HMA1 is managed to maintain a small herd of 50 burros on approximately 21,500 ac (8,700 ha) (USFS 2012b, 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 plain 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 2012b, p. 29). Therefore, we believe that the threat of trampling from burros is not a substantial threat to *E. ursina*.

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

In summary, we believe that trampling of habitat by burros and horses is a minor threat to *Eremogone ursina* at 3 of 10 pebble plain complexes.

Nonnative Plants

In our final listing rule, we identified exotic (nonnative) plants as a threat to *Eremogone ursina* 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 *Eremogone ursina* 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 *E. ursina* 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 2012b, 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 *Eremogone ursina* 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. The presence of *B. tectorum* within pebble plain habitat can provide a continuous “flashy” fuel load and the potential to increase the fire return interval (USFS 2005a, p. 101); though it is unclear to what extent fire has affected pebble plain communities, its presence represents an increasing concern for fire management (USFS 2005a, p. 101). *Bromus tectorum*, as well as *Erodium cicutarium* (filaree), represent very old invasions in the San Bernardino Mountains and are persistent threats within these complexes (Eliason 2012b, 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 pepperweed) (Eliason 2012b, pers. comm.).

In general, USFS biologists believe that the threat from nonnative plants does not appear to be significantly expanding (Eliason 2012b, pers. comm.). However, nonnative plants may impact *E. ursina* habitat at 7 of the 10 complexes.

Mining

In our listing rule, we indicated that mining activities had contributed to the decline of *Eremogone ursina* due to effects from habitat destruction, degradation, and fragmentation of pebble plain habitats (USFWS 1998, p. 49013). However, we later described mining as a

secondary threat to habitat degradation in our 2008 5-year review (USFWS 2008, p. 6) based on expected implementation of avoidance measures by the USFS for regulated mining activities (USFWS 2005, p. 235).

USFS 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 USFS orders or closures (USFS 2005b, Vol. 1, p. 294). The USFS 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 2005b, Vol. 1, p. 294). In addition, withdrawals do not guarantee that mining will not occur since USFS lands are subject to valid existing rights at the time of a withdrawal (USFS 2005b, Vol. 1, p. 294). Within the SBNF, 147,430 ac (59,663 ha) have been withdrawn from mineral entry as of 2003 (USFS 2005b, Vol. 1, p. 294; Eliason 2014, pers. comm.).

Gold mining in the Holcomb Valley area during the late 1800s greatly affected pebble plains habitat, though the scale of gold mining has been much reduced (USFS 2005b, Vol. 1, p. 107). Small-scale gold mining activities, however, continue to occur in several pebble plain complexes (e.g., Fawnskin, Gold Mountain, and Holcomb Valley; USFS 2005a, pp. 10, 54), and Plans of Operation for mining on the SBNF have the potential to affect pebble plain plant habitat (USFS 2005b, Vol. 1, p. 107). Prospecting has also become more dispersed, and is of concern because of the lack of restrictions governing this activity (USFS 2005b, Vol. 1, p. 107). The USFS 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 2005b, Vol. 1, p. 293). The number of unpatented claims on National Forest System lands changes annually, typically in response to demand; thus the number of claims may have increased with the price of gold within the past decade. The majority of mining claims are owned by individual prospectors, family trusts, or major mining companies (USFS 2005b, Vol. 1, p. 293).

Unpatented mining claims on USFS lands were previously reported for five pebble plain complexes occupied by *Eremogone ursina*: (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 *E. ursina*, specifically, gold prospecting activities or mining operations related to the ownership of mineral rights. Some of these mining activities may fall under the Notice of Intent submission exceptions of 36 CFR § 228.4 (regulations that govern locatable minerals on USFS lands) and are therefore not reviewed by the USFS, which could result in the uprooting, burying, or crushing of meadow plants (USFS 2012b, p. 33). The Holcomb Valley area, which includes 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 2012b, p. 74). Small-scale mining activities around Doble in the North Baldwin Lake pebble plain complex could affect a small portion of occupied habitat (USFS 2012b, p. 80). No effects from minerals management appear to be occurring in the Broom Flat and Fawnskin pebble plain complexes (USFS 2012b, pp. 63, 81).

The level of threat to *Eremogone ursina* 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 impacts three complexes and represent an important localized threat to *E. ursina* 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 *E. ursina* habitat that can result from active claims.

Fire Suppression

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 2005a, 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 2005a, pp. 100–101).

However, activities related to management of fire and fuels can impact *Eremogone ursina* and its habitat. Although not recognized as a threat at the time of listing, fire suppression was known to impact habitat at one pebble plain complex in 2003 (USFWS 2008, p. 7). Fuelbreaks and vegetation treatment units are very rarely located in pebble plain habitat due to the scarcity of fuels (USFS 2005c, p. 212). Fire suppression activities typically include fire line construction, fire retardant and water drops, establishment of temporary fire camps, staging areas, parking sites, safety zones, helipads, and post-fire rehabilitation (USFWS 2005, p. 27). Each of these activities can have negative impacts to *E. ursina* 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. Additionally, 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 reduction projects. Emergency consultations were prepared for impacts due to contingency fuel breaks (dozer lines) that were constructed to fight wildfires in 2006 within the Broom Flat pebble plain complex and in 2003 within the Fawnskin pebble plain complex. 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 from mechanical treatments to known occurrences of *Eremogone ursina* and its designated critical habitat would be avoided through application of design features (USFS 2012c, Appendix C); prescribed fire is not expected to directly affect *E. ursina* due to the sparse fuel conditions typical of pebble plain habitat (USFS 2012c, 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 2012c, p. 57). These effects would be reduced by

application of design features that include prohibiting operations during wet soil conditions (USFS 2012c, p. 57 and Appendix C). Other similar fuels reduction projects projected in the future with possible effects to *E. ursina* 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 2012c, 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 *Eremogone ursina* 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 construction, operation, and maintenance of roads and trails, recreational activities, and threats resulting from mining and fire suppression activities represent current threats to all pebble plain complexes supporting *Eremogone ursina*. Of these threats, the combined effects of road use, maintenance, and development with OHV and other recreational activities represent a widespread threat to *E. ursina*. Urbanization remains an important threat on private lands in the Big Bear Lake and Baldwin Lake areas (within three pebble plain complexes); however, the majority of habitat (78 percent) occurs on USFS lands where conservation measures have been defined and implemented for *E. ursina*. The threat of alteration of hydrological conditions remains a threat for all pebble plain complexes supporting *E. ursina*, primarily from the direct and indirect effects of urbanization and recreational use of roads and trails. The threat of trampling of pebble plain habitat due to burros and horses is of a low level and very localized. The USFS is managing two HMAs in the SBNF to control any future threat from trampling from burros; however, reductions in resources (funding and staff) may affect future management efforts to control burros in these and other areas. The survival and recovery of *E. ursina* 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 *E. ursina* from both patented and unpatented mining claims is still of concern, particularly gold prospecting in the Holcomb Valley and Arrastre Flats pebble plain complexes.

In summary, habitat threats continue to impact *Eremogone ursina* in all pebble plains complexes where it is found (see Appendix 1). However, protective regulatory mechanisms (discussed below in **FACTOR D**) that have changed since listing include a revision of the USFS 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 impacts to *E. ursina* habitat on USFS lands. For example, the North Baldwin-Holcomb Valley Special Interest Area, which includes portions of North Baldwin Lake and Holcomb Valley pebble plain complexes, provides additional management protections from these threats as 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 *Eremogone ursina* 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 *Eremogone ursina*. We do not believe that overutilization for commercial, recreational, scientific, or educational purposes poses a threat to *E. ursina* at this time.

FACTOR C: Disease or Predation

Disease

Disease was not known to be a threat to *Eremogone ursina* at the time of listing (USFWS 1998, p. 49014) or at the time of our 2008 5-year review (USFWS 2008, p. 8). We do not believe that disease poses a current threat to this taxon.

Predation

At the time of listing, predation was not described as a threat to *Eremogone ursina* (USFWS 1998, p. 49014). The 2002 Pebble Plain Management Guide evaluated potential grazing threats to pebble plain vegetation from burros (see **FACTOR A** 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 2012b, pers. comm.). Horses have been reported on private lands (Hitchcock Ranch; approximately 488 ac (197 ha)) in Hitchcock Meadow (Holcomb Valley pebble plain complex). The effect on *Eremogone ursina* from grazing from the reported 30 to 40 horses in this area is unknown.

Summary of Factor C

Disease does not currently pose a threat to *Eremogone ursina*. 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 *Eremogone ursina* 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 *E. ursina* 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, pp. 8–9).

State Regulatory Mechanisms

Eremogone ursina 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 *E. ursina* 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).

Eremogone ursina 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 2010, p. 1). 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 meet the definition of rare or endangered under Section 15380 of CEQA (CDFG 2012, pp. ii, viii). 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 CEQA (CDFG 2012, p. vii).

Although enforcement provisions under CEQA have the potential for providing some level of protection to *Eremogone ursina*, 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 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 *Eremogone ursina*, it does require full evaluation and disclosure of information regarding the effects of contemplated Federal actions on sensitive species and their habitats. Federal agencies may include mitigation measures in the final Environmental Impact Statement as a result of the NEPA process that help to conserve *E. ursina* 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 USFS Organic Act of 1897 (16 U.S.C. § 475–482) established general guidelines for administration of timber on USFS 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 USFS lands to include outdoor recreation, range, watershed, and wildlife and fish purposes. Under general provisions of the USFS Organic Act (16 U.S.C. § 472) and MUSY (16 U.S.C. § 551), the USFS can also designate Special Areas for protection based on their unique or outstanding physical features, environmental values or social significance (USFS 2005b, Vol. 1, p. 13). Special Areas also include administrative designations, such as Research Natural Areas and Special Interest Areas (USFS 2005b, Vol. 1, p. 13).

The North Baldwin-Holcomb Valley Special Interest Area, encompassing North Baldwin Lake and Holcomb Valley pebble plain complexes, was designated for historical, zoological, and botanical values (USFS 2005a, pp. 49, 114). Management objectives for Special Interest Areas are defined by their designation, but compatible uses are retained within a Special Interest Area to the maximum extent possible (USFS 2005b, Vol. 1 p. 13). Program management plans developed for these two Special Interest Areas provide more specific guidance than the larger SBNF Land Management Plan (USFS 2005a, p. 100), which is discussed below under National Forest Management Act.

Within the SBNF, the USFS 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 2005a, pp. 112–114). These areas overlap with 467 ac (188.5 ha) of *Eremogone ursina* occupied habitat (USFS 2005c, p. 214). If designated, these RNAs will fall under Forest Manual Directive 4063, Research Natural Areas, 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 National Forest System (NFS) land management planning rule (planning rule) was recently adopted by the USFS (effective May 9, 2012) (USFS 2012d). 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 (USFS 2012d). 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 (USFS 2012d). A land management plan does not authorize projects or activities, but projects and activities must be consistent with the plan (USFS 2012d, 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 threatened and endangered species...” (USFS 2012d, 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 2012d, pp. 21162–21276), 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 2005a; USFS 2005b). The San Bernardino Land Management Plan contains specific design criteria including place specific standards related to *Eremogone ursina* and pebble plain habitats, which includes avoiding or minimizing new ground disturbing activities that cause long-term damage to pebble plain habitat (Arrowhead, Big Bear, Big Bear Back Country, Desert Rim, and San Geronio Places) (USFS 2005a, 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 2005a, pp. 100–101).

In addition to the 2005 SBNF Land Management Plan, the USFS 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 taxa (USFS 2012b, p. 7). The 2002 Guide provides specific information on pebble plains habitat and the sensitive plants 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).

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 *Eremogone ursina*. 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 2005b, 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 2012b, 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 USFS 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 USFS 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 2005c, p. 256; USFS 2005d, 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. 7). The potential for impacts from fire suppression is also reduced by implementation of U.S. 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 *Eremogone ursina*. 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 for a total of 1,412 ac (571 ha) (USFWS 2007a, pp. 73092–73178), which partially encompasses *E. ursina* within each pebble plain complex.

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 terms of section 7(b)(4) and section 7(o)(2) of the Act, taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of an incidental take statement. Sections 7(b)(4) and 7(o)(2) of the Act generally do not apply to listed plant species because take of plants is not prohibited. However, under the taking prohibitions of section 9 of the Act plants are protected from harm in two particular circumstances. Section 9(a)(2) of the Act prohibits (1) the removal and reduction to possession (i.e., collection) of endangered plants

from lands under Federal jurisdiction, and (2) the removal, cutting, digging, damage, or destruction of endangered plants on any other area in knowing violation of any State law or regulation or in the course of 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.

The Service has an extensive section 7(a)(2) consultation history with the USFS in southern California, including the Mountaintop District of the SBNF. In 2012, the USFS submitted a biological assessment to review the effects of ongoing management activities of SBNF (USFS 2012b). This assessment was 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 2005a). The biological assessment provided updated site-specific information on existing conditions and effects of USFS management within the SBNF for *Eremogone ursina* and other federally listed plants and their critical habitat; it also outlined features to minimize effects to listed species and critical habitat that may result from activities implemented under several USFS management programs (USFS 2012b, p. 5).

On September 30, 2013, the Service completed a Programmatic Biological Opinion for the Revised Land Management Plans for the Four Southern California National Forests, California, in response to the June 8, 2009, decision by the Northern District of California (USFWS 2013, entire). The Programmatic Biological Opinion represented a revision to the biological and conference opinion issued on September 15, 2005 (USFWS 2005, entire) to include an evaluation of critical habitat for several species, including the 2007 designation for *Eremogone ursina* (USFWS 2007a, pp. 73092–73178). In the 2013 biological opinion, we determined that the implementation of the SBNF Plan was not likely to jeopardize the continued existence of *E. ursina* or result in destruction or adverse modification of its designated critical habitat (USFWS 2013, p. 237). We based this determination for the following reasons: (1) restriction of vehicles to designated roads and trails, including the relocation and redirection of several activities, and closure of the Snow Forest Ski Area; (2) implementation of conservation measures to minimize impacts from facilities and other infrastructure, as well as implementation of measures to prevent, control, and eradicate noxious weeds associated with activities in these areas; (3) no appreciable reduction in the reproduction, numbers, or distribution of the taxon on USFS lands or rangewide; and (4) no effect to the functional ability of designated critical habitat to provide conservation and recovery benefits to the taxon (USFWS 2013, p 238).

Summary of Factor D

Existing State regulatory mechanisms do not provide a comprehensive level of protection for ameliorating impacts to *Eremogone ursina* from current threats. There has been some loss of *E. ursina* and its habitat since listing, primarily on private lands. However, Federal regulatory mechanisms have reduced the overall loss and degradation of habitat of *E. ursina* 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 USFS for a proposed action to the species and the preparation of a consultation by the Service to analyze the effects of the action. Therefore, we

believe that the Act continues to remain the primary regulatory mechanism providing for the conservation of *E. ursina*. However, NFMA in conjunction with the requirements of NEPA provides additional 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 2005a), as well as conservation recommendations provided in the Pebble Plain Habitat Management Guide (USFS 2002).

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

At the time of listing, we identified the following **Factor E** threats to *Eremogone ursina*: (1) trampling by livestock; (2) competition with other plant species (i.e., nonnative plants); and (3) habitat fragmentation (USFWS 1998, pp. 49016–49017). These threats are now addressed under **Factor A**. Impacts associated with climate change, a threat not identified at the time of listing, is included here under **Factor E**.

Climate Change

In this section, we consider observed or likely environmental changes resulting from ongoing and projected changes in climate. As 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 2013a, p. 1450). The term “climate change” thus refers to a change in the mean or the variability of relevant properties, which persists for an extended period, typically decades or longer, due to natural conditions (e.g., solar cycles) or human-caused changes in the composition of atmosphere or in land use (IPCC 2013a, p. 1450).

Scientific measurements spanning several decades demonstrate that changes in climate are occurring. In particular, warming of the climate system is unequivocal and many of the observed changes in the last 60 years are unprecedented over decades to millennia (IPCC 2013b, p. 4). The current rate of climate change may be as fast as any extended warming period over the past 65 million years and is projected to accelerate in the next 30 to 80 years (National Research Council 2013, p. 5). Thus, rapid climate change is adding to other sources of extinction pressures, such as land use and invasive species, which will likely place extinction rates in this era among just a handful of the severe biodiversity crises observed in Earth’s geological record (American Association for the Advancement of Sciences (AAAS) 2014, p. 17).

Examples of various other observed and projected changes in climate and associated effects and risks, and the bases for them, are provided for global and regional scales in recent reports issued by the IPCC (2013c, 2014), and similar types of information for the United States and regions within it can be found in the National Climate Assessment (Melillo *et al.* 2014, entire).

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 “extremely likely” (defined by the IPCC as 95 to 100 percent likelihood) due to

the observed increase in greenhouse gas (GHG) concentrations in the atmosphere as a result of human activities, particularly carbon dioxide emissions from fossil fuel use (IPCC 2013b, p. 17 and related citations).

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. Model results yield very similar projections of average global warming until about 2030, and thereafter the magnitude and rate of warming vary through the end of the Century depending on the assumptions about population levels, emissions of GHGs, and other factors that influence climate change. Thus, absent extremely rapid stabilization of GHGs at a global level, 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 human actions regarding GHG emissions (IPCC 2013b, 2014; entire).

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 2013c, 2014; entire) and within the United States (Melillo *et al.* 2014, entire). 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). With regard to our analysis for *Eremogone ursina*, downscaled projections are available. We reviewed predictions from PRBO (2011, pp. 1–2), which summarizes recent regional climate models and relevant information from the literature by ecologically-defined regions, or “ecoregions.” The Southwestern California Ecoregion encompasses the range of *E. ursina*. We also reviewed predictions from other sources, such as Cal-Adapt.

Temperature Changes

According to historical climate data, the San Bernardino Mountains have already experienced a warming trend from 1951 to 2006, with warming more pronounced in higher elevations (PRISM Group 2007, pp. 1–3). We reviewed predictions from Cal-Adapt (<http://cal-adapt.org/>; CEC 2011), where projected changes in annual average temperature across the current range of *Eremogone ursina* are available for the San Bernardino Mountains (areas encompassed by the following U.S. Geological Survey 7.5-minute quadrangle maps: Fawnskin, Big Bear City, Big Bear Lake, Moonridge, and Onyx Peak). Projected future temperatures averaged across the range of *E. ursina* under a low carbon emissions scenario (B1) indicate a 2.2°C (3.9°F) increase in temperature, and a 3.9°C (7°F) increase under a high emissions scenario (A2), between a baseline time period (1961 to 1990) and an end of century period (2070 to 2090) (CEC 2011; S. Love, USFWS, 2013, pers. obs.). High temperature events are expected to become more common in the Southwestern California Ecoregion, and taxa with very narrow temperature tolerance levels may experience thermal stress to the point of direct mortality or diminished reproduction (PRBO 2011, p. 42).

Precipitation Changes

There is a general lack of consensus of the effects of future climate change on precipitation patterns in the Southwestern California Ecoregion. Some models suggest almost no change, whereas others project decreases of up to 37 percent in the ecoregion by 2070 (PRBO 2011, p. 40). Qualitative indicators of changes in concentrated near-surface water vapor (atmospheric rivers) above the Pacific Ocean in current projections suggest flood risks in California from warm-wet storms, commonly known as “pineapple express” storms, may increase beyond those known historically, mostly in the form of occasional “more-extreme-than-historical” storm seasons (Dettinger 2011, p. 522).

Snowpack Changes

High elevation areas will be most severely impacted by temperature and moisture responses (Snyder *et al.* 2004, p. 600). Temperature and precipitation are key factors affecting snowpack, which is the amount of snow that accumulates on the ground. In a warming climate, more precipitation will be expected to fall as rain, not snow, in most areas – reducing the extent and depth of snowpack (USEPA 2012, p. 1). Projected changes in snow water equivalence (amount of water contained in snowpack) across the current range of *Eremogone ursina* are available from Cal-Adapt for the San Bernardino Mountains (same area identified above under Temperature Changes). April snow water equivalence averaged across the range of *E. ursina* under a low carbon emissions scenario (B1) indicate a 80 percent reduction in snow water, and a 91.9 percent reduction in snow water under a high emissions scenario (A2), between a baseline time period (1961 to 1990) and an end of century period (2070 to 2090) (CEC 2011; Love 2013, pers. obs.).

Potential Effects on Eremogone ursina and Habitat

The Big Bear area of the San Bernardino Mountains receives an average of 21.95 in (56 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.

Climate change has already altered, and will continue to alter, the water cycle. Changes in the water cycle, which are consistent with the warming observed over the past several decades, include, but are not limited to: (1) changes in precipitation patterns and intensity; (2) changes in the incidence of drought; (3) widespread melting of snow and ice; (4) increasing evaporation; and (5) changes in soil moisture and runoff (USGCRP 2009, p. 41). Although the effects of climate change on *Eremogone ursina* and its habitat have not been measured and there is uncertainty in future predictions of downscaled climate change models, projected climate change effects mentioned above could significantly alter the hydrology that sustain and characterize pebble plain habitat occupied by *E. ursina*. 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. Although these weather-related erosion events seldom occurred historically, earlier thawing, decreased snowpack, and other changes in precipitation patterns in the future could lead to an increase of these erosion events. Additionally, increased temperatures could reduce the extent of frost heaving, theoretically leading to increased encroachment of native trees and shrubs into pebble plain habitat.

Changes in climate that occur faster than the ability of endangered species to adapt could cause local extinctions (USEPA 1989, p. 153). Many pebble plain plants appear to be adapted to drought conditions, at least in morphological features and ability to survive extended dry periods (Neel and Barrows 1990, p. 10). However, Freas and Murphy (1990, p. 8) reported reproductive failure of four pebble plain plant taxa—including *Eremogone ursina*—and significantly reduced vigor of adult plants in 1989 following several years of drought, particularly in the easternmost (i.e., driest) pebble plains. Thus, an increased number high temperature events due to the effects of climate change could create conditions that exceed the drought tolerance of *E. ursina*, causing direct mortality of individuals and decreased reproduction.

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 *Eremogone ursina* throughout its range.

III. RECOVERY CRITERIA

A recovery plan has not been completed for *Eremogone ursina*.

IV. SYNTHESIS

Based on pre-listing occupancy records, we consider *Eremogone ursina* to have occurred in 10 pebble plain complexes at the time of listing. The distribution of *E. ursina* largely remains the same as the time of listing. We currently have no comprehensive abundance estimate of *E. ursina*. The primary threats identified at the time of listing were associated with habitat loss, fragmentation, and degradation due to urbanization, OHV traffic, nonnative plants, and trampling by livestock. Fuel-wood harvesting, mining activities, and altered hydrological conditions were identified as additional threats within pebble plains habitat occupied by *Eremogone ursina*. 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 OHV and other recreational activities represent the most important rangewide threats to *Eremogone ursina*. Roads and trails can have significant direct and indirect impacts to *E. ursina* 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 habitat. Urbanization, the second most important threat to *Eremogone ursine*, impacts six pebble plain complexes through

encroachment of existing residences and proposed new residences in pebble plain 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 USFS (about 18 percent of mapped *E. ursina* habitat).

Mining activities continue to impact *Eremogone ursina* at three pebble plain complexes within the SBNF, though the level of threat is dependent on the annual activities of claims. Impacts from nonnative plants have largely remained the same since listing throughout the range of *E. ursina*, and the USFS is actively implementing a nonnative plant treatment program. Fire suppression practices represent threats in several pebble plain complexes; however, the USFS 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 *Eremogone ursina* at the time of listing; however, our 2008 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 10 pebble plain complexes supporting *E. ursina*, and the USFS is managing 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 hydrology, is likely an important rangewide threat to the species.

The Act continues to remain the primary regulatory mechanism providing for the conservation of *Eremogone ursina*. However, additional Federal regulatory mechanisms have reduced the overall loss and degradation of habitat of *E. ursina*, since the majority of habitat (78 percent) is located on USFS lands. The Organic Act allowed the Forest Service to designate a Special Interest Area, encompassing North Baldwin Lake and Holcomb Valley pebble plain complexes, within pebble plain habitat that supports *E. ursina*. The USFS Organic Act has also authorized the Forest Service to recommend Research Natural Areas; two of 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 *E. ursina* through the development and implementation of comprehensive land management plans. These measures provide additional protections to *E. ursina* and its habitat where located on lands within the SBNF.

In recognition of the magnitude of the current threats and existing management efforts, we recommend no change in the threatened status of *Eremogone ursina* at this time.

V. RESULTS

Recommended Listing Action:

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

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 *Eremogone ursina* by controlling access to its habitat. Conservation of *E. ursina* 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 *E. ursina* 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 *Eremogone ursina*. Prioritize protective measures being implemented (or planned) for controlling access to areas occupied by *E. ursina*. This should include providing comment on biological assessments for proposed activities to support SBNF program of road closures and/or assistance in securing resources for placement of more effective barriers in the areas that receive the highest recreational uses from motorized vehicles.
- 2) Conserve or preserve *Eremogone ursina* occurrences on private lands. Continue to work with the State and local groups to purchase *E. ursina* habitat from willing sellers, particularly within the Sawmill pebble plain complex.
- 3) Develop a monitoring plan to provide early detection of downward trends in the populations of pebble plain plants, such as *Eremogone ursina*, and quality of pebble plain habitat (adapted from USFS 2005a, 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 OHV trails.

- 4) Evaluate reproductive life history characteristics of *Eremogone ursina*, such as seed germination requirements, mechanism of seed dispersal, and seed viability.
- 5) Determine the distribution of genetic diversity in *Eremogone ursina* occurrences and identify the most appropriate means to preserve the diversity.

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Appendix 1: Pebble plain complexes occupied by *Eremogone ursina* (Bear Valley sandwort); prepared for the 2015 5-year Review.

Pebble Plain Complex ¹	CNDDB Occurrence Number ²	Plant Counts		Status at Listing ³	Current Status	Owner ⁴	Current Threats ⁵
		Highest # Pre-listing (#, Year)	Post-listing (#, Year)				
Arrastre Flats	33	?	?	Extant	Extant	USFS	A: Roads and Trails; Alteration of Hydrology; Nonnative Plants; Mining. E: Climate change.
	41	unk (1981)	?				
Big Bear Lake	8	unk (1978)	May be partially destroyed	Extant	Extant	PVT	A: Urbanization; Roads and Trails; Alteration of Hydrology. E: Climate change.
	9	"hundreds" (1998)	203 (2005); 500 (2010)			USFS	
	10	?	Some colonies extirpated; most degraded			PVT	
	12	unk (1981)	?			PVT	
	13	unk (1978)	?			USFS	
	17	unk (1981)	?			PVT	
	34	?	?			PVT	
	Broom Flat (including Onyx Peak)	1	?			350 (2010)	
2		?	1,030+ (2010)	USFS			

Fawnskin	23	?	possibly extirpated by development	Extant	Extant	PVT	A: Urbanization; Roads and Trails; Alteration of Hydrology; Nonnative Plants; Fire Suppression. E: Climate change.
	51	?	?			USFS	
	52	?	?			PVT/USFS	
Gold Mountain	31	?	?	Extant	Extant	USFS	A: Urbanization; Roads and Trails; Alteration of Hydrology; Nonnative Plants. E: Climate change.
Holcomb Valley	22	?	?	Extant	Extant	PVT/USFS	A: Roads and Trails; Alteration of Hydrology; Mining. E: Climate change.
	24	?	?			PVT/USFS	
	47	?	?			USFS	
	48	?	?			USFS	
	49	-	unk (2009)			USFS	
	50	?	?			USFS	
North Baldwin Lake	29	?		Extant	Extant	PVT/STATE/USFS	A: Urbanization; Roads and Trails; Alteration of Hydrology; Nonnative Plants; Mining. E: Climate change.
Sawmill	4	?	?	Extant	Extant	USFS	A: Urbanization; Roads and Trails; Alteration of Hydrology; Nonnative Plants. E: Climate change.
	6	"vigorous" (1981)	650 (2005)			PVT/USFS	
South Baldwin Ridge/Erwin Lake	30	?	1,000+ (2008)	Extant	Extant	USFS	A: Urbanization; Roads and Trails; Alteration of Hydrology; Trampling of Habitat; Nonnative Plants. E: Climate change.
	38	?	?			PVT/USFS	
	46	unk (1981)	?			USFS	

Sugarloaf Ridge	7	?	"scarce" at peak summit (2008)	Extant	Extant	USFS	<u>A</u> : Roads and Trails; Alteration of Hydrology; Trampling of Habitat; Fire Suppression. <u>E</u> : Climate change.
	43	?	west polygon: 5+ (2008); east: 1,000 (2010)				
	44	-	unk (2008)				
	45	-	?				

Notes:
¹ Name of pebble plain complex defined by USFS.
² Occurrence Number identified in CNDDDB (CNDDDB 2013).
³ Includes complexes not identified in the final listing rule, but considered extant at listing based on pre-listing occupancy records.
⁴ Owner Key: PVT - private; PVT CONS - private conservation; STATE - State; USFS - U.S. Forest Service.
⁵ Current threats to the pebble plain complex segregated by listing threat Factor (see analysis in text).

Appendix 2: Additional information on threat status at *Eremogone ursina* (Bear Valley sandwort) occurrences; prepared for the 2015 5-year Review.

Roads and Trails – Recreational Use of Roads and Trails

Holcomb Valley area

The Holcomb Valley area (Holcomb Valley, Arrastre Flats pebble plain complexes) experiences intensive recreational use, both on USFS lands and private inholdings (USFS 2012b, 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 2012b, p. 69). Even with the blocking in 2010 of more than 60 unauthorized routes in this area, including the use of large boulders (USFS 2012b, p. 69), impacts from this threat are expected to continue into the near future due to budget and staffing constraints (USFS 2012b, pp. 69, 74). Other impacts to *Eremogone ursina* related to effects of recreational activities at private summer camps in the Holcomb Valley are not known (USFS 2012b, p. 74).

Baldwin Lake area

An isolated parcel of SBNF land (northwest portion of Sawmill pebble plain complex) is completely surrounded by private land, and therefore, is challenging to access and manage. The pebble plain habitat in this area—on both SBNF and private land—is being impacted from increased OHV activity. One pebble plain (known as “Deveg/Horseshoe” pebble plain) is denuded from heavy OHV use (Figure 1). However, if the perimeter of the SBNF lands is secured, plants including *Eremogone ursina* on the edge of this pebble plain could recolonize the area. SBNF placed boulders blocking illegal trails to the site, but this proved ineffective as new illegal trails were quickly created around them. New damage to the site in the form of deep ruts occurred in March 2012 while the soil was still wet (Figure 2). Currently, a multi-agency group including SBNF, state and local agencies, private conservation groups, and landowners is meeting regularly to plan protection strategies for the area, and possible acquisition of private land (Eliason 2012c, pers. comm.; BBVET 2012, p. 1).



Figure 1. Heavy Off-Road Vehicle use at the “Deveg/Horseshoe” pebble plain within the Sawmill pebble plain complex (USFWS photo, 2012).



Figure 2. New damage in spring 2012 from Off-Road Vehicle activity at the “Deveg/Horseshoe” pebble plain site (USFWS photo, 2012).

U.S. FISH AND WILDLIFE SERVICE

5-YEAR REVIEW

***Eremogone ursina* (Bear Valley Sandwort)**

Current Classification: Threatened

Recommendation Resulting from the 5-year Review:

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

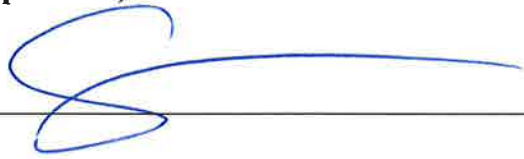
Review Conducted By: Carlsbad Fish and Wildlife Office

FIELD OFFICE APPROVAL:

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

for

Approve _____



Date _____

AUG 14 2015