

Monterey Spineflower
(Chorizanthe pungens var. pungens)

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



Photo by: David Pereksta, U.S. Fish and Wildlife Service

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

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5-YEAR REVIEW
Monterey spineflower (*Chorizanthe pungens* var. *pungens*)

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5-YEAR REVIEW

Monterey spineflower (*Chorizanthe pungens* var. *pungens*)

1. GENERAL INFORMATION

1.1. Reviewers

Lead Regional Office (Region 8): Diane Elam, Deputy Division Chief for Listing, Recovery, and Habitat Conservation Planning, 916-414-6464; and Jenness McBride, Fish and Wildlife Biologist, 916-414-6464

Lead Field Office: Ventura Fish and Wildlife Office: Diane Steeck, Ecologist, 805-644-1766, ext. 318; and Connie Rutherford, Listing and Recovery Coordinator (Plants), 805-644-1766, ext. 306

1.2. Methodology used to complete the review:

This review was conducted by staff in the U.S. Fish and Wildlife Service (Service), Ventura Fish and Wildlife Office, Ventura, California. The review is based on the following: information available in current published and unpublished literature; discussions with other agency biologists; discussions with species experts; information available on the internet; and the Ventura Fish and Wildlife Office species files.

1.3. Background:

1.3.1. FR Notice citation announcing initiation of this review:

The FR notice initiating this review was published on February 14, 2007 (72 FR 7064). This notice opened a 60-day request for information period, which closed on April 16, 2007. No information was received in response to the notice.

1.3.2. Listing history

Original Listing

FR notice: 59 FR 5499

Date listed: February 4, 1994

Entity listed: Subspecies (*Chorizanthe pungens* var. *pungens*)

Classification: Threatened

1.3.3. Associated rulemakings

Critical Habitat

FR notice: 67 FR 37498

Date designated: May 29, 2002

Area designated: 18,830 acres

Revised Critical Habitat

FR notice: 71 FR 75189

Date proposed: December 14, 2006

Area proposed: 11,032 acres

1.3.4. Review History

Since the original listing in 1994, we have developed a recovery plan (Service 1998) and two critical habitat designations for this taxon during which we reviewed its status. This is the first formal 5-year review we have produced that includes an assessment of this variety's listing classification.

1.3.5. Species' Recovery Priority Number at start of 5-year review

15. This number denotes a subspecies facing a low degree of threat and with a high recovery potential.

1.3.6. Recovery Plan or Outline

Name of plan or outline: Recovery Plan for Seven Coastal Plants and the Myrtle's Silverspot Butterfly

Date issued: 1998

Dates of previous revisions: None

2. REVIEW ANALYSIS

2.1. Application of the 1996 Distinct Population Segment (DPS) policy

The Endangered Species Act (Act) defines species as including any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate wildlife. This definition limits listings as distinct population segments (DPS) only to vertebrate species of fish and wildlife. Because the species under review is a plant and the DPS policy is not applicable, the application of the DPS policy to the species listing is not addressed further in this review.

2.2. Recovery Criteria

2.2.1. Does the species have a final, approved recovery plan containing objective, measurable criteria?

Yes

No

2.2.2. Adequacy of recovery criteria.

2.2.2.1. Do the recovery criteria reflect the best available and most up-to-date information on the biology of the species and its habitat?

Yes
 No

The recovery criteria generally reflect the best available information; however, new information on the number of populations in the interior area of Santa Cruz County and the Prunedale Hills are not reflected in the specific delisting criteria (see section 4.0 Recommendations for Future Actions). In addition, genetic analyses are currently underway for this and related *Chorizanthe* taxa in the Monterey Bay area (see Section 2.3.1 Genetics) which could influence recovery criteria in the future.

2.2.2.2. Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria (and note any new information to consider regarding existing or new threats)?

Yes
 No

While the recovery criteria are not explicitly based on the five factors, those factors are generally addressed in the criteria.

2.2.3. List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information. For threats-related recovery criteria, please note which of the 5 listing factors are addressed by that criterion. If any of the 5 listing factors are not relevant to this species, please note that here.

The recovery plan addressing *Chorizanthe pungens* var. *pungens* contains general delisting criteria that apply to all plants in the plan and specific criteria for *Chorizanthe pungens* var. *pungens*. The general delisting criteria state:

Full recovery of these taxa will be achieved when the dune systems they inhabit are secure, with experience to demonstrate that exotic plants and other threats (recreational use, off-road vehicles, etc.) are controlled and managers have demonstrated their ability to keep the threats under control. The taxa need to be secure in their presently-occupied ranges, and opportunities should be taken to introduce these plants to restored habitat in or near historic ranges. To be counted toward recovery, (re)introduced populations should be naturally reproducing in vegetation that also appears to be persisting without excessive maintenance or “gardening.” The area occupied by the plants should increase commensurate with improving habitat conditions. The determination that delisting is possible must be based on at least 15 years of monitoring for the endangered taxa, to include wet and drought years. For some of the species, aspects of demography and population biology must be understood to be assured that populations are likely to persist. The species can be considered for delisting when sites are secure from habitat modification (development), and occupied habitat is stable or improving and free of weed invasion (addresses Factors A, D, and E).

For *Chorizanthe pungens* var. *pungens*, progress has been made on most of these criteria, but they have not been fully achieved. For example, habitat enhancement on State Parks' property is underway, but is not sufficient at other occurrences. The plan's recommendation for 15 years of monitoring is also unlikely to be achieved for *C. p.* var. *pungens* based on current resources being expended on monitoring (see section 4.0 Recommendations for Future Actions).

The delisting criteria specific to *Chorizanthe pungens* var. *pungens* are:

- 1) The Fort Ord disposal and reuse process has led the management agencies to develop, fund, and implement permanent protection plans for the species' habitat including permanent iceplant suppression programs (addresses Factors A, D, and E). This criterion has not yet been met. The Fort Ord Habitat Conservation Plan, which would provide permanent protection and funding for habitat reserve lands that support this taxon on former Fort Ord, is under development, but not yet complete.
- 2) Beach-dune occurrences on State Park and private lands throughout its current range from Santa Cruz to the Monterey Peninsula are covered under a permanent protection plan. Plans at the time of writing to conserve roughly 60 percent of Fort Ord appear sufficient for recovery of the interior occurrence. A reassessment would be made should plans call for conservation of less habitat. Existing management along the coast at the State Parks units needs to be supplemented with protection and management on private lands to be determined after a thorough analysis of the beach populations (addresses Factors A and E). This criterion has not been met, but substantial progress toward it has been made on lands managed by the California Department of Parks and Recreation (State Parks). This criterion should be revised to reflect that interior populations in Santa Cruz County and the Prunedale Hills of Monterey County, in addition to those at former Fort Ord, are important to the recovery of the taxon (see section 4.0 Recommendations for Future Actions).

2.3. Updated Information and Current Species Status

2.3.1. Biology and Habitat

Chorizanthe pungens var. *pungens* is a prostrate annual species in the buckwheat family (Polygonaceae). It has long, somewhat wiry branching stems supporting aggregates of small white to pinkish flowers. Seeds typically germinate after the onset of winter rains and plants can be found above ground as early as December (Fox et al. 2006). Flowering occurs from late March to June, depending on weather patterns, and seed is dispersed in mid-summer.

Distribution and Abundance

Chorizanthe pungens var. *pungens* is currently known to be extant in southern Santa Cruz and northern Monterey Counties. Two historical collections were made farther south, in southern Monterey County near San Lucas (1935) and in northern San Luis Obispo County at San Simeon (1842), but no more recent collections or discoveries from these

areas are listed in the revised taxonomic treatment of *C. p. var. pungens* (Reveal and Hardham 1989) or in the California Natural Diversity Data Base (CNDDDB 2007).

The northernmost population of *Chorizanthe pungens* var. *pungens* is believed to be one near Rodeo Gulch Road in Santa Cruz County. To confirm the identity of this population, it is part of an ongoing genetic analysis (Baron and Brinegar 2007). From Santa Cruz County, the distribution of *C. p. var. pungens* extends south along the Monterey Bay to the Monterey Peninsula. Populations also occur inland in Monterey County in the Prunedale Hills and at Fort Ord. One population has also been located in the Soledad area of the Salinas Valley (Reveal and Hardham 1989, CNDDDB 2007). CNDDDB lists 29 occurrences of *C. p. var. pungens* in that range (CNDDDB 2007).

At the time of listing, *Chorizanthe pungens* var. *pungens* in the Monterey Bay area was known from scattered populations along the immediate coast, in the Prunedale Hills at Manzanita Park, in the coastal and inland areas of Fort Ord, and from historical collections described as east of Watsonville and near Mission Soledad in the Salinas Valley. Since its listing, additional populations of *C. p. var. pungens* have been discovered in the Prunedale Hills of Monterey County and interior areas of Santa Cruz County. However, the recovery criteria (Service 1998) emphasize protecting the species primarily in coastal dunes and the interior at former Fort Ord (see section 2.2 Recovery Criteria).

As an annual species, *Chorizanthe pungens* var. *pungens* responds strongly to annual precipitation patterns and amounts, resulting in large fluctuations in the population of plants visible above-ground from year to year. Many populations support large numbers of individuals (thousands or tens of thousands of plants) scattered in openings among the dominant perennial vegetation (CNDDDB 2007).

Reproduction and Seed Ecology

Chorizanthe pungens var. *pungens* plants produce a maximum of one seed per flower and, depending on the vigor of the plant, produce dozens of seeds per plant (Fox et al. 2006). Seed dispersal in *C. p. var. pungens* is likely facilitated by hooked spines on the structure surrounding the seed. In the *Chorizanthe* genus, these are believed to attach to passing animals and disperse seeds between plant colonies and populations (Reveal 2001). Wind also likely disperses seeds within colonies and populations.

New information concerning the soil seed bank of *Chorizanthe pungens* var. *pungens* was published in 2006 (Fox et al. 2006). This 5-year study found that the density of *C. p. var. pungens* in a population was directly related to the previous year's seed set. Results suggest that *C. p. var. pungens* germinates well under most winter conditions and does not develop an extensive persistent soil seed bank. If this is correct, loss of above-ground individuals prior to seed set could have a greater impact on populations than was previously thought. However, there also exist anecdotal reports of *C. p. var. pungens* reappearing in several areas after habitat restoration efforts removed dense cover of iceplant. Therefore, under some conditions at least, a soil seed bank that persists for several years may be present and substantial enough to repopulate a site.

No studies of the potential breeding system of *Chorizanthe pungens* var. *pungens* have been conducted; however, a pollination ecology study was conducted on the closely related robust spineflower (*Chorizanthe robusta* var. *robusta*), a federally endangered species from Santa Cruz County. Until we obtain taxon-specific data, results of this study should be considered relevant to recovery of *C. p.* var. *pungens*, because these two taxa occur in proximity to each other at several locations (Sunset and Manresa State Beaches), occupy similar plant communities, and are similar genetically (Brinegar 2006).

The pollination study compared the pollination ecology of coastal and inland populations (Murphy 2003). It found that, although *Chorizanthe robusta* var. *robusta* may self-pollinate, pollinator access to flowers significantly increased seed set. A high diversity of potential pollinators, including sweat bees (Halictidae), bumblebees (*Bombus* sp), wasps (Sphecidae), honeybees (*Apis mellifera*), and soft-winged flower beetles (Dasytidae) were found to transport pollen of this taxon. Pollinator diversity was correlated with variation in microhabitat conditions, including exposure; proximity to the coast; and the structure, composition, and density of the surrounding vegetation (Murphy 2003). These results suggest that protecting pollinator habitat and diversity is important to the recovery of the *Chorizanthe* taxa.

Genetics and Taxonomy

Researchers recently investigated the phylogenetic relationships of various members of the genus *Chorizanthe*, subsection *Pungentes*, including *C. pungens* var. *pungens* (Brinegar 2006, Baron and Brinegar 2007, Brinegar and Baron 2008). Results from the first phase of the molecular study, using ribosomal DNA internal transcribed spacer (ITS) sequencing, indicate that *C. p.* var. *pungens* and *C. robusta* var. *robusta* appear to be more closely related to one another than to the other subspecific taxa in the *C. pungens* and *C. robusta* complex. The ITS sequencing could not differentiate *C. pungens* var. *pungens* from *C. robusta* var. *robusta*; chloroplast DNA sequencing of populations found some divergence between coastal populations of *C. pungens* var. *pungens* and *C. robusta* var. *robusta*, but further analysis is needed to determine how this would affect a taxonomic treatment of these taxa.

In a second phase of analysis, researchers sequenced chloroplast DNA to determine if it was possible to further differentiate *Chorizanthe pungens* var. *pungens* from *C. robusta* var. *robusta* based on these genetic techniques. The results of this genetic analysis indicated that: 1) there is a general agreement between the results of the ITS sequencing and the DNA phylogenies for the *C. pungens*/*C. robusta* complex, while results for the other *Pungentes* taxa are often inconsistent with their position in the ITS-based phylogeny; 2) there is a general biogeographical pattern to this phylogeny with regard to the *C. pungens*/*C. robusta* complex; and 3) there is genetic diversity between populations of *C. pungens* var. *pungens*. While the researchers suggest that a taxonomic revision of the *Pungentes* complex may be in order, no changes are being proposed at this time (Baron in litt. 2008).

Habitat Characteristics

Chorizanthe pungens var. *pungens* readily grows where suitable sandy substrates occur and, like other *Chorizanthe* species, where competition with other plant species is

minimal (Harding Lawson Associates 2000; Reveal 2001). Studies of the soil requirements and shade tolerances of a related taxon, Scotts Valley spineflower (*C. p. var. hartwegiana*), concluded that this taxon is restricted to openings in sandy soils primarily due to its intolerance of shade produced by competing vegetation, rather than its restriction to the specific soil type (McGraw and Levin 1998).

Where *Chorizanthe pungens* var. *pungens* occurs within native plant communities, along the coast as well as at more interior sites, it occupies microhabitats found between shrubs where there is little cover from other herbaceous species. In coastal dune scrub, shifts in habitat composition caused by patterns of dune mobilization that create openings suitable for *C. p. var. pungens* are followed by stabilization and successional trends that result in increased vegetation cover over time (Barbour and Johnson 1988). Accordingly, over time there are shifts in the distribution and size of individual colonies of *C. p. var. pungens* found in the gaps between shrub vegetation.

Human-caused disturbances, such as scraping of roads and firebreaks, can reduce the competition from other herbaceous species and consequently provide favorable conditions for *Chorizanthe pungens* var. *pungens*, as long as competition from other plant species remains minimal. This has been observed at former Fort Ord where *C. p. var. pungens* occurs along the margins of dirt roads and trails and where it has colonized disturbances created by military training (U.S. Army Corps of Engineers (ACOE) 1992, U.S. BLM 2003). However, such activities also promote the spread and establishment of non-native species, can bury the seedbank of *C. p. var. pungens*, and do not result in the cycling of nutrients and soil microbial changes that are associated with some large-scale natural disturbances, such as fires (Stylinski and Allen 1999, Keeley and Keeley 1989).

2.3.2. Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)

2.3.2.1. Present or threatened destruction, modification or curtailment of its habitat or range:

At the time of listing in 1994, the final rule (59 FR 5499) identified the following threats to *Chorizanthe pungens* var. *pungens* habitat: industrial and residential development, recreational use, dune stabilization due to introduction of nonnative species, and road realignment or construction. The final rule also noted that much of this taxon's sandy open habitat in the Salinas Valley had been lost due to conversion of lands for agricultural crops. These threats are discussed below.

Development for residential, commercial and industrial uses.

Conversion of lands for urban development continues in the Monterey Bay area. Development projects have been proposed or approved in the last 5 years that would remove or fragment habitat of *Chorizanthe pungens* var. *pungens* in the Prunedale Hills (e.g., the Prunedale Improvement Project, Pesante Canyon developments), coastal region (e.g., at Armstrong Ranch, Monterey Airport), and on the Monterey Peninsula (e.g., at Pebble Beach) (Lowe 2001, Monterey County 2005, California

Department of Transportation (Caltrans) 2005, City of Marina 2007, Rana Creek Habitat Restoration 2007).

Development is also planned within the boundaries of the 28,000-acre former Fort Ord military base in Monterey County. On former Fort Ord, *Chorizanthe pungens* var. *pungens* is found in maritime chaparral, coastal sage scrub, and in openings in oak woodland. It occurs on parcels designated for development and habitat reserve, as well as in the margins of areas to be redeveloped. Under the closure and reuse plan for the former base (ACOE 1996) and the draft Fort Ord habitat conservation plan (HCP), approximately 6,000 acres of primarily sandy habitats will be developed and approximately 4,000 acres redeveloped. Approximately 18,000 acres of former Fort Ord will be set aside as habitat reserve and transferred to the Bureau of Land Management (BLM), the University of California Natural Reserve System, State Parks, and other entities. Within former Fort Ord, particularly dense populations of *C. p.* var. *pungens* occur at the University of California's Fort Ord Natural Reserve (FONR), while populations are more sparse and scattered to the south and east, on BLM lands and on lands still retained by the U.S. Department of the Army (Army). Former Fort Ord is one of the few locations large enough to support landscape level management actions (e.g., prescribed burns) in maritime chaparral communities. The draft HCP for former Fort Ord includes actions to maintain appropriate habitat for *C. p.* var. *pungens*, although it is not yet complete.

Recreation

Chorizanthe pungens var. *pungens* requires open sandy habitat in which to grow, so it consequently colonizes openings along roads and trails and may colonize trail beds, if use is infrequent. In at least one State Park site, at Sunset State Beach where recreational use was previously heavy, new barriers have been introduced to funnel recreational traffic and allow *C. p.* var. *pungens* to expand into the area from nearby occurrences (State Parks 2006a). Grading of trails (e.g., at former Fort Ord) may also diminish populations. However on Fort Ord Public Lands, BLM hopes to maintain adequate open space along the margins of trails and thereby retain trail use by people and continued occupancy by *C. p.* var. *pungens* along trail margins (BLM 2003). It appears that light recreational use, such as foot traffic, maintains more open habitat suitable for *C. p.* var. *pungens*, but excludes the taxon where traffic is frequent during the growing season.

Dune stabilization

The effects of nonnative species, many of which were originally introduced to stabilize dunes, are discussed further under section 2.3.2.5.

Land Ownership

The dune scrub habitat of *Chorizanthe pungens* var. *pungens* is protected from development at numerous coastal locations. In Santa Cruz County, populations occur at Sunset State Beach and Manresa State Beach. In Monterey County, coastal populations occur along the Monterey Bay on preserved lands at Zmudowski, Moss Landing, Salinas River, Marina, Monterey, and Asilomar State Beaches, the latter of

which is on the Monterey Peninsula near the southern end of this taxon's extant range (Moss 2000, State Parks 2006b, CNDDDB 2007). The interior occurrences in Santa Cruz County (e.g., Freedom Boulevard and Bel Mar areas (Service 2002: 67 FR 37498)), which are not discussed in the specific recovery criteria above, are not secure from development. In northern Monterey County in the Prunedale Hills, populations occur on easements owned by Pacific Gas and Electric, on private lands, on lands owned or managed by conservation-oriented organizations such as the Elkhorn Slough Foundation, at a County Park, and on State lands managed by the California Department of Transportation (Caltrans). The eventual use of the Caltrans land has not been determined (Siepel pers. comm. 2004; Robison 2006). *Chorizanthe pungens* var. *pungens* also occurs at numerous places on former Fort Ord, a closed military base and Superfund site that is being cleaned and planned for reuse. The population in a river dune near Soledad is privately owned and represents the southernmost interior population known to be extant.

Summary of Habitat Threats

In summary, development continues to adversely affect occurrences of *Chorizanthe pungens* var. *pungens*, but more occurrences are known than at the time of listing, so the severity of this threat has not increased. We believe the threat from recreation has decreased, due to land managing agencies more closely managing recreation on coastal dune areas and due to the increased dune habitat available as a result of nonnative invasive species removal.

2.3.2.2. Overutilization for commercial, recreational, scientific, or educational purposes:

Overutilization was not identified as a threat at the time of listing, and is not currently considered a threat.

2.3.2.3. Disease or predation:

Disease and predation were not identified as threats at the time of listing, and are not currently considered a threat.

2.3.2.4. Inadequacy of existing regulatory mechanisms:

The final rule discusses the California Endangered Species Act (CESA) and the California Environmental Quality Act (CEQA). *Chorizanthe pungens* var. *pungens* has not been state listed; therefore, the CESA does not afford it protection. The final rule cites examples of how other *Chorizanthe* species have been addressed in environmental compliance documents, under CEQA, in a manner that is insufficient to stop declining trends (59 FR 5499). The Federal listing of *C. p.* var. *pungens* appears to have afforded it more consideration under CEQA. Proposed residential, commercial, and transportation projects now typically include some type of mitigation for this taxon when adverse effects are anticipated. These include avoidance or attempts to establish new populations of the taxon elsewhere. However, there is little site specific follow-up to evaluate the effectiveness of these mitigation activities over the long-term.

2.3.2.5. Other natural or manmade factors affecting its continued existence:

The final rule identifies competition from invasive nonnative species, such as the iceplants (sea-fig) (*Carpobrotus edulis*, *Mesembryanthemum crystallinum*), and European beach grass (*Ammophila arenaria*), as a threat to this taxon (59 FR 5499). These species are particularly adept at colonizing dune sands and several of them have been used in California to promote dune stabilizations (Albert 2000). Invasive nonnative species remain a threat to *Chorizanthe pungens* var. *pungens*. In addition to the species noted in the final rule, others that have invaded maritime chaparral and coastal sage scrub where *C. p.* var. *pungens* occurs include jubata grass (*Cortaderia jubata*), French broom (*Genista monspessulana*), and invasive annual grasses of European origin, such as wild oats (*Avena* sp.), soft chess (*Bromus hordeaceus*), and ripgut brome (*Bromus diandrus*) (BLM 2003, Parsons 2004, Fusari and McStay 2007). These latter species are typically able to colonize disturbed sites with more well-developed soils than occur on dunes.

In addition to the direct effects that invasive, non-native plant species may have on *Chorizanthe pungens* var. *pungens*, *Chorizanthe* species may be indirectly affected by these species via diminished pollinator visitation. Many of the hymenopteran pollinators important to *Chorizanthe* pollination (e.g., sphecid wasps, bumblebees, and bees from the families Halictidae and Anthophoridae), require bare ground for nesting (Murphy 2003).

Although invasive nonnative species continue to occupy and invade *Chorizanthe pungens* var. *pungens* habitat, State Parks, the BLM, the Army at former Fort Ord, and other landowners have active programs to control and eradicate them. At Marina State Beach, State Parks has been removing nonnative iceplant and restoring native dune vegetation for over a decade. In 2002, the Service and State Parks cooperatively funded a restoration of coastal dune scrub at Marina State Beach that involved removing nonnative iceplant, conserving existing populations of listed species and replanting *C. p.* var. *pungens* along with other native species (State Parks 2006c). Similarly, at Sunset Beach, State Parks has removed European beach grass using prescribed fire, hand removal, and herbicides, which is allowing *C. p.* var. *pungens* and other native species to recolonize the site (State Parks 2006a). Further south on the coast, the Naval Post Graduate School has found that *C. p.* var. *pungens* was able to recolonize newly available dune openings created through nonnative species eradication programs (Kreiberg 1999).

Overall, active coastal dune enhancement on protected lands (e.g., State Parks) appears to be increasing the amount of land available for *Chorizanthe pungens* var. *pungens* to occupy, beyond that available at the time of listing. Ensuring continued maintenance of the open habitat is an important future goal. However, at inland sites, the amount of land area covered by nonnative plant species appears currently greater than the resources available for restoration and continued site maintenance. BLM has identified over 30 nonnative species they are tracking and targeting for abatement on former Fort Ord and many more than that exist on the former base in maritime chaparral and coastal sage scrub habitats where this species occurs (BLM 2003). The

encroachment of invasive nonnative plant species, particularly European annual grasses, into openings in maritime chaparral vegetation where *C. p. var. pungens* occurs is a continuing problem on the Fort Ord Natural Reserve, one of the largest concentrations of this taxon within its inland range (Fusari and McStay 2007).

Climate Change

Current climate change predictions for terrestrial areas in the northern hemisphere indicate warmer air temperatures, more intense precipitation events, and increased summer continental drying (Field et al. 1999, Cayan et al. 2005, IPCC 2007).

Recently, the potential impacts of climate change on the flora of California were discussed by Loarie et al. (2008). Based on modeling, they predicted that species' distributions will shift in response to climate change and that the species will "move" to higher elevations and northward, depending on the ability of each species to do so. Increases in species diversity in these higher elevations and northern locations due to climate change have the potential to result "...in new species mixes, with consequent novel patterns of competition and other biotic interactions..." with unknown consequences to the species which currently exist there (Loarie et al. 2008). In addition, an increase in the rate of sea level rise has been predicted for the coast of California (California Coastal Commission (CCC) 2001, California Climate Change Center 2006). In particular, beaches along the coast will be subject to greater and more frequent wave attack, resulting in erosion and shoreline retreat (CCC 2001). The extent to which such events are caused by climate change and the extent to which it could affect *Chorizanthe pungens* var. *pungens* are unknown at this time.

2.4. Synthesis

Since the time of listing in 1994, new information indicates that *Chorizanthe pungens* var. *pungens* occurs in more locations within southern Santa Cruz and Monterey Counties than was previously thought. *Chorizanthe pungens* var. *pungens* appears to be well distributed within the coastal portions of its range and able to colonize disturbed sites where sandy soils are present as long as a seed source is present, and as long as both native and nonnative invasive species do not become abundant.

The primary threats identified at the time of listing were development for human uses, recreation, and encroachment of invasive nonnative species into its habitat. While these are still occurring and diminishing *Chorizanthe pungens* var. *pungens* occurrences, other lands that support this taxon have been purchased by conservation-oriented organizations and are preserved (e.g., Long Valley in the Prunedale Hills) or have the potential for long-term preservation (e.g., Caltrans lands). Within its range, numerous occurrences are on lands being restored or enhanced (e.g., State Beaches, Naval Post-Graduate School) or are planned for restoration and enhancement (e.g., former Fort Ord). A primary component of these programs is the removal of nonnative invasive species that compete with *C. p. var. pungens*. *Chorizanthe pungens* var. *pungens* appears able to recolonize sites where nonnative species have been removed.

The results of genetic analyses are not yet complete. They should provide more information on the genetic variability within the taxon and may prompt a revised taxonomic treatment of this and closely related *Chorizanthe* taxa in the Monterey Bay area.

We believe that *Chorizanthe pungens* var. *pungens* still meets the definition of a threatened species. We conclude this is an appropriate designation for several reasons. First, although this taxon is doing well at the coast, few occurrences in inland Santa Cruz and northern Monterey Counties are on protected lands with adequate management. The delisting criteria in the recovery plan appropriately recommend that populations be secure throughout the range of the taxon. This is a common principle of conservation biology to preserve the genetic variability within a taxon and provide the best chance of it surviving in changing environments in the future. In this case, genetic analyses may be able to provide more information on the location of genetic variability within the taxon in the near future. Second, because *C. p.* var. *pungens* is particularly vulnerable to competition with nonnative plant species, and because so many nonnative plant species have invaded coastal habitats in the Monterey Bay area, an ongoing ability and commitment to maintain open habitat for *C. p.* var. *pungens* should be evident prior to delisting. This could be in the form of a set of management plan actions, a finalized HCP, or a policy that addresses habitat for sensitive species. Third, given that the preliminary molecular data do not match the existing taxonomic treatment, it would be prudent to evaluate final molecular results and any resulting taxonomic revision, before implementing a status change for this taxon.

3. RESULTS

3.1. Recommended Classification

- Downlist to Threatened
- Uplist to Endangered
- Delist (Indicate reasons for delisting per 50 CFR 424.11):
 - Extinction
 - Recovery
 - Original data for classification in error
 - No change is needed

3.2. New Recovery Priority Number

No change is needed.

3.3. Listing and Reclassification Priority Number, if reclassification is recommended

Not applicable.

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

The following recommendations may need to be revised if taxonomic revisions for the *Pungentes* complex are undertaken in the future.

1. The criteria should be revised to identify the importance of having protected populations in the interior north (Santa Cruz) and central (Prunedale Hills) portions of this taxon's range.
2. Encourage the State to establish a permanent protection and management mechanism for the Caltrans managed lands in the Prunedale Hills.
3. Continue to support and partner with organizations, agencies, and individuals to preserve, restore, and enhance lands on which this taxon occurs.
4. Develop a Memorandum of Understanding or coordinate with land managers on other mechanisms (e.g., a set of management actions within a management plan) that would meet the recovery criterion of ensuring adequate management (primarily control of nonnative species and maintaining openings in native vegetation) on lands that support *Chorizanthe pungens* var. *pungens*.
5. The current recovery criteria call for 15 years of monitoring. Coordinate with land managers to determine the most efficient means to implement and document adequate monitoring to ensure that the general trend or persistence of the populations is being tracked. Focus surveys and monitoring in years of high rainfall when the extent of its distribution is most likely to be apparent.

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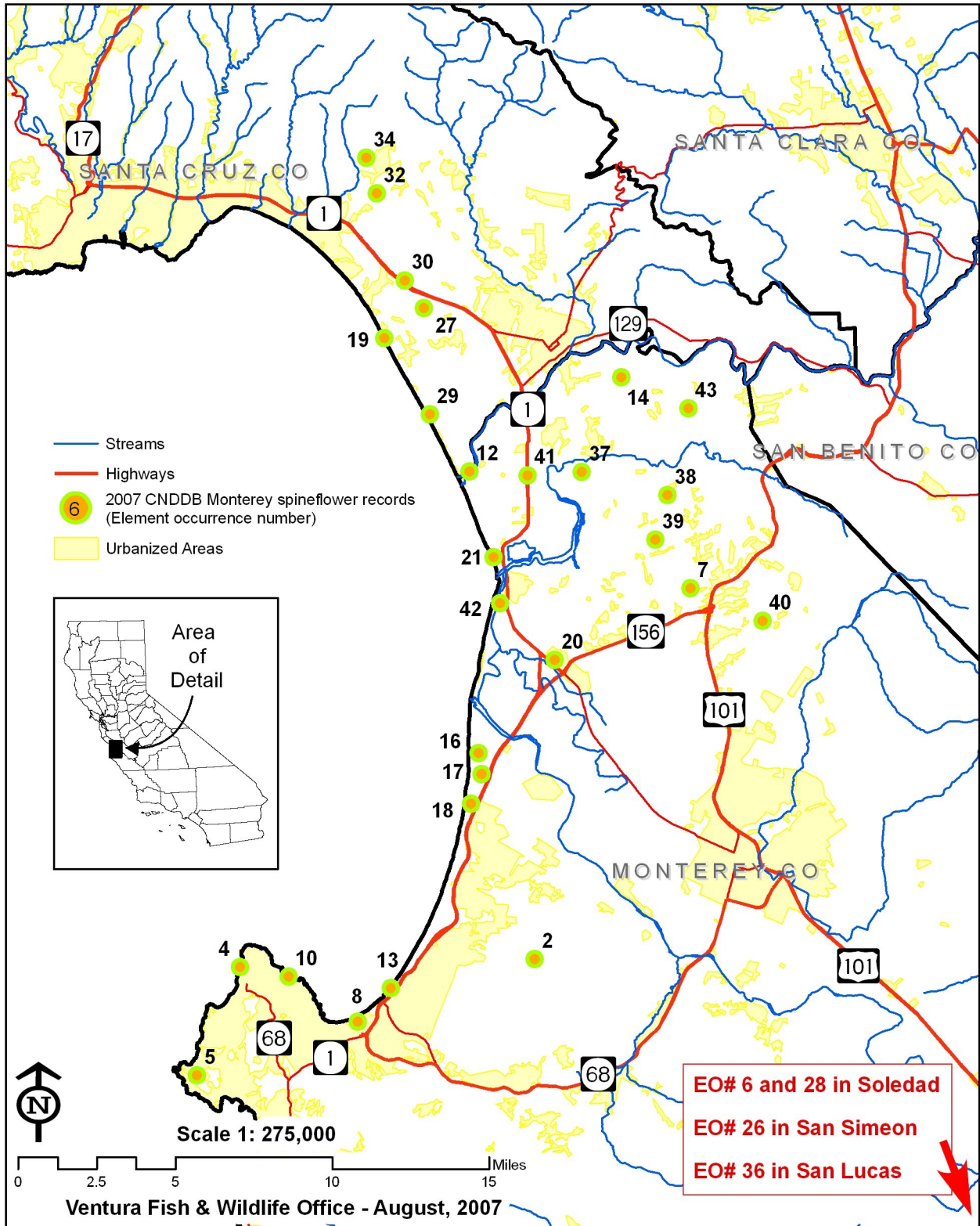
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Occurrence Records for Monterey Spineflower (*Chorizanthe pungens* var. *pungens*) Santa Cruz, Monterey Counties, California



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

Monterey spineflower (*Chorizanthe pungens* var. *pungens*)

Current Classification: Threatened

Recommendation resulting from the 5-Year Review:

- Downlist to Threatened
 Uplist to Endangered
 Delist
 No change needed

Appropriate Listing/Reclassification Priority Number: NA

Review Conducted By: Diane Steeck

FIELD OFFICE APPROVAL:

Field Supervisor, Fish and Wildlife Service

Approve Diane K. Wade Date 1/14/09

REGIONAL OFFICE APPROVAL:

Assistant Regional Director, Fish and Wildlife Service

Approve Mill F. ... Date 2-4-09