

Deinandra increscens ssp. *villosa*
(Gaviota tarplant)

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



Photos by Mark A. Elvin, USFWS, 2010

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

August 2011

5-YEAR REVIEW

Deinandra increscens ssp. *villosa* (Gaviota tarplant)

I. GENERAL INFORMATION

Purpose of 5-Year Review:

The U.S. Fish and Wildlife Service (Service) is required by section 4(c)(2) of the Endangered Species Act (Act) to conduct a status review of each listed species at least once every 5 years. The purpose of a 5-year review is to evaluate whether or not the species' status has changed since it was listed (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:

Deinandra increscens ssp. *villosa* [*Hemizonia increscens* ssp. *villosa*] (Gaviota tarplant) is an annual plant in the sunflower family (Asteraceae). The species is endemic to the mainland portion of Santa Barbara County, California. The circumscription for this species has changed several times since it was first described in 1982 (Tanowitz 1982). Historically, *Deinandra increscens* ssp. *villosa* was originally known only from the immediate vicinity of the unincorporated town of Gaviota, with plants occurring up to several kilometers in either direction along the immediate coast. Currently, it has a highly localized distribution in western Santa Barbara County, California with seven main populations that range from the vicinity of Point Sal in the north to Gaviota in the south.

Methodology Used to Complete the Review:

This review was prepared by the Ventura Fish and Wildlife Office, following guidance issued by Region 8 in March 2008. To update the species' status and threats, we used information from our files, personal communications with experts, survey information from experts who have been reporting various localities of this species, and the California Natural Diversity Database (CNDDDB) maintained by the California Department of Fish and Game. A recovery plan has not been prepared for this species. This 5-year review contains updated information on the species' biology and threats, and an assessment of that information compared to that known at the time of listing. We focus on current threats to the species that are attributable to the Act's five listing factors. The review synthesizes all this information to evaluate the listing status of the species

and provide an indication of its progress towards recovery. Finally, based on this synthesis and the threats identified in the five-factor analysis, we recommend a prioritized list of conservation actions to be completed or initiated within the next 5 years.

Contact Information:

Lead Regional Office: Larry Rabin, Deputy Division Chief for Listing, Recovery, and Environmental Contaminants, Region 8, Pacific Southwest Region; (916) 414-6464.

Lead Field Office: Mark A. Elvin, Fish and Wildlife Biologist, and Connie Rutherford, Listing and Recovery Program Coordinator for Plants; Ventura Fish and Wildlife Office; (805) 644-1766, extension 258 and 306, respectively.

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 (FR) on May 21, 2010 (Service 2010). No information was received in relation to this species.

Listing History:

Original Listing

FR Notice: 65 FR 14888

Date of Final Listing Rule: March 20, 2000

Entity Listed: *Deinandra increscens* ssp. *villosa* [as *Hemizonia increscens* ssp. *villosa*]; a plant subspecies

Classification: Endangered

State Listing

This taxon was listed as endangered by the State of California in 1990.

Associated Rulemakings:

Critical Habitat Designation: November 7, 2002 (67 FR 67968)

Review History: Since the listing rule was published in 2000 and critical habitat was designated in 2002, there have been no formal reviews conducted for *Deinandra increscens* ssp. *villosa*.

Species' Recovery Priority Number at Start of 5-Year Review: The recovery priority number for *Deinandra increscens* ssp. *villosa* is 3, according to the Service's 2010 Recovery Data Call for the Ventura Fish and Wildlife Office, based on a 1-18 ranking system where 1 is the highest-ranked recovery priority and 18 is the lowest (Service 1983). This number indicates that the taxon is a subspecies or variety (as it is currently listed under the Act) that faces a high degree of threat and has a high potential for recovery.

Recovery Plan or Outline: A recovery plan for *Deinandra increscens* ssp. *villosa* has not been prepared.

II. REVIEW ANALYSIS

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

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

Information on the Species and its Status

Species Biology and Life History

Deinandra increscens ssp. *villosa* (Gaviota tarplant) is a self-sterile annual plant in the sunflower family (Asteraceae) (Tanowitz 1982; Keil 1993; B. Baldwin, University of California, Berkeley, Jepson Herbarium, in litt. 2001; Baldwin 2010). It has pale to deep yellow disk and ray flowers. The foliage is variable gray-green and soft hairy. The plants generally range from 12 to 35 inches (30 to 90 centimeters (cm)) tall with stems that generally branch near the base. The lower leaves are 2 to 3.4 inches (5 to 8.6 cm) long. The inflorescence is typically rounded to flat-topped with the flower heads in tight groups or paired. The peduncles are generally shorter than the involucre with mostly 13 ray flowers per head, but can vary between 8 and 15 ray flowers, and generally have 16 to 32 disk flowers per head (but can have as few as 12, represented by (12–) 16 to 32) (Baldwin 2009).

Each flower head of *Deinandra increscens* ssp. *villosa* and other species in the family Asteraceae produce one-seeded fruits called achenes. The achenes of *Deinandra* species are dimorphic (of two forms). The ray flower achenes have a thicker fruit wall and germinate later than disk flower achenes (Tanowitz 1982, Tanowitz et al. 1987). Ray flower achenes in *Deinandra* are three-angled and about 0.08 inch (2 millimeters (mm)) long; the achenes of this genus lack the long set of awns that assist in wind dispersal, as are found in many other members of the sunflower family (Keil 1993). Achenes of *Deinandra* spp. are most likely dispersed by adhesion of the sticky bracts clasping the ray achenes to animal fur or feathers (Baldwin, in litt. 2001). No specific studies have been done on seed viability or seed banks for *D. increscens* ssp. *villosa*, but these types of studies have been done for other closely related tarplant species (e.g., *D. increscens* ssp. *increscens*, *D. conjugens*, *Holocarpha macradenia*). These studies indicate that the ray achenes in most *Deinandra* species and other closely related genera are strongly dormant at maturity, and are likely the basis for a seed bank for *Deinandra increscens* ssp. *villosa*. *Deinandra increscens* disc achenes germinate earlier and in higher percentages than ray achenes, but fewer are produced (Tanowitz et al. 1987; Baldwin, in litt. 2010a, 2010b).

The precise length of time *Deinandra increscens* ssp. *villosa* seed banks remain viable is unknown. During the taxonomic studies of *D. increscens*, it was noted that achene viability can be maintained for several years under lab storage conditions, but in nature the viability of embryos may be shorter or longer (Baldwin 2009; Baldwin, in litt. 2010a). The strong dormancy noted in laboratory work for the ray achenes of *D. increscens* ssp. *villosa* is likely to affect the duration of the seed bank for this species. As seeds are produced by a plant, they are subject to

several potential fates. Seeds may germinate immediately or they may be dispersed to new areas, lost to predation, or stored in a soil seed bank (immediately adjacent to the parent plant or after dispersal to a new area). Seed banks are of critical concern for annual plant species (Satterthwaite et al. 2007, Service 2009a) such as *D. increscens* ssp. *villosa*. Seed banks develop when a plant produces more viable seeds than germinate in any given year, even when conditions are optimal for germination. Seed banks contribute to the long-term persistence of a species by sustaining them through periods when conditions are not conducive to adequate germination (such as when there is not sufficient rainfall for plants to germinate, grow, and produce enough seeds to maintain the population at the same size from year to year) and the subsequent reproduction and replenishment of the seed bank (Rees and Long 1992, Adams et al. 2005, Satterthwaite et al. 2007). Annual differences in the numbers and location of standing plants are indicative of the presence of a seed bank. Considerable differences in the number of standing plants have been reported for locations supporting *D. increscens* ssp. *villosa* (see Table 1 and additional discussion below in the Abundance and Population Trends section) indicating that *D. increscens* ssp. *villosa* is a species that generates seed banks. Based on the information we have for *D. increscens* ssp. *villosa* (i.e., achene dormancy, self-incompatibility, fluctuating population numbers), similar information for other closely related tarplants (e.g., *D. conjugens*, *Holocarpha macradenia*), and other seed bank studies (Rees and Long 1992, Adams et al. 2005, Satterthwaite et al. 2007, Service 2009a); *D. increscens* ssp. *villosa* seed banks are likely to be important for its long-term survival.

Distribution

In this document, we use various terms for different assemblages of plants in discussing the status of *Deinandra increscens* ssp. *villosa*. We use the term “occurrence” to be consistent with the definition used by the CNDDDB: an assemblage of plants within 0.25 mile (0.4 kilometer (km)) of each other (CNDDDB 2007). There may be (and occasionally are) one or more discrete grouping of plants within a single “occurrence.” We use the term “population” to refer to a group of interbreeding individuals, in the biological sense of the word. There may be (and usually are) one or more “occurrences” within any population. The term “location” refers only to a particular site, area, or region, as in “at that location,” with no relation to an assemblage of plants (e.g., polygon, occurrence, population). The terms “site,” “area,” and “region” refer to physical places.

At the time the taxon was first described in 1982, *Deinandra increscens* ssp. *villosa* was known only from marine terraces in the immediate vicinity of Gaviota with plants only known to occur up to “several kilometers” in either direction along the immediate coast (Tanowitz 1982). Then between 2000 and 2002, *D. increscens* ssp. *villosa* was reported at several new locations ranging westward from Gaviota along the coast, in the Santa Ynez Mountains, and at Point Arguello (CNDDDB 2010). After *D. increscens* ssp. *villosa* was reported from these new locations, it was then considered to occur along the coast west to Point Conception and north along the coast to Point Sal, as well as in two areas in the mountains of the western Transverse Ranges: in the Santa Ynez Mountains and the Tranquillion Mountain/Sudden Peak areas. Currently, it is recognized as having a highly localized distribution in western Santa Barbara County, California with seven main populations: Lion’s Head (near Point Sal), Point Arguello, Tranquillion Mountain/Sudden Peak, Point Conception, Hollister Ranch, Santa Ynez Mountains, and Gaviota (CCH 2010; CNDDDB 2010; Baldwin 2009, 2010; Elvin 2007, 2010a, 2010b). See Figure 1 for the current distribution of *Deinandra increscens* ssp. *villosa*.



Figure 1. *Deinandra increscens* ssp. *villosa* distribution and designated critical habitat. The points in this figure represent either herbarium specimens (yellow circles) or CNDDDB occurrences (green triangles) for *D. increscens* ssp. *villosa*.

Changes in Taxonomic Classification or Nomenclature

Deinandra increscens ssp. *villosa* was originally described as *Hemizonia increscens* ssp. *villosa* in 1982 based on a collection from “Gaviota” (Tanowitz 1982). *Deinandra increscens* ssp. *villosa*, the currently recognized name, was originally listed by the Service as endangered under the name *Hemizonia increscens* ssp. *villosa* (Service 2000). In 1999, Dr. Bruce Baldwin revised the treatment for the genera *Hemizonia*, *Madia*, and *Raillardiopsis* to allow for a “revised, practical taxonomy of species in the Madiinae tribe to better reflect their phylogenetic relationships (Baldwin 1999, 2000). Dr. Baldwin’s work retained the circumscription of *D. increscens* ssp. *villosa* as it was recognized at that time. Since that time, *D. increscens* ssp. *villosa* was identified as occurring in a considerably larger area than the immediate vicinity of Gaviota (Service 2002). Recent research studies into the systematics relationships and distribution of species in the *D. increscens* species complex determined that *D. increscens* ssp. *villosa* currently has a larger distribution than at the time of listing (Baldwin 2007, 2009), but not as large as was thought during promulgation of the critical habitat rule (Service 2000, 2002). It is currently listed as *Deinandra increscens* ssp. *villosa* in the online treatment for *Deinandra* as part of the online version of the second edition of The Jepson Manual: Higher Plants of California (Baldwin 2010) and it will be listed as such in the upcoming hard copy version of the second edition of The Jepson Manual: Higher Plants of California (B. Baldwin, University of California, Berkeley, Jepson Herbarium, pers. comm. 2010a). Currently, *Deinandra increscens* ssp. *villosa* is recognized as a subspecies with a larger distribution than was recognized at the time of listing, but smaller than was recognized between approximately 2000 and 2009 (Service 2000, 2009b; Baldwin 2009, 2010).

Genetics

There have been two research projects conducted on this species since the time of listing. Both studies examined the systematics and evolutionary relationships of *Deinandra increscens*, with special attention to *D. increscens* ssp. *villosa* (Baldwin 2007, 2009). Results of the analyses obtained in these studies indicate that both *D. increscens* and *D. paniculata* occur in central California. In addition to populations in interior San Luis Obispo County, at least some interior populations in Santa Barbara County are evidently best treated in *D. paniculata* based on the molecular and morphological results. The genetic and morphological results are consistent with the interpretation that prehistoric gene flow occurred mostly from interior to coastal populations [that is to say from *D. paniculata* to *D. increscens*]. *Deinandra paniculata* usually has 8 rays per head and fewer than 16 disc florets per head. *Deinandra increscens*, as currently revised, includes only coastward populations with variable or high numbers of ray and disc florets per head (i.e., 8–13 (–15) rays and (11–) 13–32 discs). Baldwin (2009) states “*Deinandra increscens* subsp. *villosa* differs from subsp. *increscens* in having more congested and, on average, shorter (generally < 45 cm tall) capitulescences, with phyllaries shorter than associated peduncles and peduncular bracts strongly overlapping the phyllaries (covering $\geq \frac{3}{4}$ of phyllary length), sometimes forming a distinct calyculus. Compared to *D. increscens* subsp. *increscens*, *D. increscens* subsp. *villosa* often has larger heads, which can reach the largest sizes in *D. increscens*, with up to 14 (–15) rays and up to 32 discs per head, but head size overlaps strongly with that of *D. increscens* subsp. *increscens*. *Deinandra increscens* subsp. *villosa* is known only from Santa Barbara County, mostly from the vicinity of Point Conception to Gaviota and north to the northern slopes of the western Santa Ynez Mountains”, with outlying populations at Point Arguello and a northern outlier at Lion’s Head (near Point Sal) (Baldwin 2009; Baldwin, pers. comm. 2010a, pers. comm. 2010b; Elvin 2010b).

Abundance and Population Trends

Currently, *Deinandra increscens* ssp. *villosa* has a total of 26 known occurrences grouped among 7 populations ranging from the coastal terraces on the bluffs at Lion's Head near Point Sal to the mountains of the Western Transverse Ranges, to the coastal terraces on the bluffs at Point Conception and Gaviota (Service 2000, 2002, CNDDDB 2010, CCH 2010; Baldwin 2009, 2010; Elvin 2010a, 2010b). These seven populations are: Lion's Head (near Point Sal), Point Arguello, Tranquillion Mountain/Sudden Peak, Point Conception, Hollister Ranch, Santa Ynez Mountains, and Gaviota (CCH 2010; CNDDDB 2010; Baldwin 2009, 2010; Elvin 2010a). Please refer to Tanowitz 1982; Kiel 1993; Hendrickson et al. 1998; Wilken 1998; Service 2000, 2002; Baldwin 2007, 2009, 2010; CNDDDB (2010); and CNPS 2010 for additional and more in-depth discussions on the historical habitats, distribution, and range of *Deinandra increscens* ssp. *villosa*. At the time of the listing in 2000, *Deinandra increscens* ssp. *villosa* was known only from one scattered population that occurred on a total of about 60 acres (24 hectares (ha)) of habitat (Howald 1989, Service 2000). Since the time of listing, the description of the range of *D. increscens* ssp. *villosa* has varied based on our understanding of the circumscription of this species (Service 1998, 2000, 2001, 2002; Wilken 1998; L. Greene, Acciona Wind Energy USA, LLC., in litt. 2006).

Population trend information is unavailable for most populations. Of the seven populations, the most complete census information is available for the Gaviota population. The number of standing *Deinandra increscens* ssp. *villosa* plants has been shown to vary considerably within any given occurrence from year to year. One occurrence in the Point Conception population has been reported to vary between more than 10,000 standing plants in some years and less than 10 standing plants in other years (CNDDDB 2010, Elvin 2010a). The occurrences at the Gaviota population have contained thousands of standing plants in some years (CNDDDB 2010) and less than 100 standing plants in other years (CNDDDB 2010, Elvin 2010c). Because it is likely that *D. increscens* ssp. *villosa* forms seed banks, it is important to consider location and numbers of seeds in the soil and not only aboveground (standing) plants. An increase in the expression of aboveground plants may deplete seed banks, decrease the ability of the bank to buffer against environmental variability, and decrease its longevity (Satterthwaite et al. 2007); therefore, management of populations for both seed banks and aboveground plants are likely to be important for the long-term survival of this species. Table 1 below contains a summary of population data and trends for currently known populations of *D. increscens* ssp. *villosa*.

Table 1: Population records for *Deinandra increscens* ssp. *villosa* collated from various sources.

Identification Number (CNDDDB unless noted otherwise)	Location Name	Current Status (as per CNDDDB unless otherwise noted ⁴)	Last Observed/ Documented	Pop Size/Year Surveyed ¹	Reference
Lion's Head					
5 (in part)	Northwest of Lion's Head	Presumed extant	2010	Present (1973) Present (1998) Present (2010)	<i>Blakley 7171</i> (SBBG ²), <i>Elvin 6528</i> (JEPS ²), <i>Elvin 6531</i> (JEPS ²), <i>Elvin 6532</i> (JEPS ²), <i>Elvin 6533</i> (JEPS ²), <i>Parikh VAFBPS-1</i> (SBBG ²), CCH 2010, CNDDDB 2010, Elvin 2010b
N/A ³	Lion's Head	Presumed extant ⁴	2010	Present (2010)	<i>Elvin 6526</i> (JEPS ²), <i>Elvin 6527</i> (JEPS ²), Elvin 2010b
N/A ³	End of Casmalia Road	Presumed extant ⁴	2010	Present (2010)	<i>Elvin 6537</i> (JEPS ²), Elvin 2010b
Point Arguello					
19	Space Launch Complex 6	Presumed extant	2010	Present (1999) Present (2010)	<i>Parikh 701</i> (SBBG ²), <i>Parikh 705</i> (SBBG ²), <i>Parikh VAFBPS-6</i> (SBBG ²), <i>Elvin 6512</i> (JEPS ²), CCH 2010, CNDDDB 2010, Elvin 2010b
N/A ³	Boat House	Presumed extant ⁴	2002	Present (1988) >200 (2002)	<i>Hickson s.n.</i> (UCSB ²), CCH 2010
N/A ³	North of Boat House	Presumed extant ⁴	1999	Present (1999)	<i>Parikh VAFBSB-8</i> (SBBG ²), CCH 2010
Tranquillion Mountain/Sudden Peak					
18	Junction of San Miguelito Road and Sudden Road	Presumed extant	2010	>1,000 (1998) Present (2010)	<i>Parikh VAFBSB-2</i> (SBBG ²), <i>Parikh VAFBSB-3</i> (SBBG ²), <i>Parikh VAFBSB-4</i> (SBBG ²), <i>Elvin 6486</i> (JEPS ²), CCH 2010, CNDDDB 2010, Elvin 2010a
24	End of Arguello Road	Presumed extant	2010	<100 (2002) Present (2010)	<i>Elvin 6521</i> (JEPS ²), <i>Elvin 6522</i> (JEPS ²), CNDDDB 2010, Elvin 2010b
25	End of Miguelito Road	Presumed extant	2002	Present (2002)	CNDDDB 2010
26	Near end of Sloan's Canyon	Presumed extant	2002	Present (2002)	CNDDDB 2010
27	1.7 miles ESE of Tranquillion Mountain	Presumed extant	2002	Present (2002)	CNDDDB 2010
28	1.3 miles ESE of Tranquillion Mountain	Presumed extant	2002	Present (2002)	CNDDDB 2010
29	Near head of Cañada del Morida	Presumed extant	2002	Present (2002)	CNDDDB 2010
30	Near head of Cañada del Jolloru	Presumed extant	2002	Present (2002)	CNDDDB 2010

Identification Number (CNDDDB unless noted otherwise)	Location Name	Current Status (as per CNDDDB unless otherwise noted ⁴)	Last Observed/ Documented	Pop Size/Year Surveyed ¹	Reference
Santa Ynez Mountains					
6	Head of Cañada del Agua, Hollister Ranch	Presumed extant	2000	Present (1980) Present (1991) Present (1996) Present (1997) 300 (1998) 200 (2000)	<i>Fletcher 638</i> (UCSB ²), <i>Smith 12284</i> (RSA, SBBG ²), <i>Smith 12717</i> (SBBG ²), <i>Smith s.n.</i> (SBBG 114559 ²), <i>Wilken 15629</i> (SBBG ²), CCH 2010, CNDDDB 2010
Identification Number (CNDDDB unless noted otherwise)	Location Name	Current Status (as per CNDDDB unless otherwise noted ⁴)	Last Observed/ Documented	Pop Size/Year Surveyed ¹	Reference
7	Head of Cañada del Agua, Hollister Ranch	Presumed extant	1998	100 (1998)	<i>Wilken 15628</i> (SBBG ²), CCH 2010, CNDDDB 2010
20	Between Cañada de Santa Anita and Cañada del Agua, Hollister Ranch	Presumed extant	2002	Present (2002)	CNDDDB 2010
Point Conception					
10 (in part)	Government Point	Presumed extant	2010	Present (1989) Present (2001) 10,000 (2002) 6 (2009) Present (2010)	<i>Tierney s.n.</i> (SBBG 89673 ²), <i>Meyer s.n.</i> (SBBG 114126 ²), <i>Dugas s.n.</i> (SBBG 114125 ²), <i>Elvin 6481</i> (JEPS ²), <i>Elvin 6482</i> (JEPS ²), <i>Elvin 6483</i> (JEPS ²), CCH 2010, CNDDDB 2010, Elvin 2010a
12	Point Conception	Presumed extant	2007	Present (2000) 6 (2002) Present (2007)	<i>Elvin 5578</i> (JEPS ²), Elvin 2007, Baldwin 2009, CNDDDB 2010
15	Damsite Canyon, Cojo Ranch	Presumed extant	2002	>200 (2002)	CNDDDB 2010
Hollister Ranch					
8	Mouth of Bulito Creek, Hollister Ranch	Presumed extant	2000	>500 (2000)	<i>Wilken 15839</i> (SBBG ²), CCH 2010, CNDDDB 2010
9	Mouth of Alegria Canyon, Hollister Ranch	Presumed extant	2000	Present (1997) >100 (2000)	<i>Smith s.n.</i> (SBBG 114560 ²), <i>Wilken 15838</i> (SBBG ²), CCH 2010, CNDDDB 2010
21	Cañada de las Panochas, Hollister Ranch	Presumed extant	2002	Present (1980s) Present (2002)	CNDDDB 2010
22	Santa Anita Ranch, Hollister Ranch	Presumed extant	2002	Present (1980s) Present (2002)	CNDDDB 2010

Identification Number (CNDDDB unless noted otherwise)	Location Name	Current Status (as per CNDDDB unless otherwise noted ⁴)	Last Observed/ Documented	Pop Size/Year Surveyed ¹	Reference
Gaviota					
1	West of Mariposa Reiña	Presumed extant	2010	Present (1902) Present (1927) Present (1928) Present (1962) Present (1966) <1,000 (1977) Present (1979) >60 (1984) ~500 (1986) ~150 (1987) ~3,000 (1991 ⁵) ~1,500 (1992) Present (1996) ~1,500 (2003 ⁵) ~1,200 (2005 ⁵) Present (2010)	<i>Elmer 3761 (POM²), Hoffmann s.n. (SBBG 61028²), Hoffmann s.n. (SBBG 61027²), Howe 3326 (SDSU²), Chandler 3151 (SBBG²), Tanowitz 1650 (JEPS, JEPS, NY, UCSB, UCSB, UCSB, UCSB²), Smith 12726 (SBBG²), Elvin 2010c, CCH 2010, CNDDDB 2010</i>
4	East of Mariposa Reiña	Presumed extant	2010	Present (1962) Present (1965) Present (1966) ~300 (1987) Present (1988) ~3,000 (1991 ⁵) Present (1996) Present (1999) ~300 (2002) ~1,500 (2003 ⁵) ~1,200 (2005 ⁵) Present (2010)	<i>Smith 8071 (RSA, SBBG²); Smith 9046 (RSA, SBBG, SD²); Smith 9420 (RSA, SBBG²); Bramlet 1780 (RSA²); Smith 12719 (SBBG²); Parikh 702 (SBBG²); Elvin 2010c; CCH 2010; CNDDDB 2010</i>

CNDDDB identification number = occurrence number assigned by the California Natural Diversity Database (CNDDDB 2010).

¹ Population sizes are pooled and summed when more than one polygon or occurrence is reported for a specific population unless otherwise noted.

² JEPS – Jepson Herbarium at the University of California at Berkeley; NY – New York Botanical Garden; POM – Herbarium of Pomona College at Rancho Santa Ana Botanic Garden; RSA – Herbarium of Rancho Santa Ana Botanic Garden; SBBG – Santa Barbara Botanic Garden Herbarium; SD – San Diego Natural History Museum Herbarium; SDSU – San Diego State University Herbarium; UCSB – University of California Santa Barbara Herbarium.

³ These specimens are beyond the distance generally mapped by CNDDDB and will therefore receive a new CNDDDB Element Occurrence number once the data is processed by the California Department of Fish and Game (CDFG) (CNDDDB 2007).

⁴ The status of these new occurrences have not yet been assigned by CDFG because they have not been entered into the CNDDDB yet.

⁵ The population estimates submitted to CNDDDB for occurrences 1 and 4 contained one estimate for plants in both occurrences in 1991, 2003, and 2005. We split the total number of plants reported for both occurrences between the two occurrences as estimation for this table.

Habitat or Ecosystem Conditions

Throughout its range *Deinandra increscens* ssp. *villosa* is associated with grasslands comprised of native *Nassella* spp. (needlegrass), nonnative species such as *Avena* spp. (wild oats) and

Bromus diandrus (ripgut brome), and other herbs and grasses. The grasslands throughout the range of the species are interspersed with coastal sage scrub generally dominated by *Artemisia californica* (California sagebrush), *Baccharis pilularis* (coyote brush), *Hazardia squarrosa* (sawtooth golden bush), and *Eriogonum fasciculatum* (California buckwheat) (California Natural Diversity Database (CNDDDB) 2010). This species is associated with marine terraces and uplifted marine sediments, ranging from 150 feet (46 meters (m)) in elevation along the lowest terraces to 1,000 feet (305 m) and fractured shales in the Tranquillion Mountain and Sudden Peak area (Hendrickson et al. 1998 Wilken 1998; CNDDDB 2010; U.S. Department of Agriculture, Soil Conservation Service 1972, 1981). This plant occurs mostly on the Conception, Tierra, Maymen, Los Osos, Botella, Gaviota and Milpitas-Positas soil series, which consist of acidic, sandy loam, clay loam, loamy sand, and loam soils; duneland; and rock outcrop complexes (U.S. Department of Agriculture, Soil Conservation Service 1972, 1981; All American Pipeline Company 1995). A subsurface clay layer 1 to 36 inches (2.5 to 90 cm) deep may serve as a reservoir of soil moisture in an area otherwise characterized by summer drought (Howald 1989). However, *D. increscens* ssp. *villosa* consistently occurs where the depth to clay is only 1 to 2 inches (2.5 to 5 cm) (K. Rindlaub, biologist, in litt. 1998).

Species-specific Research and/or Grant-supported Activities

Aside from the genetics research (see discussion in Genetics section above), we are not aware of any other specific studies focusing on this taxon that have been conducted since the time of listing. In fall of 2010, the California Department of Fish and Game was awarded a grant of approximately \$193,000 to study the pollinator relationships in a suite of moths that exclusively use tarplants (in the broad sense), including *Deinandra increscens* ssp. *villosa*, *D. conjugens*, and *Holocarpha macradenia* (Service, in litt. 2010).

Five-Factor Analysis

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

In the final rule to list the species (Service 2000), we stated in the Factor A discussion that threats to its continued existence consisted of (1) habitat fragmentation and alteration of species composition and vegetation structure; (2) reduced distribution resulting from (a) the loss of habitat; (b) the development and alteration of habitat from petroleum extraction, water and petroleum pipeline installation and maintenance, recreational pathways and facilities; and (c) the introduction, invasion, or encroachment by invasive weed species; and (3) additional habitat modifications due to continued energy-related operations, including maintenance activities, hazardous waste cleanup, and other commercial development (Service 2000). In that rule we discussed modification or conversion of habitat (e.g., from invasion of nonnative weeds) under Factor E, but we now include it under Factor A. At the time of listing, *Deinandra increscens* ssp. *villosa* was thought to have an extremely limited natural distribution, which only spanned approximately 2.0 miles (3.2 kilometers (km)) of terraces along the coastal bluffs at Gaviota; however this species is now considered to occur on coastal terraces from Gaviota to Point Sal, 37 miles (60 km) to the northwest, as well as in the Santa Ynez Mountains and western Transverse Ranges. An analysis of these threats is contained in the final rule and remains currently valid; but it should be noted that the current known distribution is much larger than was known at the time of listing and, therefore, those threats identified at the time of listing may not be as severe to

the species as a whole as when it was thought to have a much narrower distribution (see additional discussion regarding this under the (1) Distribution and (2) Abundance and Population Trends sections of this review).

Since the time of listing, threats to the species and its habitat discussed under Factor A continue and in some cases have increased. Threats to the species that were recognized at the time of listing, but have increased include: (1) degradation and loss of habitat due to agriculture and urban development (CNDDDB 2010) and (2) invasion of additional nonnative species of *Eucalyptus* (M. Ritter, California Polytechnic State University, San Luis Obispo, pers. comm. 2010). Threats recognized at the time of listing that have not been alleviated include: (1) habitat fragmentation and alteration of species composition and vegetation structure; (2) reduced distribution resulting from (a) the loss of habitat; (b) the development and alteration of habitat from petroleum extraction, water and petroleum pipeline installation and maintenance, recreational pathways and facilities; and (c) the introduction, invasion, or encroachment by invasive weed species; (3) habitat modifications due to energy-related operations, including maintenance activities, hazardous waste cleanup, and other commercial development; and (4) modification or conversion of habitat (e.g., from invasion of nonnative weeds). Threats that have been recognized since the time of listing include: (1) loss of habitat and indirect effects from wind energy development (CH2M Hill 2007, CNDDDB 2010), (2) loss of habitat due to sea level rise resulting from climate change, and (3) the development and alteration of habitat from mission operations at VAFB (Service 2006, 2007; U.S. Air Force 2008; Baldwin 2009; CNDDDB 2010).

Degradation and Loss of Habitat Due to Agriculture and Urban Development

Since the time of listing, threats to *Deinandra increscens* ssp. *villosa* and its habitat by degradation and loss of habitat have increased due to agriculture and urban development (Service 2000, CNDDDB 2010). Populations on Hollister Ranch, along the coast, and in the Santa Ynez Mountains are affected by trampling from cattle and horses, discing for agricultural practices, and residential development (CNDDDB 2010; M. Meyer, California Department of Fish and Game (CDFG), in litt. 2010a). For instance, CDFG issued an incidental take permit (ITP) for a single family house to be located within an area known to be occupied by *D. increscens* ssp. *villosa* (CDFG ITP permit 2018-2004-042-05) in 2004. Cattle and horses continue to graze in *D. increscens* ssp. *villosa* habitat between Gaviota State Park and Jalama Beach County Park (CNDDDB 2010). Cattle grazing in some areas occupied by *D. increscens* ssp. *villosa* appears to have facilitated the displacement of *D. increscens* ssp. *villosa* and favored the dominance of *D. fasciculata*, (fascicled tarplant) a common native tarplant in other parts of southern California (Rindlaub, in litt. 1998). Approximately 1,000 acres (405 ha) were reported as being disced on Bixby Ranch during the winter of 2010 (E. Turenchalk, Turenchalk Planning Services, pers. comm. 2011). Approximately 200 acres (81 ha) within *Deinandra increscens* ssp. *villosa* critical habitat were documented as disced as of March 2011, of which approximately 47 acres (19 ha) have been documented as occupied by *D. increscens* ssp. *villosa* (Padre and Associates, Inc. 2010; CNDDDB 2010; Santa Barbara County 2011; H. Johnston, California Coastal Commission, in litt. 2011).

Invasion of Additional Nonnative Species of *Eucalyptus*

Nonnative *Eucalyptus* trees were planted in the Gaviota area on adjacent private lands and along Highway 101 as visual screens, windbreaks, and landscaping during the early 1900s and have

continued to spread since then. Several species of *Eucalyptus* are present on various private and public properties in the area. Some species are expanding and increasingly overtaking coastal grasslands and scrub-lands (e.g., *Eucalyptus conferuminata*, *E. globulus*) (Meyer, in litt. 2010a; Ritter, pers. comm. 2010; Ritter, in litt. 2011). Dr. Ritter stated that he believes the *Eucalyptus* spp. in the Gaviota area will expand and overtake the entire Gaviota population if they are not managed and removed (Ritter, pers. comm. 2010; in litt. 2011).

Loss of Habitat and Indirect Effects from Wind Energy Development

The Lompoc Wind Energy Project is a commercial wind energy facility proposed to be constructed and operated on approximately 2,950 acres (1,194 ha) in the Sudden Peak and Tranquillion Mountain area (CH2M Hill 2007). The project is planned to include the following components: 60 to 80 wind turbine generators, new access roads and road improvements, a communication system, meteorological towers, an operations and maintenance facility, onsite electrical collection and distribution lines, an onsite project substation, a new 7.85-mile (12.6-km), 115-kilovolt Pacific Gas and Electric (PG&E) power line to the Lompoc area to interconnect with the PG&E electric grid, and upgrades to existing PG&E facilities in the area. *Deinandra increscens* ssp. *villosa* occurs throughout the central and western portions of the 2,950-acre (1,194-ha) project site and all 791 acres (320 ha) of the Sudden Peak Unit of critical habitat for *D. increscens* ssp. *villosa* occur within the project site (CH2M Hill 2007, Service 2002). This proposed project would likely have direct and indirect effects to occupied *D. increscens* ssp. *villosa* habitat. Effects from this project (direct and indirect) are estimated to include loss or modification of habitat; changes in hydrology; temporary or permanent loss of individuals; changes in vegetation; and an increase in nonnative or invasive species, night-lighting, dust, noise, and vehicle emissions (CH2M Hill 2007). The effects of competition with nonnative species is most problematic immediately adjacent to habitat that has been isolated or fragmented by development (Alberts et al. 1993). The development of wind energy projects in areas occupied by *D. increscens* ssp. *villosa* may also affect individuals or seed banks for this species and are further discussed in Factor E below. This project may include some form of mitigation to compensate for effects to *D. increscens* ssp. *villosa* to comply with the California Environmental Quality Act (CEQA); the project is still in the early stages of planning, but has begun geotechnical testing on the project site. There are additional leases for wind energy development within the range of *D. increscens* ssp. *villosa* (Meyer, in litt. 2011), at the north end of the range near Point Sal and at the south end of the range near Point Conception.

Sea Level Rise Due to Climate Change

Sea level rise, as a result of global climate change, has the potential to alter and diminish the habitat of *Deinandra increscens* ssp. *villosa* because of its proximity to the coastline. At the time of listing *D. increscens* ssp. *villosa*, we did not discuss the potential effects of climate change on its long-term persistence (Service 2000). Current climate change predictions for terrestrial areas in the Northern Hemisphere indicate warmer air temperatures, more intense precipitation events, a rise in sea level, and increased summer continental drying (Field et al. 1999, Cayan et al. 2005, Intergovernmental Panel on Climate Change 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, specifically that the species will "move" or disperse to higher elevations and northward, depending on the ability of each species to do so. Species diversity will also shift in response to these changes with a general trend of increasing diversity shifting towards the coast and northwards with these areas

becoming de facto future refugia. However, predictions of climatic conditions for smaller sub-regions such as California remain uncertain. It is unknown at this time if climate change in California will result in a warmer trend with localized drying, higher precipitation events, or other effects. The specific manner in which climate change could affect *D. increscens* ssp. *villosa* is unknown at this time due to the general nature of these predictions. Because five of the seven populations of *D. increscens* ssp. *villosa* occurrences are on coastal terraces, erosion of these areas and corresponding loss or decreased quality of habitat could adversely affect these populations by causing habitat conversion within and adjacent to occupied habitat areas for this species. Climate change and sea level rise may also affect individuals or seed banks for this species and are further discussed in Factor E below.

Development and Alteration of Habitat from Mission Operations at VAFB

Facility maintenance and development for military and private commercial purposes planned at VAFB may result in loss and alteration of habitat occupied by *Deinandra increscens* ssp. *villosa* (U.S. Air Force 2008). *Deinandra increscens* ssp. *villosa* is known to occur in and around launch sites on VAFB (CNDDDB 2010, Elvin 2010b). The U.S. Air Force conducts vegetation maintenance activities around launch facilities at VAFB to reduce the chance of fires. Additionally, the potential for deposition of exhaust products from launch vehicles could adversely affect *D. increscens* ssp. *villosa* and its habitat. Mission operations (e.g., antiterrorism operations, space launches), infrastructure support activities (e.g., road and utility maintenance), and environmental management programs (e.g., grazing and invasive species removal) may affect *D. increscens* ssp. *villosa* (U.S. Air Force 2008). Missile launch operations, such as adjacent to Space Launch Complex-6, could adversely affect habitats surrounding launch facilities. For example, in 1993 a missile was destroyed shortly after launching at VAFB, and a series of brush fires caused by burning rocket fuel burned more than 400 acres (162 ha). Large fragments of metal blasted downward toward the ground caused physical damage to the habitat on base around the launch site (Wallace 1993). In September 1997, a 500-acre (200-ha) fire and a 1,500-acre (600-ha) fire burned near occupied habitat of *Eriodictyon capitatum* (Los Angeles Times 1997a). Fire containment lines constructed by bulldozers in the vicinity of the species were observed after the fire (J. Watkins, U.S. Fish and Wildlife Service, pers. comm. 1997). On November 1, 1997, a 1,225-acre (495-ha) fire that was accidentally set by an explosives disposal team at VAFB was partially contained by back-burning (Los Angeles Times 1997b). Mission operations may also have direct effects to individual *D. increscens* ssp. *villosa* plants and the seed bank and are further discussed in Factor E below. While mission operations at VAFB may have some adverse effects to *D. increscens* ssp. *villosa* and its habitat, the U.S. Air Force's mission at VAFB is expected to have long-term benefits to *D. increscens* ssp. *villosa* and its habitat because, in order to accomplish its mission at VAFB, the U.S. Air Force needs to maintain extensive tracts of undeveloped and encroachment-free property. These extensive tracts of undeveloped and encroachment-free property will likely allow *D. increscens* ssp. *villosa* to persist.

In summary, threats to *Deinandra increscens* ssp. *villosa* under Factor A that were discussed in the final rule to list the species continue. However, even though these threats remain at one or more populations each, the magnitude of each of these threats is likely to be reduced to the species as a whole because the species is known to have a much larger distribution now than at the time of listing. Many threats to the habitat or range remain at about the same level (e.g., development, recreation, agriculture); some threats have increased in intensity (e.g., invasion of

nonnative species); and additional threats have been identified or have developed since that time (e.g., climate change).

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

In the final rule to list the species (Service 2000), we stated in the Factor B discussion that overutilization was not known to be a threat to this species (i.e., *Deinandra increscens* ssp. *villosa* was not known to be sought after by collectors), but that simply listing a species could attract commercial or scientific interest, both legal and illegal, which could threaten the species through unauthorized and uncontrolled collection. The species was thought to be vulnerable to overutilization because of its limited distribution. Vandalism was also considered to be a threat to this species. An analysis of these threats is contained in the final rule. There are no data to indicate that this is currently a threat.

FACTOR C: Disease or Predation

In the final rule to list the species (Service 2000), we stated in the Factor C discussion that disease was not known to be a threat to the continued existence of *Deinandra increscens* ssp. *villosa*. We stated that approximately 50 percent of the disk and ray achenes of *D. increscens* ssp. *villosa* had been observed to be infested by an unidentified flower beetle (Rindlaub, in litt. 1998). We also stated that cattle grazing has occurred within the habitat of *D. increscens* ssp. *villosa* and that low levels of grazing may enhance the opportunities for it to propagate successfully, as it may serve to reduce competition from nonnative species. However, some evidence indicates that heavy grazing has affected individuals of *D. increscens* ssp. *villosa* by reducing their stature and the number of seeds that can be produced. Populations on Hollister Ranch, along the coast, and in the Santa Ynez Mountains are affected by cattle and horse grazing (CNDDDB 2010; Meyer, in litt. 2010a). VAFB leases grazing allotments that overlap with portions of all three populations on the base, the allotments are managed under a rest and rotation system that minimizes adverse effects and maximizes the reproductive success of populations that are grazed (U.S. Air Force 2008). An analysis of these threats is contained in the final rule and appears to remain currently valid.

Since the time of listing, these threats to *Deinandra increscens* ssp. *villosa* and its habitat have not diminished; however, the current known range of the species is greater than was known at the time of listing; therefore, these threats will not likely affect the species to the degree thought at listing. While this plant appears to be able to withstand some herbivory, herbivory may cause a reduction in its reproductive success due to the loss of flowers and the corresponding reduction in the production of seeds. While we know that these threats occur range-wide for this species, we do not know the extent of these threats throughout its range.

FACTOR D: Inadequacy of Existing Regulatory Mechanisms

In the final rule to list the species (Service 2000), we stated in the Factor D discussion that regulatory mechanisms thought to have some potential to protect *Deinandra increscens* ssp. *villosa* included: (1) listing under the California Endangered Species Act (CESA); and (2) CEQA. The listing rule (Service 2000) provides an analysis of the level of protection that was

anticipated from those regulatory mechanisms. An analysis of these mechanisms and their potential to reduce threats to the species is contained in the final rule and appears to remain currently valid.

State Regulatory Mechanisms

Deinandra increscens ssp. *villosa* was listed as endangered by the State of California in 1990. As such, projects that would affect *D. increscens* ssp. *villosa* are subject to CESA and CEQA requirements. Conservation of listed species through CEQA is dependent upon the discretion of the lead agency involved. To the best of our knowledge, only two projects (the Cojo/Bixby Point Conception Decommissioning project and a proposed house on Parcel 84 within Hollister Ranch) subject to CEQA and CESA have directly impacted this species since it was listed (CDFG 2002, 2004); however, proposed projects that may have been revised to either avoid adverse effects or result in benefits to sensitive species would not necessarily come to our attention.

California Coastal Act

The California Coastal Commission (CCC) considers the presence of listed species in determining environmentally sensitive habitat lands subject to section 30240 of the California Coastal Act of 1976, which requires their protection. Its mission is to protect, conserve, restore, and enhance environmental and human-based resources of the California coast and ocean for environmentally sustainable and prudent use by current and future generations (CCC 2010). Certain local jurisdictions have developed their own Local Coastal Programs (LCP) or Land Use Plans that have been approved by the CCC. The County of Santa Barbara has developed its own LCP (the Santa Barbara County Coastal Plan), which was partially certified by the CCC in March 1981. This species occurs within the area covered by the Santa Barbara County Coastal Plan. Proposed projects that are not exempt and occur within the LCP jurisdiction would need to obtain approval from the County of Santa Barbara. Protection of listed species through the Santa Barbara County Coastal Plan is dependent upon the discretion of the County of Santa Barbara. We are not aware of any specific circumstances where protections have been afforded to *Deinandra increscens* ssp. *villosa* as a result of individual project review by the County or the CCC; however, proposed projects that may have been revised to avoid adverse effects to sensitive species would not necessarily come to our attention. Additionally, State and local regulations may not protect the species from secondary impacts that occur from such threats as development in adjacent areas and the spread of nonnative species.

Federal Regulatory Mechanisms

Federal Endangered Species Act

Section 7(a)(2) of the Endangered Species Act requires Federal agencies to consult with the Service to ensure any project they fund, authorize, or carry out does not jeopardize federally listed species or destroy or adversely modify designated critical habitat. Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take (to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct) of federally endangered wildlife; however, the take prohibition does not apply to plants. Instead, plants are protected from harm in two particular circumstances. Section 9 prohibits (1) the removal and reduction to possession (i.e., collection) of endangered plants from lands under Federal jurisdiction, and (2) the removal, cutting, digging, damage, or destruction of endangered plants on any other area in knowing violation of a State law or regulation or in the course of any violation of a State criminal trespass law. Federally listed plants may be incidentally protected if

they co-occur with federally listed wildlife species.

Sikes Act

The Sikes Act (16 U.S.C. 670) authorizes the Secretary of Defense to develop cooperative plans with the Secretaries of Agriculture and the Interior for natural resources on public lands. The Sikes Act Improvement Act of 1997 requires Department of Defense installations to prepare Integrated Natural Resource Management Plans (INRMPs) that provide for the conservation and rehabilitation of natural resources on military lands consistent with the use of military installations to ensure the readiness of the Armed Forces. INRMPs incorporate, to the maximum extent practicable, ecosystem management principles and provide the landscape necessary to sustain military land uses. While INRMPs are not technically regulatory mechanisms because their implementation is subject to funding availability, they can be an added conservation tool in promoting the recovery of endangered and threatened species on military lands. Vandenberg Air Force Base recently completed an INRMP that includes *Deinandra increscens* ssp. *villosa*. Measures incorporated in this INRMP include vegetation management (i.e., weed removal), the training of personnel to familiarize them with sensitive species, timing control efforts around this species (e.g., grazing, herbicide application), limiting drift of chemicals in and adjacent to *D. increscens* ssp. *villosa* and its habitat, limiting heavy equipment use in and adjacent to *D. increscens* ssp. *villosa* and its habitat, and conducting surveys for *D. increscens* ssp. *villosa*.

Since the time of listing, the Service has conducted 20 interagency consultations pursuant to section 7 of the Act that evaluated adverse effects to *Deinandra increscens* ssp. *villosa* or its designated critical habitat.

For projects without a Federal nexus that would likely result in incidental take of listed wildlife species, the Service may issue incidental take permits to non-Federal applicants pursuant to section 10(a)(1)(B). To qualify for an incidental take permit, applicants must develop, fund, and implement a Service-approved habitat conservation plan (HCP) that details measures to minimize and mitigate the project's adverse impacts to listed species. There has been one completed HCP (a low effect HCP) that includes *Deinandra increscens* ssp. *villosa* as a covered species. The project for this HCP includes geotechnical borings associated with the evaluation of a proposed project site for the Lompoc Wind Energy Project in the Tranquillion Mountain vicinity near Point Conception. The geotechnical borings project would impact 0.52 acre (0.21 ha) of occupied *D. increscens* ssp. *villosa* habitat and proposes to establish a conservation easement on 1.43 acres (0.58 ha) within an area of their lease onsite (Pacific Renewable Energy Generation LLC 2011, Service 2011).

In summary, existing regulatory mechanisms do not appear to have ameliorated threats to *Deinandra increscens* ssp. *villosa* substantially since the time of listing. Other Federal and State regulatory mechanisms (e.g., CEQA, California Coastal Act) have the potential to provide some protections to listed plants, but the protections for the species are discretionary and are based on the current management direction of the implementing agencies.

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

In the final rule to list the species (Service 2000), we stated in the Factor E discussion that there were potential threats to the existence of *Deinandra increscens* ssp. *villosa* from: (1)

displacement by nonnative weeds; (2) altered fire regimes; (3) facility accidents by oil companies; (4) small population sizes; (5) loss of reproductive vigor in small populations; (6) habitat fragmentation (due to residential, commercial, agricultural, and oil and gas development, roads and pathways); (7) herbicides used to control nonnative species; (8) stochastic (i.e., random) extirpation/extinction events (due to the small size and isolation of the species, e.g., naturally occurring events, such as failure to produce viable seed and catastrophic incidents; because of the small population sizes, this species' vulnerability is heightened by natural events, such as drought, flooding, fires, earthquakes, outbreaks of insects or disease, or other catastrophic events, that could destroy a significant percentage of the individuals of this species). An analysis of these threats is contained in the final rule (Service 2000) and appears to remain currently valid except that the known distribution is considerably larger now than at the time of listing, and these threats are likely not as severe to the species as a whole because of the increased number of known plants and populations (see Distribution and Abundance and Population Trends sections above).

Since the time of listing, the extent of some threats discussed in the final rule under Factor E appear to have diminished, some remain the same, and some have increased. Threats from oil extraction activities have decreased. Some facilities have been decommissioned and activities no longer occur at those facilities; therefore, they do not pose a threat to the species (CDFG 2002). Threats recognized at the time of listing that have not diminished include: (1) displacement of plants by nonnative weeds; (2) altered fire regimes; (3) small population sizes; (4) loss of reproductive vigor in small populations; (5) herbicides used to control nonnative species; and (6) stochastic (i.e., random) extirpation/extinction events.

Since the time of listing we have noted the following additional threats under Factor E to *Deinandra increscens* ssp. *villosa*: (1) genetics issues as affected by small population size, (2) displacement caused by the invasion of additional nonnative species of *Eucalyptus* (please see additional discussion in Factor A above), (3) climate change, (4) wind energy projects, (5) crushing of plants resulting from emergency response activities, and (6) loss of and damage to plants from mission operations at VAFB (Elvin 2007; Service 2009b; U.S. Air Force 2008; CNDDDB 2010, Baldwin 2010). Some of these threats also affect the habitat or range of the species and the effects of those threats to the destruction, modification, or curtailment of habitat or range are discussed under Factor A above.

Genetics Issues as Affected by Small Population Size

As previously mentioned in the Species Biology and Life History section, most species in the genus *Deinandra* (including *D. increscens* ssp. *villosa* specifically) are self-incompatible and cannot produce viable seeds without cross pollinating within their respective taxa (Baldwin, in litt. 2001). Gene flow between individuals and populations increases the likelihood of viability by maintaining genetic diversity and is essential for the long-term survival of self-incompatible species (Ellstrand 1992). Evolutionary processes such as mutation, natural selection, genetic migration, and random genetic drift are known to adversely affect small populations (Barrett and Kohn 1991). Adverse effects from these evolutionary processes on self-incompatible species such as *D. increscens* ssp. *villosa* are magnified by its self-incompatibility (Keck 1959; Tanowitz 1982; Baldwin, in litt. 2001). Maintaining gene flow among the populations (and consequently maintaining genetic diversity in each population) is essential to counter the adverse effects from the evolutionary forces mentioned above and to ensure the long-term survival and conservation

of this species. Both theoretical and empirical evidence indicates that smaller populations (those also possessing lower genetic variation) tend to have higher mortality rates and reduced fecundity, which leads to demographic fluctuations (e.g., slower population growth, reduced pollination success and lowered recruitment) (Lande 1988, Les et al. 1991, DeMauro 1993, Heywood 1993, Lacy 1997, Frankham et al. 2002). At the extreme, very small populations suffer from inbreeding depression and the adverse effects of genetic drift (the accumulation of deleterious mutations or fixation of alleles that reduce fitness) (Barrett and Kohn 1991, Les et al. 1991). In plant species exhibiting sporophytic self-incompatibility (a chemical system of self-incompatibility in which secretions of the stigmatic tissue or the transmitting tissue prevent the germination or growth of incompatible pollen, which thereby prevents the production of seeds), such as *D. increscens* ssp. *villosa*, the potential for adverse effects from inbreeding and genetic drift are greater than in species with gametophytic self-incompatibility (a system of self-incompatibility in which the gametes from the same parent plant prevent the formation of a viable zygote after fertilization, or if a zygote forms, then it fails to develop) (Baldwin, in litt. 2001). A reduction in population size, due to demographic or environmental stochasticity or long-term fragmentation of populations, could reduce the pool of S alleles, thereby reducing successful cross-pollination and reproduction (Les et al. 1991, DeMauro 1993).

Climate Change

At the time of listing *Deinandra increscens* ssp. *villosa*, we did not discuss the potential effects of climate change on its long-term persistence (Service 2000). Despite the uncertainty regarding the specific effects of climate change on this species, it is clear that an increase in the rate of sea level rise has been predicted for the coast of California (CCC 2001, California Climate Change Center 2006, Heberger et al. 2009). In particular, beaches and coastal bluffs along the coast will be subject to greater and more frequent wave attack, with a general rule of thumb that 50 to 100 feet (15 to 30 m) of beach width will be lost from use for every foot of sea level rise by the year 2100 with an estimated rise in sea level in Santa Barbara County at 5.28 feet (1.61 m) (CCC 2001, Heberger et al. 2009). Because many *D. increscens* subsp. *villosa* occurrences are on the terraces on coastal bluffs, erosion of these areas caused by an estimated rise in sea level could cause a loss of individual plants and seed banks in five of the seven populations of this species. See Factor A for additional discussions regarding climate change in relation to this species.

Wind Energy Development

As mentioned above under Factor A, the Lompoc Wind Energy Project is a commercial wind energy farm proposed to be constructed and operated on approximately 2,950 acres (1,194 ha) in the Sudden Peak and Tranquillion Mountain area (CH2M Hill 2007). The development of this project, as proposed, will cause the permanent loss of a substantial number of *Deinandra increscens* ssp. *villosa* plants. See Factor A for a more in-depth discussion regarding aspects of this proposed project.

Emergency Response Activities

Many *Deinandra increscens* ssp. *villosa* populations occur on coastal bluffs or open areas in the Santa Ynez Mountains that are associated with grasslands and sparse coastal sage scrub. Many of the known populations of this species grow in and adjacent to large open areas that generally have little vegetation and a flat or level geography that also has easy access from paved roads. These features are attractive to and preferred by emergency response organizations for use as staging areas and command posts during emergency response situations such as wildfires or

other law enforcement actions. Establishing staging areas and or command posts quickly and close to a developing situation is important and the agencies may not have the ability to check resource databases (e.g., CNDDDB) before setting up these posts to conduct their essential operations. Establishing a staging area or command post on *D. increscens* subsp. *villosa* plants would result in the crushing of these plants and seeds. As an example, on July 22, 2010, the Santa Barbara County Sheriff's Office issued a search warrant to access Cañada San Onofré, on the western boundary of the *D. increscens* ssp. *villosa* mitigation bank near Gaviota, to investigate an illegal *Cannabis sativa* (marijuana) cultivation site. At least 20 vehicles, ranging from Sheriff's cars, a U.S. Forest Service truck, Search and Rescue vans, horse trailers, and personal trucks and cars, parked on the occupied habitat of *D. increscens* ssp. *villosa*, which was in full bloom and producing seeds at the time. Meyer estimated that approximately 1.8 acres (0.7 ha) of occupied *D. increscens* ssp. *villosa* habitat were parked on and driven on, which crushed and damaged the plants in that area (Meyer, in litt. 2010b). Each of the populations throughout the range of this species contains these features (e.g., easy access, minimal vegetation, flat), which puts them at risk from these activities.

In summary, most threats under Factor E that were discussed in the final rule to list the species continue and additional threats have been identified or have developed since that time. Some threats discussed in the final rule appear to have diminished (e.g., threats from oil extraction activities) and some appear to remain consistent (e.g., altered fire regimes, habitat fragmentation, stochastic events). Additional threats to *Deinandra increscens* ssp. *villosa* identified since the time of listing include (1) genetic issues as affected by small population size, (2) climate change, (3) wind energy development, and (4) crushing of plants resulting from emergency response activities. Some of the threats in Factor E are range-wide (e.g., genetics, climate change, crushing of plants resulting from emergency response activities) and some are specific to individual populations (e.g., wind energy projects).

III. RECOVERY CRITERIA

Recovery plans provide guidance to the Service, States, and other partners on ways to minimize threats to listed species and on criteria that may be used to determine when recovery is achieved. There are many paths to accomplishing recovery of a species and recovery may be achieved without fully meeting all recovery plan criteria. For example, one or more criteria may have been exceeded while other criteria may not have been accomplished. In that instance, we may determine that, over all, the threats have been minimized sufficiently, and the species is robust enough, to reclassify the species from endangered to threatened or perhaps to delist it. In other cases, new recovery opportunities unknown at the time the recovery plan was finalized may be more appropriate. Likewise, new information may change the extent that criteria need to be met for recognizing recovery of the species. Overall, recovery is a dynamic process requiring adaptive management, and assessing a species' degree of recovery is likewise an adaptive process that may, or may not, fully follow the guidance provided in a recovery plan. We focus our evaluation of the species' status in this 5-year review on progress toward eliminating or reducing the threats discussed in the five-factor analysis. In that context, progress towards fulfilling recovery criteria serves to indicate the extent to which threat factors have been reduced or eliminated.

A recovery plan for *Deinandra increscens* ssp. *villosa* has not yet been developed, and, therefore, recovery criteria have not been established for this species. Recovery actions that either have or will benefit this species are discussed in this 5-year review in the sections entitled Five-Factor Analysis and Recommendations for Actions over the Next Five Years.

IV. SYNTHESIS

The status of *Deinandra increscens* ssp. *villosa* is not as severe as it was considered to be at the time of listing in 2000. The known abundance and distribution of the taxon is now larger than what was understood previously. At the time of listing, this taxon was known from one narrowly distributed population that ranged over a distance of 2 miles (3.2 km). Currently, *D. increscens* ssp. *villosa* is considered to be extant in 7 populations comprising 26 occurrences that are widely distributed over a range of 37 miles (60 km). The increased number of populations and the increase in range of the taxon, compared to what was known at the time of listing, spreads the risk of local extirpations over a larger number of populations, thereby decreasing the risk of extinction to the entire taxon.

While all threats identified at the time of listing do not exist at each population, the sum intensity of those threats remains fairly consistent. Some specific threats have increased in intensity (e.g., degradation and loss of habitat due to agriculture and urban development, invasion of nonnative species) while other specific threats have decreased in intensity (e.g., threats from oil extraction activities). New threats to *Deinandra increscens* ssp. *villosa* have also been identified since the time of listing. Some of these new threats occur at specific sites (e.g., effects from wind energy development, the development and alteration of habitat from mission operations at VAFB, displacement caused by the invasion additional nonnative *Eucalyptus* spp.). Other new threats occur throughout its range (e.g., climate change).

Whether threats were previously identified or new, they vary in our ability to manage for them. Site-specific threats such as the presence of *Eucalyptus* spp. are highly manageable, and successful management using established techniques depends largely on funding available to carry out the task. Pervasive, range wide threats, such as the continuing spread of nonnative herbs and grasses throughout the coastal grasslands where *D. increscens* ssp. *villosa* occurs are challenging to address because techniques have not yet been developed to address this management need on a landscape level. We believe it will be difficult to fully recover this species because many of the threats to it are pervasive, widespread, and difficult to alleviate.

In sum, *Deinandra increscens* ssp. *villosa* continues to face numerous threats which vary in how widespread they occur and how manageable they are. Even so, the risk of extinction to the taxon in the foreseeable future has been slightly reduced since the time of listing, primarily because the risk is spread over a larger range and a larger number of populations than was known at that time. Based on this information, we believe that *Deinandra increscens* ssp. *villosa* faces a moderate degree of threat, but has a low potential for recovery (see discussion under New Recovery Priority Number and Brief Rationale section below). We conclude that presently this taxon continues to be in danger of extinction throughout all or a significant portion of its range and it continues to meet the definition of endangered under the Act; therefore, no status change is recommended at this time. While this species continues to meet the definition of endangered

under the Act, we believe that the overall threat to its continued existence is not as severe throughout its range as at the time of listing.

V. RESULTS

Recommended Listing Action:

- 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

New Recovery Priority Number and Brief Rationale: 12

The recovery priority number for *Deinandra increscens* ssp. *villosa* is currently listed as 3, according to the Service's 2010 Recovery Data Call for the Ventura Fish and Wildlife Office. This number indicates that it is a subspecies that faces a high degree of threat and has a high potential for recovery.

Degree of threat: We rank the degree of threat to a species as high, medium, or low, with the high category indicating that extinction is almost certain for a species in the immediate future because of rapid population decline or habitat destruction; the moderate category indicates that a species will not face extinction if recovery is temporarily held off, although there is continual population decline or threat to its habitat; a low category indicates that a species is facing a population decline which may be a short-term, self-correcting fluctuation, or the impacts of threats of the species' habitat are not fully known.

This species is facing threats that are pervasive; some occur throughout its range and some only to parts of its range. Because the annual fluctuations in numbers of individuals fits the profile of other annual species that exhibit such fluctuations that are cued by climatic conditions, years with low numbers of individuals of this species is not necessarily indicative of increasing threats. In addition, the increased number of known populations since the time of listing has, in effect, spread the exposure to specific threats across a larger number of populations. Therefore, we now categorize the threats to this species as moderate. We may change this determination as we obtain more information in the future, such as on the magnitude and severity of particular threats.

Recovery Potential: We rank the recovery potential as either high or low based on three criteria: (1) biological and ecological timing factors, (2) threats to species' existence, and (3) management needed.

(1) *Biological and ecological timing factors:* These factors are ranked as (a) high if they are well understood or (b) low if they are poorly understood. Biological and ecological factors important for this species' conservation and recovery are fairly well understood, but we do not have sufficient information to have a solid understanding of the ecological conditions necessary to recover this species. For example, we have a thorough understanding of how to eliminate nonnative species, but we do not have a reliable ability to shift coastal grasslands invaded by nonnative species back to a robust, native grassland. Therefore, we cannot consider this species to have a high recovery potential for the biological and ecological factors' criterion to recover this species and we rank this criterion as low.

(2) *Threats to the Species' Existence:* The recovery potential based on threats to species' existence are ranked as (a) high if they are well understood and easily alleviated or (b) low if they are poorly understood or are pervasive and difficult to alleviate. The threats to this species are fairly well understood, but they are pervasive and difficult to alleviate. The distribution of this species is larger now than was known at the time of listing, therefore, the threats identified at the time of listing are likely not as severe to the species as a whole because of the increased number of known plants and populations; however, additional threats have been identified since the time of listing. Some of these additional threats are range-wide and some are specific to

some populations. Therefore, we cannot consider this species to have a high recovery potential for the threats criterion to recover this species and we rank this criterion as low.

(3) *Management needed for the species*: These are ranked as (a) high if intensive management is not needed and the techniques are well documented with a high probability of success or (b) low if intensive management is needed with a low probability of success or the techniques are unknown or still experimental (Service 1983). Some of the management needs to recover this species are fairly well understood, others are not. Intensive management actions will most likely be needed for this species throughout its range and they would probably only have a moderate probability of success. Success rates could be high for some populations, but they would be expensive and would probably have to occur for extended periods of time (possibly in perpetuity). Therefore, we cannot consider this species to have a high recovery potential for the management needs criterion to recover this species and we rank this criterion as low.

Based on this information, we consider *Deinandra increscens* ssp. *villosa* to have a moderate degree of threat and a low potential for recovery; it would then be appropriate to revise the recovery priority number to 12.

VI. RECOMMENDATIONS FOR ACTIONS OVER THE NEXT 5 YEARS

1. Develop a recovery outline and recovery plan for *Deinandra increscens* ssp. *villosa*.
2. Work with the U.S. Air Force at VAFB to implement site-specific management activities (e.g., refining grazing regimes, eradicating nonnative species) to maintain suitable habitat on the base for this species.
3. Work with partners to manage threats to this species throughout its range, such as increasing efforts to remove nonnative species and planning the timing of activities that occur within and adjacent to occupied habitat.
4. Develop conservation and land use management plans or habitat conservation plans with the County of Santa Barbara, the agricultural community, developers, local landowners and stakeholders to facilitate this species occurring and migrating throughout its historical range.
5. Conduct updated surveys throughout the range of the species.

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

Deinandra increscens ssp. *villosa* [*Hemizonia increscens* ssp. *villosa*]
(Gaviota tarplant)

Current Classification: Endangered

Recommendation Resulting from the 5-Year Review:

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

Review Conducted By: Mark A. Elvin

FIELD OFFICE APPROVAL:

Field Supervisor, U.S. Fish and Wildlife Service

Approve Diane K. Wade Date 8/10/11