

*Astragalus pycnostachyus* var. *lanosissimus*  
(Ventura marsh milk-vetch)

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



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

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## **5-YEAR REVIEW**

*Astragalus pycnostachyus* var. *lanosissimus* (Ventura marsh milk-vetch)

### **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:**

As summarized in the listing rule for this species (Service 2001), *Astragalus pycnostachyus* var. *lanosissimus* is an herbaceous perennial in the Fabaceae (pea family) that was believed to be extinct until its rediscovery in 1997. At the time of listing, the only known extant population of this taxon occurred in Ventura County, California on less than 0.2 hectare (ha) (0.6 acre (ac)) of degraded dune habitat that was previously used for disposal of petroleum wastes. After rediscovery of the taxon, several attempts have been made to establish populations within the historical range of the taxon, with varying success.

#### **Methodology Used to Complete the Review:**

This review was prepared by the Ventura Fish and Wildlife Office (VFWO), following the Region 8 guidance issued in March 2008. We used information from the listing rule, critical habitat rule, survey information from experts who have been monitoring various localities of this species, and the California Natural Diversity Database (CNDDDB) maintained by the California Department of Fish and Game (CDFG). Personal communications with experts were our primary sources of information used to update the species' status and threats. This 5-year review contains updated information on the species' biology and threats, and an assessment of that information compared to that known at the time of listing. We focus on current threats to the species that are attributable to the Act's five listing factors. The review synthesizes all this information to evaluate the listing status of the species and provide an indication of its progress towards recovery. Finally, based on this synthesis and the threats identified in the five-factor

analysis, we recommend a prioritized list of conservation actions to be completed or initiated within the next 5 years.

**Contact Information:**

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**Lead Field Office:** Ventura Fish and Wildlife Office: Jenny Marek, Fish and Wildlife Biologist, (805) 644-1766, extension 325; and Connie Rutherford, Listing and Recovery Program Coordinator for Plants, (805) 644-1766, extension 306.

**Cooperating Field Office:** Carlsbad Fish and Wildlife Office: Gary Wallace, Botanist, (760) 431-9440.

**Federal Register Notice Citation Announcing Initiation of This Review:** A notice announcing initiation of the 5-year review of this taxon and the opening of a 60-day period to receive information from the public was published in the Federal Register (FR) on March 25, 2009 (74 FR 12878). No information was received in relation to this species during the period.

**Listing History:**

**Original Listing**

**FR Notice:** 66 FR 27901

**Date of Final Listing Rule:** May 21, 2001

**Entity Listed:** *Astragalus pycnostachyus* var. *lanosissimus* (a plant variety)

**Classification:** Endangered

**Associated Rulemakings:**

**Critical Habitat**

**FR Notice:** 69 FR 29081

**Date of Critical Habitat Rule:** May 20, 2004

**State Listing**

*Astragalus pycnostachyus* var. *lanosissimus* was listed as endangered by the State of California in 2000.

**Review History:** N/A

**Species' Recovery Priority Number at Start of 5-Year Review:** The recovery priority number for *Astragalus pycnostachyus* var. *lanosissimus* is 6C according to the Service's 2008 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 (Endangered and Threatened Species Listing and Recovery Priority Guidelines, 48 FR 43098, September 21, 1983). This number

indicates that the taxon is a subspecies that faces a high degree of threat and has a low potential for recovery. The C indicates conflict with construction or other development projects.

**Recovery Plan or Outline:** N/A

## II. REVIEW ANALYSIS

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

The Act defines species as including any subspecies of fish or wildlife or plants, and any distinct population segment (DPS) of any species of vertebrate wildlife. This definition limits listing as distinct population segments 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.

### Information on the Species and its Status

#### Species Biology and Life History

*Astragalus pycnostachyus* var. *lanosissimus* is a short-lived herbaceous perennial, believed to have a 3 to 4-year life span (Wilken and Wardlaw 2001). This member of Fabaceae (pea family) has a thick taproot and multiple erect, reddish stems, 40 to 90 centimeters (cm) (16 to 36 inches (in)) tall that emerge from the root crown. The pinnately compound leaves are densely covered with silvery-white hairs with 27 to 39 leaflets that are 5 to 20 millimeters (mm) (0.2 to 0.8 in) long. The numerous yellowish-white to cream colored flowers are in dense clusters and are 7 to 10 mm (0.3 to 0.4 in) long with 2 to 4 cm (0.8 to 1.6 in) peduncles (Spellenberg 1993). The calyx tube is 3 to 4 mm (0.12 to 0.16 in) long with 1.2- to 1.5-mm (0.04-in) long calyx teeth (Spellenberg 1993). The nearly sessile, single-celled pod is 8 to 11 mm (0.31 to 0.43 in) long (Barneby 1964). This variety is distinguished from *A. pycnostachyus* var. *pycnostachyus* by the length of calyx tube, calyx teeth, and peduncles, and occupies a distinct geographic area that does not overlap with *A. pycnostachyus* var. *lanosissimus*.

Limited studies focusing on the reproductive biology of *Astragalus pycnostachyus* var. *lanosissimus* have been conducted since rediscovery of the taxon in 1997. The blooming time has been recorded as July to October (Barneby 1964); however, the population at the site where the plants were rediscovered, referred to as the site of natural occurrence, was observed in flower in June 1997. Wilken and Wardlaw (2001) observed peak flowering of the plants at this site in mid-July with most flowers maturing into fruits by early September. The variety appears to be self-compatible and partly self-pollinating (Wilken and Wardlaw 2001); however, the flower structure of this variety, and other *Astragalus* species, suggests that pollination requires manipulation of flower parts by insects (Wilken and Wardlaw 2001). Wilken and Wardlaw (2001) observed a limited number of skippers (family Hesperidae) and bumblebees (*Bombus* spp.) visiting the plants. Other researchers have observed bumblebees frequently visiting *A. pycnostachyus* var. *lanosissimus*, along with carpenter bees (likely *Xylocopa* spp.), marine blue butterflies (*Leptotes marina*), common hairstreak butterflies (*Strymon melinus*), and honey bees (*Apis mellifera*) (Meyer 2007a, Jensen 2007), indicating that insects may be the natural

pollinators of this plant. The life cycle of *A. pycnostachyus* var. *lanosissimus* likely requires a pollinator community to be present (Greer et al. 1995; Karron 1987).

Wilken and Wardlaw (2001) observed an average of 26 inflorescences per plant, with an average of 36 flowers per inflorescence, and between 7 and 9 ovules per ovary (a potential maximum of 7 to 9 seeds per flower). However, the number of seeds per fruit was only approximately 2 on average. This level of productivity is low relative to many other species of *Astragalus* that are known to be self compatible and therefore would be expected to produce more seed (Karron 1987). Seed production is suspected to be limited by a lack of pollination. The reason for the low pollination rate observed by Wilken and Wardlaw is unknown, but could be attributed to factors that affect the local pollinator community, such as habitat loss, pesticides, and competition for nectar. In addition, Wilken and Wardlaw (2001) observed that up to 50 percent of the fruits appeared to be damaged by insect herbivory, and seed predation by weevils (family Bruchidae) has been documented at the site of natural occurrence (Wilken and Wardlaw 2001; D. Steeck and M.E. Meyer, Service and CDFG, *in litt.* 1997), and at outplanting sites (Meyer 2007a).

Like many other *Astragalus* species, seeds of *Astragalus pycnostachyus* var. *lanosissimus* have a hard coat, which may require scarification (scraping or small cuts) prior to germination (Baskin and Baskin 2001). The seed may survive for 1 year or more in the soil until the seed coat can break down or be penetrated by some mechanical means. *Astragalus* species are known to produce seed that can remain dormant for 40 years (Ikeda and Meyer 2000). This prolonged dormancy may also be true of *A. pycnostachyus* var. *lanosissimus*, as indicated by the appearance of this variety at the site of natural occurrence, which is hypothesized to have been established from dormant seed brought in from some other location nearby, potentially in the sand that was used to cap the oil waste present on the property (Meyer 2007a). This delayed seed germination, combined with the observation that plants may not become reproductive until 18 to 30 months following germination, and a low seedling survival rate (Wilken and Wardlaw 2001), indicates a low recruitment rate for the variety, which will likely complicate recovery efforts.

### Distribution

As summarized in the listing rule (Service 2001), the type locality for *Astragalus pycnostachyus* var. *lanosissimus* is “La Bolsa,” where the plant was collected in 1882 by S.B. and W.F. Parish (Barneby 1964). Based on the labeling of other specimens collected by the Parishes in 1881 and 1882, Barneby (1964) suggested that this collection may have come from the Ballona marshes in Los Angeles County. However, Critchfield (1978) believed that “La Bolsa” could easily have referred to Bolsa Chica, a coastal marsh system located to the south in what is now Orange County. He noted that Orange County was not made a separate county from Los Angeles County until 1889, seven years after the Parish collection was made. In the five decades following its discovery, *A. pycnostachyus* var. *lanosissimus* was collected only a few times, always from locations in coastal Los Angeles and Ventura Counties. In Los Angeles County, it was collected from near Santa Monica in 1882, the Ballona marshes just to the south in 1902, and “Cienega” in 1904, also likely near the Ballona wetlands. In Ventura County, it was collected in 1901 and 1925 from Oxnard and in 1911 from Ventura, California, a city adjacent to Oxnard.

By 1964, Barneby (1964) believed that *Astragalus pycnostachyus* var. *lanosissimus* had certainly been extirpated from Santa Monica southward, noting that there was still the possibility it survived in Ventura County (although he knew of no locations at the time). The taxon was rediscovered in 1967 through the chance collection by R.M. Chase of a single specimen growing by a roadside between the cities of Ventura and Oxnard. Searches uncovered no other living plants at that location, although some mowed remains that were discovered on McGrath State Beach lands across the road from the collection site were believed to belong to this taxon (information on herbarium label from specimen collected by R.M. Chase in 1967). Floristic surveys and focused searches conducted in the 1970s and 1980s at historical collection locations did not locate any populations of *A. pycnostachyus* var. *lanosissimus* and the plant was presumed extinct (Isley 1986, Spellenberg 1993, Skinner and Pavlik 1994). On June 12, 1997, a population of the plant was rediscovered by Service biologist Kate Symonds, in a degraded coastal dune system near Oxnard, California. This population is located about 1.6 km (1 mile) from the site of Chase's 1967 collection at McGrath State Beach. The plants at this site of natural occurrence are within an area of less than 0.2 ha (6 ac) (Ikeda and Meyer 2000; Meyer, *in litt.* 2007b).

*Astragalus pycnostachyus* var. *lanosissimus* plants have been introduced in three locations in Ventura County within the historical range: Mandalay State Beach, located at the northwest intersection of Harbor Boulevard and West 5<sup>th</sup> Street in Oxnard; McGrath State Beach in Oxnard; and Ormond Beach, between Port Hueneme and Point Mugu. Populations have also been established at two locations in Santa Barbara County outside of the known historical range, at the Carpinteria Salt Marsh Reserve and Coal Oil Point Reserve. Figure 1 in Appendix A shows a distribution map of the historical sites, the extant site of natural occurrence, and outplanting sites.

#### Abundance and Population Trends

Table 1 lists the known historical sites, the extant site of natural occurrence, and outplanting sites along with available population information. It includes element occurrence (EO) data from CNDDDB (defined as the occurrence number assigned to a particular instance of a species or community that uniquely identifies it from other occurrences of the same species or community) as well as other sources. Abundance information for historical populations is not available; however, successive collections at "La Bolsa" (EO 1), "meadow near seashore" (EO 3), and "Ballona Marshes" (EO 4), indicate that the plants persisted for a number of years at these locations before their habitat was altered or destroyed, or the plants were otherwise unable to continue inhabiting these areas.

The site of natural occurrence, a property owned by North Shore at Mandalay Bay, LLC (North Shore) on the northeast corner of Harbor Boulevard and West 5<sup>th</sup> Street in Oxnard, has fairly complete abundance information starting in 1997 when *Astragalus pycnostachyus* var. *lanosissimus* was discovered there. The number of individuals (adults and juveniles) observed at the time of rediscovery was 374. By 2000, the population had dipped to a low of 39 individuals. By 2002, the number of individuals had rebounded to 280, and in 2009 the population was back down to 31 individuals. This brief history demonstrates a widely fluctuating number of individuals over the course of 12 years, possibly due to local precipitation patterns and possibly

**Table 1. Occurrence records for *Astragalus pycnostachyus* var. *lanosissimus* collated from CNDDDB and other sources. All abundance information includes adults and juveniles. For a breakdown by age classes, see Appendix B.**

EO #	Name	Status/ Year Surveyed	Reference	Ownership
<b>Orange County</b>				
1	"La Bolsa" (Assumed to be Bolsa Bay), Sunset Beach and Huntington Beach	Collected (1881) Collected (1882) Not Observed (1987)	CNDDB 2009	Public and Private
<b>Los Angeles County</b>				
3	Meadow near seashore, Santa Monica	Collected (1882) Collected (1900) Not Observed (1964)	CNDDB 2009	Unknown
Unassigned	Coastal plains and basins, Santa Monica	Collected (1931)	CCH 2009	Unknown
4	Ballona Marshes, Marina Del Rey and southern Venice	Collected (1988) Collected (1902) Collected (1951) Not Observed (1964) Not Observed (1981)	CNDDB 2009 CCH 2009	Unknown
<b>Ventura County</b>				
2	Santa Clara River Mouth, Oxnard	Collected (1967) Presumed Extirpated (2000)	CNDDB 2009 Jensen 2007 Ikeda and Meyer 2000	Ventura County
6	San Buenaventura State Beach, Exact location unknown, Ventura	Collected (1911) Not Observed (1987)	CNDDB 2009	Unknown
7	North Shore at Mandalay Property, Oxnard [Natural occurrence site]	374 individuals (1997) 192 individuals (1998) 39 individuals (2000) 300 individuals (2001) 280 individuals (2002) 152 individuals (2006) 31 individuals (2009)	CNDDB 2009 Impact Sciences 1998 Wilken and Wardlaw 2001 Meyer 2007 Meyer 2009	Private
8	Silver Strand beach, Port Hueneme	Collected (1927) Presumed Extirpated (2000)	CNDDB 2009 Ikeda and Meyer 2000	Unknown
Unassigned	No specific locality stated, Ventura	Collected (1892)	CCH 2009	Unknown
Unassigned	No specific locality stated, Oxnard	Collected (1901) Collected (1925)	CCH 2009	Unknown
Unassigned	Mandalay State Beach, Oxnard [Outplanting site]	96 individuals planted (2003-4) 3 individuals (2009)	Meyer 2007 Marek and Dellith 2009	State Parks, Ventura County
Unassigned	McGrath Lake, McGrath State Beach, Oxnard [Outplanting site]	167 individuals planted (2002) 147 individuals (2003) 10 individuals (2009)	Soza et. al. 2003 Marek and Dellith 2009	State Parks
Unassigned	Ormond Beach, between Port Hueneme and Point Mugu [Outplanting site]	40 individuals (2004) 0 individuals (2006)	Meyer 2007	California State Coastal Conservancy
<b>Santa Barbara County</b>				
Unassigned	Coal Oil Point Reserve, Goleta [Outplanting site]	110 planted + ~600 seeds released (2003-4) 524 individuals (2006) 50 individuals (2009)	Meyer 2007 Marek and Dellith 2009	UC Natural Reserve System
9	Carpinteria Salt Marsh, Carpinteria Marsh Reserve, Carpinteria [Outplanting site]	40 individuals planted (2000) 155 individuals Planted (2002) 68 individuals (2003) 419 individuals (2006)	CNDDB 2009 Soza et. al. 2003 Meyer 2007	UC Natural Reserve System

due to recent management activities. These counts are inclusive of both adults and juveniles, and therefore may imply an exaggerated fluctuation in the number of individuals at this site due to the high number of juveniles that can be present early in the growing season but die before reaching maturity. Age class information for this occurrence is shown in Figure 1 of Appendix B. The most recent population decline is hypothesized to have been caused by remediation

activities surrounding the occurrence (Meyer, *in litt.* 2009a), and may not reflect the natural fluctuations that were seen in previous years.

Due to the small and fluctuating population at the site of natural occurrence, and the proposed development at the site, the CDFG has undertaken several attempts to reintroduce the species to potentially suitable locations within and outside of the known historical range of the variety. The locations were selected based on recommendations from Ikeda and Meyer (2000) and analysis by Wilken and Wardlaw (2001); more detailed information about site selection and outplanting methodology is found in Soza et al. (2003), Meyer (2007a), and Jensen (2007). Outplanting sites include Ormond Beach, Mandalay State Beach, McGrath State Beach, Carpinteria Salt Marsh Reserve, and Coal Oil Point Reserve. Information about each of these sites is presented below.

#### *Ormond Beach*

Located in southwest Ventura County, Ormond Beach is situated between Port Hueneme and Point Mugu. The site that was selected for outplanting of *Astragalus pycnostachyus* var. *lanosissimus* is owned by the California State Coastal Conservancy and supports coastal dunes and non-tidal coastal salt marsh (Jensen 2007; Meyer 2007a). In March of 2004, 40 container-grown plants were installed in a transitional area between wetlands that support salt marsh and mud/salt flats and dunes (Meyer 2007a). Within 1 week of planting, rabbit (presumably *Lepus* spp. or *Sylvilagus* spp.) herbivory eliminated one-third of the plants, and shortly thereafter individuals growing in moist salt marsh soil died, presumably from excessive salinity (Jensen 2007; Meyer 2007a). The few individuals that survived through the first year were killed following heavy rains in 2005 that inundated the site (Jensen 2007). Further outplanting efforts have not been made at this location.

#### *Mandalay State Beach*

Located at the northwest corner of Harbor Boulevard and West 5<sup>th</sup> Street in Oxnard, Mandalay State Beach is owned by the California Department of Parks and Recreation (CDPR), and is managed by the County of Ventura. The outplanting sites at Mandalay State Beach are located in recently restored habitat behind the primary foredunes in swales dominated by facultative wetland species (Meyer 2007a). On February 23, 2003, 30 container-grown *Astragalus pycnostachyus* var. *lanosissimus* plants were planted at three sub-sites within Mandalay State Beach. Two of the sub-sites were located in shallow dune swales that were ultimately decided to be too dry for the variety to persist, and plants were installed at three additional sub-sites in 2004 (Meyer 2007a). Abundance information for all sub-sites collectively is shown in Appendix B, Figure 2. Although heavy rains in the winter of 2004-2005 allowed for recruitment of juveniles in 2005, this outplanting site appears to provide only marginal habitat for *A. pycnostachyus* var. *lanosissimus*, possibly due to lack of access to a perched water table, limiting recruitment at the site to wetter than normal years (Meyer 2007a; Jensen 2007; Meyer, *in litt.* 2009d). As of August 2009, only six individuals (three adults and three juveniles) remained at the site (Meyer, *in litt.* 2009c).

#### *McGrath State Beach*

Owned and managed by CDPR, McGrath State Beach is located in the city of Oxnard and includes lands west of Harbor Boulevard between the mouth of the Santa Clara River and West 5<sup>th</sup> Street. McGrath State Beach includes the freshwater-dominated McGrath Lake and



surrounding wetlands, which provide the most suitable outplanting location on the property (Soza et al. 2003). Five outplanting sub-sites were selected along a transitional gradient between marsh areas surrounding the perimeter of McGrath Lake and increasingly dry dune areas. *Carpobrotus edulis* and *C. chilensis* (iceplant) were removed from the outplanting sub-sites where it occurred, and a total of 167 *Astragalus pycnostachyus* var. *lanosissimus* plants were installed in 2002 (Appendix B, Figure 3). Eighty-eight percent of the plants survived through the first year (Soza et al. 2003). In 2005, heavy rainfall caused McGrath Lake to overflow and inundate the sub-sites, killing all of the original plants and seedlings that had sprouted (Jensen 2007). The storms transported the buoyant *A. pycnostachyus* var. *lanosissimus* seeds away from the original sub-sites, leading to plants becoming established beyond the original planting locations (Jensen 2007). In her 2007 analysis of the outplanting sites, Meyer concluded that McGrath State Beach provides the most suitable habitat for *A. pycnostachyus* var. *lanosissimus* of all the sites explored, due to the fresh-water dominated wetlands surrounding McGrath Lake, sufficient open space, and sufficient pollinator community. Currently 17 individuals are surviving at this location (Meyer, *in litt.* 2009c), all of which are naturally recruited from seeds that were deposited by introduced plants. *Salix lasiolepis* (arroyo willow) and *S. exigua* (sandbar willow) expanded and established throughout the wetland transition area following the 2005 flooding of McGrath Lake (Meyer, *in litt.* 2009d). Meyer (*in litt.* 2009d) reported that these species are continuing to thrive and may create a monoculture in some areas that are not likely to continue supporting *A. pycnostachyus* var. *lanosissimus*. The McGrath Lake locations that currently support the most individuals are more sparsely vegetated and are not dominated by wetland obligate species (Meyer, *in litt.* 2009d).

#### *Carpinteria Salt Marsh Reserve*

The University of California Reserve System owns and manages approximately 49 ha (120 ac) of the 93-ha (230-ac) Carpinteria Salt Marsh in the city of Carpinteria, in Santa Barbara County. The marsh occurs in a basin that was created by faulting and consists of tidal channels at the terminus of Franklin and Santa Monica Creeks (Soza et al. 2003). The marsh is more heavily influenced by saline marine inputs than by freshwater inputs (Soza et al. 2003). The most suitable location for the outplanting of *Astragalus pycnostachyus* var. *lanosissimus* was identified to be the northeastern edge of the marsh within a transitional zone from salt marsh to delta scrub in silty loam soils overlying clay (Soza et al. 2003). Five sub-sites along this transitional gradient were selected and a total of 155 plants were installed in April of 2002 (Soza et al. 2003). Approximately 44 percent of the plants survived through the first year (Appendix B, Figure 4) with greater survival and reproduction at the sites with the lowest salinity, and lowest survival and reproduction at sites with the highest salinity (Soza et al. 2003). Between 2007 and 2009, greater seedling recruitment occurred at the Carpinteria Salt Marsh Reserve than at the other outplanting sites (Meyer, *in litt.* 2009d). Meyer (*in litt.* 2009d) hypothesizes that because the soils at this site contain more fines and clays, soil moisture may be less of a limiting factor in dry years than at the other outplanting sites that support more sandy soils. The total number of plants at the site as of August 2009 was 746 (252 flowering and 494 non-flowering), which far exceeds the number of individuals at any other outplanting site.

#### *Coal Oil Point Reserve*

The Coal Oil Point Reserve is owned and administered by the University of California Reserve System and is located west of the town of Isla Vista in Santa Barbara County. The Reserve is 63

ha (158 ac) and includes Devereux Slough and the surrounding wetlands. Two sub-sites, the “pond” site and the “lagoon” site, were selected for outplanting of *Astragalus pycnostachyus* var. *lanosissimus* and were planted with container-grown plants in 2003 and 2004 (Meyer 2007a). Seeds were also distributed adjacent to the pond and lagoon (Jensen 2007, Meyer 2007a). Abundance information for all sub-sites collectively is shown in Appendix B, Figure 5. The pond site experienced wide fluctuations in the water table level during successive drought and rainfall periods in 2004 and 2005, which were thought to negatively impact the plants at the sub-site, with only a few individuals remaining in 2006 (Meyer 2007a; Jensen 2007).

Vegetation trends at this site are moving toward increased cover and less bare ground (Meyer, *in litt.* 2009d). Conditions for *Astragalus pycnostachyus* var. *lanosissimus* may improve if the site becomes inundated during the wet season once again. Since the 2004-2005 storms, vegetation at the lagoon site has largely overtaken the formerly sparse areas that were most suitable for *A. pycnostachyus* var. *lanosissimus*, and remaining individuals are primarily confined to patches dominated by annual grasses and bare ground (Meyer, *in litt.* 2009d). As of August 2009, 32 total plants were documented at the lagoon and pond sites of the Coal Oil Point Reserve (Meyer, *in litt.* 2009c).

#### Habitat or Ecosystem Conditions

At the time of listing, little was known of the habitat requirements of this taxon. Many of the known collections of this taxon were made prior to 1930, and specimen labels from these collections and original published descriptions contain virtually no habitat information. The site of natural occurrence is located in a sparsely vegetated low area, at an elevation of approximately 10 meters (m) (30 feet (ft)) on the North Shore property, which was previously used for disposal of petroleum waste products (Impact Sciences, Inc. 1997). Based on existing information from historical collections, Wilken and Wardlaw (2001) concluded that the variety occurs in low-elevation coastal dune-swale areas where freshwater levels (in the form of saturated soils or groundwater) are high enough to reach the roots of the plants. Sometimes, high groundwater is indicated by the presence of water in sloughs or coastal creeks, but more typically evidence for freshwater availability is seen in the presence of native freshwater-dependent plants such as *Salix* spp. (willows), *Typha* spp. (cattails), *Baccharis salicifolia* (mulefat), and others. The soils associated with *Astragalus pycnostachyus* var. *lanosissimus* are well-drained, yet contain a mix of sand and clay. Because of the freshwater influence, the soils do not exhibit a white crust that would normally indicate saline or alkaline conditions.

Research conducted at the outplanting sites appears to support Wilken and Wardlaw’s assumptions about potentially suitable habitat for this variety. The outplanting sites were selected based on criteria developed by Wilken and Wardlaw and include palustrine/lacustrine wetland margins within coastal dune systems and transitional areas between wetlands and uplands adjacent to salt marshes and coastal lagoons (Meyer 2007a). Soza et al. (2003) concluded that freshwater marsh areas appear to be preferred over coastal marsh areas, and Meyer (2007a) concluded that the most successful outplanting site was at McGrath State Park in a wetland transition zone adjacent to McGrath Lake, a freshwater-dominated system (Meyer 2007a). Meyer (2007a) indicated that low competition from native and nonnative species contributes to the success of *Astragalus pycnostachyus* var. *lanosissimus* establishment in these areas, and that continual management has been necessary to remove intrusive vegetation. In addition to salinity and availability of low-competition growing sites, herbivory by small

mammals and distance to a perched water table appear to influence survival (Meyer 2007a). Because transitional wetland areas preferred by the variety are generally dynamic in nature, Meyer concluded that *A. pycnostachyus* var. *lanosissimus* may be a taxon that functions as metapopulations (occurs on the landscape with both temporal and spatial variability) and exists at locations that are only suitable for limited periods of time (Meyer 2007a). Therefore, it may require the conservation and management of large blocks of habitat within which the variety may be present in different microhabitat sites over time.

#### Changes in Taxonomic Classification or Nomenclature.

No changes in taxonomic classification or nomenclature have occurred since the time of listing.

#### Genetics

No new studies concerning the genetics of this taxon have been conducted since the time of listing.

#### Species-specific Research and/or Grant-supported Activities

*Astragalus pycnostachyus* var. *lanosissimus* is the focus of a multi-year effort by the CDFG, supported by Section 6 funding from the Service, to identify suitable locations for the outplanting and establishment of this variety. As described above, five locations were selected for outplanting of *A. pycnostachyus* var. *lanosissimus* (Ormond Beach, Mandalay State Beach, McGrath State Beach, Carpinteria Salt Marsh, and Coal Oil Point). In a 2007 report, McGrath Lake at McGrath State Beach was identified as providing the most suitable habitat for the species of the five outplanting sites (Meyer 2007a). The study concluded: “The concept that Ventura Marsh milk-vetch populations should exhibit a stable population trend and maintain predictable above-ground populations year after year at the same exact location is likely biologically and ecologically flawed. To further recovery, efforts should focus on establishing multiple Ventura Marsh milk-vetch colonies within a given coastal system that will likely fluctuate spatially and temporally” (Meyer 2007a, p.170). These findings are crucial to the success of future *A. pycnostachyus* var. *lanosissimus* outplanting attempts, and will greatly benefit the recovery of the species. CDFG continues to monitor the persisting outplanting sites.

### **Five-Factor Analysis**

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

In the final rule listing *Astragalus pycnostachyus* var. *lanosissimus*, we noted that the most significant threat to the variety at the time was direct destruction of the individuals at the only known native site from proposed soil remediation, residential development, and associated activities (Service 2001). At the time of listing, *A. pycnostachyus* var. *lanosissimus* was believed to have been extirpated from all but one of the general areas from which it was historically collected. In Los Angeles County, the coastal areas where the species was previously collected are now urbanized. An estimated 90 percent of the Ballona wetlands, once encompassing almost 800 ha (2,000 ac), have been drained, dredged, and developed into the urban areas of Marina del Rey and Venice (Critchfield 1978; Friends of Ballona Wetlands 1998). Ballona Creek, the primary freshwater source for the wetland, had been straightened, dredged, and channelized by

1940 (Frisen et al. 1981). Barneby (1964) believed that *A. pycnostachyus* var. *lanosissimus* was extirpated from all areas south of Santa Monica by the mid-1960s. In 1987, botanists searched for *A. pycnostachyus* var. *lanosissimus* at previous collection locations throughout its range in coastal habitats, including Bolsa Chica in Orange County and on public lands around Oxnard in Ventura County without success (T. Thomas, pers. comm. 1997; Jensen 2007).

In 1998, the City of Oxnard published a Final Environmental Impact Report (FEIR) for the North Shore development on the site of the only known *Astragalus pycnostachyus* var. *lanosissimus* population (Impact Sciences, Inc. 1998). The proposed project, as described in the FEIR, would substantially adversely affect the only known site of natural occurrence of *A. pycnostachyus* var. *lanosissimus*, resulting in the likely extirpation of this taxon from this location. The proposal for the site included remediation of soils contaminated with hydrocarbons, followed by construction of 364 homes and a 2-ha (6-ac) lake on a total of 37 ha (91 ac) of land. The proposed soil remediation would involve excavation and stockpiling of the soils, followed by soil treatment and redistribution over the site (Impact Sciences, Inc. 1998), thereby destroying the *A. pycnostachyus* var. *lanosissimus* population that was identified late in the planning process. In order to mitigate for this loss, the project included provisions for seed collection and horticultural propagation, and transplantation of greenhouse seedlings and plants collected from the site of natural occurrence to off-site locations. In 1999 the CDFG signed a Memorandum of Understanding (MOU) with the project proponent to establish a preserve that was intended to protect the plants at the site of natural occurrence.



**Figure 1. North Shore at Mandalay LLC, property where *Astragalus pycnostachyus* var. *lanosissimus* was rediscovered. The plants occur within the fenced area, while the rest of the site is undergoing remediation (Photo Meyer 2007b.)**

In 2007, the area surrounding the *Astragalus pycnostachyus* var. *lanosissimus* plants was cleared of vegetation in conjunction with the oil waste remediation occurring at the site (Figure 1). CDFG biologists hypothesize that remediation activities adjacent to the *A. pycnostachyus* var. *lanosissimus* individuals at the North Shore site have caused the artificially perched water table to lose its water-holding capacity, thereby disconnecting *A. pycnostachyus* var. *lanosissimus* from the perched water table that allowed it to become established at the site initially (Meyer, *in litt.* 2009a). An irrigation system was installed in the summer of 2009 as an attempt to provide

supplemental water to the remaining plants at the site (Meyer, *in litt.* 2009a). Initial monitoring has indicated that the irrigation system appears to be improving plant vigor, but that 2009 flowering was impaired and very little seed was produced during this growing season (Meyer, *in litt.* 2009d).

In summary, much of the habitat that supported historical populations of *Astragalus pycnostachyus* var. *lanosissimus* has been altered or destroyed such that it is no longer suitable for the species. Habitat conditions at the North Shore site have been altered by remediation activities, but will be protected by a preserve created as part of the MOU between CDFG and the project proponent. Potential threats associated with the preserve design are discussed in Factor E below. None of the experimental sites are subject to destruction of habitat at this time because they have been intentionally situated in protected areas; these sites are discussed under Factor E.

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

At the time of listing in 2001, we discussed that overutilization is not known to be a problem for *Astragalus pycnostachyus* var. *lanosissimus* (Service 2001), and overutilization is not known to be a threat at this time.

### **FACTOR C: Disease or Predation**

As described in the listing rule (Service 2001) a sooty fungus associated with aphid secretions was found on the leaves of *Astragalus pycnostachyus* var. *lanosissimus* in late summer of 1997, as leaves began to senesce and the plants entered a period of dormancy (Impact Sciences, Inc. 1997; Meyer, *in litt.* 2009a). The plants appeared robust when in flower in June 1997, matured and set seed by October 1997, and were regrowing in March 1998, after a period of dormancy, without obvious signs of the fungus. Meyer (*in litt.* 2009b) reported that aphids occasionally establish on the plants at the site of natural occurrence, and were more abundant with the use of tree tubes, which increased moisture around the plants. Meyer (*in litt.* 2009b) suspects that aphid outbreaks, and subsequent fungus infestations, are likely tied to summer conditions that are more moist than usual, and can also be exacerbated by the presence of Argentine ants (*Linepithema humile*), which tend to protect and promote the aphids. The sooty fungus, however, does not appear to significantly adversely affect the overall health or productivity of individuals.

The seeds of *Astragalus pycnostachyus* var. *lanosissimus* at the site of natural occurrence were heavily infested with seed beetles (Bruchidae: Coleoptera) in 1997. In a seed collection made for conservation purposes in 1997, most fruits partially developed at least 4 seeds but seed predation reduced the average number of undamaged seeds to only 1.8 per fruit (Steeck and Meyer, *in litt.* 1997). Heavy seed predation by seed beetles and weevils



**Figure 2.** *Astragalus pycnostachyus* var. *lanosissimus* seeds magnified 30 times. The seed in the center shows an exit hole presumably made by a seed weevil or predatory wasp (Meyer 2007a).

has been reported among other members of the genus *Astragalus* (Platt et al. 1974, Lesica 1995). In 2003 and 2004, Meyer (2007a) quantified the percentage of seed lost to seed beetles and found beetle exit holes in less than 1 percent of seeds in 2003 (Figure 2), and in approximately 2 percent of the seeds in 2004. Meyer (2007a) concluded that the level of seed loss due to beetle infestation likely fluctuates between sites and with climatic conditions, and does not recommend controlling infestations with insecticides due to potential impacts to non-target species.

The nonnative milk snail (*Otala lacteal*) was observed causing damage to the foliage of *Astragalus pycnostachyus* var. *lanosissimus* in 1998 and 1999 concurrent with a dramatic decline in seedling plants (Meyer 2007a). European brown garden snails (*Helix aspera*) are frequently observed at the outplanting sites and can potentially defoliate individual plants, damage new growth, and compromise vigor (Jensen 2007; Meyer 2007a). Snail management has consisted of periodic use of “Deadline” snail bait, hand removal, and removal of structures (e.g., rebar used to mark plants) and vegetation (e.g., *Raphanus sativus* (wild radish)) that harbor snails (Meyer 2007a).

Meyer (2007a) reports that gophers (*Thomomys bottae*), rabbits (presumably *Lepus* spp. or *Sylvilagus* spp.), and meadow voles (*Microtus* spp.) are common at the milk-vetch outplanting sites and impact plants by removing seedlings and damaging established plants. At McGrath State Beach and Carpinteria Salt Marsh Reserve, underground baskets made of mesh poultry netting were installed in planting holes to prevent gopher herbivory (Soza et al. 2003). Other herbivory control methods include the use of battery-operated gopher deterrent devices, and above-ground rabbit exclosures (Meyer 2007a).

In summary, threats from disease and predation are generally the same as thought at the time of listing; however, small mammal herbivory may be a more substantial threat than originally recognized. Continual small mammal management has been essential to the health of the outplanted *Astragalus pycnostachyus* var. *lanosissimus* populations. Sooty fungus continues to be occasionally observed on *A. pycnostachyus* var. *lanosissimus* individuals, but does not appear to substantially adversely affect the health or productivity of the plants. Seed beetles continue to decrease the amount of viable seed produced, but the magnitude of the impact may fluctuate between sites and with climatic conditions.

#### **FACTOR D: Inadequacy of Existing Regulatory Mechanisms**

In the listing rule (Service 2001), we discussed that regulatory mechanisms with potential to protect *Astragalus pycnostachyus* var. *lanosissimus* included: (1) California Endangered Species Act (CESA); (2) California Environmental Quality Act (CEQA); (3) Coastal Zone Management Act/ California Coastal Act; and (4) Ventura County Land Use Plan. The listing rule provides an analysis of the level of protection that was anticipated from those regulatory mechanisms.

*Astragalus pycnostachyus* var. *lanosissimus* was listed as endangered by the State of California in 2000. As such, projects that would affect *A. pycnostachyus* var. *lanosissimus* are subject to CESA and CEQA requirements. Section 2080 of the California Fish and Game Code prohibits take (i.e., hunting, pursuing, catching, capturing, killing, or attempting to hunt, pursue, catch, capture or kill) of any State-listed threatened or endangered species, including plants (CDFG

2009a). The CESA allows for take of species that is incidental to otherwise lawful projects through the issuance of permits or memoranda of understanding, and may require mitigation measures to offset losses of listed species and their essential habitats (CDFG 2009a). CEQA applies to discretionary projects that are proposed to be conducted or approved by a California public agency, for the purpose of disclosing significant environmental effects of a proposed discretionary project through the preparation of an Initial Study, Negative Declaration, or Environmental Impact Report (CDFG 2009b).

As noted previously, in 1998 the City of Oxnard published a FEIR for development on the site of the only known *Astragalus pycnostachyus* var. *lanosissimus* population known at the time (Impact Sciences, Inc. 1998). On July 27, 1999, CDFG signed a MOU with the project proponent to establish a permanent rare plant preserve on site and provide for experimental off-site mitigation. The intent of the MOU was to increase protections to *A. pycnostachyus* var. *lanosissimus* beyond those documented in the FEIR for the North Shore development. However, implementing the MOU has not been able to prevent intensive habitat disturbance during soil remediation, up to the edge of the extant stand of *A. pycnostachyus* var. *lanosissimus*. Under the MOU, when the project is complete, there will be a 2-ha (5-ac) preserve protected by a conservation easement with CDFG, surrounded by urban land use.

With regard to federally listed plant species, section 7(a)(2) of the Act requires Federal agencies to consult with the Service to ensure any project they fund, authorize, or carry out does not jeopardize a listed plant species. Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the “take” of federally threatened and 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. In brief, the Act has only limited ability to protect *Astragalus pycnostachyus* var. *lanosissimus* and other federally listed plant species on non-Federal land.

Since the time of listing, the Service conducted an interagency consultation with the Environmental Protection Agency (EPA) regarding remediation activities at the North Shore site and potential adverse effects on *Astragalus pycnostachyus* var. *lanosissimus*. Reports and analyses provided to the Service during the consultation indicated that the hydrology at the site would not be affected by the proposed remediation activities. As described previously, recent monitoring of the site has indicated that the hydrology actually may have been altered and the Service is working with the EPA and CDFG to address this issue. The Service has also encouraged project proponents to conduct surveys for *A. pycnostachyus* var. *lanosissimus* prior to the implementation of projects that were either funded, authorized, or carried out by a Federal agency and were likely to adversely impact suitable habitat for the species, but no additional occurrences have been identified.

In summary, in the case of the North Shore project, the CEQA review process was instrumental in establishing on-site and off-site mitigation and research aimed at protecting the species;

however, neither CEQA nor the Act were able to prevent the changes in hydrology that may have resulted from soil remediation on adjacent lands. While CESA, CEQA, and the Act have provided certain protections for the species, the Coastal Zone Management Act and Ventura County Land Use Plan have not come into play to this point.

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

At the time of listing *Astragalus pycnostachyus* var. *lanosissimus* in 2001, we discussed that the taxon is threatened with extinction from unanticipated human activities and natural events by virtue of the very limited number of individuals in, and the small area occupied by, the only known extant population. A wildlife predation event in the summer before seeds have matured, a plane crash (the taxon is under the extended center flight line of the Oxnard airport and a crash occurred on the site in 1995), and other natural or unanticipated human-caused events could eliminate the existing population and result in the extirpation of this taxon from the only known remaining site of natural occurrence in the wild.

The conservation biology literature commonly notes the vulnerability of taxa known from one or very few locations and/or from small and highly variable populations (e.g., Shaffer 1981, 1987; Primack 1998). In particular, although the plants are apparently self-compatible and capable of self-fertilization, the small size of populations makes it difficult for this species to persist while sustaining the impacts of soil damage (e.g., alteration in soil hydrology, compaction, and erosion) and habitat alteration that favors nonnative species.

Since the time of listing, as described earlier in this review, *Astragalus pycnostachyus* var. *lanosissimus* has been outplanted at potentially suitable locations within and outside of the known historic range of the variety. The success of these outplantings has been widely varied, from the complete loss of plants at Ormond Beach, to populations that are naturally recruiting individuals at McGrath Lake, Carpinteria Salt Marsh Reserve, and Coal Oil Point Reserve. These outplanting efforts have proven challenging and the populations require constant attention and management. With the emerging concerns for the future viability of the North Shore site plants due to altered hydrogeology and potential future urban impacts, the success of the outplanting sites is crucial to the continued existence of *A. pycnostachyus* var. *lanosissimus* in the wild.

Factors not considered at the time of listing include inadequate preserve design, competition from native and nonnative species; climate change, and sea level rise. Each of these factors are described below.

##### Inadequate Preserve Design

An MOU signed by CDFG and the North Shore project proponent would establish a 2-ha (5-ac) preserve surrounding the *Astragalus pycnostachyus* var. *lanosissimus* at the site of natural occurrence, with the intent of protecting the population and enabling off-site outplantings from the native seeds produced on-site. A preserve should be large enough to maintain the ecological functions upon which the target species depends, and it should have a ratio of edge to total area that minimizes edge effects and fragmentation. To increase the certainty that the target species will persist over the long term, land uses adjacent to a preserve should be compatible with



maintaining the integrity of the preserve (Jensen 1987; Shafer 1995; Rathcke and Jules 1993; Kelly and Rotenberry 1993).

The small size of the preserve and its proximity to future urban and suburban uses makes it subject to the effects of nonnative, invasive plant and animal species, increased nutrient-rich water supply due to suburban irrigation runoff and increased impervious surfaces, and chemicals such as herbicides, pesticides, and fertilizers (see Conservation Biology Institute 2000, CDFG 2000 and references therein). Independently or in combinations, these factors present difficult management challenges which, if not adequately addressed, could lead to the elimination of *A. pycnostachyus* var. *lanosissimus* from the North Shore site. Nonnative plant and animal species are competitors and predators, respectively, that can directly reduce survival of native plants and they can also upset the invertebrate (pollinator) and vascular plant associations upon which native plants depend (Conservation Biology Institute 2000). While the life history requirements of *A. pycnostachyus* var. *lanosissimus* are not well understood, any factor that substantially alters the hydrology of the site, such as increases or decreases in urban/suburban runoff, may make the site unsuitable for this wetland species (Conservation Biology Institute 2000). Likewise, increased levels of chemicals arriving via runoff or drift can be expected in small preserves and can harm native species (Conservation Biology Institute 2000). These increases could harm *A. pycnostachyus* var. *lanosissimus* directly, or alter the pollinator or plant associations upon which it depends.

Though not specifically discussed at the time of listing, the plants at the North Shore site may also be impacted by recreation after the North Shore property is developed and the 2-ha (5-ac) preserve is established. It is likely that a small preserve, such as the one proposed under CDFG's MOU with the project proponent, will receive heavy visitation from the surrounding community. It is unclear what type of public access, if any, will be allowed within the preserve. Even in the absence of public access, it is likely that the site will receive some level of unauthorized access or urban impacts, such as illegal dumping and vandalism, because of its immediate proximity to the proposed development.

#### Competition

Nonnative weeds such as iceplant, as well as some native species such as *Anemopsis californica* (yerba mansa), *Potentilla anserina* (silverweed) and *Distichlis spicata* (salt grass) can form dense continuous patches that exclude *Astragalus pycnostachyus* var. *lanosissimus* (Meyer 2007a). Iceplant can be controlled by hand-pulling or with herbicide application, and should be kept out of outplanting sites to allow open space to which *A. pycnostachyus* var. *lanosissimus* may disperse. The presence of some native plants, such as *Heliotropium curassavicum* (heliotrope) may benefit *A. pycnostachyus* var. *lanosissimus* by attracting pollinators and providing cover for juvenile plants during hot summer months, while not competitively excluding *A. pycnostachyus* var. *lanosissimus*.

#### Climate Change

A potential threat that was not considered at the time of listing is 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, Hayhoe et al. 2004, 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, and that species will "move" or disperse to higher elevations and northward, depending on the ability of each species to do so. Species diversity may also shift in response to these changes with a general trend of increasing diversity towards the coast and northwards with these areas becoming potential future refugia. These increases in species diversity in the refugia, due to climate change, have the potential to result "...in new species mixes, with consequent novel patterns of competition and other biotic interactions..." with the species present (Loarie et al. 2008) with unknown consequences to the species present.

We recognize that climate change is an important issue with potential effects to listed species and their habitats. While we lack adequate information to make specific and accurate predictions regarding how climate change, in combination with other factors such as small population size, will affect *Astragalus pycnostachyus* var. *lanosissimus*, small-ranged species, such as *A. pycnostachyus* var. *lanosissimus*, are generally more vulnerable to extinction due to these changing conditions (Pimm and Raven 2000, Loarie et al. 2008).

#### Sea Level Rise

Another potential effect of climate change is sea level rise. An increase in the rate of sea level rise has been predicted for the coast of California (California Climate Change Center 2006). The occurrences of *Astragalus pycnostachyus* var. *lanosissimus* at Mandalay State Beach, McGrath Lake, and Carpinteria Salt Marsh Reserve are bounded by residential, industrial, or agricultural areas that would preclude the taxon's migration inland as sea level rises. Coal Oil Point Reserve is less severely restricted, with the exception of a golf course and residential developments further inland. The North Shore site is separated from the coastline by Harbor Boulevard and may be surrounded by development, which would likely be protected from sea level rise by future flood control and armoring structures if these areas become threatened by increasing sea level.

In summary, additional natural or manmade threats to *Astragalus pycnostachyus* var. *lanosissimus* have been identified since the time of the listing in 2001. In addition to threats from unanticipated human activities and small population size, urban impacts on the North Shore site preserve, competition from native and nonnative species, climate change, and sea level rise may also threaten this taxon. One factor that has had a positive impact on the species is the outplanting attempts led by CDFG.

### **III. RECOVERY CRITERIA**

Recovery plans provide guidance to the Service, States, and other partners and interested parties on ways to minimize threats to listed species, and on criteria that may be used to determine when recovery goals are achieved. There are many paths to accomplishing the recovery of a species and recovery may be achieved without fully meeting all recovery plan criteria. For example, one or more criteria may have been exceeded while other criteria may not have been accomplished. In that instance, we may determine that, over all, the threats have been minimized sufficiently, and the species is robust enough, to downlist or delist the species. In other cases, new recovery approaches and/or opportunities unknown at the time the recovery plan was finalized may be

more appropriate ways to achieve recovery. Likewise, new information may change the extent that criteria need to be met for recognizing recovery of the species. Overall, recovery is a dynamic process requiring adaptive management, and assessing a species' degree of recovery is likewise an adaptive process that may, or may not, fully follow the guidance provided in a recovery plan. We focus our evaluation of species status in this 5-year review on progress that has been made toward recovery since the species was listed (or since the most recent 5-year review) by 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 *Astragalus pycnostachyus* var. *lanosissimus* has not yet been developed.

#### IV. SYNTHESIS

At the time of listing in 2001, *Astragalus pycnostachyus* var. *lanosissimus* was known to occur at only one known location (the North Shore site); this site was proposed for development and supported approximately 300 individuals in 2001. Currently the North Shore site supports only 31 individuals and the habitat at the site has possibly been permanently negatively altered by remediation activities in areas surrounding the plants. Although the North Shore site will be included in a 2-ha (5-ac) preserve that will be established when the property is developed, the ability of that preserve to continue to provide suitable habitat for *A. pycnostachyus* var. *lanosissimus* is questionable because of altered hydrogeology and surrounding urban influences.

In 2001, little was known about the habitat requirements or life history of the species, because the last known specimen was collected in 1967 and the species was only rediscovered in 1997. Research was conducted to identify potential suitable habitat characteristics and introductions were attempted at several sites within and outside the historic range of the species, including Ormond Beach, Mandalay State Beach, McGrath Beach, Carpinteria Salt Marsh, and Coal Oil Point. *Astragalus pycnostachyus* var. *lanosissimus* did not survive at Ormond Beach and subsequent outplantings have not been attempted at that location. Plants currently remain at the other outplanting sites, but have shown a relatively steady decline in abundance since the heavy rains of 2004-2005, and may benefit from another substantially wet season. Each of these sites require continual maintenance to prevent substantial losses due to herbivory or exclusion by other plant species. Multi-year studies by CDFG have concluded that this variety may not necessarily persist at one location through time, but rather may follow the transitional zones surrounding coastal freshwater-influenced wetlands as they fluctuate through time.

Due to the decline in individuals and habitat alteration at the site of natural occurrence, limited opportunities for establishing *Astragalus pycnostachyus* var. *lanosissimus* at other locations, threats from mammal, snail, and beetle herbivory, and competition from other species, *A. pycnostachyus* var. *lanosissimus* remains in danger of extinction throughout all of its known extant range. As a result, this taxon continues to meet the definition of endangered under the Act and no status change is recommended at this time.

## V. RESULTS

### 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

**New Recovery Priority Number and Brief Rationale:** N/A

## VI. RECOMMENDATIONS FOR FUTURE ACTIONS

1. Convene a recovery team and develop a recovery plan for *Astragalus pycnostachyus* var. *lanosissimus*.
2. Work with C DPR staff to continue iceplant removal and habitat restoration around McGrath Lake to improve and expand available habitat for *Astragalus pycnostachyus* var. *lanosissimus*.
3. Determine if changes in the upper aquifer at the North Shore site have resulted from remediation activities surrounding the plants, and determine whether a supplemental watering system can compensate for altered water availability, or if additional measures are needed to compensate for negative impacts.
4. Build on the work of Meyer, Jensen, Wilken, and others to identify freshwater-dominated coastal wetlands with sufficient surrounding area and proper vegetation (i.e., sufficiently sparse areas, free of dense mats of vegetation) for *Astragalus pycnostachyus* var. *lanosissimus* introduction.

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**U.S. FISH AND WILDLIFE SERVICE**  
**5-YEAR REVIEW**  
*Astragalus pycnostachyus* var. *lanosissimus*  
(Ventura marsh milk-vetch)

**Current Classification:** Endangered

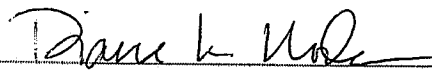
**Recommendation Resulting from the 5-Year Review:**

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

**Review Conducted By:** Jenny Marek


**FIELD OFFICE APPROVAL:**

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

Approve  Date 6/23/10

**Cooperating Field Supervisor, U.S. Fish and Wildlife Service**

ACTING

Approve  Date MAY 21 2010

**Scott A. Sobiech**

**Appendix A.** Historic and current distribution of *Astragalus pycnostachyus* var. *lanosissimus*

Figure 1. Distribution of *Astragalus pycnostachyus* var. *lanosissimus* (Ventura marsh milk-vetch), Santa Barbara, Ventura, and Los Angeles Counties, California



**Appendix B.** Population trends at the native and outplanting sites. Flowering plants are assumed to be adults, and non-flowering plants are assumed to be juveniles.

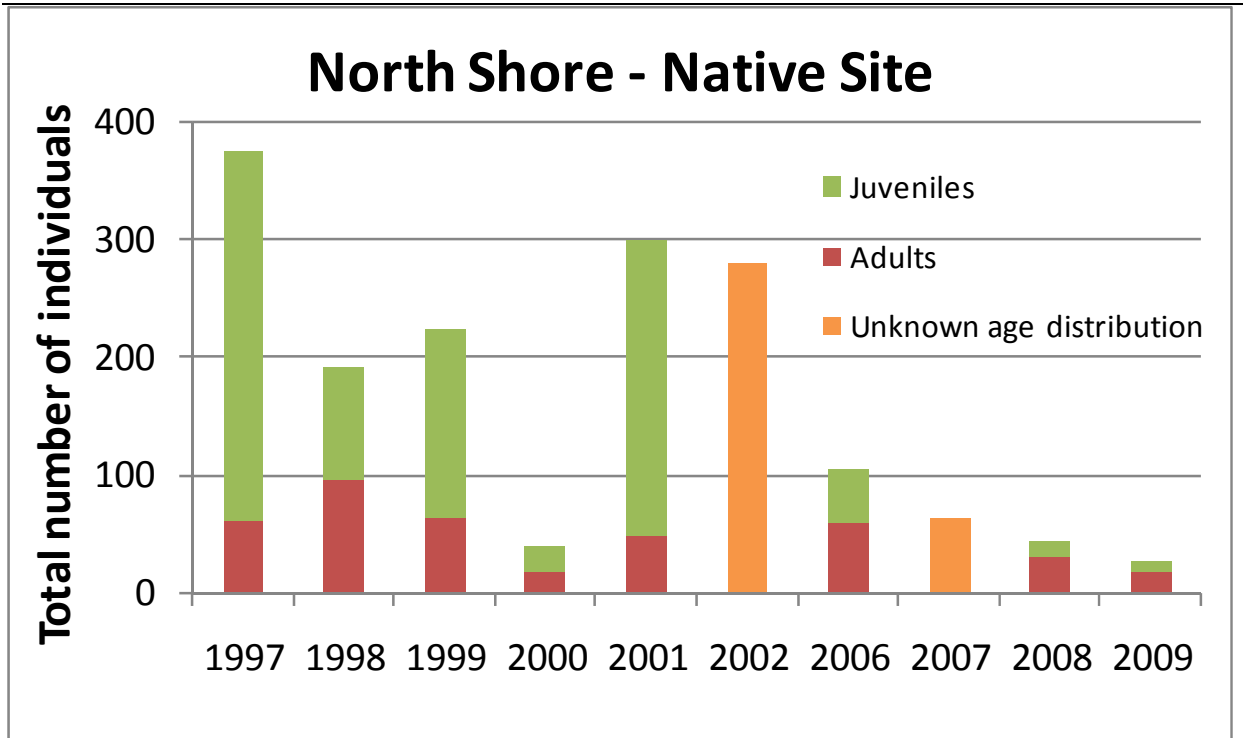


Figure 1. The number of *Astragalus pycnostachyus* var. *lanosissimus* individuals at the rediscovery site, North Shore at Mandalay Bay, represented by the adults in red and juveniles in green. In years where age distribution data is not available, the total number of individuals is represented in orange (Adapted from Ikeda and Meyer 2000; Wilken 2002; Meyer 2007a; Meyer, *in litt.* 2009a; and Meyer, *in litt.* 2009c).

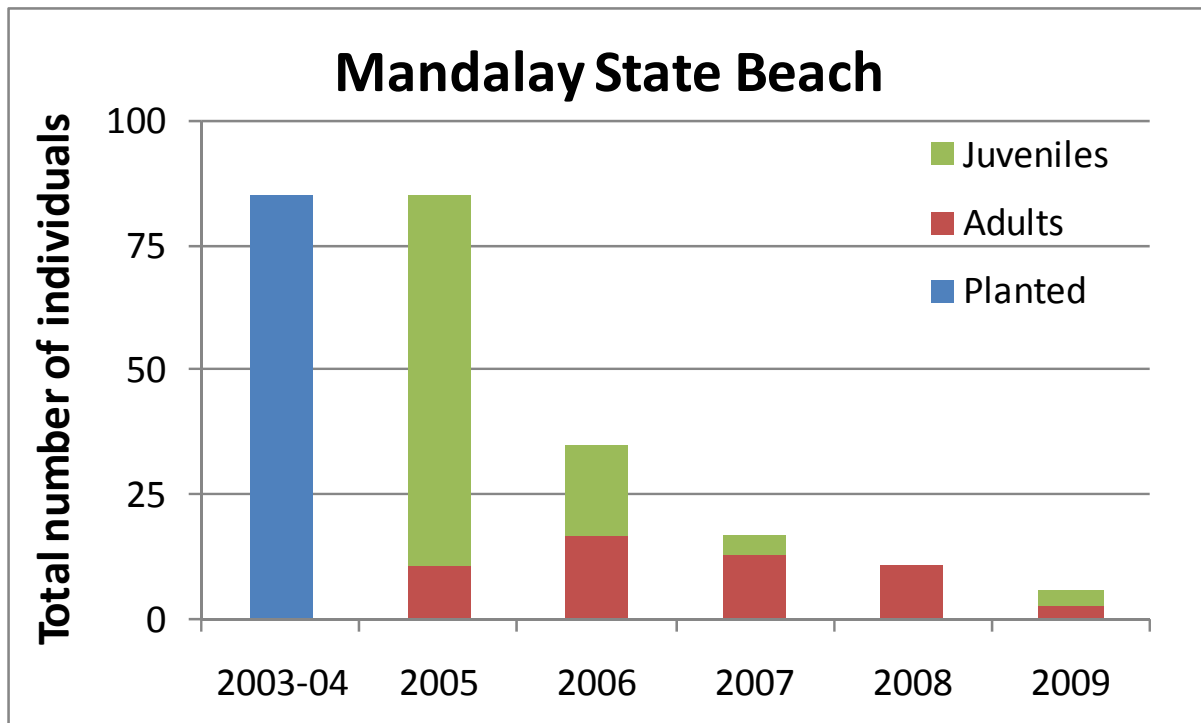


Figure 2. Number of *Astragalus pycnostachyus* var. *lanosissimus* at Mandalay State Beach represented by individuals planted in blue, adults in red, and juveniles in green (Adapted from Meyer 2007a and Meyer, *in litt.* 2009c).

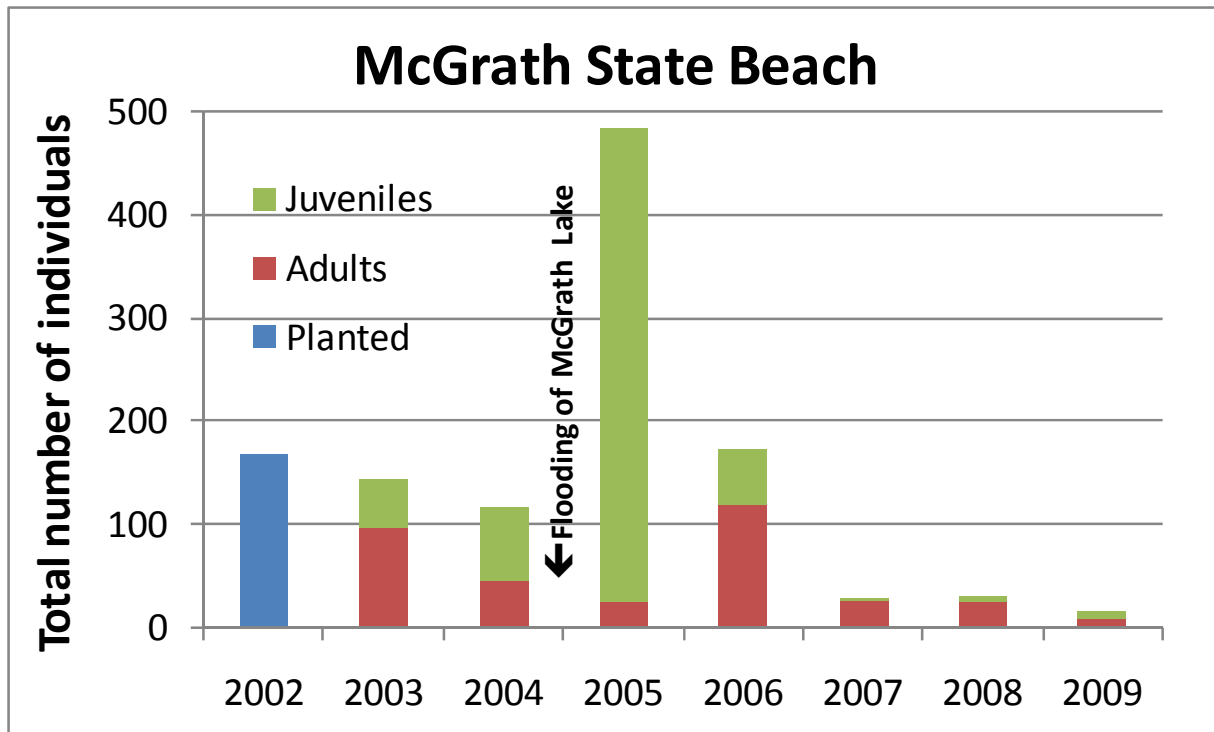


Figure 3. Number of *Astragalus pycnostachyus* var. *lanosissimus* at McGrath State Beach represented by the individuals planted in blue, adults in red, and juveniles in green (Adapted from Meyer 2007a and Meyer, *in litt.* 2009c).

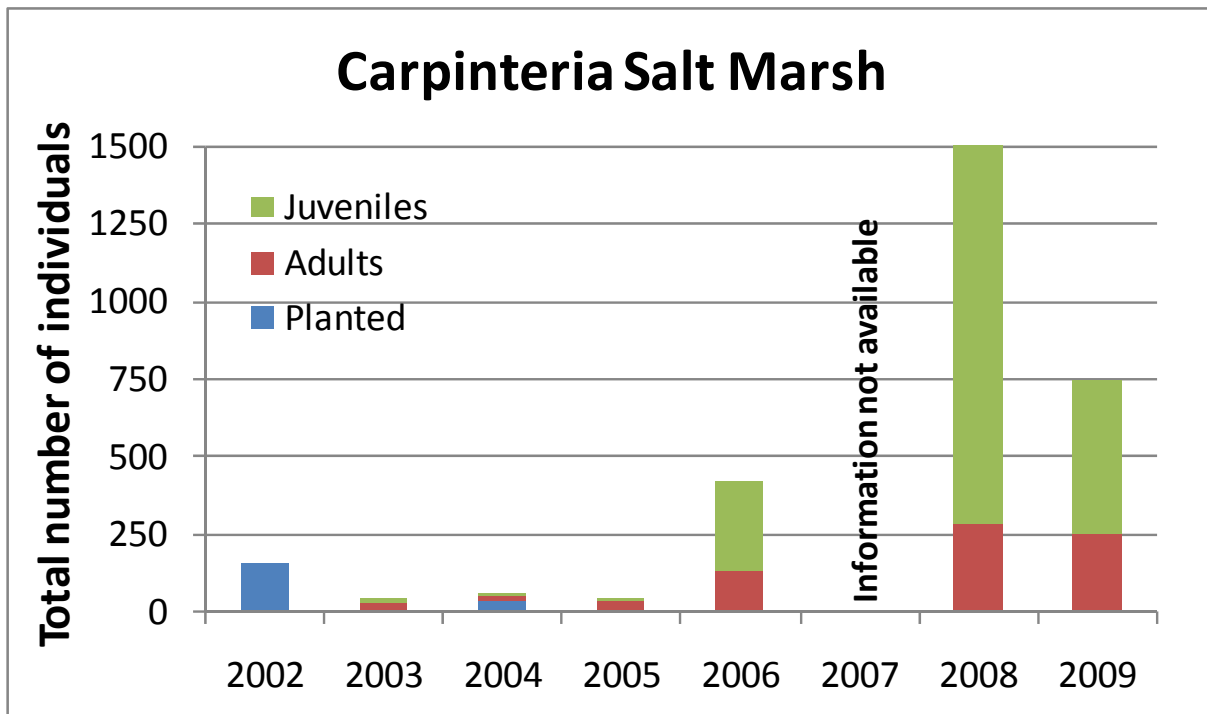


Figure 4. The number of *Astragalus pycnostachyus* var. *lanosissimus* individuals at Carpinteria Salt Marsh represented by planted individuals in blue, adults in red, and juveniles in green (Adapted from Meyer 2007a and Meyer, *in litt.* 2009c).

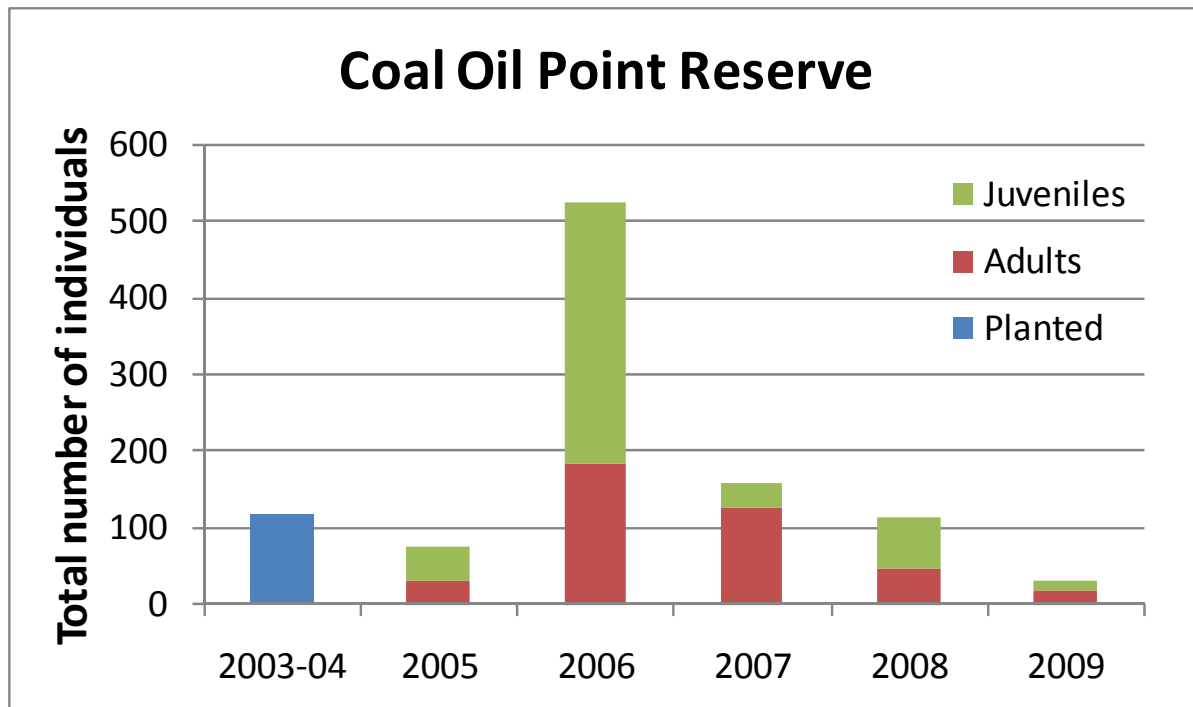


Figure 5. The number of *Astragalus pycnostachyus* var. *lanosissimus* individuals at Coal Oil Point Reserve represented by the number of individuals planted in blue, adults in red, and juveniles in green (Adapted from Meyer 2007a and Meyer, *in litt.* 2009c).