

Coastal dunes milk-vetch (*Astragalus tener* var. *titi*)

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



Photo: Todd Lemein

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

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5-YEAR REVIEW
Coastal dunes milk-vetch (*Astragalus tener* var. *titi*)

GENERAL INFORMATION

Species: *Astragalus tener* var. *titi*
FR citation: 63 FR 43100
Date listed: August 12, 1998
Classification: Endangered

BACKGROUND

Most recent status review

U.S. Fish and Wildlife Service. 2009. *Astragalus tener* var. *titi* (Coastal dunes milk-vetch) 5-Year Review: Summary and Evaluation. Ventura Field Office. Ventura, California.

FR Notice citation announcing this status review

Endangered and Threatened Wildlife and Plants; Initiation of 5-Year Status Reviews of 76 species in California and Nevada. (86 FR 27462), May 20, 2021.

Critical Habitat Designation

No critical habitat has been designated.

State Listing

Listed as endangered under the California Endangered Species Act (CNDDDB 2021a, p. 3).

ASSESSMENT

Information acquired since the last status review

This 5-year review was conducted by the U.S. Fish and Wildlife Service (Service) Ventura Fish and Wildlife Office. Initiation of this review was announced through a Federal Register notice on May 21, 2020. We contacted land managers and species experts to request any data or information we should consider in our review. Additionally, we conducted a literature search and a review of information in our files. The Service funded surveys for coastal dunes milk-vetch in a portion of its range for three years beginning in 2020.

Background

Distribution

The current distribution of coastal dunes milk-vetch is limited to a single extant occurrence on the Monterey Peninsula along 17-Mile Drive in Pebble Beach (Figure 1). The occurrence is located on a coastal terrace boarded to the west by the Pacific Ocean and to the east by the Monterey Peninsula Country Club and residential areas. The occurrence consists of colonies of the species, fragmented by walking paths, a road, and the layout of the golf course. Considered

as a whole, the areal extent of the occurrence is approximately 1 mile long by 0.5 mile wide, although the majority of the population exists in an area 0.25 mile long and 100 to 300 feet wide.

Historically, coastal dunes milk-vetch also occurred in Los Angeles and San Diego Counties (Figure 1). In Los Angeles County, coastal dunes milk-vetch has not been collected since 1903 and the historical occurrences have been heavily urbanized. There are very few undeveloped coastal areas that may still support the species in Los Angeles County and, since listing, no collections or observations have been reported to the Consortium of California Herbaria (CCH) or the California Natural Diversity Database (CNDDDB), (CCH2 2021, data; CNDDDB 2021b, data). In San Diego County, suitable habitat may remain along undeveloped coastal terraces, but the species has not been observed since 1983 (Service 2004, pp. 11-12). The 2009 5-year review considered the historical Los Angeles and San Diego County occurrences likely extirpated (Service 2009, p. 5). Rare plant surveys for coastal dunes milk-vetch and other species have been conducted in areas of suitable habitat on Marine Corps Base Camp Pendleton in the vicinity of a historical occurrence, but have not identified any individuals of coastal dunes milk-vetch (TDS 2000, entire; AMEC 2007, entire; AMEC 2008, entire). We consider coastal dunes milk-vetch possibly extirpated from San Diego County because the species is unlikely to be naturally occurring, but potential suitable habitat remains that represents the greatest chance of success for reintroduction to the southern extent of the historical range.

Habitat

The habitat that currently supports coastal dunes milk-vetch is characterized by its location on a coastal terrace immediately adjacent to the Pacific Ocean. The coastal terrace is approximately 20 to 50 feet above sea-level. During surveys in 2020 and 2021, coastal dunes milk-vetch was found in association with common exotic species including cut-leaf plantain (*Plantago coronopus*), soft chess (*Bromus hordeaceus*), and silver hair grass (*Aira caryophylla*). California burclover (*Medicago polymorpha*) and rattail fescue (*Festuca myuros*) also occurred in occupied habitat where freeway iceplant (*Carpobrotus edulis*) had invaded. Native species were less abundant and included Chilean trefoil (*Acmispon wrangelianus*), coastal tarweed (*Deinandra corymbosa*), sea thrift (*Armeria maritima* ssp. *californica*), California oatgrass (*Danthonia californica*), salt grass (*Distichlis spicata*), tufted hairgrass (*Deschampsia cespitosa*), and brown-headed rush (*Juncus phaeocephalus*) (McGraw 2021, p. 15). Previous surveys had found coastal dunes milk-vetch in vernal wet areas on the coastal terrace in association with goldfields (*Lasthenia gracilis*), yarrow (*Achillea millefolium*), scarlet pimpernel (*Lysimachia arvensis*), California burclover, owl's clover (*Orthocarpus* sp.), cut-leaf plantain, California oatgrass, and tufted hairgrass (Fraga 2008, p. 4; Service 2004, pp. 12-13). Bordering coastal scrub habitat may be characterized by *Eriophyllum staechadifolium* (lizard's tail), *Baccharis pilularis* (coyote brush), *Artemisia californica* (coastal sage brush), and *Erigeron glaucus* (seaside daisy).

Abundance and Population Trends

The Monterey Peninsula occurrence of coastal dunes milk-vetch occurs on land owned by the Pebble Beach Company and Monterey Peninsula Country Club. The portion of the occurrence on land owned by the Pebble Beach Company occurs on the western side of 17-Mile Drive and is fragmented by paved and social walking paths. The portion of the occurrence on the eastern side of 17-Mile Drive is owned by Monterey Peninsula Country Club where the species occurs along

the margins of a golf course. Annual surveys for the species were conducted from 1992 to 2011 (B. Huettmann 2010, pers. com.). In 2019, an estimate of the population on the Pebble Beach portion was provided by Leslie Zander (L. Zander 2019, pers. com.). The Service also funded surveys for coastal dunes milk-vetch on the Pebble Beach portion of the occurrence from 2020 to 2022 (J. McGraw 2021, pers. com.). However, no surveys have been conducted on the Monterey Peninsula Country Club areas since the data reported in the 2009 5-year review (Service 2009, pp. 5-6).

In the 2009 5-year review we found that no trend in abundance could be evaluated because data were collected intermittently. Since 2009, data were again collected intermittently, using different methods, with an eight-year gap between 2011 and 2019 (Table 1). The differing methodologies between years, or within years, make analysis of trends potentially unreliable. For example, in 2007 during seed collection, population size was estimated to be 3,500 individuals. However, in that same year, the volunteer who had been consistently estimating population size estimated 6,779 individuals (Fraga 2008, p. 1; Service 2009, p. 6). The available data do suggest that there are areas that consistently support individuals of coastal dunes milk-vetch, while other areas may be periodically suitable for the species, but do not consistently support individuals. The number of observed individuals has ranged from a low of 9 in 1996 to a high of approximately 7,000 in 2007. The mean population size spanning all available years of data is approximately 1,400 individuals. The available data suggest a variable population that has periods of low abundance and relatively fewer years of high abundance. Variability in rare annual species is not uncommon and is likely driven by temporal variation in rainfall and temperature (Levine et al. 2008, pp. 799-802).

Table 1. Survey results for the Monterey Peninsula occurrence of coastal dunes milk-vetch. Each named or lettered area represents a grouping of plants separated from others by a pathway, road, fence, or golf course. Data are presented for the years when monitoring was conducted since the previous 5-year review in 2009.

	2009	2010	2011	2019	2020	2021
Enclosure	NA	3	12	0	203	44
A	0	0	0	NA	0	0
B	10	36	19	NA	0	0
C	0	0	0	NA	0	0
D	~450	772	1614	~750	78	834
E	10	57	48	NA	22	0
F	0	0	0	NA	NA	NA
G	~50	9	0	NA	NA	NA
H	0	0	0	NA	0	0
I	0	0	0	NA	0	0
J	0	518	47	NA	NA	NA
K	4	3	6	NA	6	0
L	11	7	12	NA	0	0
M	14	9	46	NA	76	29
N	0	0	0	NA	22	2
O	~200	116	343	~750	770	379
P	0	0	0	NA	26	1
Q	0	0	0	NA	0	0
R	0	0	0	NA	0	0
S	~35	188	237	NA	805	456
T	NA	83	0	NA	0	0
Total	~784	1,801	2,384	~1,500	2,008	1,745

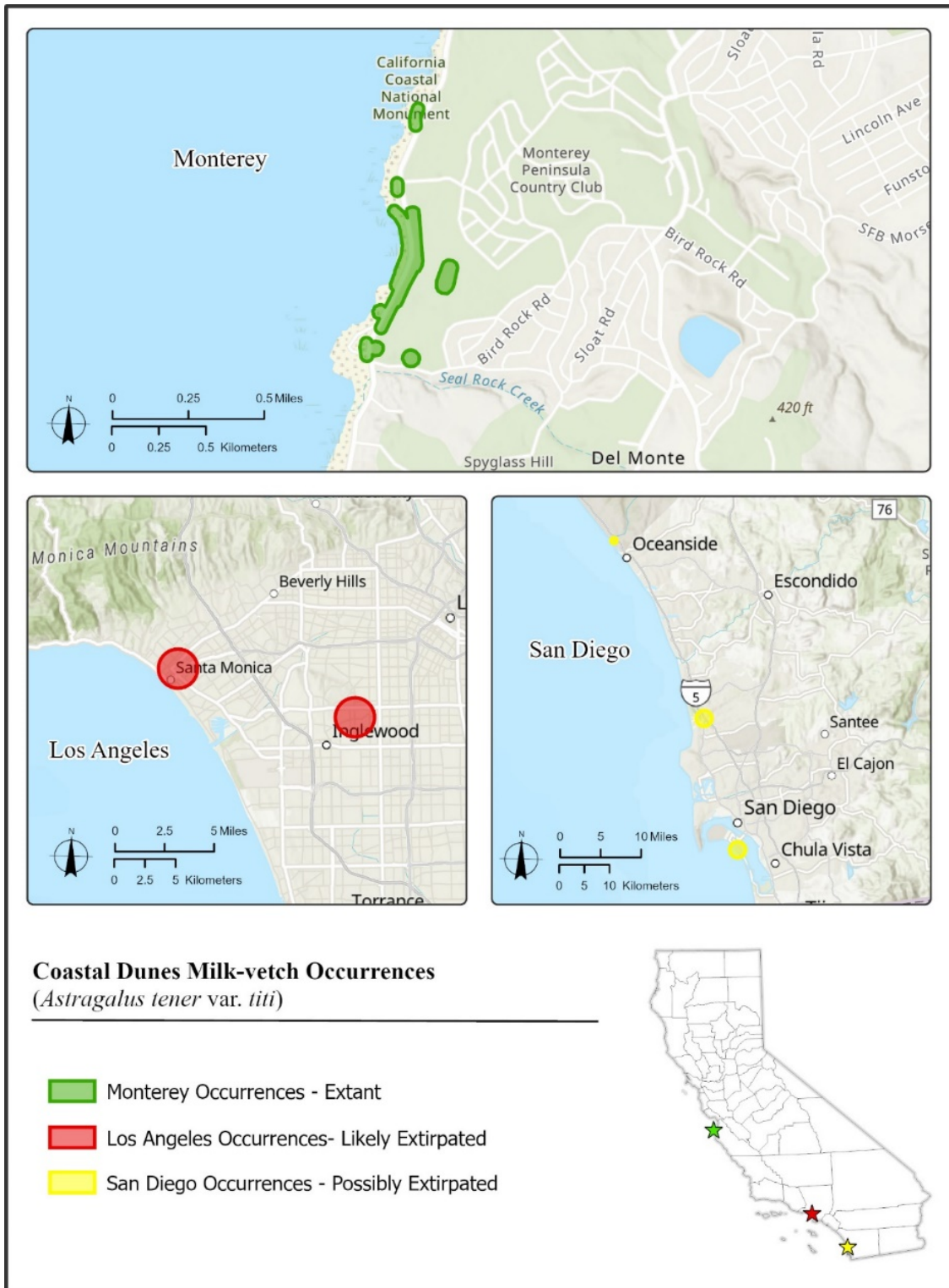


Figure 1. Coastal dunes milk-vetch occurrences (CNDDDB 2021b, data). The extant occurrence on the Monterey Peninsula produces plants that reproduce and set seed annually. The likely extirpated occurrences in Los Angeles County have been urbanized and no suitable habitat remains. The possibly extirpated occurrences in San Diego County contain potentially suitable habitat but the species has not been observed for over 30 years.

Evaluation of Threats

When listed in 1998, the threats to coastal dunes milk-vetch were habitat loss, trampling from recreational activities, stochastic events, and invasive species (Service 1998, pp. 43101, 43109). The 2004 Recovery Plan reiterated these threats and considered herbivory as a potential threat (Service 2004, pp. 14-15). In 2009, the 5-year review described the same threats while also noting climate change as an additional threat (Service 2009, pp. 7-10). A current evaluation of these threats follows.

Habitat Loss and Trampling from Recreational Activities

The Monterey Peninsula occurrence of coastal dunes milk-vetch is located in an area of high pedestrian and vehicular traffic. The patches where the species occurs are generally separated by a paved walking path, social trails (unmanaged trails from repeated use), 17-Mile Drive, and the golf course layout. There is a single area that is fenced, suggesting that people should not enter, although signs are not posted and in many years the majority of the population occurs outside of the fenced area (Table 1). Accidental trampling is likely a common occurrence when people leave the established walking path. There is no current monitoring of the frequency or magnitude of pedestrian trampling and the severity of the threat is unknown. However, the main attraction of 17-Mile Drive is the rocky shoreline and bird watching. Most tourists are likely to remain on established trails, decreasing the frequency and magnitude of trampling. Similarly, the areas adjacent to the golf course are likely to be affected infrequently by golfers, and more frequently by golf course maintenance and layout adjustments. The effects of golf course maintenance including mowing, herbicide application, fertilizer application, and changes to the natural hydrology, which may have severe effects on remaining patches of coastal dunes milk-vetch.

Salvage of abandoned boats along the coastal terrace where the species occurs has emerged as an additional cause for potential habitat loss and trampling. There have been two salvage operations since 2018 that have involved the staging of equipment (e.g., cranes, tow trucks), and lifting or dragging a boat from the rocky intertidal area through the vegetated backshore onto a vehicle for removal. Both of these salvage operations occurred in the area where coastal dunes milk-vetch has historically occurred, although activities were undertaken in a manner to minimize impacts to the species (L. Saum 2021, pers. com.).

Direct habitat loss is only likely to occur if the existing paved walkway is expanded, social trails paved, or layouts of 17-Mile Drive or the golf course expanded or altered. Changes to these features would likely result in loss of habitat that could not be replaced or restored elsewhere. Climate change may also result in habitat loss and is discussed under “Climate Change” below.

Stochastic Extinction

Coastal dunes milk-vetch is composed of a single, small population measured either by areal extent (the majority of the population occurs in an area 0.25 mile long and 100 to 300 feet wide) or abundance (mean population size approximately 1,400 individuals). As a result, environmental (drought, flood, erosion) and demographic (mortality and reproduction) stochastic events are likely to have strong effects on the persistence of the species. The Monterey Peninsula occurrence is surrounded by unsuitable habitat which increases the chance that stochastic events could result in a permanent loss of the species.

Invasive Species

Invasive species such as *Carpobrotus* spp. (iceplant), *Cortaderia* spp. (pampas grass), *Ammophila* spp. (beach grass) are competitors that could reduce habitat suitability and abundance through conversion of habitat and competition for resources. Currently, these invasive species are not present in sufficient abundance to pose an imminent threat to coastal dunes milk-vetch. However, these species and others are present, and if expansion occurs, the loss of coastal dunes milk-vetch could occur quickly. There is no known active management of invasive species either on the Pebble Beach or Monterey Peninsula Country Club properties.

Climate Change

Coastal dunes milk-vetch may be affected by climate change through changes in, and variability of, precipitation, minimum and maximum temperatures, sea level rise, wave induced erosion, and fog. Average precipitation is predicted to increase by 1.5 to 1.8 inches and average minimum and maximum temperatures are expected to increase by 2.9 to 4.6 degrees Fahrenheit (F) from 2022 through 2099 in Monterey where the species currently occurs (Table 1, CalAdapt 2021, data). The predicted increases in average temperature and precipitation are less than the natural range of precipitation and temperatures values across historical range of the species. Although the changes in average temperature and precipitation are small, increases in timing of precipitation and a predicted increase in the frequency of extreme droughts may create conditions that are not suitable for persistence of the species. For example, although precipitation may increase, the precipitation may be delivered in a small number of large storm events leading to periods of dryness that can cause mortality. Fog may lessen the severity of periods of dryness by inhibiting desiccation and reducing evapotranspiration, but current modeling is variable in predictions of fog presence under the influence of climate change (Langridge 2018, pp. 18-20).

Although coastal dunes milk-vetch is a terrestrial plant, its habitat is located immediately adjacent to the ocean, exposing it to the effects of sea level rise, wave induced erosion, and saltwater intrusion through cliff overtopping during extreme storm events such as El Niño. Saltwater intrusion and cobblestone deposition were observed following severe storms during the 2007-2008 winter (Service 2009, p. 8). Sea level rise, erosion, and increases in extreme storm events may increase the frequency of this recurring. The rate of sea level rise is predicted to increase through 2100 leading to an increase of 16.1 to 62.6 inches to mean sea level (ESA PWA 2014, p. 8). An increase in sea level, coupled with a lack of sediment, would result in increased landward erosion (Langridge 2018, pp. 24-25). The effects of sea level rise and erosion will be exacerbated by predicted increases in extreme storm events such as El Niño. El Niño events, or larger than average storms, bring increased wave energy and sea levels that increase the likelihood of cliff overtopping and erosion (Langridge 2018, pp. 20-21, 29). Any loss of the coastal terrace where coastal dunes milk-vetch occurs, due either to erosion or to loss of habitat suitability from salt deposition, will result in a permanent loss of habitat. There is no available space for the species to migrate because the Monterey Peninsula occurrence is bordered to the west by the Pacific Ocean and the east by a road and a golf course.

Because precipitation and temperature variability across the historical range of the species is greater than the predicted increases under climate change, it is not expected that the change in average values will be the dominant threat from climate change. Instead, variability in timing of precipitation, frequency of droughts, and increases in wave-based erosion and saltwater intrusion

from cliff overtopping due to sea level rise and storm frequency are the most likely threats resulting from climate change.

Table 2. Changes in precipitation, minimum average temperature, and maximum average temperature for low and high emission scenarios compared to historical averages for coastal dunes milk-vetch throughout the current and historical range.

	Precip (inches)	Precip (inches)	Min T (deg. F)	Min T (deg. F)	Max T (deg. F)	Max T (deg. F)
	Historical Average	RCP 4.5 (RCP 8.5)	Historical Average	RCP 4.5 (RCP 8.5)	Historical Average	RCP 4.5 (RCP 8.5)
Monterey Peninsula	16.0	17.5 (17.8)	48.5	51.5 (53.1)	66.4	69.3 (70.9)
Los Angeles	16.0	17.2 (17.5)	54.7	58.0 (59.7)	71.0	74.3 (76.0)
San Diego	10.3	10.8 (10.6)	55.0	58.5 (60.3)	71.8	75.4 (77.1)

Precip = Precipitation; Min T = Minimum Average Temperature; Max T = Maximum Average Temperature. Reported values for the modeled futures are based on the average of the HadGEM2-ES (warmer and drier) and CNRM-CM5 (cooler and wetter) future scenarios as reported by CalAdapt.org (CalAdapt 2021). The Representative Concentration Pathway (RCP) 4.5 scenario refers to a future scenario where emissions peak near 2040 and then decline, while RCP 8.5 refers to a scenario where emissions continue to rise strongly through 2050 and plateau near 2100. The historical average is based on the years 1950–2005 as reported by cal-adapt.org. The modeled values are estimates from the years 2022–2099. Reported values are from spatial files delineating the approximate current and historical range of the species in each county.

Summary of Threats

The threats at time of listing and described in the recovery plan and previous 5-year review remain current. The greatest threat to coastal dunes milk-vetch is the loss of habitat resulting from trampling, golf course maintenance, or climate change, followed by the potential loss of patches of the species due to stochastic events. Invasive species are a threat that will increase if left unmanaged, although current levels of invasive species are relatively low. Because the species occupies a small, isolated portion of the coastline bordered by the ocean and development, any loss of habitat is likely to be permanent, requiring restoration and reintroduction to a new location.

EVALUATION OF DOWNLISTING AND DELISTING CRITERIA

Downlisting criteria are described in the Recovery Plan (Service 2004, pp. 49-50). An amendment to the Recovery Plan was published in 2019 describing delisting criteria (Service 2019, p. 8). Downlisting for coastal dunes milk-vetch may be considered when all of the following criteria have been achieved:

- a) At least five viable populations (i.e., populations that are stable or increasing based on multiple years of monitoring, including at least two populations in San Diego or Los

Angeles Counties) occur on suitable habitat with few to no nonnative competitors, and no threats from trampling. The area surrounding each population should allow for movement and expansion.

- b) A minimum of five populations are on land that is permanently protected from development (e.g., residential, commercial, recreational, etc.) including the population that currently exists on Pebble Beach and Monterey Peninsula Country Club property. Funds must be available for appropriate long-term management. Protected habitat must be of adequate size and configuration to ensure that ecosystem and community processes (i.e., hydrologic regime, food webs, pollinator fauna, coastal dune community associates, and associated species) are maintained, and an adequate diversity of sites exist for colonization of new areas as microhabitat conditions change.
- c) Site selection, restoration, and plant reintroduction has been initiated in at least two historical localities in Los Angeles or San Diego Counties. These two reintroduced populations will be considered as part of the five populations of plants described in (a) and (b) above.
- d) The populations of plants are being adequately maintained, such that encroachment by nonnative plants, excessive herbivory, fire prevention activities, or other threats are not negatively affecting coastal dunes milk-vetch directly or indirectly.
- e) The 17-Mile Drive population and additional populations have been appropriately managed such that monitoring has determined that these populations are stable or increasing for a minimum of 3 consecutive years.
- f) A seed bank has been established at a recognized institution that is certified by the Center for Plant Conservation.

Currently, there is a single population of coastal dunes milk-vetch found on the Monterey Peninsula that is highly fragmented and occurs on private land with no designated protections or management. Identification of potential reintroduction areas in Monterey County, Los Angeles County, or San Diego County has not begun. As a result, recovery criteria a, b, c, and d have not been met. The Monterey occurrence along 17-Mile Drive has data spanning several years, which indicate that the population is limited in abundance and areal extent, but is stable around 1,400 individuals. However, data collection methods are inconsistent and may not be reliable. As a result, recovery criterion “e” may be considered partially met. Seed was collected by the California Botanic Garden (formerly Rancho Santa Ana Botanic Garden) in 2007 (Fraga 2008, entire). Three accessions were made totaling 6,882 seeds from 215 plants (Fraga 2008, entire). These seeds are stored at the California Botanic Garden and a subset was sent to the National Center for Genetic Resources Preservation, fulfilling recovery criterion “f.” The California Botanic Garden conducted a follow up germination test in 2018 from the seed collected in 2007. Twenty-two of 25 seeds (88 percent) used in the germination test germinated with scarification. The seedlings that were grown out produced 2,558 seed that are stored at the California Botanic Garden (C. Birker 2021, pers. com.). This suggests that coastal dunes milk-vetch has a high

germination rate and can produce many seeds from few individuals with relatively low effort under nursery conditions.

Because the majority of downlisting recovery criteria have not been met and because the population remains limited in abundance and distribution, with all threats at listing still present, delisting criteria are not considered at this time.

CONCLUSION

The evaluation of threats affecting the species under the factors in 4(a)(1) of the Act and the analysis of the status of the species in our 2009 5-year review remain accurate reflections of the species current status. After reviewing the best available scientific information, we conclude that coastal dunes milk-vetch remains an endangered species.

RECOMMENDATIONS FOR FUTURE ACTIONS

1. Establish a minimum 10-year monitoring program for coastal dunes milk-vetch on the Monterey Peninsula that includes the entirety of the population. The monitoring program should include annual systematic surveys of abundance and more frequent assessments of invasive species, trampling, or other emergent threats.
2. Evaluate the existence of a seed bank at sites in Monterey that have been recently occupied (within the past 3 years) and sites that have not been occupied for at least 5 years.
3. Conduct restoration and outplanting trials at suitable sites in Monterey County.
4. Conduct surveys, site evaluation, restoration and outplanting trials at sites in Los Angeles and San Diego County after successful trials in Monterey County.

APPROVAL

Lead Field Supervisor, Fish and Wildlife Service

Approved _____ Date 1/6/2022
Acting for Stephen P. Henry, Field Supervisor

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