Astragalus lentiginosus var. *coachellae*
(Coachella Valley milk-vetch)

5-Year Review:
Summary and Evaluation

Astragalus lentiginosus var. *coachellae*, photo by Jon Avery (USFWS)

U.S. Fish and Wildlife Service
Carlsbad Fish and Wildlife Office
Carlsbad, California

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5-YEAR REVIEW

Astragalus lentiginosus var. *coachellae* (Coachella Valley milk-vetch)

I. GENERAL INFORMATION

Purpose of 5-Year Reviews:

The U.S. Fish and Wildlife Service (Service) is required by section 4(c)(2) of the Endangered Species Act (Act) to conduct a 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:

Astragalus lentiginosus var. *coachellae,* a member of the Fabaceae (pea family), is an annual or short-lived perennial endemic to the Coachella Valley, Riverside County in the southern California portion of the western Sonoran desert. *Astragalus lentiginosus* var. *coachellae* is strongly affiliated with active, stabilized, and shielded sandy substrates (Sanders and Thomas Olsen Associates 1996). This taxon is primarily found on loose aeolian (wind transported) or alluvial (water transported) sands that are located on dunes or flats and along disturbed margins of sandy washes (USFWS 2004). At listing it was estimated that there were less than 25 known occurrences. Additional occurrences have been identified since listing, however, suitable habitat has likely decreased since listing due to habitat conversion and degradation.

Methodology Used to Complete This Review:

This review was conducted by the Carlsbad Fish and Wildlife Office (CFWO), following the Region 8 guidance issued in March 2008. We used information in our 1998 listing rule (USFWS 1998, p. 53596), our proposed critical habitat designation (USFWS 2004, p. 74468), our final critical habitat designation (USFWS 2005, p. 74112), the Coachella Valley Multiple Species Habitat Conservation Plan (Coachella Valley MSHCP 2007), our Biological Opinion for the Coachella Valley MSHCP (USFWS 2008c), the Agua Caliente Band of Cahuilla Indians draft Tribal Habitat Conservation Plan (Agua Caliente

Tribal HCP) (Agua Caliente Tribal HCP 2007), reports and information in our files, or information sent to us or obtained from interviews with individuals involved in surveys, research, or management of *Astragalus lentiginosus* var. *coachellae*. This 5-year review contains updated information on the taxon's biology and threats, and an assessment of that information compared to that known at the time of listing or since the last 5-year review. We focus on current threats to the taxon that are attributable to the Act's five listing factors. The review synthesizes all this information to evaluate the listing status of the taxon 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: Diane Elam, Deputy Division Chief for Listing, Recovery, and Habitat Conservation Planning, and Jenness McBride, Fish and Wildlife Biologist, Region 8; (916) 414-6464.

Lead Field Office: Ayoola Folarin and Bradd Baskerville-Bridges, Carlsbad Fish and Wildlife Office; (760) 431-9440.

Federal Register (FR) Notice Citation Announcing Initiation of This Review:

A notice announcing initiation of the 5-year review of this taxon and the opening of a 60-day period to receive information from the public was published in the Federal Register on March 22, 2006 (USFWS 2006, p. 14538). We received one letter regarding this 5-year review. Relevant information provided in this letter has been included in the review.

Listing History:

Original Listing
FR notice: 63 FR 53596
Date listed: October 6, 1998
Entity listed: *Astragalus lentiginosus* var. *coachellae* (Coachella Valley milk-vetch), a plant variety.
Classification: Endangered

Associated Rulemakings:

Proposed Critical Habitat
FR Notice: 69 FR 74468
Date of Proposed Critical Habitat Rule: December 14, 2004

Final Critical Habitat
FR Notice: 70 FR 74112
Date of Final Critical Habitat Rule: December 14, 2005

Review History:

No previous 5-year reviews have been completed for *Astragalus lentiginosus* var. *coachellae*.

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

The recovery priority number for *Astragalus lentiginosus* var. *coachellae* is "6C" according to the 2009 Recovery Data Call for the Carlsbad Fish and Wildlife Office. This indicates that this plant is a subspecies (under the Act, the ranks of variety and subspecies are considered equivalent in plant taxa) facing a high degree of threats but having a low recovery potential. The "C" indicates conflict with construction or other development projects or other forms of economic activity. This number is based on a 1-18 ranking system that takes into account the degree of threat, the potential for recovery, and the taxonomic rank of the organism. According to this scale, 1 is the highest-ranked recovery priority and 18 is the lowest (USFWS 1983, p. 43098).

Recovery Plan or Outline:

No Recovery Plan or Recovery Outline has been completed for *Astragalus lentiginosus* var. *coachellae*.

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 Description

Astragalus lentiginosus var. *coachellae* (Coachella Valley milk-vetch) was described by Rupert C. Barneby (1964, p. 695) based on a specimen collected in 1913 by Alice Eastwood in Palm Springs, California. *Astragalus lentiginosus* var. *coachellae*, a member of the Fabaceae (pea family), is an annual or short-lived perennial with ascending stems 4-12 inches (10-30 centimeters) tall. The leaves, stems, and fruits are densely covered with short, appressed (pressed flat), white hairs. The pink-purple flowers are arranged in 11 to 25-flowered racemes (a simple, elongated inflorescence) and the two-chambered fruits are strongly inflated. *Astragalus lentiginosus* var.

coachellae is one of 19 varieties of *A. lentiginosus* found in California (Spellenberg 1993, pp. 597 – 598), none of which occur in the same region or habitat types. *Astragalus aridus* and *A. crotalariae* may be found within the geographical and ecological range of *A. lentiginosus* var. *coachellae*; however, both of these taxa may be distinguished from *A. lentiginosus* var. *coachellae* by their single chambered fruits.

Species Biology and Life History

Astragalus lentiginosus var. *coachellae* seeds germinate in fall to early winter (Meinke et al. 2007, p. 46). Seasonally dormant root crowns (i.e., the point at which the root and stem of a plant meet) sprout new shoots in December - January. The date of first flowering may be as early as December in perennial plants, but usually not until January or February for plants in their first year, and continues into April (Meinke et al. 2007, p. 6). Fruits of *A. lentiginosus* var. *coachellae* are inflated, an apparent adaptation for being dispersed by wind. As such, wind transport corridors between populations facilitate gene flow and population growth. As summer progresses, the plants may die or aerial stems may die back and persist through the summer and fall as dormant root crowns (Meinke et al. 2007, p. 6). It has been observed that the proportion of plants surviving the summer and fall is dependent upon climatic conditions (Meinke et al. 2007, p. 31). Plants in the northwestern portion of the range where rainfall is higher may survive into their second year or longer, while plants that occur in the southeastern extent of the range which receives less rain are primarily annuals (Meinke et al. 2007, p. 31).

Astragalus lentiginosus var. *coachellae* populations can survive prolonged drought periods as dormant seeds (seed bank) (Sanders and Thomas Olsen Associates 1996, p. 3) in the soil, so the numbers of above ground plants at any given time is only a limited and partial indication of population size. It is not known how long seeds may remain viable, although studies on *A. lentiginosus* var. *micans* demonstrate that buried seeds may remain viable for at least eight years (Pavlik 1987, p. 317). Suitable habitat that lacks above-ground individuals may in fact sustain the species through one or more dry years as an undetectable seed bank and dormant root crowns and may therefore be important to the long-term survival of this taxon.

Astragalus lentiginosus var. *coachellae* is genetically self-compatible (i.e., capable of producing viable seeds from the union of pollen and ovules from the same plant), although it is only minimally autogamous (self pollinating) (Meinke et al. 2007, pp. 36 – 37). The mechanism by which seed set is limited in self-crossings is unknown. Meinke et al. (2007, p. 36) placed bags over inflorescences on plants in the field to exclude pollinators and found that only 1.9 percent of flowers produced fruits that contained viable seed when pollinators were excluded and corollas were not manually tripped. Only 14.5 percent of flowers produced fruits with seed when pollinators were excluded and corollas were manually tripped to effect self-pollination. Additionally, 5 bagged inflorescences on different plants produced 2 fruits with 11 seeds total, while an equal number of paired inflorescences on the same plants left open to pollinators produced 72 pods with a total of 596 seeds. These experiments demonstrate that seed production in *Astragalus lentiginosus* var. *coachellae* is highly dependent on pollinators.

Bees in the family Megachilidae are known to visit flowers of *Astragalus lentiginosus* taxa. These include *Anthidium dammersii* and *Megachile astragali* on *Astragalus lentiginosus* var. *fremontii* (Hurd 1979, pp. 1987, 2062) and *Anthocopa robustula* and *Osmia marginata* on *A. lentiginosus* var. *borreganus* (as *A. coulteri)* Hurd 1979, pp. 2022, 2040). The habitat requirements and flight ranges of these native bees are unknown. The primary pollinator of *Astragalus lentiginosus* var. *coachellae* in some instances may be nonnative honeybees (*Apis mellifera*) (Meinke et al. 2007, p. 36). Meinke et al. (2007, p. 36) observed that less than 1 percent of pollinator visits to *A. lentiginosus* var. *coachellae* plants were made by native bees (not identified; possibly a species of *Anthidium*).

Spatial Distribution

The spatial distribution of *Astragalus lentiginosus* var. *coachellae* has remained the same since the taxon was listed as endangered in 1998, and at that time the distribution was effectively the same as the known historical distribution of the taxon. *Astragalus lentiginosus* var. *coachellae* has a distribution limited to the Coachella Valley, Riverside County in the southern California portion of the western Sonoran desert. Barneby (1964, pp. 695–696) initially described this taxon as confined to the Coachella Valley. The majority of verified historical and extant occurrences are found in the northern Coachella Valley from just east of Cabazon eastward to the dunes off Washington Avenue, north and west of Indio within approximately 3 miles (5 kilometers) of Interstate 10 (Barrows 1987 (map), CNDDB 2008). Most of the known occurrences are in and around the Snow Creek area, Whitewater River, Mission and Morongo Creeks, Willow Hole, The Big Dune, and the Thousand Palms Reserve. Collections from along approximately a 5-mile (8-kilometer) portion of Highway 177 northeast of Desert Center in the Chuckwalla Valley east of the Coachella Valley were thought to represent disjunct occurrences of *A. lentiginosus* var. *coachellae*. However, these have since been determined to most likely be *Astragalus lentiginosus* var. *variabilis* (Knaus 2006, p. 18).

Extensive dune systems once occurred at the base of the Santa Rosa Mountains in what are now the cities of Rancho Mirage, Palm Desert, and Indian wells (Barrows 1987, p. 2). As a result of this development, Barrows (1987, p. 2) stated that many populations of *Astragalus lentiginosus* var. *coachellae* within this historical range were presumably lost. The direct and indirect effects of development have eliminated, degraded, and fragmented the majority of historical habitat (USFWS 2008c, pp. 16–17).

Abundance

The historical abundance of *Astragalus lentiginosus* var. *coachellae* plants is unknown. Detecting changes in numbers of individuals of *A. lentiginosus* var. *coachellae* and demographic trends over time is difficult because the number seeds in a given area that germinate and produce standing plants can vary widely from year to year depending on environmental conditions (Sanders and Thomas Olsen Associates 1996, p. 3). Additionally, the number of standing plants at any given time is only a partial indication of population size because the other portion of the population is the seed bank in the

substrate that can persist dormant for a number of years (Sanders and Thomas Olsen Associates 1996, p. 3). A qualitative assessment of abundance may be made by recording whether the plant is present or absent at sites known to provide suitable habitat.

At the time of listing (1998), extant occurrences of *Astragalus lentiginosus* var. *coachellae* were estimated to number less than 25 and the quantity of suitable habitat for this taxon was considered to be decreasing due to continuing direct and indirect impacts of development. Additional occurrences have been detected within the range of the taxon since 1998. However, it is likely that these occurrences existed at the time of listing, and we are aware of them now because of increased survey efforts. Differences in reporting/defining an occurrence make it difficult to discern the remaining number of *Astragalus lentiginosus* var. *coachellae* occurrences. Documented occurrences of *A. lentiginosus* var. *coachellae* are shown in Figure 1.

Since listing, the trend of habitat loss and degradation has continued. Development has replaced occupied habitat in many areas, and altered the sand transport system responsible for the creation and maintenance of *Astragalus lentiginosus* var. *coachellae* habitat within much of the range of the species. Therefore, we estimate that *A. lentiginosus* var. *coachellae* has likely decreased since listing, due to substantial losses of suitable habitat through habitat conversion and degradation.

Habitat or Ecosystem

Astragalus lentiginosus var. *coachellae* is strongly associated with active, stabilized, and shielded sandy substrates (Sanders and Thomas Olsen Associates 1996 p. 3). This taxon is primarily found on loose aeolian (i.e., wind transported) or alluvial (i.e., water transported) sands that are located on dunes or flats, and along disturbed margins of sandy washes (Sanders and Thomas Olsen Associates 1996, p. 3).

Many taxa in the genus *Astragalus*, including *A. lentiginosus* var. *coachellae*, are endemic to habitats with specific substrate or hydrologic conditions. These taxa are therefore naturally limited in distribution by the combination of various physical factors (Spellenberg 1993, pp. 583–605). Most of the sandy habitat suitable for *A. lentiginosus* var. *coachellae* is generated from aeolian sand derived from alluvial fans and floodplains of several drainages within the Indio Hills and San Bernardino Mountains, the Little San Bernardino Mountains, and the San Jacinto Mountains (Griffiths et al. 2002, Figure 2, pp. 10–11). Sediment enters the watershed system from slopes and channels in the headwaters and drainage mid-reaches, and is transported downstream in channels and along floodplains during infrequent flood events (Griffiths et al. 2002, p. 5). Fluvial transport is the dominant mechanism that moves sediment into fluvial depositional areas in watershed systems in the Coachella Valley (Griffiths et al. 2002, p. 5). Some sediment remains on terraces within channels following smaller flood flows, whereas during larger flood events, sediment remains on the surface of large coalescing alluvial fans as floodplain deposits, or is transported from the alluvial fan surface, as well as through these fans, in washes and deposited over broad depositional areas on the valley floor where a portion enters the aeolian sand transport system (Griffiths et al. 2002, p. 5;

USFWS 2000 p. 2). The distribution, maintenance, and morphology of sand dunes in the Coachella Valley that support *A. lentiginosus* var. *coachellae* depend upon adequate sand sources and an intact aeolian sand transport system that is not blocked by structures or windbreaks.

The sandy substrates in the Coachella Valley take many forms, including the following: terraces within watershed channels; floodplain deposits; active sand dunes; stabilized or partially stabilized dunes; active sand fields; stabilized sand fields; and shielded sand dunes and fields. Active sand dunes are an important habitat type for *Astragalus lentiginosus* var. *coachellae* and are generally characterized as almost barren expanses of moving sand where few perennial shrub species survive. The highest densities of *A. lentiginosus* var. *coachellae* have been found in locations containing large areas of aeolian sand, including Snow Creek (Sanders and Thomas Olsen Associates 1996, p. 3), The Big Dune, and Willow Hole areas (Service files). Active sand dunes may intergrade with stabilized or partially stabilized dunes, which have similar sand accumulations and formations. Dunes with a degree of cover provided by evergreen or deciduous shrubs, scattered low annuals, and/or perennial grasses are somewhat stabilized and less susceptible to loss of sand due to wind action. Sand fields are similar to sand dunes, but are smaller sand accumulations of insufficient depth to form dunes. They may be characterized as hummocks forming behind individual shrubs or clumps of vegetation. Stabilized sand fields are similar to active sand fields but contain sand accumulations that are stabilized by vegetation (Holland 1986, p. 5). Armoring is the process where the wind picks up and moves small sand grains and smaller particles, and leaves behind larger sand grains and gravels forming an “armor” that prevents wind from moving additional smaller particles trapped below (Sharp and Saunders 1978, p. 12). The stabilized sand fields in the latter case are temporary, becoming active when the armor is disturbed over large areas (e.g., by flood flows or human activities), or new blow sand is deposited from upwind fluvial depositional areas (Sharp and Saunders 1978, p. 12). Shielded sand dunes and fields have similar sand formations as compared to active and stabilized sand dunes and fields, except that sand source and transport systems that would normally replenish these areas have been interrupted or shielded by human development (USFWS 2004, p. 74471).

Astragalus lentiginosus var. *coachellae* also occur in localized patches of aeolian sand or along active washes that are, in some cases, fairly distant from large dunes or sand field areas (USFWS GIS data). Some of these localized patches of aeolian sands are characterized as ephemeral sand accumulations lacking dune formation (Barrows and Allen 2007, p. 323). This type of habitat generally occurs at the western end of the Coachella Valley where wind velocities are highest (Barrows and Allen 2007, p. 323). Additionally, the species is sporadically found on alluvial soils on flooplain terraces (with little aeolian sands) on large alluvial fans, such as along Morongo Wash in Desert Hot Springs (J. Avery, USFWS Biologist, pers. obs. 2004-2009).

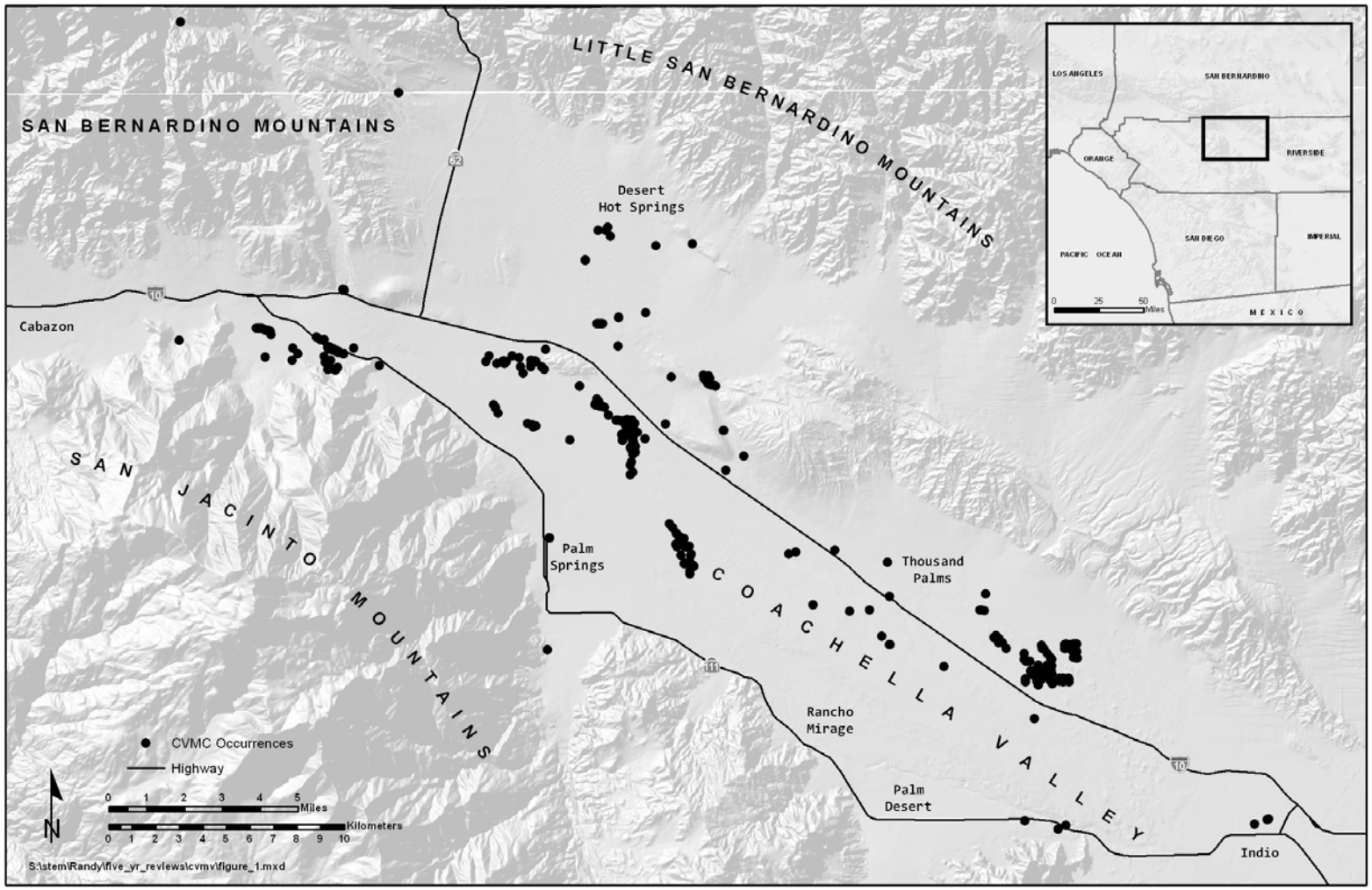

Figure 1: Documented occurrences of *Astragalus lentiginosus var*. *coachellae*.

The sandy substrates that provide suitable habitat for *Astragalus lentiginosus* var. *coachellae* are extremely dynamic in terms of spatial mobility and tendency to change back and forth from active to stable over time (Lancaster 1995, p. 231). This dynamic characteristic has significant consequences for this taxon because population densities vary with different types of sandy substrates (Sanders and Thomas Olsen Associates 1996, p. 3). Suitable habitat may be transitory and consequently currently unoccupied areas may become suitable following fluvial and/or aeolian events, and vice versa. For instance, the greatest densities of plants have been recorded on dune and hummock habitats (e.g., The Big Dune, Snow Creek, and Willow Hole), whereas smaller densities of plants have been recorded on stabilized sand fields (BLM, unpublished GIS data 2001). Conservation of a the wide variety of sandy substrate types that support the species is important for the conservation of *A. lentiginosus* var. *coachellae* because of the dynamics of the aeolian sand transport processes (USFWS 2004, p. 74472).

Species found in association with *Astragalus lentiginosus* var. *coachellae* include *Larrea tridentata* (creosote bush), *Ambrosia dumosa* (burro-weed), *Psorothamnus emoryi* (indigo bush), *Atriplex canescens* (four-wing saltbush), *Abronia villosa* (sand verbena), *Dicoria canescens* (dicoria), *Achnatherum hymenoides* (Indian ricegrass), *Croton californicus* (croton), *Chamaesyce polycarpa* (sandmat), *Petalonyx thurberi* (sandpaper plant), *Astragalus aridus* (annual desert rattleweed), *A. crotalariae* (salton milk-vetch), and *Oenothera deltoides* (devil's lantern).

Changes in Taxonomic Classification or Nomenclature

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

Genetics

Brian Knaus, (graduate student, Oregon State University) compared genotypic and phenotypic traits across several varieties of *Astragalus lentiginosus* and within individual *Astragalus lentiginosus* varieties. He discovered a lack of distinctiveness exists between morphological traits (e.g., calyx tooth length, fruit dimensions) and genetic traits (e.g., chloroplast DNA haplotypes) among *Astragalus lentiginosus* varieties occurring in the southern California desert (B. Knaus, Oregon State University, pers. comm. 2008). Additionally, he observed a great deal of genetic variation between *A. lentiginosus* var. *coachellae* individuals and speculates that this variation could be due to the apparently long-lived seed bank of the taxon, which may result in grossly overlapping generations (i.e., young seeds and much older seeds germinating contemporaneously) (Knaus pers. comm. 2008).

Species-specific Research and/or Grant-supported Activities

The genetic work of Meinke et al. (2007, p. 36) is part of a larger project aimed at developing management and recovery strategies for *Astragalus lentiginosus var. coachellae* by studying the life-history of the plant; seed bank dynamics; and the effects

of various disturbances, especially habitat fragmentation and encroachment of nonnative competitors such as *Brassica tournefortii* (Sahara mustard) on *A. lentiginosus* var. *coachellae* populations. This work is funded by a section 6 grant awarded in 2006.

Five-Factor Analysis

The following five-factor analysis describes and evaluates the threats attributable to one or more of the five listing factors outlined in section 4(a)(1) of the Act. The listing rule analyzed threats in the context of approximately 25 known occurrences. Our current analysis examines all known occupied habitat.

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

At the time of listing the primary threat to *Astragalus lentiginosus* var. *coachellae* was habitat destruction due to extensive urban development in the Coachella Valley (USFWS 1998, p. 53598). The listing rule noted that populations were destroyed by direct conversion of land on which they occur and by development-related activities altering or reducing the source and transport of blow sands that maintain the sand habitats in the Coachella Valley (Barrows 1987, pp. 2, 6; USFWS 1998, p. 53598). Development of wind energy parks and degradation from OHV use were also listed as threats under Factor A (USFWS 1998, p. 53598).

The listing rule stated that remaining *Astragalus lentiginosus* var. *coachellae* habitat areas were vulnerable to one or more of the following disturbances: urban development, development of wind energy parks, and degradation by off-highway vehicle (OHV) use – also a threat to the plant itself as further discussed under Factor E below. The threat posed by invasive nonnative plants and ground water pumping, not identified in the listing rule, is also described in this section.

Development

Extensive urban development in the Coachella Valley was identified as the primary threat to *Astragalus lentiginosus* var. *coachellae* habitat at the time of listing (USFWS 1998, p. 53598). Dune systems suitable for *A. lentiginosus* var. *coachellae* once occurred along much of the length of the Coachella Valley floor. The elimination of this habitat type largely began with the introduction of agriculture over a century ago, and urbanization has accelerated these losses in the past 40 years. Significant dune systems that once occurred along the southwest edge of the Coachella Valley at the base of the Santa Rosa Mountains now support cities such as Rancho Mirage and Palm Desert (Barrows 1987, p. 2). Coachella Valley has experienced significant growth since the 1970s. The projection of a population of 500,000 people by 2010 in the listing rule (USFWS 1998, p. 53605) is close to current projections of approximately 418,300 people by the year 2010 and 518,500 by 2010 forecasted by the Southern California Association of Governments and provided in the Coachella Valley MSHCP (Coachella Valley MSHCP 2007, Table 2-1, p.

2-2). This predicted growth suggests urban and commercial/industrial development pressures will continue to rise within the extant range of *A. lentiginosus* var. *coachellae*.

Development continues to result in direct or indirect impacts to *Astragalus lentiginosus* var. *coachellae* habitat. Direct impact includes loss of habitat by conversion of the sandy substrates to development. Development activities indirectly impact habitat through alteration of the wind sand transport systems of wind, and modifications of flood scour and sediment deposition patterns. These impacts, in turn, ultimately diminish the amount and distribution of sand available to maintain habitat for the species, and diminish the amount and ecological functions of sandy habitats themselves (causes of habitat degradation). These topics are discussed in greater detail below.

Habitat Loss

Direct loss of *Astragalus lentiginosus* var. *coachellae* habitat results when essential habitat features are displaced by structures, roads, or landscaping. These losses include complete loss of specific habitat types necessary for germination and survival of future cohorts of *A. lentiginosus* var. *coachellae* as well as the mortality of any plants and seeds in the seed bank occupying the developed former habitat. Development of *A. lentiginosus* var. *coachellae* habitat has continued since the taxon was listed in 1998, although many of these development projects have been subject to consultation under section 7 of the Act (Service files).

Based on calculations made for the critical habitat proposal, an estimated 17,746 acres (7,182 hectares) of land was potentially occupied by *Astragalus lentiginosus* var. *coachellae* at the time of listing (USFWS 2005, p. 74127). About 3,655 acres (1,479 hectares) of this area was protected from development on the three Coachella Valley fringe-toed lizard (*Uma inornata*) reserves in the Coachella Valley Preserve System at that time. The remainder of potentially occupied habitat was mostly on privately owned lands, which included land owned by Southern California Edison and land on the Agua Caliente Indian Reservation. The lands containing potential habitat for the species on the Agua Caliente Indian Reservation along the Whitewater River and on The Big Dune have not been protected from development.

Since listing, development projects with a Federal nexus and potential effects to the species have been subject to consultation under section 7 of the Act, resulting in the implementation of conservation measures that reduce impacts to the taxon and its habitat. These measures have variously included avoidance, reduction of direct and indirect impacts, restoration of some affected habitat areas, long term maintenance and monitoring of habitat in some areas, and payment of conservation fees. These fees have been used to acquire and preserve lands that contain either suitable habitat for the taxon or ecosystem processes essential to the maintenance of habitat for the species. Analysis of development projects covered by Habitat Conservation Plans (HCPs) and our associated section 10 permits under the Act are discussed further under Factor D below.

Substantial habitat for *Astragalus lentiginosus* var. *coachellae* has been lost since listing; however, actions have been taken to preserve and manage some remaining habitat areas in the Coachella Valley MSHCP Plan Area. The Coachella Valley MSHCP outlines five goals and corresponding objectives aimed at protecting and managing *A. lentiginosus* var. *coachellae* in portions of the Plan Area (HCP reserve areas and species conservation goals and objectives are discussed in more detail in the Factor D section of this review). Although losses of *A. lentiginosus* var. *coachellae* habitat are likely lessened on private lands via avoidance and minimization measures associated with section 7 consultations and conservation provisions of the Coachella Valley MSHCP, this taxon continues to remain vulnerable to habitat loss. It is expected that Agua Caliente Tribal HCP will provide substantial conservation measures commensurate with the impacts to be covered, if covered by a future section 10(a)(1)(B) permit.

Alteration to Sand Transport

The listing rule lists artificial alterations in the sand transport system as a threat to *Astragalus lentiginosus* var. *coachellae*. Since listing, development has continued to encroach on the essential sand transport corridors of the Coachella Valley, and the resulting effects on the necessary movement of blow sands through the Valley are still considered a significant threat to the taxon.

Structures, percolation ponds, utility substations, spoil piles and levees, road fill, and windrows associated with development have been constructed or planted within most of the sand source and sand transport corridors remaining in the Coachella Valley. This development has artificially stabilized, confined, re-directed, or blocked the majority of fluvial or aeolian sand that previously would have moved freely southeasterly down the valley. Therefore, the continued replenishment of blow sand in *Astragalus lentiginosus* var. *coachellae* habitat has been greatly reduced or prevented in many areas.

Mequite hummocks contribute to the creation and stabilization of sand dunes and sand fields by anchoring dunes and making them less vulnerable to wind erosion. The honey mesquite shrubs associated with the Banning Fault are senescent, degraded, and appear to be dying along its western extent (between Mission Creek and Morongo Wash), likely due to ongoing artificial lowering of groundwater levels in the subbasin to provide water for human use (Mission Springs Water District 2008); they are predicted to be effectively dead by 2016. Loss of the mesquite hummocks may lead to the erosion of blow sand deposits, therefore affecting *Astragalus lentiginosus* var. *coachellae* habitat created/maintained by the trapping of blow sand.

Wind Energy Parks

The listing rule cited development of wind energy parks as a threat to *Astragalus lentiginosus* var. *coachellae* populations. However, subsequent to the construction and operation of several facilities, the taxon has been observed to persist within and downwind of wind energy parks as long as impacts to habitat during facility construction and maintenance are minimized (Coachella Valley MSHCP 2007, pp. 9–20; Meinke et al.

2007, p. 63) and natural flood flows and associated fluvial sand deposition are not impeded by associated facilities (USFWS 2008b). Provided these impacts continue to be minimized, the development of wind energy parks may not be a significant long-term threat to *A. lentiginosus* var. *coachellae*.

Nonnative Plant Species

A threat to *Astragalus lentiginosus* var. *coachellae* not identified in the listing rule is degradation and loss of habitat due to invasive nonnative plants, such as *Brassica tournefortii* (Saharan mustard), *Erodium* spp. (filaree), and *Schismus barbatus* (Mediterranean grass). Invasive, nonnative plant species can potentially affect *A. lentiginosus* var. *coachellae* habitat by stabilizing loose sediments in otherwise unsuitable locations and obstructing transport of sediment to occupied habitat downwind.

Nonnative plants, in particular the annual *Brassica tournefortii*, potentially pose a significant threat to *Astragalus lentiginosus* var. *coachellae*. *Brassica tournefortii* has invaded most suitable habitat occupied by *A. lentiginosus* var. *coachellae* in the Coachella Valley, and in years when precipitation has been high, dense populations of *B. tournefortii* have been found in reserve areas vital to the persistence of *A. lentiginosus* var. *coachellae* (Meinke et al 2007, p. 51). *Brassica tournefortii* populations reproduce prolifically and create large, long-lived seed banks which sustain populations through dry years, and make eradication of the species effectively impossible (Meinke et al 2007, p. 64). In addition to competition for space, nonnative plants that germinate and grow more readily even in dryer years may also directly compete with *A. lentiginosus* var. *coachellae* for water. The impact of competition of nonnative species on *Astragalus lentiginosus* var. *coachellae* is discussed below under Factor E.

Off-Highway Vehicles (OHVs)

Recreational OHV use was identified in the listing rule as a threat to *Astragalus lentiginosus* var. *coachellae* habitat. Off-highway vehicle use continues to threaten the taxon and its habitat, although control of unauthorized OHV use in habitat occupied by *Astragalus lentiginosus* var. *coachellae* has recently improved through stepped-up local enforcement. Habitat effects of OHV use include disruption of soil hydrology and changes in plant community composition (USFWS 2008a, p. 8766). Off-highway vehicle use also impacts *A. lentiginosus* var. *coachellae* by directly damaging plants and seeds; this is discussed in Factor E below.

Summary of Factor A

Since *Astragalus lentiginosus* var. *coachellae* was listed, consultations under section 7 of the Act and protections carried out under the Coachella Valley MSHCP and proposed in the Agua Caliente Tribal HCP will likely result in improved levels of protection for the taxon from development. However, direct loss of habitat will likely continue at some level and the indirect impacts of altered sand transport systems will persist and perhaps intensify even with approved development. Invasion of nonnative plants is a newly

identified threat to suitable *A. lentiginosus* var. *coachellae* habitat and is likely to be persistent and rangewide.

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

No threats attributable to this factor were noted in the listing rule (USFWS 1998, p. 53606). We are not aware of current threats to *Astragalus lentiginosus* var. *coachellae* attributable to this listing factor.

FACTOR C: Disease or Predation

Neither disease nor predation was known to be a threat to *Astragalus lentiginosus* var. *coachellae* at the time it was listed (USFWS 1998, p. 53606). Since listing, consumption of leaves, fruits, and seeds have been documented for this taxon. Additionally, since listing, a fungal or viral disease has been observed to infect *Astragalus lentiginosus* var. *coachellae*.

Predation of *Astragalus lentiginosus* var. *coachellae* seeds was documented in a 2005/2006 study (Meinke et al. 2007, p. 40). The most commonly observed larval seed predators were a chalcid wasp *(Bruchophagus mexicanus)* and seed beetles (Brucidae; genus *Acanthoscelides*). Additionally, weevil larvae (Curculionidae; possibly genus *Tychius*) and stinkbug nymphs (Pentatomidae; genus *Chlorochora*) were believed to feed on ovules and seeds in pods (Meinke et al. 2007, pp. 40 – 43). Larval predation of ovules and seeds may result in the destruction of a sizable proportion of the annual seed output for *A. lentiginosus* var. *coachellae*. For example, in 2005 and 2006, 78.4 percent and 64.2 percent, respectively, of mature pods sampled by Meinke et al. (2007, p. 43) had been impacted by at least one larval seed predator, all of which were native species.

Mammal herbivory on *Astragalus lentiginosus* var. *coachellae* leaves and green seed pods was also observed (Meinke et al. 2007, pp. 43 – 44). Herbivory by mammals (possibly rabbits and ground squirrels) was more prevalent in 2006 than 2005, possibly because 2006 was a drier year and forage was at a premium. Destruction and presumed predation of green seed pods (most likely by ground squirrels and/or kangaroo rats) though uncommon overall, was also observed more often in 2006. Herbivory likely decreases the survival and reproductive potential of the plants and therefore input to the seed bank.

An unidentified fungal or viral disease was observed to infect *Astragalus lentiginosus* var. *coachellae* during 2005, possibly due to the wetter, cooler weather conditions (the disease was not observed in 2006; Meinke et al. 2007, p. 45). The disease caused all flowers on infected racemes to wilt, which prevented pollination and production of fruit, and at times killed the entire plant (Meinke et al. 2007, p. 45).

FACTOR D: Inadequacy of Existing Regulatory Mechanisms

At the time of listing, regulatory mechanisms thought to have some potential to protect *Astragalus lentiginosus* var. *coachellae* included: (1) the California Endangered Species Act of 1984 (CESA), (2) the California Environmental Quality Act (CEQA), (3) the Act, (4) the Clean Water Act, and (5) regional planning efforts (USFWS 1998, pp. 53596–53615). The following discussion describes State, Federal, and regional regulatory mechanisms that contribute to the conservation of *Astragalus lentiginosus* var. *coachellae* and have reduced the impacts of development and other threats to this plant.

State Protections

State laws providing protection to *Astragalus lentiginosus var*. *coachellae* include CESA, the Native Plant Protection Act (NPPA) enacted in 1977, CEQA, and the Natural Communities Conservation Planning Act (NCCP) enacted in 1991.

California Endangered Species Act (CESA) and Native Plant Protection Act (NPPA)

The CESA (California Fish and Game Code, section 2080 *et seq*.) prohibits the unauthorized take of State-listed threatened or endangered species. The NPPA (Division 2, Chapter 10, section 1908) prohibits the unauthorized take of State-listed threatened or endangered plant species. The CESA requires State agencies to consult with CDFG on activities that may affect a State-listed species and mitigate for any adverse impacts to the species or its habitat. Pursuant to CESA, it is unlawful to import or export, take, possess, purchase, or sell any species or part or product of any species listed as endangered or threatened. The State may authorize permits for scientific, educational, or management purposes, and to allow take that is incidental to otherwise lawful activities.

Furthermore, with regard to prohibitions of unauthorized take under NPPA, landowners are exempt from this prohibition for plants to be taken in the process of habitat modification. Where landowners are notified by the State that a rare or endangered plant is growing on their land, the landowners are required to notify CDFG 10 days in advance of changing land use in order to allow salvage of listed plants. CESA generally requires an incidental take permit for activities that would result in take of a State-listed species. Among other requirements for a State incidental take permit, a project proponent must demonstrate that any such take will be fully mitigated. Although *Astragalus lentiginosus* var. *coachellae* is not listed under CESA, it can co-occur with other listed state species and, therefore, may receive indirect protection under CESA and NPPA.

California Environmental Quality Act (CEQA)

CEQA is the principal statute mandating environmental assessment of projects in California. The purpose of CEQA is to evaluate whether a proposed project may have an adverse affect on the environment and, if so, to determine whether that effect can be reduced or eliminated by pursuing an alternative course of action or through mitigation.

CEQA applies to projects proposed to be undertaken or requiring approval by State and local public agencies (*http://www.ceres.ca.gov/topic/env_law/ceqa/summary.html*). CEQA requires disclosure of potential environmental impacts and a determination of "significant" if a project has the potential to reduce the number or restrict the range of a rare, threatened, or endangered species ("rare, threatened, or endangered species" include species listed as threatened, or endangered under the Act (CEQA Guideline section 15380)). However, projects may move forward if there is a statement of overriding consideration. If significant effects are identified, the lead agency has the option of requiring mitigation through changes in the project or to decide that overriding considerations make mitigation infeasible (CEQA section 21002). Protection of listed species through CEQA is, therefore, dependent upon the discretion of the lead agency involved.

The Natural Community Conservation Planning (NCCP) Act

The NCCP program is a cooperative effort between the State of California and numerous private and public partners with the goal of protecting habitats and species. An NCCP identifies and provides for the regional or area-wide protection of plants, animals, and their habitats, while allowing compatible and appropriate economic activity. The program began in 1991 under the State's NCCP Act (CFG Code 2800-2835). The primary objective of the NCCP program is to conserve natural communities at the ecosystem scale while accommodating compatible land uses (*http://www.dfg.ca.gov/nccp/*). Regional NCCPs provide protection to federally listed species by conserving native habitats upon which the species depend. Many NCCPs are developed in conjunction with Habitat Conservation Plans (HCPs) prepared pursuant to the Act, such as the Coachella Valley MSHCP. *Astragalus lentiginosus* var. *coachellae* is covered under the Coachella Valley MSHCP and is discussed below.

Federal Protections

Federal laws providing protection to *Astragalus lentiginosus var*. *coachellae* include the National Environmental Policy Act (NEPA), the Clean Water Act, the Act, and regional planning efforts.

National Environmental Policy Act (NEPA)

NEPA (42 U.S.C. 4371 *et seq*.) provides some protection for listed species that may be affected by activities undertaken, authorized, or funded by Federal agencies. Prior to implementation of such projects with a Federal nexus, NEPA requires the Federal agency to analyze the project for potential impacts to the human environment, including natural resources. In cases where that analysis reveals significant environmental effects, the Federal agency must propose mitigation alternatives that would offset those effects (40 C.F.R. 1502.14F). These mitigations can provide some level of protection for listed species. However, NEPA does not require that environmental impacts be avoided, only that effects be assessed and the analysis disclosed to the public. Therefore, this regulatory mechanism may not be adequate to fully protect the species.

Clean Water Act

Under section 404, the U.S. Army Corps of Engineers (Corps) regulates the discharge of fill material into waters of the United States, which include navigable and isolated waters, headwaters, and adjacent wetlands (33 U.S.C. 1344). In general, the term "wetland" refers to areas meeting the Corps' criteria of hydric soils, hydrology (either sufficient annual flooding or water on the soil surface), and hydrophytic vegetation (plants specifically adapted for growing in wetlands). Any action with the potential to impact waters of the United States must be reviewed under the Clean Water Act, NEPA, and the Act. These reviews require consideration of impacts to listed species and their habitats, and recommendations for mitigation of significant impacts. Most occupied habitat for *Astragalus lentiginosus* var. *coachellae* is found outside of the Waters of the United States, thus most of the impacts to the taxon would not fall under Corps jurisdiction.

Endangered Species Act of 1973, as amended (Act)

Since listing, the Act is the primary Federal law that may provide protection for this species. The Service's responsibilities include administering the Act, including sections 7, 9, and 10. Section 7(a)(2) of the Act requires Federal agencies, including the Service, to ensure that actions they fund, authorize, or carry out do not "jeopardize" a listed species or result in the "destruction or adverse modification" of habitat in areas designated by the Service to be "critical". Critical habitat was proposed for this taxon (USFWS 2005, pp. 74112-74136), however, all habitat with essential features was determined to exist within areas to be conserved and managed by the draft Coachella Valley MSHCP, and therefore all essential habitat was excluded or exempted from critical habitat under section 4(b)(2) or 3(5)(A) of the Act, and 0 acres of critical habitat were designated for *Astragalus lentiginosus* var. *coachellae*. A jeopardy determination is made for a project that is reasonably expected, either directly or indirectly, to appreciably reduce the likelihood of both the survival and recovery of a listed species in the wild by reducing its reproduction, numbers, or distribution (50 C.F.R. § 402.02). A non-jeopardy opinion may include reasonable and prudent measures that minimize the amount or extent of incidental take of listed species associated with a project. Destruction or adverse modification means a direct or indirect alteration that appreciably diminishes the value of critical habitat for both the survival and recovery of a listed species. Such alterations include, but are not limited to, alterations adversely modifying any of those physical or biological features that were the basis for determining the habitat to be critical (50 C.F.R. § 402.02).

Under Section 9(a)(2) or the Act, with respect to endangered plant taxa, it is unlawful to remove and reduce to possession (i.e. collect) any such taxon from areas under Federal jurisdiction; maliciously damage or destroy any such taxon on any such area; or remove, cut, dig up, or damage or destroy any such species on any other area in knowing violation of any law or regulation of any State or in the course of any violation of a State criminal trespass law. As noted above *Astragalus lentiginosus var. coachellae* is not State-listed,

but it does occur on Federal lands. Therefore, this species is only afforded protections under section 9 of the Act on Federal lands.

Under Section 10(a)(1)(A) of the Act there are provisions for collection of plants or plant parts for scientific purposes or to enhance the propagation and survival of the species. Under section 10(a)(1)(B) the Service may issue "incidental take" (take is defined in section 3(18) of the Act) permits for listed animal species to non-Federal applicants. Take and therefore incidental take protections are not extended to plants. "Incidental take" refers to taking of listed species that results from, but is not the purpose of, carrying out an otherwise lawful activity by a Federal agency or applicant (50 CFR 402.02). 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 impact of such taking to listed species including listed plants. Issuance of an incidental take permit by the Service is subject to provisions of section 7 of the Act; thus, the Service is required to ensure that the actions proposed in the HCP are not likely to jeopardize the animal or plant species or result in the destruction or adverse modification of critical habitat. Therefore, HCPs may provide an additional layer of regulatory protection. *Astragalus lentiginosus* var. *coachellae* is covered under the Coachella Valley MSHCP and will be covered under the Agua Caliente Tribal HCP once it is completed. These two HCPs are discussed below.

Coachella Valley Multiple Species Habitat Conservation Plan (MSHCP)

The Coachella Valley Multiple Species Habitat Conservation Plan/Natural Community Conservation Plan (Coachella Valley MSHCP) was finalized in 2007 by the Coachella Valley Association of Governments (CVAG) with the aim of balancing environmental protection and economic development objectives in the Coachella Valley MSHCP Plan Area and simplifying compliance with endangered species related laws (Coachella Valley MSHCP 2007, pp. 1-2). The Coachella Valley MSHCP was permitted by the Service under section 10 of the Act in 2008. The Coachella Valley MSHCP, to the maximum extent practicable, minimizes and mitigates the impacts of take of 27 covered species, including *Astragalus lentiginosus* var. *coachellae*.

Approximately 36,398 acres (14,730 hectares) of potential habitat for *Astragalus lentiginosus* var. *coachellae* occurs in the Coachella Valley MSHCP Plan Area, according to CVAG. Under the Coachella Valley MSHCP, 15,706 acres (6,356 hectares) of modeled *A. lentiginosus* var. *coachellae* habitat will be lost to development. To mitigate this loss, the Coachella Valley MSHCP will preserve 7,176 acres (2,904 hectares) of modeled habitat for the species in perpetuity. Another 4,497 acres (1,820 hectares) are anticipated to be conserved through complementary and cooperative efforts by Federal and State agencies and non-governmental organizations. Additionally, 7,707 acres (3,118 hectares) of *A. lentiginosus* var. *coachellae* modeled habitat within the Plan Area were preserved prior to completion of the Coachella Valley MSHCP on the three fringe-toed lizard reserves in the Coachella Valley Preserve System. These lands and the 11,650 acres (4,715 hectares) of lands yet to be conserved under the Coachella Valley MSHCP will total 19,357 acres (7,833 hectares) of *A. lentiginosus* var. *coachellae*

modeled habitat within the Coachella Valley MSHCP Reserve System. As habitat areas are acquired under the Coachella Valley MSHCP, they are legally protected within the Reserve System and the direct impacts of development are precluded. This protection, as well as implementation of the avoidance, minimization, and mitigation measures and management and monitoring programs identified in the Coachella Valley MSHCP will reduce impacts to this taxon compared to what would have occurred otherwise.

The City of Desert Hot Springs did not seek a permit under the Coachella Valley MSHCP. Therefore, the private lands within the City of Desert Hot Springs are not subject to the Coachella Valley MSHCP and the requirements of the Service's associated section 10(a)(1)(B) permit. Lands under the jurisdiction of Desert Hot Springs are essential to the conservation of *Astragalus lentiginosus* var. *coachellae* because they contain substantial areas of densely occupied habitat and two essential alluvial sand sources (Mission Creek and Morongo Wash) (floodplains of both of these drainages occur in areas approved or planned for development by the City). Most of the predicted development impacts to the *A. lentiginosus* var. *coachellae* within the City of Desert Hot Springs would not be addressed under section 7 of the Act (as most would not have a federal nexus). However, we anticipate that some of this future development may require other section 7 review (if a Federal action is involved) or permitting through Section 10 (if co-located with a threatened or endangered animal species). Pursuant to CEQA, the City of Desert Hot Springs should avoid, minimize, and mitigate the impacts to *A. lentiginosus* var. *coachellae* of planned development (CEQA Guidelines section 15065). Desert Hot Springs recently passed a resolution to adopt measures to ensure project approval in compliance with the Coachella Valley MSHCP, thus development-related impacts to *A. lentiginosus* var. *coachellae* on non-Federal lands to date have will be mitigated for any future projects approved within the City. The City of Desert Hot Springs is actively pursuing its intent to join the Coachella Valley MSHCP in the near future through a major amendment to the MSHCP, but that will take several months to complete (USFWS 2008a, Appendix A, p. 43).

Agua Caliente Tribal Habitat Conservation Plan (HCP)

Under the draft Agua Caliente Tribal HCP, much of the suitable habitat for *Astragalus lentiginosus* var. *coachellae* would be lost including areas supporting dense populations of the taxon (USFWS 2008c, p. 24). Conservation of 177 acres (72 hectares) of habitat in Section 6 (Township 4 South, Range 5 East, San Bernardino Meridian) of the HCP area is expected, though only a few scattered *A. lentiginosus* var. *coachellae* individuals have been found here (Agua Caliente Tribal HCP 2007, pp. 4–29). Other measures provide further protection for the taxon, but the vast majority of the modeled habitat in the Agua Caliente Tribal HCP plan area would be lost to development under the draft plan.

Summary of Factor D

The Act is the primary Federal law providing protection for *Astragalus lentiginosus* var. *coachellae* on Federal lands or in instances where there is a Federal nexus. Other Federal and State regulatory mechanisms provide discretionary protections for the species based

on current management direction, but do not guarantee protection for the species absent its status under the Act. Significant regional protection from the Coachella Valley MSHCP provides protection for the taxon and its habitat through the majority of its range. This plan provides long-term protections, management, and monitoring of *A. lentiginosus* var. *coachellae* occurrences. The above laws and regulations have helped to ameliorate impacts of development and other threats on *A. lentiginosus* var. *coachellae* and its habitat. Additionally, many threats are mitigated because most occurrences are in areas of Federal or private preservation. Therefore, we believe that the Act still provides the most extensive protection for *Astragalus lentiginosus* var. *coachellae*.

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

No threats attributable to this factor were discussed in the listing rule (USFWS 1998, p. 53608). However, threats to the taxon's habitat (e.g. development, nonnative species, and OHV use) discussed under Factor A above, can also impact *Astragalus lentiginosus* var. *coachellae* standing plants and seed bank via habitat fragmentation, competition for resources, and damage to plants and seeds respectively. Climate change is also a potential threat, though little information is available specific to this species' range.

Habitat Fragmentation

As habitat for the taxon becomes increasingly fragmented by urban development, remaining populations become more vulnerable to edge effects at the habitat/development interface. Impacts often thought to increase edge effects include: disturbance caused by OHV use, roadside maintenance or subsequent paving/landscaping, and nonnative plant invasions that may accompany such activities (USFWS 2008c, p. 30). Fragmentation increases the potential for stochastic events to detrimentally affect long-term survival of smaller or more isolated occurrences. Similarly, fragmentation decreases the taxons' resilience to rebound from periodic or local extinctions (USFWS 2008c, p. 17). Seed dispersal and pollinator movement can be inhibited by habitat fragmentation or degradation. *Astragalus lentiginosus* var. *coachellae* depends on insect pollinators and wind dispersal of fruits and habitat fragmentation poses a significant threat to the populations of *A. lentiginosus* var. *coachellae* by diminishing the opportunities for these actions.

Competition with Nonnative Plants

Competition with nonnative plants was not identified as a threat to *Astragalus lentiginosus var*. *coachellae* in the listing rule. Nonnative plant species can compete with *A. lentiginosus* var. *coachellae* for light, space, water, and other resources and in large numbers may inhibit growth of standing plants (Meinke et al. 2007, p. 57; USFWS 2008c, p. 15; Barrows et al. 2009, p. 679). Nonnative plants have become established in habitat occupied by *A. lentiginosus* var. *coachellae* throughout its range, including the conservation areas set aside by the Coachella Valley MSHCP. The effects of *Brassica tournefortii* (Sahara mustard) competition on *A. lentiginosus* var. *coachellae* was studied in the field by Barrows et al. (2009) who found that *A. lentiginosus* var. *coachellae* plants

growing within a dense colony of *B. tournefortii* plants produced fewer fruits than plants growing where *B. tournefortii* cover was removed (Barrows et al. 2009, p. 679). The researchers noted that the active sand dunes and ephemeral sand fields supporting *A. lentiginosus* var. *coachellae* seem to be resistant to invasion by *B. tournefortii*, but that the species could become a management concern if it increases in dominance in these community types (Barrows et al. 2009, p. 684). *Brassica tournefortii* infestations are difficult to control due to their large, long-lived seed bank. Therefore, we consider competition with at least this nonnative plant species to potentially be a significant threat to *A. lentiginosus* var. *coachellae*.

Off-Highway Vehicles (OHVs)

The threat from OHV use on *Astragalus lentiginosus var*. *coachellae* habitat was identified in the listing rule and discussed under Factor A above. However, it is likely that there is also a low level threat to standing plants and their seed bank from crushing and disturbance by OHVs. Meinke et al. (2007, pp. 47–51) conducted a field study in which they compared frequency of *A. lentiginosus* var. *coachellae* plants occurring in areas subjected to OHV and/or heavy foot traffic (e.g., dirt paths created by OHV use) to frequency of *A. lentiginosus* var. *coachellae* plants occurring in nearby undisturbed areas. Their results indicate that low level of disturbance may not be harmful and may even be beneficial to *A. lentiginosus* var. *coachellae* at early stages in its life cycle and "…may be mimicking the natural habitat fluctuations believed to promote germination and establishment in more unspoiled environments" (Meinke et al. 2007, p. 51). However, heavy OHV usage in occupied area has been observed to result in the elimination of plants and could pose a significant threat to *A. lentiginosus* var. *coachellae* if not controlled.

Climate Change

Since listing, it has become apparent that there is potential for threats to biota from ongoing, accelerated climate change (IPCC 2007). Current climate change predictions for terrestrial areas in the Northern Hemisphere indicate warmer air temperatures, more intense precipitation events, and increased summer continental drying (Field et al. 1999, Cayan et al. 2005, IPCC 2007). 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. One study predicted that 5 to 10 percent of California's native plant species would no longer find suitable habitat within the state, and thus be vulnerable to extinction, if average temperatures warmed 5–6° F (Morse et al. 1995, p. 393). Impacts to the species under predicted future climate change are unclear. A trend of warming in the mountains of western North America is expected to decrease snowpack, hasten spring runoff, and reduce summer stream flows, and increased summer heat may increase the frequency and intensity of wildfires (IPCC 2007). While it appears reasonable to assume *Astragalus lentiginosus* var. *coachellae* may be affected, we lack sufficient certainty regarding how and when climate change will affect the species and the extent of average temperature increases in California.

Summary of Factor E

In the listing rule no threats attributable to this factor were discussed. However, threats to the taxon's habitat (development, nonnative species, and OHV use) can also impact *Astragalus lentiginosus* var. *coachellae* plants and seed banks via habitat fragmentation, competition for resources, and physical damage. As habitat for the species becomes increasingly fragmented by urban development, remaining populations become more vulnerable to adverse effects of vehicular activities, roadside maintenance, or subsequent paving/landscaping and accompanying nonnative plant invasions. Fragmentation increases the potential for stochastic events that detrimentally affect long-term survival probability for smaller and more isolated populations and similarly, fragmentation decreases the taxons' resilience to rebound from such events. Seed dispersal and pollinator movement can be inhibited by habitat fragmentation. Nonnative plant species can compete with *A. lentiginosus* var. *coachellae* for light, space, water, and other resources and in large numbers may inhibit growth of *A. lentiginosus* var. *coachellae*. Use of OHVs in areas occupied by *A. lentiginosus* var. *coachellae* has been documented to result in damage to plants and could be a significant threat to the taxon if not controlled. All of these threats, not considered in the listing rule, collectively and at times individually may be significant on a rangewide basis.

III. RECOVERY CRITERIA

No approved final or draft recovery plan exists for *Astragalus lentiginosus* var. *coachellae*.

IV. SYNTHESIS

Astragalus lentiginosus var. *coachellae* continues to exist in the Coachella Valley, although population estimates are unknown. Suitable habitat is defined by sand conditions and maintained by a dynamic sand transport system. Urbanization has reduced available habitat and the sand transport system necessary to maintain this habitat. Suitable habitat for *A. lentiginosus* var. *coachellae* is becoming increasingly fragmented by urban development and more vulnerable to adverse effects of OHV activities and nonnative plants. The Coachella Valley MSHCP has been approved, and will provide for conservation of the taxon and avoidance, minimization, and mitigation of impacts to the taxon, its habitat, and the sand transport system. However, planned development in the City of Desert Hot Springs (not covered under the Coachella Valley MSHCP) will impact occupied habitat at two of the four main alluvial sand sources (Mission Creek and Morongo Wash). Previously approved development in the Coachella Valley has altered the sand transport system which results in the continued degradation of *A. lentiginosus* var. *coachellae* habitat. The continued loss and degradation of habitat, disturbance, fragmentation of populations, and loss or degradation of sand sources and sand transport corridors necessary to sustain remaining habitat and populations of *A. lentiginosus* var. *coachellae* are essentially rangewide. These conditions make the survival of this species

questionable in the long-term. Stability of landscapes associated with urbanization is contrary to the required dynamic and transitory nature of habitat needed for *A. lentiginosus* var. *coachellae*. In recognition of the magnitude of current threats we recommend no change be made and that the status of *A. lentiginosus* var. *coachellae*, as endangered, remain unchanged at this time.

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

__X__ No Change

New Recovery Priority Number and Brief Rationale: 12C

We recommend that the recovery priority number for *Astragalus lentiginosus* var. *coachellae* be changed from 6C (high degree of threat, low recovery potential and conflict associated with development) to a 12C (moderate degree of threat, low recovery potential, and conflict associated with development). The degree of threat is reduced for this species because the impacts from development are expected to be minimized as the Coachella Valley MSHCP is implemented.

VI. RECOMMENDATIONS FOR ACTIONS OVER THE NEXT 5 YEARS

1) Work with partners and identify opportunities through the Service's Partners for Fish and Wildlife Program to seek habitat management, restoration, and enhancement opportunities for *Astragalus lentiginosus* var. *coachellae*.

2) Determine the magnitude of the threat posed to *Astragalus lentiginosus* var. *coachellae* and its habitat from nonnative plants, especially *Brassica tournefortii* (Sahara mustard), and effective management options.

3) Determine the identity of native *Astragalus lentiginosus* var. *coachellae* pollinators, their ecology, and management needs.

    a. Incorporate management of native pollinators and their habitat into management strategies for *A. lentiginosus* var. *coachellae*.

b. Determine threshold habitat conditions for *Astragalus lentiginosus* var. c*oachellae* and its pollinators to include occupancy patterns.

4) Implement a system for tracking *Astragalus lentiginosus* var. *coachellae* habitat losses (or habitat degradation), and gains due to permanent conservation.

5) Develop a Recovery Plan for *Astragalus lentiginosus* var. *coachellae* that would coordinate and direct survey and research actions beneficial to species recovery and that will reduce or eliminate threats to the species. Include occurrence map with risk assessment.

VII. REFERENCES CITED

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

***Astragalus lentiginosus* var. *coachellae* (Coachella Valley milk-vetch)**

Current Classification: Endangered

Recommendation Resulting from the 5-Year Review:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
_X_ No change needed

Review Conducted By: Carlsbad Fish and Wildlife Office

FIELD OFFICE APPROVAL:

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

Approve _____ Date 9/1/09