Braunton's milk-vetch
(Astragalus brauntonii)

5-Year Review:
Summary and Evaluation

photo by C. Hamilton, U.S. Fish and Wildlife Service

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

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5-YEAR REVIEW
Braunton's milk-vetch (*Astragalus brauntonii*)

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5-YEAR REVIEW
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1. GENERAL INFORMATION

1.1. Reviewers:

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Field Office: Ventura Fish and Wildlife Office; Christine Hamilton, Fish and Wildlife Biologist, (805) 644-1766 x369; and Connie Rutherford, Listing and Recovery Coordinator, (805) 644-1766 x306

1.2. Methodology used to complete the review:

This review was conducted by Christine Hamilton of the Ventura Fish and Wildlife Office (VFWO), and is based on published and unpublished literature, discussions with biologists, and files from VFWO and Carlsbad Fish and Wildlife Office.

1.3. Background

1.3.1. FR Notice citation announcing initiation of this review:

On February 14, 2007, the U.S. Fish and Wildlife Service announced initiation of the five-year review for *Astragalus brauntonii* and asked for information from the public regarding the species' status (72 FR 7064). This notice opened a 60-day request for information period, which closed on April 16, 2007. No information was received as a result of this request.

1.3.2. Listing history

Original Listing
FR notice: 62 FR 4172
Date listed: January 29, 1997
Entity listed: species (*Astragalus brauntonii*)
Classification: Endangered

1.3.3. Associated rulemaking:

Critical habitat for this species was designated on November 14, 2006 (71 FR 66374) and comprised of 3,300 acres (ac) (1,337 hectares (ha)) in Ventura, Los Angeles, and Orange Counties.

1.3.4. Review History:

No formal status reviews have been completed since the time of listing. However, the species' status was reviewed for preparation of the proposed critical habitat rule published on November 10, 2005 (70 FR 68982).

1.3.5. Species' Recovery Priority Number at start of review: *Astragalus brauntonii* has been assigned a recovery priority of 8, meaning that this species has a moderate degree of threat but also a high potential for recovery.

1.3.6. Recovery Plan or Outline

Name of plan or outline: Recovery plan for six plants from the mountains surrounding the Los Angeles Basin.

Date issued: September 30, 1999

Dates of previous revisions, if applicable: N/A

2. REVIEW ANALYSIS

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

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

2.2. Recovery Criteria

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

__X_ Yes
_____ No

2.2.2. Adequacy of recovery criteria:

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

__X_ Yes
_____ No

2.2.2.2. Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria (and is there no new information to consider regarding existing or new threats)?

__X_ Yes
_____ No

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

Astragalus brauntonii should be evaluated for reclassification to threatened status when:

1) All current sites (including seed banks) are fully protected and managed with the primary intention of preserving the populations in perpetuity. This criterion has not been met. We assumed that "current" sites were referring to those known at the time that the recovery plan was written in 1999. In the recovery plan, 16 known extant occurrences of *Astragalus brauntonii* were identified. Six of these occur on private lands or local agency lands where there are no known protections for the species, and therefore they could be threatened by existing or future urban development, recreational activities, or other land management activities. Four occurrences are on local agency lands (Conejo Open Space Conservation Agency (COSCA) and Monrovia Wilderness Preserve), four on State lands (Topanga State Park, Chino Hills State Park, and Coal Canyon Ecological Reserve), and two on Federal lands (Santa Monica Mountains National Recreation Area) that are known to have protections for the species because these areas have the stated purpose of preserving, protecting and managing open space resources, including sensitive plant species, in perpetuity (California Natural Diversity Data Base (CNDDB) 2006). In total, 10 of the 16 occurrences, or 63 percent, meet this criterion of being protected in perpetuity.

2) Seed collected from all populations is stored at a certified Center for Plant Conservation botanical garden. Seed has been collected from 6 of the 20 known populations and stored at Rancho Santa Ana Botanic Garden, Claremont, California. Therefore, this criterion has not been met.

3) Reliable seed germination and propagation techniques for the species are understood. This criterion has been met. *Astragalus brauntonii* seeds have been collected from the wild and successfully propagated on several occasions. In a study conducted by Fotheringham and Keeley (1998), growth response to differing substrates, shading, and soil moisture was examined for *A. brauntonii* grown in pots.

* The 5 listing factors are:
A) Present or threatened destruction, modification or curtailment of its habitat or range;
B) Overutilization for commercial, recreational, scientific, or educational purposes;
C) Disease or predation;
D) Inadequacy of existing regulatory mechanisms;
E) Other natural or manmade factors affecting its continued existence.

In 2006, Rancho Santa Ana Botanic Garden collected and germinated *A. brauntonii* seeds with 100 percent success rate.

> *Astragalus brauntonii* should be evaluated for delisting when populations are shown to be self-sustaining over a minimum of 15 years or longer, because life history data shows that individuals of this species lives for 5 years and exists as seed banks from 15 to 95 years. This criterion has not been met. Two of the 16 known occurrences were known 15 years ago (1982); all others were discovered less than 15 years ago, although these occurrences likely existed, undiscovered, long before 1982 (CNDDB 2007). As long as the habitat remains, and land use activities are compatible with the species, we assume that a population will be self-sustaining even though individual plants may cease to grow for many years until a disturbance stimulates dormant seeds to germinate. Therefore, *A. brauntonii* habitat that has undergone succession and is dominated by dense woody shrubs may not be harmful to the long-term persistence of the plant as long as periodic disturbances are allowed to occur and nonnative species have not altered the habitat in some fundamental way that does not allow the seed bank to be expressed. Therefore, the 10 occurrences that are protected in perpetuity may meet this criterion.

2.3. Updated Information and Current Species Status

2.3.1 Biology and Habitat

Habitat characteristics: *Astragalus brauntonii* is a short-lived perennial herb in the pea family (Fabaceae); a thick taproot gives rise to stems that reach a height of 5 feet (ft) (1.5 meters (m)), making it one of the tallest species in the genus. The species appears to be limited to shallow calcium carbonate soils derived from marine substrates; it occasionally occurs on non-carbonate soils at down-wash sites near other known occurrences, although survivorship of plants may be reduced on non-carbonate soils (Mistretta 1992, Fotheringham and Keeley 1998, Landis 2005).

Astragalus brauntonii is associated with chaparral and coastal sage scrub plant communities and generally occurs along the tops of knolls ranging from 800 to 2,100 ft (244 to 640 m) in elevation (Fotheringham and Keeley 1998, CNDDB 2007, Landis 2005). The habitat has been described as scrub dominated by chaparral with a high overall percentage (>80 percent) of vegetative cover, however, the species does not tolerate shading and is associated with surrounding bare ground (Carroll 1987, Fotheringham and Keeley 1998). It may persist for several years where microsite conditions inhibit shrub growth, or it may be gradually crowded out by more robust and tough-woody chaparral plants until the next disturbance that removes plant cover (Carroll 1987, Fotheringham and Keeley 1998).

The most common disturbance that occurs in *Astragalus brauntonii* habitat is wildfire, particularly during the extreme conditions of the hot, dry “Santa Ana” winds (Beyers and Wakeman 2000). Under such conditions, fire may rapidly burn

thousands of hectares of chaparral and coastal sage scrub. Most of the Santa Monica Mountains have burned 3 to 5 times in the last 60 years, with an average interval of every 12.4 to 20.7 years (Radtke et al. 1982). Many of the plant species that comprise chaparral and coastal sage scrub communities regenerate after fire, either through the release of a dormant seed bank whose germination is stimulated by fire, or through basal burl sprouting (Hanes 1971, Keeley and Zedler 1978). The above-ground expression of *A. brauntonii* populations are patchy over time and space as a result of the dormant seed bank and are subject to the dynamic habitat conditions and physical processes where it occurs.

In the final critical habitat rule, published November 14, 2006 (71 FR 66374), the primary constituent elements required to sustain the essential life history functions of *Astragalus brauntonii* were: 1) calcium carbonate soils derived from marine sediment; 2) low proportion (<10 percent) of shrub cover directly around the plant; and 3) chaparral and coastal sage scrub communities characterized by periodic disturbances that stimulate seed germination (e.g., fire, flooding, erosion) and reduce vegetative cover.

Reproduction: Like other *Astragalus* species, *A. brauntonii* is self-fertile, but also produces seed through cross-pollination (Fotheringham and Keeley 1998). Known pollinators include megachilid bees (*Ashmeadiella* spp.) and bumblebees (*Bombus* spp.) (Fotheringham and Keeley 1998). These insect pollinators are polylectic, meaning that they use several plant species in an area, and a variety of plants may be necessary to sustain populations of pollinators (Karron 1987).

Seeds are enclosed in dense hairy pods that require heat or physical scarification (breaking, scratching, or mechanically altering the seed coat) to germinate. Disturbances such as fire, erosion, and mechanical scraping of soil (e.g., during road or trail maintenance) are known to stimulate germination (Fotheringham and Keeley 1998). Each plant may support upwards of several hundred flowers, and each seed pod produces three to six seeds (Barneby 1964), therefore, each plant can produce a large number of seeds which are deposited in the soil (seed bank). Seeds have the ability to remain dormant for many years until the next disturbance. Neither the fruits or the seeds have specialized adaptations to facilitate seed dispersal by wind; therefore, it is likely that most seeds fall within a short distance of the parent plant (Cain et al. 2000). Long-distance dispersal, however, is likely achieved by water (during rainstorms), and by transport of seeds by wildlife. Small mammals facilitate seed dispersal through consumption and elimination of undigested seed and through seed caching (Cain et al. 2000, Sieg 1987).

Where a dormant seed bank is present, *Astragalus brauntonii* establishes quickly after a disturbance that removes other plant competitors and stimulates germination of dormant seeds (Fotheringham and Keeley 1998). Individual plants have a lifespan of two to three years, although some individuals may live five years or more if conditions are favorable, and then plants are not visible again until the next disturbance (Fotheringham and Keeley 1998).

Distribution: *Astragalus brauntonii* is endemic to coastal southern California and only occurs in five disjunct geographic areas in Ventura, Los Angeles, and Orange Counties, California. These areas include: 1) Simi Hills in eastern Ventura and western Los Angeles Counties; 2) eastern Santa Monica Mountains in Los Angeles County; 3) western Santa Monica Mountains near Pacific Palisades, Los Angeles County; 4) San Gabriel Mountains in Monrovia, Los Angeles County; and 5) Santa Ana Mountains in Orange County (CNDDB 2007). The current distribution is similar to the historical distribution, with the exception of a historical record in West Hollywood from 1910 (CNDDB 2007).

Land ownership: There are currently 20 known occurrences; 6 of these (30 percent) are on private lands, 8 (40 percent) are on local agency lands (city and regional parks), 4 (20 percent) are on State lands (Topanga State Park, Chino Hills State Park, and Coal Canyon Ecological Reserve), and 2 (10 percent) are on Federal lands (Santa Monica Mountains National Recreation Area; CNDDB 2007).

Abundance and population trends: In most cases, the number of plants within a population is in the hundreds to thousands following a disturbance, and declines to fewer than ten plants within a few years (CNDDB 2007). The dormant seed bank makes it difficult to determine the complete distribution of the species, and it is possible that there are more populations that will remain undetected until a disturbance stimulates seed germination. One population was revealed in 1999 in the eastern Santa Monica Mountains along a ridgetop after a prescribed fire stimulated germination of dormant seeds, resulting in hundreds of plants (CNDDB 2007). This population was about 8 miles (13 kilometers) from the nearest known occurrence, which consisted of a single plant last seen in 1984.

Taxonomy: No name changes or changes in taxonomic relationship have been made since listing.

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

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

At the time of listing, the primary threats to *Astragalus brauntonii* included direct loss of plants and habitat from urban development and fire suppression (62 FR 4178). Indirect effects from urban development could include habitat fragmentation which reduces gene flow between sites, reduction in insect pollinators, increases in nonnative plants and animals, and changes in hydrology that affect plant communities (Conservation Biology Institute 2000). Direct and indirect threats from urban development still remain, given that most occurrences are in the vicinity of urban areas.

Land management actions that result in frequent disturbances, such as yearly road maintenance where *Astragalus brauntonii* occurs, may be contributing to the

decline of populations by mowing and removing plants before seeds mature and replenish the seed bank. This has been known to occur for plants along unpaved fire access roads and utility corridors. Other land management activities such as herbicide application, cattle grazing, and recreational activities such as off-road vehicle and equestrian use that results in trampling of plants may be affecting *A. brauntonii*.

Of the currently known 20 occurrences, we are unaware of protections for the 6 occurrences on private lands and for 4 of the 8 occurrences on local agency lands, and therefore we presume they could be threatened by indirect or direct effects from existing or future urban development, recreational activities, or other land management activities. Since the time of listing, one occurrence in Oak Park on lands owned by Rancho Simi Recreation and Parks District was extirpated due to park expansion. Another occurrence was partially removed by the Ventura County Public Works Agency for creation of a detention basin, and the remaining portion of this occurrence has been proposed for development into the Lang Ranch Community Park by Conejo Recreation and Park District. The remaining six occurrences on State and Federal lands, and four of the eight occurrences on local agency lands are protected from habitat destruction. In total, 10 of the 20 known occurrences, or 50 percent, are protected from habitat destruction.

2.3.2.2. Overutilization for commercial, recreational, scientific, or educational purposes:
This was not identified at the time of listing as a threat, and is not currently considered a threat.

2.3.2.3. Disease or predation:
This was not identified at the time of listing as a threat, and is not currently considered a threat. Cattle grazing occurs within the vicinity of one population; however, considering cattle grazing preferences, we do not consider this to be a significant threat to the species.

2.3.2.4. Inadequacy of existing regulatory mechanisms:
State regulations: Under Factor D in the final listing document, the inadequacy of existing regulatory mechanisms was discussed as a threat/factor in determining endangered status for *Astragalus brauntonii*. The species is not listed as threatened or endangered under the California Endangered Species Act (CESA), and therefore does not benefit from CESA regulations. Under the California Environmental Quality Act (CEQA), mitigation is typically proposed, as part of a project proposal, to offset impacts to sensitive species. However, local lead agencies have approved projects that have allowed impacts to *A. brauntonii* and its habitat (62 FR 4172), or approved mitigation measures that affect the long-term conservation of *A. brauntonii* in the wild.

Federal regulations: The two populations that are on National Park Service (NPS) land within Santa Monica Mountains National Recreation Area (SMMNRA). The

SMMNRA was established in 1978 in part to protect one of the last remaining examples of Mediterranean-type ecosystems in the world (PL 95-625). The NPS Organic Act of 1916 (39 Stat. 535, 16 U.S.C. 1, as amended), states that the National Park Service "shall promote and regulate the use of the Federal areas known as national parks, monuments, and reservations … to conserve the scenery and the national and historic objects and the wildlife therein . . ." The NPS Organic Act as well as NPS natural resources management guidelines would most likely provide some level of protection for these two populations even in the absence of listing under the ESA.

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

Fire

One threat to *Astragalus brauntonii* discussed in the listing rule is the impact of fire management policies over the last 200 years on southern California ecosystems. The listing rule stated that fire exclusion has resulted in an accumulation of fuels in woody vegetation, making fire intensity and duration more severe. However, wildlands near urban areas have been experiencing increased fire frequencies, resulting in vegetation changes from shrub to grass and facilitating the spread of non-native, invasive annual plants. Despite efforts to suppress fires in coastal southern California, the current fire frequency of every 15 years or less, is substantially higher than it was historically, which is thought to be every 50 to 100 years (Keeley 2006).

The impacts of fire suppression and/or increased fire frequencies near urban areas on *Astragalus brauntonii* are unclear. As of 1997, we believed that fire suppression activities resulted in the extirpation of *A. brauntonii* during the Old Topanga fire of 1993 (Service 1997); however, more recent surveys have revealed plants growing in that area (CNDDB 2007). Extirpation of populations is unlikely as long as habitat remains, although above-ground plants may cease to grow for many years until a disturbance stimulates dormant seeds to germinate. Therefore, *A. brauntonii* habitat that has undergone succession and is dominated by dense woody shrubs may not be harmful to the long-term persistence of the plant as long as periodic disturbances are allowed to occur.

Stochastic extinction

Astragalus brauntonii may be vulnerable to extirpation by stochastic factors including demographic stochasticity, environmental stochasticity, and genetic stochasticity (Shaffer 1981). Demographic stochasticity refers to random variability in survival or reproduction among individuals within a population (Shaffer 1981), and could play a role in the extirpation of small populations of *A. brauntonii*. In most cases, the number of plants within a population is in the hundreds to thousands following a disturbance, and declines to fewer than ten plants within a few years (CNDDB 2007). Environmental stochasticity is the variation in birth and death rates from one season to the next in response to weather, disease, competition, predation, or other factors external to the

population (Shaffer 1981), and this could also play a role in extirpations of small populations. Genetic stochasticity results from changes in gene frequencies due to founder effect, random fixation, or inbreeding (Shaffer 1981). The disjunct distribution of *A. brauntonii* decreases genetic exchange between populations, which could impair the species' ability to adapt to changes in the environment or contribute to inbreeding depression (i.e., loss of reproductive fitness or vigor).

Climate Change

Climate change was not discussed in the rule to list the species. Current climate change predictions for terrestrial areas in the Northern Hemisphere indicate warmer air temperatures, more intense precipitation events, and increased summer continental drying (Field et al. 1999, Hayhoe et al. 2004, Cayan et al. 2005, Intergovernmental Panel on Climate Change (IPCC) 2007). Recently, the potential impacts of climate change on the flora of California were discussed by Loarie (et al. 2008). Based on modeling, they predicted that species' distributions will shift in response to climate change, specifically that the species will "move" or disperse to higher elevations and northward, depending on the ability of each species to do so. Species diversity will also shift in response to these changes with a general trend of diversity increases shifting towards the coast and northwards with these areas becoming de facto future refugia.

The Santa Monica Mountains is expected to increase in diversity, becoming one of these potential future refugia (Loarie et al. 2008). These increases in species diversity in the refugia, due to climate change, have the potential to result "…in new species mixes, with consequent novel patterns of competition and other biotic interactions…" to the species present (Loarie et al. 2008) with unknown consequences to the species present. We recognize that climate change is an important issue with potential effects to listed species and their habitats. While we lack adequate information to make specific and accurate predictions regarding how climate change, in combination with other factors such as small population size, will affect *Astragalus brauntonii*, small ranged species, such as *Astragalus brauntonii*, may be more vulnerable to extinction due to these changing conditions (Pimm and Raven 2000, Loarie et al. 2008).

2.4. Synthesis

The range of *Astragalus brauntonii* is naturally restricted to calcium carbonate soils derived from marine substrates that occurs in widely disjunct areas of southern California. Most populations are small enough that they are vulnerable to extirpation from stochastic factors alone. Known threats include direct loss and indirect effects of urban development, habitat fragmentation, and alteration of fire cycles.

Since the time of listing in 1997, seven additional occurrences have been discovered, and 10 of the 20 currently known occurrences are considered to be protected from habitat loss or degradation. However, since listing, two occurrences on local agency

lands have been extirpated by development activities. Half of currently known occurrences, 10 out of 20, are on private or local agency lands and are potentially threatened by indirect or direct effects from existing or future urban development, recreational activities, and/or other land management activities.

Three of the four recovery criteria for this species have not been met, and half of the known occurrences are unprotected, which suggests that *Astragalus brauntonii* remains threatened with extinction. Therefore, we recommend that the status of *A. brauntonii* remain unchanged as endangered.

3.0 RESULTS

Recommended Classification:

____ Downlist to Threatened

____ Uplist to Endangered

____ Delist (Indicate reasons for delisting per 50 CFR 424.11):

____ Extinction

____ Recovery

____ Original data for classification in error

_X_ No change is needed

New Recovery Priority Number and Brief Rationale: 8 (no change)

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

1) Work with private landowners and local agencies to protect and manage habitat for *Astragalus brauntonii*. This may be accomplished by conservation easements or other permanent devices.

2) Work with local agencies, fire departments, and utility companies to ensure that maintenance activities, such as grading of roads and/or mowing along dirt fire access roads and utility corridors, do not negatively impact *Astragalus brauntonii*. This includes conservation measures such as waiting until seeds mature to cut plants, and depositing plants and seeds on-site so that they replenish the seed bank.

3) Examine genetic diversity in the species and incorporate that data into the sampling and maintenance methodologies for seed banking called for in the recovery plan.

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

Braunton's milk-vetch (*Astragalus brauntonii*)

Current Classification: Endangered

Recommendation resulting from the 5-Year Review:

____ Downlist to Threatened

____ Uplist to Endangered

____ Delist

_X_ No change is needed

Appropriate Listing/Reclassification Priority Number: N/A

Review Conducted By: Christine Hamilton

FIELD OFFICE APPROVAL:

Field Supervisor, Fish and Wildlife Service

Approve Diane K. Noda Date 1/14/09

REGIONAL OFFICE APPROVAL:

Assistant Regional Director, Fish and Wildlife Service

Approve Michael Fris Date 2-4-09