

Astragalus brauntonii (Braunton's milk-vetch)

5-Year Review: Evaluation and Summary



Photo: Mark Mendelsohn, National Park Service

**U.S. Fish and Wildlife Service
Ventura Fish and Wildlife Office
Ventura, California
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Astragalus brauntonii (Braunton's milk-vetch)

5-Year Review: Evaluation and Summary

GENERAL INFORMATION:

Species: *Astragalus brauntonii*

FR citation: 62 FR 4172

Date listed: 29 January 1997

Classification: Endangered

BACKGROUND:

Most recent status review:

U.S. Fish and Wildlife Service. 2009. *Astragalus brauntonii* (Braunton's milk-vetch) 5-Year Review: Summary and Evaluation. Ventura Fish and Wildlife Office. Ventura, California.

FR Notice citation announcing this status review:

Initiation of 5-Year Status Reviews of 40 Species in California, Nevada and Oregon. Notice of initiation of reviews; request for information. (87 FR 5832), 22 February 2022.

Critical Habitat Designation:

The Service designated critical habitat for *A. brauntonii* in 2006 (71 FR 663740).

State Listing:

A. brauntonii has a California Rare Plant Rank of 1B.1 (California Natural Diversity Database [CNDDB] 2023 p. 17).

Recovery Plan:

U.S. Fish and Wildlife Service. 1999. Recovery Plan for Six Plants from the Mountains Surrounding the Los Angeles Basin. Portland, Oregon. 67 pp.

ASSESSMENT:

Information acquired since the last status review:

The U.S. Fish and Wildlife Service (Service) Ventura Fish and Wildlife Office conducted this 5-year review. The Service announced this review through a Federal Register notice on February 2, 2022 (87 FR 5832). We did not receive any information from the public about *Astragalus brauntonii* in response to the notice. We also contacted the Carlsbad Fish and Wildlife Office, the Santa Monica Mountains National Recreation Area, and species experts to request any data or information we should consider in our review. Additionally, we conducted a literature search and a review of information in our files.

Introduction:

Astragalus brauntonii is a short-lived perennial forb in the pea family (Fabaceae). It is generally found on carbonate soils in fire-prone chaparral and coastal sage scrub plant communities, but

can occur in other habitats if seeds have been washed down from higher elevations (Service 1997). Germination is stimulated by fire or mechanical disturbance, and plants generally persist in an area until taller, more woody plants displace them. After this, a soil seed bank can persist for many years until a future fire or other disturbance again stimulates germination.

The species occurs from the western Santa Monica Mountains and Simi Hills of Ventura County, California, to the south and east along the Santa Monica Mountains into Los Angeles County, and then disjunctly further east to Monrovia in the San Gabriel Mountains (California Department of Fish and Wildlife [CDFW] 2023). It also occurs disjunctly further south in the Santa Ana Mountains of Orange County, very near the intersection with San Bernardino and Riverside Counties. Recently a second variety, *A. brauntonii* var. *lativexillum*, has been described from México near Tijuana, Baja California (Estrada Castellón et al. 2022, pp. 6–9). We do not consider this new variety to be part of the listed taxon, and the new taxon is discussed further in the Recent Taxonomy section below.

Distribution:

Currently, the California Natural Diversity Database (CNDDDB) recognizes 57 Element Occurrences (EOs, Table 1, CDFW 2023) of *A. brauntonii*. An EO is a group of plants separated by at least 400 meters (1/4 mile) from the closest group of plants of the same species (CNDDDB 2018 entire). The occurrences can be grouped into four areas: the Santa Monica Mountains, the south slope of the Simi Hills, the San Gabriel Mountains near Monrovia, and the Santa Ana Mountains. At the time of listing in 1997 (Service 1997), *A. brauntonii* was described as being found in the same four general areas, with 6 occurrences distributed among those areas. The recovery plan identified 20 occurrences (it combined EO# 15 and EO# 17, and listed an EO# 21 which is not currently recognized; Service 1999 pp. 8–10). The critical habitat designation (Service 2006) did not list occurrences, and the 2009 5-year review did not add any new occurrences (Service 2009).

Most of the occurrences (52 of 57, Table 1) are presumed by CNDDDB to be extant, and most of the presumed extant occurrences (39 of 52) may be at least partly on land managed for resource conservation. Most of the occurrences are in the Santa Monica Mountains and Simi Hills (22 and 24 respectively), with only 4 in the San Gabriel Mountains and 7 in the Santa Ana Mountains.

Table 1. Occurrences of *Astragalus brauntonii* Occurrences are at least partly on public lands have italicized Site Owner. Data are from CDFW 2023. CNDDDB = California Natural Diversity Database, EO = Element Occurrence, CDPR = California Department of Parks and Recreation, SP = State Park, CDFW = California Department of Fish and Wildlife, ER = Ecological Reserve, RPD = Recreation and Parks District, SMMNRA = Santa Monica Mountains National Recreation Area, COSCA = Conejo Open Space Conservation Agency, SMMC = Santa Monica Mountains Conservancy, CRPD = Conejo Recreation and Park District, DOD = Department of Defense.

CNDDDB EO Number	Location	Extant?	Last Year Seen	Site Owner	Notes
Santa Monica Mountains					
1	Sherman	possibly extirpated	1930	unknown	includes former EO# 35
2	Topanga Cyn	possibly extirpated	1941	unknown	mapped to entire canyon
3	Malibu Lagoon	possibly extirpated	1984	unknown	mapped to entire canyon
7	Burro Flats	presumed extant	2018	private	
8	Los Liones	presumed extant	1975	<i>CDPR- Topanga SP</i>	
14	Trailer Cyn Rd	presumed extant	2019	private	
15	Temescal Ridge Rd	presumed extant	2020	<i>CDPR- Topanga SP, private</i>	
17	Temescal Fire Rd	presumed extant	2019	<i>CDPR- Topanga SP</i>	
18	Temescal Cyn	possibly extirpated	1971	unknown	exact location uncertain
27	Zuma Ridge	presumed extant	2007	<i>SMMNRA</i>	
32	Upper Zuma Cyn	presumed extant	~2002	<i>SMMNRA</i>	exact location uncertain
34	Brentwood	presumed extant	1921	unknown	exact location uncertain
36	Kanan Rd	presumed extant	2020	unknown	
43	Eagle Spring	presumed extant	2014	<i>CDPR- Topanga SP</i>	
49	Long Grade Cyn	presumed extant	1989	unknown	
58	Rogers Fire Rd	presumed extant	2019	<i>CDPR-Topanga SP</i>	
59	W Ridge Temescal Cyn	presumed extant	2018	<i>CDPR-Topanga SP</i>	
60	Parker Cyn	presumed extant	2020	<i>CDPR-Topanga SP</i>	
61	Kanan Dume Rd	presumed extant	2020	<i>SMMNRA</i>	
62	Zuma Cyn	presumed extant	2020	<i>SMMNRA</i>	
63	Willow Creek	presumed extant	2019	<i>CDPR- Leo Carrillo SP</i>	
68	Pt Mugu	presumed extant	2020	<i>DOD- Naval Base Ventura County?</i>	
Simi Hills					
11	Medea Creek	presumed extant	2020	<i>Rancho Simi RPD</i>	includes former EO# 46
19	Palo Comado Cyn	presumed extant	2020	<i>SMMNRA, Rancho Simi RPD, private</i>	
20	Oak Park	presumed extant	2020	<i>Rancho Simi RPD, private</i>	
22	Oakbrook	presumed extant	2020	<i>COSCA</i>	includes former EO# 26
23	Dayton Cyn	presumed extant	2019	private	includes former EO# 37
25	Westlake/Lang Ranch ridge	presumed extant	2019	<i>private, COSCA</i>	

CNDDDB EO Number	Location	Extant?	Last Year Seen	Site Owner	Notes
28	Bus Canyon	presumed extant	2020	<i>Rancho Simi RPD, private</i>	
29	Ahmanson Ranch	presumed extant	1998	<i>private</i>	may be part of EO# 7
30	Pathfinder/Falling Star	presumed extant	2019	<i>City of Thousand Oaks</i>	
31	Bus/Runkle Ridge	presumed extant	2007	<i>private</i>	
33	Cheeseboro/Las Virgenes Ridge	presumed extant	2007	<i>SMMNRA, SMMC</i>	
38	Sulphur Springs trail	presumed extant	2020	<i>SMMNRA</i>	includes former EO#s 39 and 44
40	Simi Peak	presumed extant	2007	<i>SMMNRA</i>	
45	Cheeseboro Cyn	presumed extant	2010	<i>SMMNRA</i>	
47	Erbes Rd	presumed extant	1977	<i>unknown</i>	
48	Paige Lane	presumed extant	2013	<i>CRPD</i>	
50	Lone Oak Cyn	presumed extant	2003	<i>unknown</i>	
51	Simi Peak	presumed extant	2006	<i>SMMNRA</i>	
52	Schoolhouse/Lindero Ridge	presumed extant	2003	<i>COSCA</i>	
53	Schoolhouse/Lindero 2	presumed extant	2020	<i>COSCA</i>	
64	Hidden Canyon Tr	presumed extant	2020	<i>City of Thousand Oaks</i>	
65	Kilburn Ct	presumed extant	2020	<i>Rancho Simi RPD?</i>	
66	Deerhill/Kanan	presumed extant	2016	<i>Rancho Simi RPD</i>	
67	Wistful Vista Trail	presumed extant	2020	<i>Rancho Simi RPD</i>	
San Gabriel Mountains					
6	Above Monrovia	extirpated	1981	<i>private</i>	
16	Clamshell Cyn	presumed extant	2019	<i>private, City of Monrovia</i>	
24	Clamshell Motorway	presumed extant	2001	<i>private</i>	
57	Monrovia Cyn Mouth	presumed extant	2018	<i>City of Monrovia</i>	
Santa Ana Mountains					
4	Lower Coal Canyon	presumed extant	2020	<i>CDPR-Chino Hills SP</i>	includes former EO# 13
10	South of Coal Canyon	presumed extant	2020	<i>private, CDFW Coal Canyon ER</i>	
41	Mouth of Fremont Cyn	presumed extant	2012	<i>unknown</i>	
42	Santa Ana Canyon	presumed extant	2010	<i>Orange County</i>	
54	Santiago Cyn	presumed extant	2016	<i>Orange County</i>	
55	Gypsum Cyn	presumed extant	2019	<i>Orange County</i>	
56	San Juan Hill	presumed extant	2010	<i>private</i>	

Abundance:

Information about total population size (number or area of plants) was not given for *A. brauntonii* when we listed the species (Service 1997). Many field observations of the species

have unknown numbers of plants, either because they were not recorded (herbarium collections), or because the descriptions of numbers are ambiguous (Table 2). Many surveys are known to only partially cover the occurrence. There is no consistent standardized monitoring of occurrences across the species range.

Most observed population numbers are in the low hundreds or less, but sometimes the number of plants at an occurrence can be in the thousands. Sometimes this is documented to have been preceded by a fire at the occurrence a year before the survey (EO# 22 and EO# 23 in 2006 after the 2005 Topanga Fire; EO# 19 and EO# 22 after the 2018 Woolsey Fire). This is consistent with seeds in a soil seed bank being stimulated to germinate after a fire or other disturbance. Because plants of *A. brauntonii* are gradually outcompeted by recovering vegetation after a disturbance, it is expected that there would be a decrease of plants at an occurrence over the time it takes for vegetation recovery. After that time, when there are no or few above-ground plants, there is probably still a substantial soil seed bank. Overall, the number of seeds in an occurrence may be a much more important indicator of the condition of an occurrence than the number of above ground plants. This important parameter should be investigated.

Given the relatively few occurrences and few plants documented from the San Gabriel and Santa Ana Mountains, these areas should be more intensively searched for undiscovered occurrences, and known occurrences should be more frequently monitored, especially after disturbance events such as fire.

Table 2. Abundance of *Astragalus brauntonii*. Data are from CDFW 2023. CNDDDB = California Natural Diversity Database, EO = Element Occurrence, CDPR = California Department of Parks and Recreation, SP = State Park, CDFW = California Department of Fish and Wildlife, ER = Ecological Reserve, RPD = Recreation and Parks District, SMMNRA = Santa Monica Mountains National Recreation Area, COSCA = Conejo Open Space Conservation Agency, SMMC = Santa Monica Mountains Conservancy, CRPD = Conejo Recreation and Park District, DOD = Department of Defense.

CNDDDB EO Number	Location	Site Owner	Year Surveyed	Number of Plants	Notes
Santa Monica Mountains					
1	Sherman	unknown	1901 1907 1930	unknown unknown unknown	
2	Topanga Cyn	unknown	1916 1917 1941	unknown unknown unknown	
3	Malibu Lagoon	unknown	1984 1997	1 0	from seed washed down from upslope?
7	Burro Flats	private	1999 2006 2009 2011 2013 2018	3 33,500 18,500 1000s <2000 unknown	partial surveys

CNDDDB EO Number	Location	Site Owner	Year Surveyed	Number of Plants	Notes
8	Los Liones	CDPR- Topanga SP	1975 1996 1997	<10 0 present	
14	Trailer Cyn Rd	private	1987 1988 1996 1997 2001 2003 2004 2007 2019	200 11 0 0 28 19 95 89 seen	scraping in 2003
15	Temescal Ridge Rd	CDPR- Topanga SP, private	1987 1996 1997 1998 2003 2004 2006 2007 2010 2018 2019 2020	1 <2000 <2000 333-1333 827 959 271 2121 134 100+ unknown unknown	
17	Temescal Fire Rd	CDPR- Topanga SP	1979 1980 1981 1986 1996 1997 2006 2019	unknown unknown unknown 0 <2,000 <2,000 45 unknown	
18	Temescal Cyn	unknown	1942 1960 1971 1996 1997	unknown unknown unknown 0 0	exact location uncertain
27	Zuma Ridge	SMMNRA	1995 1999 2000 2004 2007	50 100 unknown 163 36	
32	Upper Zuma Cyn	SMMNRA	2002?	>300	
34	Brentwood	unknown	1921	unknown	exact location uncertain
36	Kanan Rd	unknown	2006 2011 2020	1 rare unknown	partial surveys
43	Eagle Spring	CDPR- Topanga SP	2014	unknown	
49	Long Grade Cyn	unknown	1989	unknown	
58	Rogers Fire Rd	CDPR-Topanga SP	2019	unknown	

CNDDDB EO Number	Location	Site Owner	Year Surveyed	Number of Plants	Notes
59	W Ridge Temescal Cyn	CDPR-Topanga SP	2018	unknown	
60	Parker Cyn	CDPR-Topanga SP	2020	1	
61	Kanan Dume Rd	SMMNRA	2020	unknown	
62	Zuma Cyn	SMMNRA	2020	unknown	
63	Willow Creek	CDPR- Leo Carrillo SP	2019	unknown	
68	Pt Mugu	DOD- Naval Base Ventura County?	2020	unknown	
Simi Hills					
11	Medea Creek	Rancho Simi RPD	1985 1993 1996 1997 1998 2003 2015 2016 2019 2020	100+ 290 200+ 2 1 4 1 5 31,100 seen	partial surveys Woolsey Fire in 2018
19	Palo Comado Cyn	SMMNRA, Rancho Simi RPD, private	1987 1996 1997 1998 2011 2018 2020	<30 1-2 5 148 a few unknown unknown	partial surveys
20	Oak Park	Rancho Simi RPD, private	1990 1995 1997 1998 1999 2000 2001 2002 2003 2004 2007 2015 2020	20 1,450 2-300 850 300 <100 <100 800-850 340-390 <175 70 1 unknown	partial surveys
22	Oakbrook	COSCA	1989 1992 1996 1997 2003 2004 2006 2007 2012 2020	15 29 0 3 0 7 4,400 rare rare massive extent	partial surveys Topanga Fire in 2005 Woolsey Fire in 2018

CNDDDB EO Number	Location	Site Owner	Year Surveyed	Number of Plants	Notes
23	Dayton Cyn	private	1989 1999 2004 2006 2010 2019	2 14 3 1,581 unknown 4,150	partial surveys Topanga Fire in 2005 Woolsey Fire in 2018
25	Westlake/Lang Ranch Ridge	private, COSCA	1997 1999 2000 2001 2003 2012 2019	3 7 6 7 0 1 8	partial surveys
28	Bus Canyon	Rancho Simi RPD, private	1998 1999 2006 2020	2-3 3 16 4+	partial surveys
29	Ahmanson Ranch	private	1998	1	
30	Pathfinder/Falling Star	City of Thousand Oaks	2001 2003 2004 2006 2007 2019	35 68 <175 27 40 unknown	
31	Bus/Runkle Ridge	private	2004 2007	66 130	partial surveys
33	Cheeseboro/Las Virgenes Ridge	SMMNRA, SMMC	1999 2000 2004 2006 2007	130 30 15 1,593 1,310	partial surveys
38	Sulphur springs trail	SMMNRA	2006 2007 2010 2018 2020	627+ 1155 unknown unknown unknown	partial surveys
40	Simi Peak	SMMNRA	2006 2007	<1% cover 447	
45	Cheeseboro Cyn	SMMNRA	2010	unknown	
47	Erbes Rd	unknown	1977	unknown	
48	Paige Lane	CRPD	2013	1	
50	Lone Oak Cyn	unknown	2003	<1% cover	
51	Simi Peak	SMMNRA	2006	<1% cover	
52	Schoolhouse/Lindero Ridge	COSCA	2003	<1% cover	
53	Schoolhouse/Lindero 2	COSCA	2003 2020	<1% cover 10-20	
64	Hidden Canyon Tr	City of Thousand Oaks	2020	4	partial survey
65	Kilburn Ct	Ranch Simi RPD?	2020	1000s	partial survey, likely many more plants.

CNDDDB EO Number	Location	Site Owner	Year Surveyed	Number of Plants	Notes
66	Deerhill/Kanan	Rancho Simi RPD	2015 2016	unknown unknown	
67	Wistful Vista Trail	Rancho Simi RPD	2020	“tons”	
San Gabriel Mountains					
6	Above Monrovia	private	1980 1981	3 2	
16	Clamshell Cyn	private, City of Monrovia	1993 1995 1996 1997 1998 2001 2004 2007 2009 2013 2019	42 24 1-2 24 31 330 1465 286 300 <50 1	partial surveys scraping in 2002
24	Clamshell Motorway	private	1994 1996 1997 2001	3 1-2 0 <20	
57	Monrovia Cyn Mouth	City of Monrovia	2018	11-50	
Santa Ana Mountains					
4	Lower Coal Canyon	CDPR- Chino Hills SP	1986 1994 2001 2002 2003 2005 2006 2007 2011 2012 2018 2019 2020	151 1 1 5 245 117 14 dead plants unknown unknown 1000 971 11-50	partial surveys
10	South of Coal Canyon	private, CDFW Coal Canyon ER	1983 1986 2003 2005 2006 2007 2020	50-100 259 5092 1900 264 1 unknown	partial surveys
41	Mouth of Fremont Cyn	unknown	2012	1	from seed washed down from upslope?
42	Santa Ana Canyon	Orange County	2010	1	
54	Santiago Cyn	Orange County	2016	unknown	
55	Gypsum Cyn	Orange County	2019	22	

CNDDB EO Number	Location	Site Owner	Year Surveyed	Number of Plants	Notes
56	San Juan Hill	private	2010 2013	400 0	

Conservation Seed Banking:

There are currently ten accessions from five occurrences of *A. brauntonii* seed stored at Center for Plant Conservation (CPC) approved conservation seed banks (Table 3, California Plant Rescue 2023). There are no accessions from the Santa Ana Mountains. Only one accession is recorded as being by maternal line (meaning that they were collected from and tracked by individual plant mother plant), and that accession was collected on an unknown date. The most recent accessions are more than 15 years old. Seed longevity is unknown for *A. brauntonii*, but other *Astragalus* species have germinated after more than 130 years of storage (Molnár V. et al. 2015, p. 322).

Table 3. *Astragalus brauntonii* conservation seed banking (California Plant Rescue 2023).

CNDDB = California Natural Diversity Database, EO = Element Occurrence.

CNDDB EO #	Collection Date	Storage Facility	Location Description	Maternal Lines	Total Seeds
Santa Monica Mountains					
15	7/1/1997	California Botanic Garden	Temescal Ridge Road	data deficient	128,381
15	7/1/1997	California Botanic Garden	Temescal Ridge Road	data deficient	12,885
15	7/18/2006	California Botanic Garden	Temescal Ridge Road	data deficient	6,565
Simi Hills					
20	6/6/1995	California Botanic Garden	Oak Park	data deficient	57,795
20	7/9/1998	California Botanic Garden	Oak Park	data deficient	382,176
23	unknown	California Botanic Garden	Dayton Canyon	7	127,823
25	2/5/2001	California Botanic Garden	Westlake/Lang Ranch Ridge	data deficient	1,277
30	4/1/2007	Santa Barbara Botanic Garden	Pathfinder/Falling Star	data deficient	100
San Gabriel Mountains					
16	4/24/1995	California Botanic Garden	Clamshell Canyon	data deficient	11,6738
16	1/24/1997	California Botanic Garden	Clamshell Canyon	data deficient	690

Recent Taxonomy:

Recently, a new taxon, *Astragalus brauntonii* var. *lativexillum*, has been described from northwestern Baja California, México (Estrada Castellón et al. 2022, pp. 6–9). Because this new taxon is different from the original listed *Astragalus brauntonii*, the authors have given the name *Astragalus brauntonii* var. *brauntonii* to the original listed taxon to separate it from the new taxon. This is standard plant nomenclatural practice (M. Williams pers. comm.). We will continue to refer to the original taxon in the United States simply as *Astragalus brauntonii*, and will not consider *Astragalus brauntonii* var. *lativexillum* further.

EVALUATION OF THREATS:

At the time of listing in 1997 (Service 1997), the threats to *A. brauntonii* were identified as direct loss from urban development, fragmentation of habitat, fragmentation of land ownership of individual occurrences, alteration of fire cycles, and random extinction of a species with populations of limited abundance because of natural occurring stochastic events. The 1999 recovery plan also recognized the threats of loss of habitat from fire suppression activities (Service 1999 p. 10), reduction of pollinators, and other land use practices that negatively affect the species. The 2006 designation of critical habitat (Service 2006 p. 66387) further identified the threats of weed abatement collateral death, vegetation type conversion from increased fire frequencies, competition from non-native plants, trampling from human recreational activities and grazing, and decline of the soil seed bank from increased mortality of pre-reproductive plants. The threat of climate change to the species is introduced in the 2009 5-year review (Service 2009 p. 9). Here, we summarize the threats identified in previous Service documents, and expand upon climate change threats.

All of the above threats continue to act on the species, at least to some degree. Also, many of these threats are related to and interact with each other, amplifying their effects.

Urban Development:

Of the 52 extant occurrences of *A. brauntonii*, 39 occur partly or completely on local, state, or federal lands and are relatively protected from development (Table 1, CDFW 2023). The remaining 13 occurrences are on private land, where they are at risk of development, or ownership is unknown. Often the species is found on steep terrain that may be less desirable for development, but modern earthmoving practices can make these areas viable for development. For example, the San Juan Hill occurrence (EO# 56) is on a steep slope that is entirely within the footprint of a proposed residential development (CAA Planning Inc, 2016 pp. 5-143, 5-204).

Besides being federally listed as endangered, the species is a special status plant for the State of California (CNDDDB 2023 p. 17). However, as the 2009 5-year review discusses (Service 2009 pp. 10–11), protections are often functionally weak, and plants can still be impacted by future development. Development is uncertain and remains a current threat to the species.

Fragmented Ownership:

An occurrence that is not totally on public land also may occur on or be adjacent to land of one or more private owners. If development occurs on the private parcels, the areal extent of the occurrence is decreased, leading to a decrease in current or future population size of adult plants

and the soil seed bank, increased geographical isolation of occurrences, and to potential problems associated with small population size (see section on limited population sizes below). Fragmented ownership of occurrences remains a current threat to the species

Maintenance Activities Related to Development:

With urbanization comes the need to maintain developments, and this encompasses several threats to *A. brauntonii*, generally related to fire suppression. This includes unintentional killing of adult plants by chemical and manual weed control activities around existing structures and during the construction and maintenance of fuel breaks and fire roads. In addition to removing adult plants, these actions can alter habitat to make it unsuitable for future growth, or can remove the soil seed bank. If there is annual killing of vegetative plants that have not yet produced seed, continual germination of the soil seed bank without seed replenishment can lead to soil seed bank depletion. Maintenance of structures, fuel breaks, and fire roads remains a threat when it intersects occurrences.

Trampling:

Occurrences on both private and public lands are subject to damage from trampling of plants from activities including hiking, mountain biking, off-highway vehicle use, equestrian use, and, in a few cases, grazing. In some situations, the disturbance of these activities can stimulate germination of an existing soil seed bank, with the resulting plants succumbing to trampling before being able to produce seeds. Trampling by recreational use remains a threat to the species when trails cross through occurrences.

Pollination Reduction:

The recovery plan (Service 1999 p. 10) and critical habitat designation (Service 2006 p. 66387) listed a reduction in pollinators because of habitat fragmentation as a possible threat. A pollination study (Fotheringham and Keeley 1998 pp. 14–15) found that the species self-pollinates and produces seeds at a rate not significantly different than if it is open to visitation by generalist bees. The study did not investigate the genetic consequences of the lack of pollination by other *A. brauntonii* within or between occurrences. There could be local inbreeding effects if there was no effective pollen transfer between occurrences, but this remains to be investigated. The magnitude of the threat of reduction of pollinators is unclear.

Limited Population Size, Habitat Fragmentation, and Random Extinction of Small Populations:

Most of the occurrences of *A. brauntonii* have relatively small numbers of plants at the time of any given survey. These small numbers might reflect relatively small soil seed banks, although a fire or other disturbance can trigger the germination of a large number of individuals at an occurrence. Occurrences may be separated in space by a landscape that is increasingly fragmented by development, or by a mosaic of vegetation that results from patchy disturbance. Occurrences may also be separated in time by germination-stimulating fires occurring at different times over the landscape. This isolation can make the occurrences vulnerable to random extirpation by stochastic events (short-interval wildfires, catastrophic flooding and erosion, drought) that can decimate plant populations with few individuals (Matthies et al. 2004, pp. 484–486), and over time this can scale up to encompass the species. The threat of stochastic processes acting on isolated small populations to cause random extirpation remains a threat to the species.

Alteration of Fire Cycles, Type Conversion, and Competition with Non-Native Plants:

The alteration of normal fire cycles was identified as a threat to the *A. brauntonii* and its habitat at listing (Service 1997). This is a threat that can operate both at short and long-time scales. If fire intervals are shortened because of increased numbers of human-induced ignitions, plants on the landscape may produce a relatively low number of seeds before they are killed by fire, and the soil seed bank becomes depleted. As discussed in the designation of critical habitat (Service 2006), shortened fire cycle can also lead to type conversion from woody perennial vegetation to annual grasses and forbs, which are easily ignited and decrease fire intervals, which reinforces the type conversion. If fire intervals are increased because of fire suppression, germination is suppressed, and over time the soil seed bank becomes depleted as seeds die over time. If altered fire cycles result in local extirpations of the species, occurrences may have fewer plants that are highly dispersed on the landscape, leading to the problems of small population sizes discussed above. Additionally, as introduced in the designation of critical habitat (Service 2006) a short fire interval is expected to promote the abundance of non-native plants and increase competition. Increased nonnative cover also increases the amount of flashy fuel that can carry fire (Hall et al. 2018 p. 53), further favoring a decreased fire return interval. Therefore, the effects of alteration of fire cycles, type conversion, and competition are persistent threats to *A. brauntonii* and its habitat.

Climate Change Effects:

The 2009 5-year review (Service 2009 p. 14) introduced climate change as a threat to *A. brauntonii*. Expected climate change for the Los Angeles area includes rising annual and extreme high temperatures (Hall et al. 2018 pp. 10–11), increased episodic rainfall with more extreme floods, and drier droughts (Hall et al. 2018 pp. 11–14, 18). Changes in climate will likely threaten *A. brauntonii* in several ways. First, as considered in the 2009 5-year review (Service 2009 p. 14), as climate changes and vegetation shifts, optimal habitat for *A. brauntonii* may also shift, and the species may not be able to disperse far and fast enough to match the vegetation shifts. Second, the more intensively dry summers coupled with long-term drought could kill plants that germinated but have not yet set seed. Third, more intense precipitation could cause increased erosion, destroying plants and eliminating suitable habitat. Finally, with changing climate, non-native annual grasses and forbs are expected to increase in dominance both because of increased fire frequency (Hall et al. 2018 p. 53) and with increasing annual temperatures (Sandel and Dangremond 2012 entire). The increased annual grass dominance can have both greater negative competitive effects on seedling and adult *A. brauntonii*, decreasing plant longevity and reproductive output, and promote future fires, further vegetation type conversion, and lead to fire cycles too short for optimal *A. brauntonii* survival and reproduction. The threats of climate change to *A. brauntonii* remain throughout its range.

RECOVERY CRITERIA:

We developed the following downlisting criteria for *A. brauntonii* in the 1999 Recovery Plan (Service 1999, p. 41):

1. *All current sites (including seedbanks) with the species are fully protected and managed with the primary intention of preserving the populations in perpetuity.*

- This criterion has been partially met. The 1999 recovery plan identified 20 occurrences. Of these 18 are presumed extant, and of the 18, four are on private property that is not fully protected. The number of occurrences has increased to 57, with 39 of these both extant and at least partially protected on public land. A more comprehensive review of management plans and protective measures in place on public lands would be useful to more fully evaluate the latter part of this criterion.
2. *Seed collected from all populations is stored at a certified Center for Plant Conservation botanical garden.*
 - This criterion has not been met. There is inadequate representation of occurrences over a range of years, with accessions from only 6 occurrences, and none from the Santa Ana Mountains. Conservation seed banking best practices call for repeat seed collections at a site over at least several years, so that the genetic representation of plants that germinate under different environmental conditions is captured.
 3. *Reliable seed germination and propagation techniques for the species are understood.*
 - This criterion has been met. Detailed techniques were developed by Fotheringham and Keeley (1998, pp. 9–18).

We also developed the following delisting criterion for *A. brauntonii* in the 1999 Recovery Plan (Service 1999, p. 41):

1. *Populations are shown to be self-sustaining over a minimum of 15 years.*
 - This criterion has not been met. There has not been adequate monitoring to determine the status of this criterion. Additionally, the short-lived dramatic increase in visible plants following disturbance make the 15-year period less meaningful than the ability for populations to respond to several disturbance events over a series of years. A more meaningful indicator of a self-sustaining population may be a robust soil seed bank as reflected by the number of plants that germinate and reproduce after a disturbance. Currently, these data are lacking.

CONCLUSION:

We reviewed the best available scientific information and evaluated the threats affecting *Astragalus brauntonii* in 2023 under factors in 4(a)(1) of the U.S. Endangered Species Act of 1973 (as amended). While more occurrences of the species are known since the time of listing, all the identified threats continue to act on the species. These threats include urban development and the associated effects, trampling, pollination reduction, conditions promoting the random extirpation of small populations, alteration of fire cycles and the related effects, and climate

change effects. The San Gabriel Mountains (3 presumed extant) and Santa Ana Mountains (6 presumed extant) occurrences are fewer in number than the Santa Monica Mountains (18 presumed extant) and Simi Hills (24 presumed extant) occurrences, and thus could benefit from greater survey effort, especially after fire. Therefore, we conclude that the species still meets the definition of an endangered species.

RECOMMENDATIONS FOR FUTURE ACTIONS:

1. Conduct thorough population census surveys of all known occurrences and areas of suitable habitat, especially in the San Gabriel Mountains and Santa Ana Mountains areas. These surveys are needed to accumulate baseline information about distribution so that it can be compared with distribution after wildfire or other disturbance.
2. Develop and implement a monitoring plan for all occurrences. Monitoring should include population abundance surveys, habitat condition assessment, and documentation of existing and potential threats. Monitoring data should be in place so that comparisons can be made if at future dates the monitoring areas burn.
3. Review protective measures in place for all occurrences on public lands.
4. Work with public and private entities to prevent damage to plants and raise public awareness to support appropriate conservation measures.
5. Develop a method to assess the number of seeds in the soil seed banks of occurrences, and test how that relates to numbers of plants that germinate after disturbance.
6. Increase the number of accessions in conservation seed banks so that a greater number of known occurrences are represented and add accessions for previously collected occurrences so that a greater number of years is represented.

APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approved _____

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