INDIAN KNOB MOUNTAINBALM
(*Eriodictyon altissimum*)

5-Year Review:
Evaluation and Summary

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

June 2024

5-YEAR REVIEW

Indian Knob mountainbalm (*Eriodictyon altissimum*)

GENERAL INFORMATION

Species: Indian Knob mountainbalm (*Eriodictyon altissimum*)
Date listed: December 15, 1994
Federal Register (FR) citation: 59 FR 64613–64623
Classification: Endangered

Critical Habitat Designation:
We have not designated critical habitat for Indian Knob mountainbalm.

State Listing:
The state of California listed Indian Knob mountainbalm as Endangered under the California Endangered Species Act in 1979 (California Natural Diversity Database [CNDDB] 2024a).

Recovery Plan:
[Service] U.S. Fish and Wildlife Service. 1998. Recovery Plan for the Morro Shoulderband Snail and Four Plants from Western San Luis Obispo County, California. U.S. Fish and Wildlife Service, Portland, Oregon. 75 pp.

[Service] U.S. Fish and Wildlife Service. 2019a. Recovery Plan for the Morro Shoulderband Snail and Four Plants from Western San Luis Obispo County, California. Amendment 1. U.S. Fish and Wildlife Service, Ventura, California. 15 pp.

BACKGROUND

Species overview:
Indian Knob mountainbalm (*Eriodictyon altissimum*) is a narrowly endemic, perennial shrub in the Namaceae (nama) family. It grows up to 5.5 meters (m or 18 feet [ft]) tall. Indian Knob mountainbalm has dark green, linear leaves with revolute (strongly rolled under) margins. The inflorescences are scorpioid cymes, where the oldest flower in the arrangement terminates the main axis and continues to branch and curl over in a one-sided coil, like a scorpions' spiraling tail. The individual flowers occur on pedicels, are purple, and are funnelform in shape with five lobes. Indian Knob mountainbalm blooms March through July. It has capsule fruits with four valves (and two separate chambers), and most members of the genus generally produce many seeds (Hannan 2021, website; Keil 2022, pp. 555–556). However, seed production in Indian Knob mountainbalm is considered low to absent. The species has both above-ground stems and underground rhizomes. A single genetic individual can spread vegetatively via the rhizomes, producing a colony (genet) of identical above-ground stems ([ramets], Guilliams and Hasenstab-Lehman 2021, pp. 1–2). This clonality can pose challenges in the field when trying to assess the actual number of individuals present in a given stand because groupings of Indian Knob mountainbalm ramets likely contain few distinct individuals.

Indian Knob mountainbalm occurs on sandstone substrates largely derived from ancient sand dunes within the San Luis Range, in western San Luis Obispo County, California. It occurs in maritime chaparral habitat types, where it is a local component of these plant communities originating from the Indian Knob landform (located roughly north-northeast of the City of Pismo Beach). This landform is located between the cities of San Luis Obispo and Pismo Beach. Its range extends from the community of Los Osos, roughly southeast to the City of Pismo Beach (Keil 2022, p. 556).

This species, like other species within *Eriodictyon*, is a relatively short-lived perennial and considered an early successional (or pioneer) species because it often proliferates in disturbed sites such as roadcuts, and other fire-prone vegetation communities. It has an affinity for disturbed areas including steep, rocky slopes; cliff faces; fallen rock debris; sand dunes (shifting sand); roadsides and roadcuts; graded areas, such as dirt/rock roads and talus pilings; and trails. In these conditions, Indian Knob mountainbalm often spreads rhizomatously. After disturbance, a single genetic individual can produce a colony (referred to as a genet) of several genetically identical above-ground stems (referred to as ramets). Disturbances such as fire and vegetation clearing activities result in some destruction and loss of ramets within any given genet. However, new stems quickly grow from existing rhizomes to produce new ramets (Guilliams and Hasenstab-Lehman 2021, p. 2). Most reproduction in the species is believed to occur asexually via this mechanism, and Indian Knob mountainbalm is likely self-incompatible (Kofron et al. 2019, p. 26). Other *Eriodictyon* species do reproduce sexually by seed, with increased germination from fire-associated cues such as heat and charate[1] treatments (Guilliams and Hasenstab-Lehman 2021, p. 2). Sexual reproductive mechanisms, amounts of seed production, seedbank longevity and seed viability, and effects of fire cues on seed germination in Indian Knob mountainbalm are largely unknown.

Most recent status review:

[Service] U.S. Fish and Wildlife Service. 2019b. Indian Knob mountainbalm (*Eriodictyon altissimum*). 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service, Ventura Fish and Wildlife Office, Ventura, California. 7 pp.

We recommended no status change for Indian Knob mountainbalm.

FR Notice citation announcing this status review:

[Service] U.S. Fish and Wildlife Service. 2023. Endangered and Threatened Wildlife and Plants; Initiation of 5-Year Status Reviews of 47 species in California, Nevada, and Oregon. FR 88: 56042–56044.

ASSESSMENT

Information acquired since the last status review:

The U.S. Fish and Wildlife Service's (Service) Ventura Fish and Wildlife Office (VFWO) conducted this 5-year review. We announced the review through a FR notice on August 17, 2023 (Service 2023; 88 FR 56042–56044). We conducted a literature search and review of information in our files, and contacted other agencies, species experts, and stakeholders to request data and any other pertinent information we should consider in our review. Little new information is available since our last Indian

[1] Charate is powdered, charred wood experimentally used to stimulate seed germination in treatments conducted on several fire-adapted plant species. Charate preparations are typically made by charring fresh chamise (*Adenostoma fasciculatum*) stems and grinding them to a coarse powder, which mimics post-fire conditions (Keeley 1987, pp. 434–435).

Knob mountainbalm 5-year review (Service 2019b). However, we have new data on the species distribution, conservation seed banking efforts, genetics work, and other research to report. We provide these updates below.

Distribution and abundance:
Here we use the term "Element Occurrence" (EO) to mean a specific location where Indian Knob mountainbalm is or was known to occur according to the California Department of Fish and Wildlife's (CDFW), California Natural Diversity Database (CNDDB). EOs are based on observation data and other information about a known location of the species from various sources and represent a summary of all available observation information for a documented location of the species. EOs can potentially include several years of data summarized into a single record (CNDDB 2020, pp. 9–10). CDFW separates EOs when there is at least 0.4-kilometer ([km] or 0.25-mile [mi]) distance between documented locations. Once an EO number is used within the CNDDB for a species, it is not reused again. Therefore, it may appear that EO numbers in a series are missing for some species if they are reconfigured, deleted, or merged due to misidentification, new information, or other factors (CNDDB 2020, pp. 10–11).

At the time of federal listing, we knew of six Indian Knob mountainbalm EOs. We considered all of them extant. We estimated that the species abundance was less than 600 total individuals (Service 1994, pp. 64614 and 64618). Indian Knob mountainbalm was known from these same six documented EOs in 2009 when we completed the first Indian Knob mountainbalm 5-year review. We considered all the documented EOs extant, except for one (EO number 1), which could not be relocated during field surveys. We estimated the species abundance to be greater than 480 total individuals (Service 2009, pp. 5–6 and 9). We received a petition to reclassify Indian Knob mountainbalm from endangered to threatened in 2011, and completed a status review of the species to determine whether or not reclassification was warranted. We determined that Indian Knob mountainbalm reclassification was not warranted (Service 2013; 78 FR 75313–75321). In 2013, we accounted for seven Indian Knob mountainbalm EOs, with one new location added since the 2009 5-year review (EO number 7). Of these seven EOs, we considered two likely extirpated (EO numbers 1 and 4; Service 2013, p. 75315). We did not provide any updated information about the species abundance in the 2013 12-month finding (Service 2013; 78 FR 75313–75321).

We completed another Indian Knob mountainbalm 5-year review in 2019 and knew of seven Indian Knob mountainbalm EOs, including one newly documented location (EO number 8; Service 2019b, pp. 2 and 5). Of these, we considered two locations likely extirpated. We still considered EO number 1 likely extirpated, which was the same status reported for it in 2013 (Service 2019b, pp. 2 and 5; Service 2013, p. 75315). We also considered EO number 3 likely extirpated in 2019 (Service 2019b, pp. 2 and 5). Indian Knob mountainbalm plants were found again at EO number 4 starting in 2016, so this location was no longer considered extirpated (Service 2019b, pp. 2 and 5). CDFW quickly merged the new location added in 2013 (EO number 7), into another previously documented location (EO number 5), located within relatively close proximity. As a result, we didn't show EO number 7 on our figures in 2019 (Service 2019b, pp. 2 and 5; Service 2013, p. 75315). We provided an estimate of the total species abundance based on data collected in 2016 of approximately 6,489 individuals (Service 2019b, pp. 2 and 5). We provide a summary of the historical Indian Knob mountainbalm EO data below in Table 1.

Table 1. Summary of historical Element Occurrence (EO) data for Indian Knob mountainbalm (*Eriodictyon altissimum*), San Luis Obispo County, California.

Location	Geographical Area	Service Document 1994/EO Number	Service Document 2009/EO Number	Service Document 2013/EO Number	Service Document 2019/EO Number
Morro Dunes Ecological Reserve/Broderson Site	Los Osos	1	1*	1*	1*
South side of Hazard Canyon, Montaña de Oro State Park, Ridge Trail	Los Osos	2	2	2	2
North side of Hazard Canyon, Montaña de Oro State Park	Los Osos	3	3	3	3*
Morro Dunes Ecological Reserve, Bayview Unit	Los Osos	4	4	4*	4
Guidetti Ranch, Southwest	Indian Knob	5	5	5	5(7)
Morro Dunes Ecological Reserve/Bayview Unit, Water Tank	Los Osos	6	6	6	6
Guidetti Ranch, Baron Canyon	Indian Knob	–	–	7	–
Guidetti Ranch, Southeast	Indian Knob	–	–	–	8

*Indicates CNDDB included EO as extirpated.

We compiled all available occurrence data and for Indian Knob mountainbalm in geographic information system to visualize the species historical and current range and distribution (Figure 1). Our data came from two sources:

1. EOs: Government version of the CNDDB through the Biogeographic Information and Observation System (CNDDB 2024b, website) and
2. Herbarium specimens: Specimen data from the Consortium of California Herbaria (CCH2) Data Portal (CCH2 2024, website).

We provide more detailed information about the data shown in Figure 1 within the Appendix.

There are currently a total of six known Indian Knob mountainbalm EOs[2] (CNDDB 2024b, website). We had seven Indian Knob mountainbalm EOs in our 2019 compilation, but the numbers used to

[2] All known EOs are shown on Figure 1, regardless of whether they are considered extant or likely extirpated.

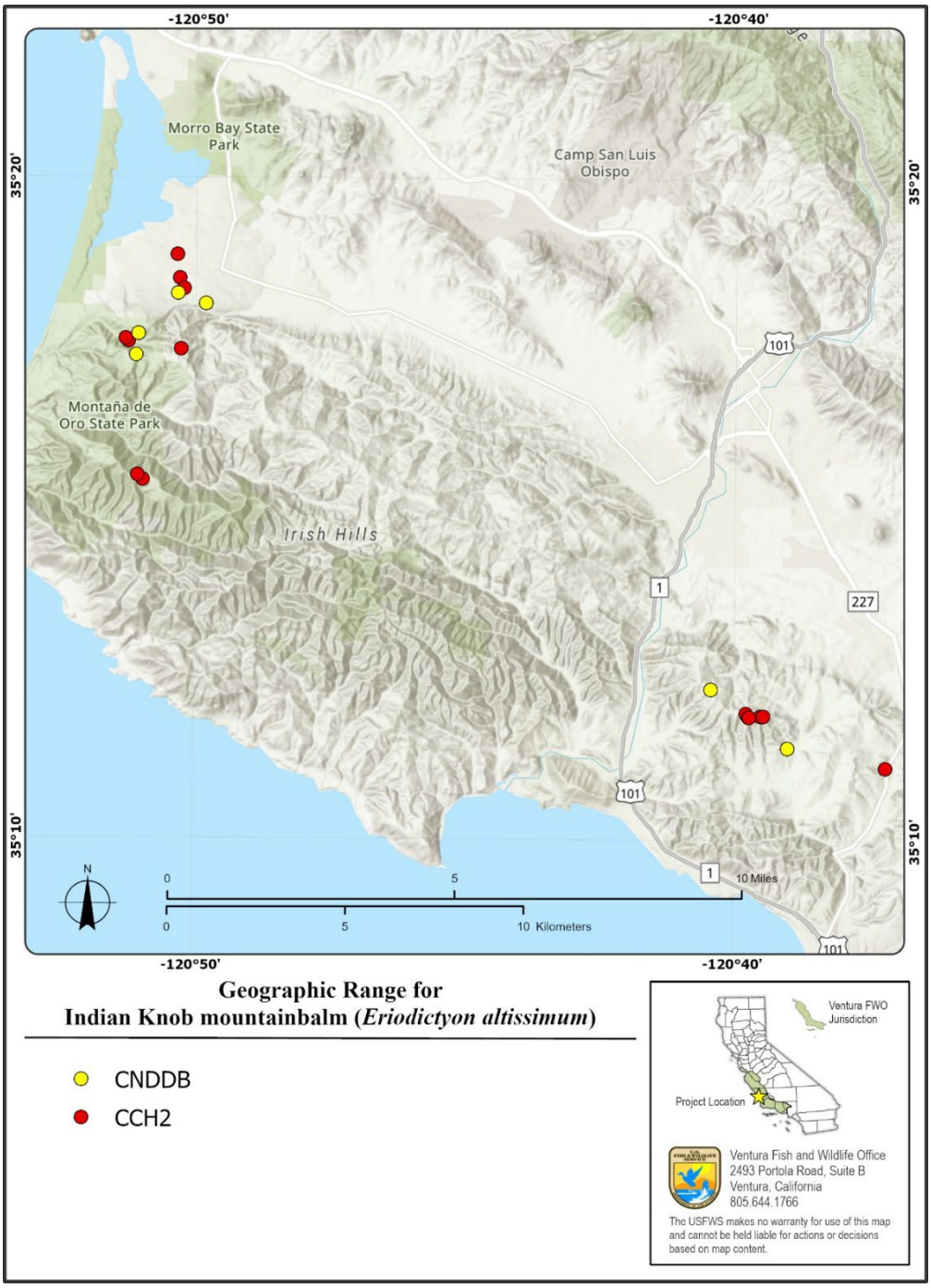

Figure 1. Geographic range and distribution of Indian Knob mountainbalm (*Eriodictyon altissimum*), San Luis Obispo County, California based on data from the California Natural Diversity Database (CNDDB) and Consortium of California Herbaria (CCH2) Data Portal (CNDDB 2024b, website; CCH2 2024, website).

identify them in 2019, do not correspond with the current CNDDB numbering (Table 1; Service 2019b, pp. 2 and 5; CNDDB 2024b, website). CDFW combined former EO number 4 with EO number 1 because of their proximal locations. Therefore, EO number 1 is no longer considered likely extirpated. We consider only one EO (EO number 3), likely extirpated (CNDDB 2024b, website). We do not have any updated Indian Knob mountainbalm abundance data to report, and we are not aware of any planned or proposed census survey work for the species.

Indian Knob mountainbalm is also known from a total of 20 geo-referenceable herbarium specimens from CCH2 (CCH2 2024, website). CCH2 Geo-referenceable herbarium specimens are included in Figure 1 for completeness, and to help characterize the historical and current range of the species. CCH2 herbarium specimens are not considered EOs. These point locations represent a single snapshot in time on the collection date, and the records do not necessarily include associated abundance data. Therefore, we are not able to ascertain their status and do not know whether these locations are extant or extirpated. Several of the CCH2 herbarium specimen locations overlap with one another, or with EOs when mapped.

Conservation seed banking:
We did not provide information about Indian Knob mountainbalm conservation seed banking in the 2019 5-year review (Service 2019b). To date there is only one Indian Knob mountainbalm seed accession made by the Santa Barbara Botanic Garden (SBBG) in 2015 that contains 43 seeds. Botanists collected the seeds at the Guidetti Ranch, which corresponds with CNDDB occurrence number 5 (Birker 2024, pers. comm.; CNDDB 2024b, website).

Research:
We received a final technical report from partners at SBBG on Indian Knob mountainbalm genetics that VFWO funded (Guilliams and Hasenstab-Lehman 2021). SBBG applied population-genomic techniques to answer a series of questions about the species' inherent genetic diversity. SBBG found Indian Knob mountainbalm to have moderate genetic diversity, and that the genetic diversity of individuals within EOs sampled was roughly proportional to the total number of ramets. Specifically, the largest EO, located on the Indian Knob landform, exhibited the highest genetic diversity overall, and the EOs centered around Los Osos exhibited much lower genetic diversity. They also found that the occurrences associated with the Los Osos were genetically distinct from the those located at Indian Knob, which was expected given that they are separated by approximately 20.9 km (13 mi). While the sampled EOs from Los Osos exhibited relatively low genetic diversity, they were genetically distinct from each other and strongly distinct from those at Indian Knob. The Indian Knob samples were all genetically similar to one another. Lastly, SBBG recommended a plausible metric to use in the field, based on their results, to estimate the number of individuals (putative genets) present within groupings of ramets (above-ground stems; see species overview section, p. 6 for background). Their data suggest that ramets within approximately 8 m (26 ft) of each other and separated from other ramets by approximately 20 m (66 ft), is reasonable to use for distinguishing between individuals (Guilliams and Hasenstab-Lehman 2021, pp. 17–18). This increases our understanding of Indian Knob mountainbalm clonality because we can now more accurately estimate the number of individuals present within a given, occupied spatial area.

SBBG also completed another study examining the current taxonomic circumscriptions of *Eriodictyon* using phylogenomic techniques. They found Indian Knob mountainbalm and Lompoc yerba santa (*Eriodictyon capitatum*) to be reciprocally monophyletic and sister groups. In other words, their

investigations confirmed that the two species are evolutionarily distinct and that they are likely both derived from a shared common ancestor. SBBG's data also showed that the two species are not more closely related to any other species in the genus, including the other species that have narrow, linear leaves. Their work further supports the current *Eriodictyon* taxonomy (Guilliams and Hasenstab-Lehman 2023, pp. 1, 12, 15, and 19).

A final study from SBBG measured germination rates in Indian Knob mountainbalm's sister taxon, Lompoc yerba santa, in a laboratory setting. They tested seeds subject to five different physical treatments including control, dry heat, hot soak, liquid smoke, and scarification under both light and dark conditions to better understand the species life history. They observed the highest germination rates with seeds sown in the dark and treated with liquid smoke, which suggests Lompoc yerba santa may be adapted to fire. While they did not investigate the specific mechanism(s), liquid smoke preparations contain chemicals similar to those present in the environment during and after a natural fire event, and these chemicals likely function to stimulate or cue seed germination in fire-adapted plants. Many native species within chaparral and sage scrub vegetation communities require fire-related cues to complete their life cycles. Periodic fires may also function to promote genetic diversity in Lompoc yerba santa by stimulating a flush of germination from the resident soil seed bank (Schneider et al. 2021, pp. 87, 91–92, and 94). Because the two species are so closely related and occur in similar maritime chaparral habitat types, Indian Knob mountainbalm may also require fire-related cues for germination of its seed bank—a question worthy of future investigation. We still regard the species as a fire-adapted chaparral plant, which is how it has been described previously, even though we have no historical or current records of fire at the known occurrences (Service 2019b, p. 2; Kofron et al. 2019, p. 26).

Threats:
Threats to Indian Knob mountainbalm identified in the 2019 5-year review included altered fire regime and fire suppression, small populations and limited distribution, stochastic events, and climate change (Service 2019b, p. 3). We also noted vegetation clearing and removal activities, trampling by hikers, disturbance from vehicles (which may damage plant tissues and possibly result in death), and road or trail maintenance activities as threats impacting the species at several locations. We also described detrimental effects to Indian Knob mountainbalm resulting from fire suppression by the associated vegetation growing progressively thicker and denser over time. Therefore, we considered declines in habitat quality associated with prolonged absence of fire a threat to the species (Service 2019b, p. 3).

Given our current understanding of the status and distribution of Indian Knob mountainbalm, and the known land uses of occupied and surrounding areas, we consider all the threats described in the 2019 5-year review to continue to negatively impact the species (Service 2019b, p. 3).

In addition to these threats, we consider habitat loss and fragmentation from land conversion and development a new threat to the species. Most of the occupied areas mapped within the Indian Knob landform area (EO numbers 5 and 8) occur on the privately-owned Guidetti Ranch [CNDDB 2024b, website]), which is currently listed for sale. Therefore, little is known about future land use(s) of the property. The City of San Luis Obispo (City) holds conservation easements on two separate portions of the ranch, including limited areas located in the southwest and south-central regions of the property that support Indian Knob mountainbalm. The current landowner employed many generally beneficial land use and stewardship practices onsite (such as sustainable grazing strategies) and had a positive relationship with the City. The current landowner also gave partners access to the ranch for tours,

research, and other monitoring activities. Approximately 690 acres (279 hectares) of the total 1,611-acre (652-hectare) ranch is active pastureland. The Guidetti Ranch could be developed if sold or subdivided. Oil, mineral, and gas extraction activities may resume, and other natural areas may be converted to vineyards, orchards, or pastures, depending on the plans of the new owner(s) for the property. Any change in land use at the Guidetti Ranch, or deviations from the current practices at occupied sites and in areas adjacent to sites occupied by the species, has potential to adversely affect Indian Knob mountainbalm in terms of its survival, reproduction, and overall persistence.

Evaluation of Recovery Criteria:
We developed the following downlisting criteria for Indian Knob mountainbalm in the 1998 Recovery Plan (Service 1998, p. 41):

1. At least five occurrences from throughout its range are on lands secure from human-induced threats.

2. Surrounding habitat is protected in amounts adequate to permit management of the vegetation community using prescribed fire if it is deemed beneficial for the species.

3. Populations are projected to be self-sustaining and either stable or increasing as determined from long-term monitoring and research results.

At this time, we have not met any of the downlisting criteria established for the species. None of the occurrences are totally secure from human-induced threats, whether or not they are publicly or privately owned. Examples of human-induced threats include altered fire regime/fire suppression, climate change, unauthorized clearing and trimming of vegetation, trampling, and disturbance from vehicles. Human-induced threats, as well as other threats, continue to negatively impact the species. Portions of EO numbers 5 and 8 occur on private lands and are therefore unprotected from development. Other areas within EO numbers 5 and 8 are also on private lands within the Guidetti Ranch but are subject to the provisions of conservation easements held by the City. Therefore, these occupied sites are unlikely to be developed if Guidetti Ranch sells and changes in land use occurs. They would however be subject to indirect effects like habitat fragmentation and edge effects. There is currently no management, or any management plans for any of the Indian Knob mountainbalm EOs. Habitat surrounding occupied areas are not protected in adequate amounts to permit management using prescribed fire or any other techniques deemed beneficial to the species. No management activities deemed beneficial to the species of any kind are currently being implemented. We do not have long-term monitoring data on the extant Indian Knob mountainbalm EOs; therefore, we are unable to assess population trends.

We did not include delisting criteria in the 1998 Recovery Plan because we generally lacked sufficient data on the species reproductive biology, soil seed bank dynamics, clonality, genetics, and response to fire and other disturbances. While we gained some new information about the species in these areas, we still need more information about the species' biology and recovery needs, especially effective management strategies.

Section 4(f)(1)(B)(ii) of the U.S. Endangered Species Act of 1973 (as amended) requires that each Recovery Plan incorporate, to the maximum extent practicable, "objective, measurable criteria which, when met, would result in a determination… that the species be removed from the list." To satisfy this

requirement, we amended the 1998 Recovery Plan in 2019 to include delisting criteria for Indian Knob mountainbalm (Service 2019a, entire).

We developed the following delisting criteria for the species in Amendment 1 (Service 2019a, p. 6):

1. Threats are reduced or eliminated so that occurrences are capable of persisting without significant human intervention or perpetual endowments are secured for management necessary to maintain the continued existence of the species. The most outstanding management needs currently are:

    a. Integrate, or find a replacement for, a fire regime as a means of revitalizing declining or senescing colonies;
    b. Manage adjacent shrub habitat through thinning to provide sufficient space for the species to expand in numbers; and
    c. educational signing to deter the public from cutting shrubs along trails.

2. The occurrences remain viable for at least 15 years to demonstrate long-term viability under a range of environmental conditions. Range-wide surveys in 2016 and 2017 provide a baseline for numbers of stems or individuals, and in some cases, additional information regarding vigor of individuals, as measured by size. These data should provide a basis for monitoring occurrence attributes to determine viability over time.

3. An *ex-situ* collection of plant material is established in a Center for Plant Conservation-affiliated botanic garden. A soil seed bank would typically provide a strategy for a species to regenerate populations in the face of stochastic events, as well as natural senescence. However, this species is suspected to have low seed production. Research on seed production and viability will be undertaken in the near future. Whether reproduction through banked seeds proves to be efficacious or not, reproduction through vegetative propagation (e.g., cuttings) also holds potential as a means of replenishing occurrences, should it be necessary in the future.

We did not evaluate the delisting criteria because the downlisting criteria have not been met.

Summary:
Indian Knob mountainbalm is currently known from six EOs (CNDDB 2024b, website), and 20 geo-referenceable herbarium specimens from CCH2 (CCH2 2024, website). Of the six EOs, we presume one is likely extirpated (EO number 3, see p. 7; CNDDB 2024b, website). We are not able to ascertain the status of Indian Knob mountainbalm at the CCH2 documented locations. We also lack updated census or survey information to report about the species abundance throughout its range and are unable to assess population status trends, even at the spatial scale of individual occurrences. Threats identified as negatively affecting Indian Knob mountainbalm in 2019 include altered fire regime and fire suppression, associated changes in habitat quality from canopy expansion and overgrowth, small populations and limited distribution, stochastic events, climate change, and other human activities (including vegetation clearing and removal, trampling from hikers, disturbance from vehicles, and road/trail maintenance, Service 2019, p.3). Because there is no change in status at any of the EOs, and we are not aware of implementation of any new management activities, we presume that all these same threats continue to act negatively on Indian Knob mountainbalm. We also identified a new threat to the species posed by

habitat loss and fragmentation resulting from development in this 5-year review. Lastly, none of the downlisting or delisting criteria established in the species Recovery Plan have currently been met.

Conclusion:
After reviewing the best available scientific information, evaluating threats affecting the species, and analyzing the species recovery criteria, we conclude that Indian Knob mountainbalm remains an endangered species and recommend no change in status at this time.

RECOMMENDATIONS FOR FUTURE ACTIONS

1. Obtain access to all six known Indian Knob mountainbalm occurrences (CNDDB 2024b, website) to conduct comprehensive surveys of abundance, assess the overall status of the species, and evaluate current threats to the species at each location. Include estimates of the total number of Indian Knob mountainbalm individuals present at each location, using the metric provided in Guilliams and Hasenstab-Lehman 2021 (pp. 17–18) and map the total occupied area using global positioning system (GPS). Collect other pertinent ecological and demographic data including co-occurring and co-dominant species, estimate of canopy cover, presence and abundance of nonnative, invasive species, timing of phenology, and observations of any potential insect pollinators. Provide data and interpreted findings to the Service and CDFW to ensure that resource databases and species relevant updates remain both accurate and current.

2. Conduct experimental research to better understand Indian Knob mountainbalm's reproductive biology. Specifically, investigate germination cues related to fire, seed bank dynamics, and seed viability. We also need to better understand why seed production is low to near absent, in wild populations and which environmental cues or conditions may stimulate production of seed.

3. Conduct experimental research to determine the most effective/optimal management techniques to apply to extant, wild populations of Indian Knob mountainbalm to ensure both persistence and expansion of the species within currently occupied areas. In particular, we must evaluate the use of prescribed burns and other disturbance techniques to stimulate new plant growth and regenerate senescent stands.

4. Work with partners who own or hold conservation easements on occupied Indian Knob mountainbalm sites and help them develop and implement conservation and recovery actions through habitat management plans for their properties. Support these partners and assist them to acquire and secure adequate funding and other endowments to manage the species and its habitat for conservation and recovery in perpetuity.

5. Conduct introductions at suitable sites that include long-term management strategies to ensure success and persistence of the species at introduced locations. Develop protocols for propagation of the species from both cuttings and seed.

6. Make adequate accessions of Indian Knob mountainbalm seed for conservation banking so that all known occurrences are represented in the established collections. Conduct seed bulking activities, if feasible, to have an ample source of seed for recovery efforts and to serve as a backup in the event of stochastic loss and possible extirpation.

APPROVAL

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

Approved STEPHEN HENRY Digitally signed by STEPHEN HENRY
Date: 2024.06.04 10:57:04 -07'00'

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Personal Communication

Birker, C. 2024. Email from Cheryl Birker, California Botanic Garden to Kristie Scarazzo, Ventura Fish and Wildlife Office, regarding Indian Knob mountainbalm seed banking. February 16, 2024.

APPENDIX A

Table A-1. Data for all known element occurrences of Indian Knob mountainbalm (*Eriodictyon altissimum*) California Natural Diversity Database (CNDDB) Occurrences

CNDDB Element Occurrence Number	Number of Polygons Mapped within Occurrence	Occurrence Name/ Geographical Reference	Land Ownership	Last Known Date Observed	Population Estimate	Reference	Status
1	2	Morro Dunes Ecological Reserve/Broderson, Los Osos	CDFW/SLO County	2018	–	VFWO	Presumed Extant
2	3	South side of Hazard Canyon, Montaña de Oro State Park	CDPR	2016	18	CNDDB	Presumed Extant
3	1	North side of Hazard Canyon, Montaña de Oro State Park	CDPR	1985	7	CNDDB	Likely Extirpated
5	5	Guidetti Ranch	Private	2016	6,346 stems	CNDDB	Presumed Extant
6	1	Morro Dunes Ecological Reserve/Water tank, Los Osos	Private	2016	20 stems	CNDDB	Presumed Extant
8	1	Guidetti Ranch	Private	2016	80 stems	CNDDB	Presumed Extant

*California Natural Diversity Database ([CNDDB] 2024b, website); California Department of Fish and Wildlife (CDFW); San Luis Obispo (SLO); Ventura Fish and Wildlife Office (VFWO); California Department of Parks and Recreation (CDPR).

Table A-2. Data for all known occurrences of Indian Knob mountainbalm (*Eriodictyon altissimum*) Consortium of California Herbaria (CCH2) Data Portal Occurrences

CCH2 Specimen Number	Geographical Reference	Habitat	Collection Date	Collector	Population Estimate	Institution
143897	Los Osos, between extensions of Palisades Avenue and Ravenna Avenue.	Sandy hillside, slope; dune scrub-chaparral.	1986	Keil	25 individuals	SBBG
181576	Los Osos, hillside south of Highland Drive between sand extensions of Palisades Avenue and Ravenna Avenue.	Sand slope with dune scrub/chaparral.	1986	Keil	25 individuals	OBI
2150345	Hillside south of Highland Drive, between Roderson Avenue and Bayview Drive, Los Osos.	Openings in chaparral on stabilized dune sand on hillside, with *Arctostaphylos morroensis*.	1982	Messick	–	CHSC
1816772	South of Highland Drive between Roderson Avenue and Bayview Drive, Los Osos.	Stabilized dune.	1982	Messick	–	HSC
5841230	Montaña de Oro State Park. Along the road on the south side of Hazard Canyon.	On sandstone with chaparral elements.	1972	Anderson	–	MBNHM
53911	South side of Hazard Canyon, San Luis Range.	Loose, open growth.	1972	Edge	Scattered	SBBG
4105460	2 miles East of Pecho Road along southern leg of East Hazard Canyon loop trail, Montaña de Oro State Park.	Along roadcut and immediately downslope, 500 feet, on south-facing crest of ridge, with manzanita and *Adenostoma*. Colonizing in disturbed habitat.	1981	Griffiths	–	CDA

CCH2 Specimen Number	Geographical Reference	Habitat	Collection Date	Collector	Population Estimate	Institution
181572	Montaña de Oro State Park, two miles east of Pecho Road along south leg of east Hazard Canyon loop trail.	On south-facing crest of ridge, with manzanita and *Adenostema*, scattered colonies along roadcut and immediately downslope.	1981	Griffiths	–	OBI
181574	Montaña de Oro State Park.	–	1972	Anderson	–	OBI
1682505	Indian Knob tar sands, near excavation pit below Indian Knob.	Central coastal scrub, rock outcrop.	1978	Vanderwier	Common	UCR
3453256	Indian Knob.	Ridge, on sterile white sandstone, overtops other chaparral shrubs.	1966	Hoover	–	UCJEPS
1371977	Indian Knob Ridge.	On sterile white sandstone, overtops other chaparral shrubs.	1966	Hoover	Locally plentiful	DAV
3718609	Indian Knob Ridge.	Sterile white sandstone, overtops other chaparral shrubs.	1966	Hoover	Locally plentiful	SBBG
1371976	Indian Knob provenance.	Colonizing in disturbed habitat.	1986	Griffiths	–	DAV
362524	Indian Knob, three miles west of the San Luis airport.	Sandy soil, associated with *Quercus*, *Adenostoma*, *Arctostaphylos*, and *Mimulus*.	1965	Savage	–	SJSU

CCH2 Specimen Number	Geographical Reference	Habitat	Collection Date	Collector	Population Estimate	Institution
511177	Indian Knob.	Tar sands.	1978	Vanderwier	Common	SD
181579	Indian Knob.	On tar sands.	1978	Vanderwier	Common	OBI
3752464	Indian Knob, along the east end of ridge, informally called Section G, at the saddle, roadside.	Disturbed chaparral.	2016	Guilliams	–	SBBG
1828329	Montaña de Oro State Park, Manzanita trail.	Coastal scrub.	1988	Bricknell	–	HSC
4068955	Indian Knob provenance.	Colonizing in disturbed habitat.	1986	Griffiths	–	CDA

*Consortium of California Herbaria Portal ([CCH2] 2024, website); Clifton Smith Herbarium, Santa Barbara Botanic Garden (SBBG); Robert F. Hoover Herbarium, Cal Poly State University, San Luis Obispo (OBI); Chico State Herbarium, California State University, Chico (CHSC); Humboldt State University Vascular Plant Herbarium, California State University, Humboldt (HSC); Morro Bay Natural History Museum (MBNHM); California Department of Agriculture (CDA); Riverside Herbarium, University of California, Riverside (UCR); University and Jepson Herbaria, University of California, Berkeley (UCJEPS); UC Davis Herbarium, University of California, Davis (DAV); Carl W. Sharsmith Herbarium, California State University, San Jose (SJSU); SD Herbarium, San Diego Natural History Museum (SD).