NIPOMO MESA LUPINE
(*Lupinus nipomensis*)

5-Year Review:
Evaluation and Summary

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

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5-YEAR REVIEW

Nipomo Mesa lupine (*Lupinus nipomensis*)

GENERAL INFORMATION

Species: Nipomo Mesa lupine (*Lupinus nipomensis*)
Date listed: March 20, 2000
FR citation(s): 65 Federal Register (FR) 14888–14897
Classification: Endangered

Critical Habitat Designation:
We have not designated Nipomo Mesa lupine critical habitat.

State Listing:
The state of California listed Nipomo Mesa lupine as Endangered under the California Endangered Species Act in 1987 (California Natural Diversity Database [CNDDB] 2024a).

Recovery Plan:
[Service] U.S. Fish and Wildlife Service. 2021. Nipomo Mesa lupine (*Lupinus nipomensis*) Recovery Plan. U.S. Fish and Wildlife Service, Ventura, California. 14 pp.

BACKGROUND

Species Overview:
Nipomo Mesa lupine (*Lupinus nipomensis*) is a narrowly endemic, annual herb in the Fabaceae family. It can grow up to 20 centimeters (cm or 8 inches [in]) tall. The plant is hairy, and the leaves are succulent and palmately compound. Nipomo Mesa lupine inflorescences are dense racemes (unbranched inflorescences) with spirally arranged flowers along a central axis (peduncle). The bottom flowers mature first. The flowers are blue, purplish pink, to light lavender in color, and typically bloom March through May. The species has legume fruits that resemble conventional pea pods (Keil 2022, p. 474; Sholars and Riggins 2022, website).

Nipomo Mesa lupine has an explosive seed dispersal mechanism caused by the drying out of the seed pods (Walters and Walters 1989, p. 12). Like many other lupine species, it likely has a persistent seed bank. In 2012, researchers successfully germinated seeds frozen in cold storage since 2007 and 2005 (Cheadle Center for Biodiversity and Ecological Restoration [CCBER] 2013, pp. 2 and 4). Therefore, *ex-situ* seeds subject to cold storage are viable for at least seven years.

We have little information about Nipomo Mesa lupine reproductive biology. Researchers agree that it is likely capable of both selfing and outcrossing, and that outcrossing most likely occurs via insect pollinators. However, investigators have not been able to identify any specific pollinators (Australian Government 2013, pp. 15 and 17; Wilken 2019, pers. comm.; Motta et al. 2022, p. 1).

Nipomo Mesa lupine only occurs on a specific set of stabilized back dunes, associated with the Nipomo Mesa landform, within the Guadalupe-Nipomo Dunes complex, located in southwestern San Luis

Obispo County. These stabilized coastal sand dunes occur behind the active Calendar dune sheet, which is the northern-most dune sheet (of three) that compose the complex. Nipomo Mesa lupine occurs on dry, sandy flats in coastal dune scrub habitat, behind the open, unvegetated, active dune sand (Keil 2022, pp. 471 and 474; Chipping 1987, p. III-3; Sholars and Riggins 2022, website).

Most Recent Status Review:

[Service] U.S. Fish and Wildlife Service. 2019. Nipomo Mesa lupine (*Lupinus nipomensis*) 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service, Ventura Field Office, Ventura, California. 24 pp.

We recommended no status change for Nipomo Mesa lupine.

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. 88 FR 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 Federal Register (FR) notice on August 17, 2023 (Service 2023; 88 FR 56042–56044). We did not receive any information from the public in response to our FR notice. We conducted a literature search and review of information in our files, and contacted other agencies, species experts, and stakeholders to request any data or additional information we should consider in our review. We have new data on the species' distribution, annual abundance, management, conservation seed banking efforts, habitat requirements, and other research. We provide these updates below.

Distribution:

When we listed Nipomo Mesa lupine in 2000, we knew of a single, extended, extant population of the species. Most of the population was distributed around the privately owned 1,780-acre Santa Maria Oil Refinery, which was owned and operated by the Phillips 66 Petroleum Refinery Company (Phillips 66). We described the population as consisting of seven colonies that spread over a total area of 2.4 kilometers (km or 1.5 miles [mi]). We also mentioned that at least three historical Nipomo Mesa lupine localities were extirpated, including the type locality (Service 2000, p. 14890).

In our 2009 5-year status review, the population consisted of approximately six colonies distributed over an area about 3.2-km (2 mi) (Service 2009, p. 4). In our 2019 5-year review we described the population as three occurrences that we referred to as Occurrence 1, 2, and 3 (Service 2019). These correspond to Element Occurrence 1, 10, and 3, respectively; the term "Element Occurrence" (EO) refers to a specific location where Nipomo Mesa lupine 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 often 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 identification 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).

There are currently three known extant Nipomo Mesa lupine EOs: Santa Maria Oil Refinery/Phillips 66 Petroleum Company (EO 1); Kathleen's Overlook Canyon ([KCO] EO 3); and BLEA (EO 10). VFWO visited areas within each EO with partners during the peak of the Nipomo Mesa lupine blooming season in April 2024. We observed the species at each location, assessed the threats, and noted overall habitat conditions. We were unable to access portions of EO 1 on the east side of the Southern Pacific Railroad at the Phillips site in April 2024. Phillips 66 gave VFWO and CDFW a tour of their property on July 11, 2023, which was not within the Nipomo Mesa lupine blooming period.

CNDDB still lists KCO as extirpated (CNDDB 2024b, website), but we consider it extant in this status review because of recent outplanting efforts completed at this location. Partners worked to establish Nipomo Mesa lupine at KCO with Traditional Section 6 Grant funding awarded to CCBER. The team conducted the initial Nipomo Mesa lupine seeding from 2019 through 2021, using seed collected from EO 1 in 2005 and bulked by CCBER (Luong and Nolan 2016, p. 2).

Nipomo Mesa lupine is also known from a total of 15 geo-referenceable herbarium specimens from CCH2 (CCH2 2024, website). CCH2 herbarium specimens are not considered EOs, although these two types of data may overlap, and CDFW often incorporates herbarium specimen data into information associated with EOs. We included geo-referenceable herbarium specimens from CCH2 in this status review for completeness, and to help characterize the historical and current range of the species. CCH2 point locations represent a single snapshot 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 these locations overlap with one another or other EOs when mapped.

We compiled all available occurrence data for Nipomo Mesa lupine in geographic information system to visualize the species historical and current range and distribution (Figure 1). We mapped data as discrete points, including EOs from CNDDB and specimen data from the CCH2 Data Portal (CNDDB 2024b, CCH2 2024). Although mapped as discrete points here, EOs often consist of multiple polygons within the 0.4-km (0.25-mi) distance and can cover variable areas. For example, EO 1 is composed of 37 polygons (CNDDB 2024b, website) and covers an area that encompasses multiple points from the CCH2 specimen data. Although in Figure 1 the CCH2 herbarium specimens appear to cover a broader

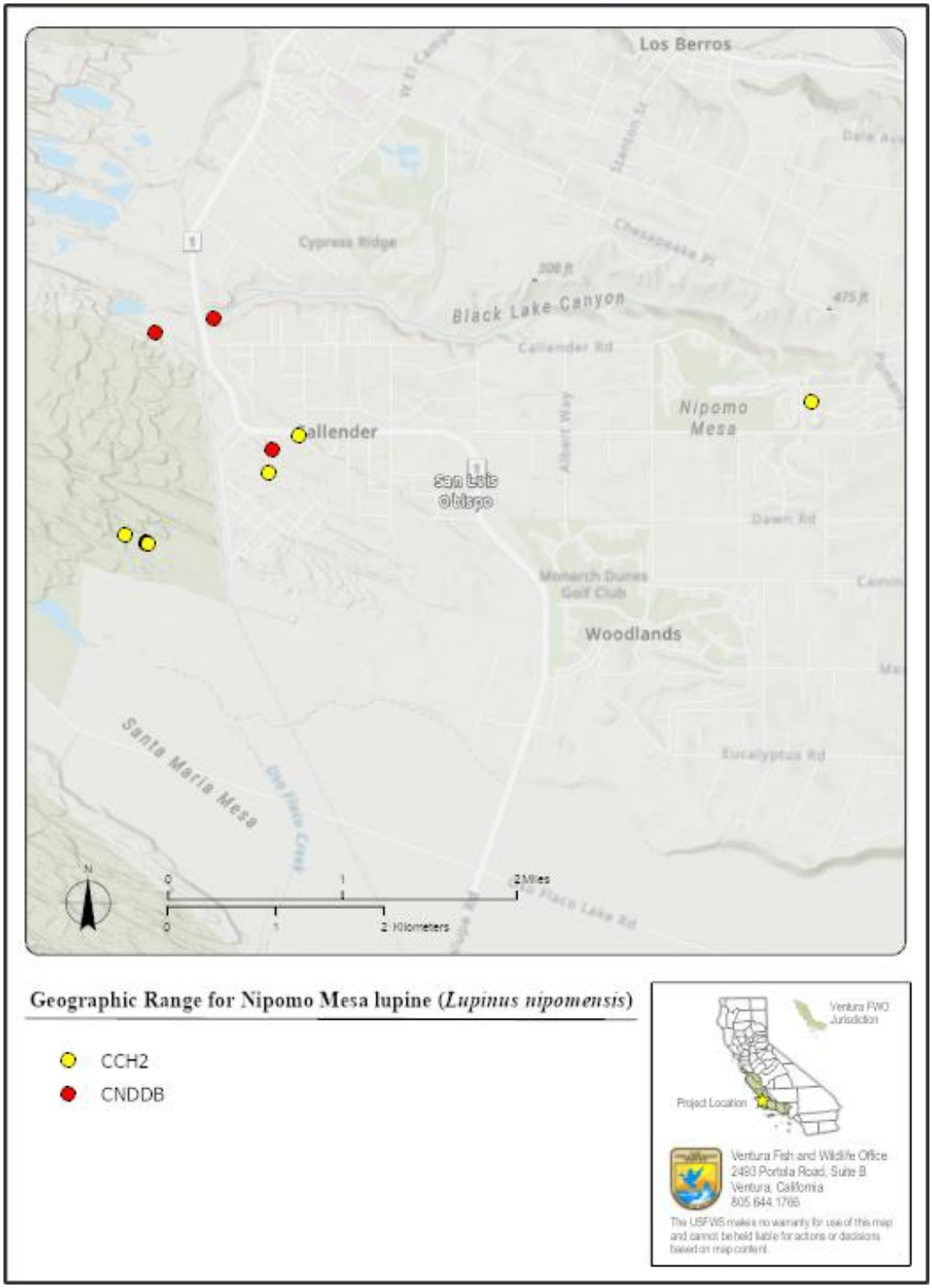

Figure 1. Geographic range and distribution of Nipomo Mesa lupine (*Lupinus nipomensis*), San Luis Obispo County, California, based on data from the California Natural Diversity Database (CNDDB) and Consortium of California Herbaria (CCH2) Data Portal (CNDDB 2024b, website; CCH2 2024, website).

geographic extent than the EO points, these specimens do not change our understanding of the range of the species. We provide more detailed information about the data shown in Figure 1 within Appendix A.

Abundance:
We estimated that the population described at listing had fewer than 700 total individuals in the 2000 Listing Rule (Service 2000, p. 14890). Our previous 5-year reviews presented census data collected by LCSLO from 2006 to 2017 at selected locations within the Phillips 66 property (EO 1; CNDDB 2024b, website). The number of individuals within these selected monitoring plots ranged from 118 (2016) to 1,677 (2013) (Service 2019, p. 12). In 2017, LCSLO completed a comprehensive Nipomo Mesa lupine census survey throughout the Phillips 66 site and counted 911 total individuals. They also monitored Nipomo Mesa lupine at BLEA from 2015 through 2018. LCSLO and partners counted 118 Nipomo Mesa lupine individuals in 2015, 343 in 2016, 81 in 2017, and 89 in 2018 at BLEA (Service 2019, p. 12).

We provide additional monitoring data since the 2019 5-year review below.

Oceano Dunes State Vehicular Recreation Area. Oceano Dunes State Vehicular Recreation Area (ODSVRA) has an informal access agreement with Phillips 66 to use approximately 64 acres of the site (P66-west) for alternate access routes and emergency evacuation purposes. ODSVRA completed Nipomo Mesa lupine annual abundance monitoring from 2020 through 2024 (Table 1) and implemented several other recovery actions for the species.

Table 1. Annual Nipomo Mesa lupine abundance monitoring data at Oceano Dunes State Vehicular Recreation Area (ODSVRA) Phillips 66-west (P66-west) site, in San Luis Obispo County, California (ODSVRA 2024, ODSVRA 2024, pers comm)

Monitoring Year	Number of Individuals	Effective Population (plants that set seed)
2020	157	52
2021	48	30
2022	247	93
2023	769	331
2024	834	396
*2023 seeded plots	980	598
*2024 seeded plots	1,279	929
2023 total	1,749	929
2024 total	2,113	732

Black Lake Ecological Area. LCSLO and CCBER conducted annual Nipomo Mesa lupine census monitoring at BLEA from 2019 through 2023 (Table 2).

Table 2. Annual Nipomo Mesa lupine abundance monitoring data at Black Lake Ecological Area (BLEA) site, in San Luis Obispo County, California (CCBER 2024, pers comm)

Monitoring Year	Number of Individuals	Effective Population (plants that set seed)

2019	194	128
2020	192	38
2021	119	18
2022	1,358	182
2023	372	144

Kathleen's Canyon Overlook. LCSLO and CCBER conducted annual Nipomo Mesa lupine abundance monitoring at KCO from 2020 through 2023 (Table 3). Funding for most of the work completed at this site came from a Traditional Section 6 Grant (see the Research section for more information about results from the grant).

Table 3. Annual Nipomo Mesa lupine abundance monitoring data at KCO in San Luis Obispo County, California (CCBER 2024, pers comm.)

Monitoring Year	Number of Individuals	Effective Population (plants that set seed)
2020	0	0
2021	80	22
2022	365	54
2023	1,416	388

Management:
Partners are conducting management activities for Nipomo Mesa lupine recovery at ODSVRA, BLEA, and KCO in support of the Recovery Plan (Service 2021). These activities include herbicide treatments targeting veldt grass (*Ehrharta calycina*) and iceplant (*Carpobrotus* spp.) to ameliorate threats from nonnative, invasive species, and to increase abundance.

Oceano Dunes State Vehicular Recreation Area. ODSVRA cooperates closely with VFWO, CDFW, and other Nipomo Mesa lupine partners and initiated a robust habitat restoration, monitoring, and recovery program for the species within P66-west starting in 2020. This was partly in response to the end of LCSLO's annual monitoring program and worries about veldt grass detrimentally affecting Nipomo Mesa lupine colonies within this location. The program supports Nipomo Mesa lupine recovery and increases abundance by invasive species management targeting veldt grass. Treatments include aerial (helicopter) applications and more targeted backpack and truck-mounted applications of herbicide. They also conduct manual weed and treated thatch removal activities; supplemental seeding in treated areas where Nipomo Mesa lupine previously occurred but had not been relocated since 2015; and maintenance of roads, trails, and vegetation. ODSVRA also installed caging on individual plants and colonies to prevent herbivory (ODSVRA 2024, entire; ODSVRA 2024, pers comm).

Black Lake Ecological Area. LCSLO cooperates closely with VFWO, CDFW, and other Nipomo Mesa lupine partners to conduct annual monitoring and other intensive habitat management and restoration efforts at BLEA. They treat highly infested areas and other locations adjacent to areas occupied by the species with aerial applications of grass-specific herbicide targeting invasive veldt grass. They also conduct targeted backpack and truck-mounted applications of herbicide, and manual weed and treated

thatch removal activities in occupied areas. LCSLO installs cages to inhibit herbivory, completes road and trail maintenance activities, and conducts other vegetation maintenance activities (e.g., tree and shrub trimming), to benefit the species.

Kathleen's Canyon Overlook. LCSLO conducts manual weed and thatch removal efforts around the outplanted sites, and installs cages as needed to prevent and minimize herbivory.

Conservation Seed Banking:
The California Plant Rescue (CAPR) Conservation Collections database currently includes six Nipomo Mesa lupine seed accessions from the following years: 1985; 2003; 2005(1); 2005(2); 2005(3); and 2007 (CAPR 2024, website). We also requested information from SBBG directly, which is the main Nipomo Mesa lupine seed banking affiliate cooperating with CAPR. Table 4 provides a summary of the Nipomo Mesa lupine accessions currently stored at the SBBG seed bank.

Table 4. Nipomo Mesa lupine conservation seed bank accessions stored at the Santa Barbara Botanic Gardens, Santa Barbara County, California (SBBG 2024, pers comm)

Accession Year	Collection Year	Number of Seeds	Status	Origin	EO Number	Collection Location
2004	1985	400	Frozen	Wild	EO 1	near Jack Lake, 1.5 km south/southwest of Callender, SLO Co
2004	2003	50	Frozen	Wild	EO 1	near Jack Lake, 1.5 km south/southwest of Callender, SLO Co
2005	2005	100	Deaccessioned*	Wild	EO 1	1.5 km south/southeast of Callender, Nipomo Dunes, SLO Co
2005	2005	100	Deaccessioned*	Wild	EO 1	0.9 km south/southeast of Callender, Nipomo Dunes, SLO Co
2005	2005	80	Deaccessioned*	Wild	EO 1	southeast of Jack Lake, 2 km south/southeast of Callender, Nipomo Dunes, SLO Co
2007	2007	50	Frozen	Wild	EO 1	State Highway 1, Nipomo Mesa, along access road south of County Fire Station, waif at edge of road, SLO Co

Accession Year	Collection Year	Number of Seeds	Status	Origin	EO Number	Collection Location
2024	2023	921	Frozen	Cultivated	EO 10**	bulked at CCBER greenhouse, from KCO swale, plot ID numbers 2A, 1A, and 1B, SB Co
2024	2023	396	Frozen	Cultivated	EO 10**	bulked at CCBER greenhouse, from KCO, plot number N5A, SB Co
2024	2023	234	Frozen	Cultivated	EO 10**	bulked at CCBER greenhouse, from BLEA swale 5, SB Co
2024	2023	1,105	Frozen	Cultivated	EO 10**	bulked at CCBER greenhouse, from BLEA swale, 10 X10 plots, SB Co

*SBBG sent deaccessioned seeds to CCBER for the initial outplanting at BLEA in 2014 and 2015, and to start their Nipomo Mesa lupine seed bulking activities for implementation of the Traditional Section 6 Grant.
**Seeds used to establish Nipomo Mesa lupine at these locations originated from EO 1.

Research:

Traditional Section 6 Experimental Plots. The primary purpose of most of the work completed at BLEA under the Traditional Section 6 grant was to establish a new, robust Nipomo Mesa lupine population at this location through seeding. The secondary purpose was to establish experimental plots within seeded areas to characterize the ecological requirements of the species.

Seeding. CCBER installed the initial 1,440 seeds at BLEA in 2014 and installed another 1,440 seeds onsite in 2015 (Luong and Nolan 2016, p. 5). They completed a third round of seeding in 2019 with 1,500 seeds and again in 2020 with another 1,500 seeds (CCBER 2020a, p. 2; CCBER 2024, p. 3). CCBER conducted the last Nipomo Mesa lupine seeding efforts for the project at BLEA in 2021 sowing 4,500 seeds and seeded again in 2022 with another 1,500 seeds.

In 2019, CCBER installed the first 1,500 seeds at KCO. They had low germination with the 2019 seeds and reseeded 2,500 additional Nipomo Mesa lupine seeds at KCO in 2020 (CCBER 2024, p. 6–8). They completed another round of seeding in 2021 and sowed 2,500 additional seeds at KCO (CCBER 2020a, p. 2; CCBER 2024, p. 3).

Experimental Plots. CCBER installed all seeds at BLEA and KCO in experimental plots with various ecological or environmental treatments, including controls (CCBER 2024, p. 3). At BLEA, CCBER evaluated the effects of fog drip and seed herbivory on Nipomo Mesa lupine seedling emergence. CCBER assumed that additional fog drip resulting from moisture accumulation on the fine mesh cages used on their plots was beneficial for seedling emergence. All the experimental plots had cages. CCBER lifted the cages of half of the plots 10.16 cm (four in) up off the ground to allow free access for

herbivores, and non-lifted cages served as controls. CCBER monitored plots on a biweekly basis for four consecutive years (CCBER 2024, p. 6). Lifted cages had significantly ($p < 0.009$) lower plant cover of both Nipomo Mesa lupine and other co-occurring annual forbs. Seedlings in the lifted cage treatments also had significantly ($p < 0.03$) lower fruit production. Non-lifted cages had a significantly ($p < 0.001$) higher proportion of germinants that reached reproductive maturity (meaning flowering plants). CCBER's results clearly indicate that herbivory is a key threat to Nipomo Mesa lupine seedlings (CCBER 2024, p. 6).

At KCO, CCBER investigated the effects of competition and shading on Nipomo Mesa lupine germination, growth, and seed production. They set up caged experimental plots in fully weeded areas where they removed all nonnative, invasive weeds within the plots and within a 1-m (3.3 ft) buffer of the treatment plots. Unweeded areas within existing, resident vegetation served as controls. CCBER monitored on a biweekly basis for four consecutive years and found no significant differences in Nipomo Mesa lupine germination, growth, and seed production with the weeded versus unweeded treatments (CCBER 2024, p. 6).

CCBER added more caged and uncaged plots to both BLEA and KCO in 2021 and seeded them to augment the Nipomo Mesa lupine populations. They monitored these new plots biweekly for two consecutive years. They found significantly higher germination in the caged versus uncaged plots ($p < 0.001$; CCBER 2024, p. 8).

Traditional Section 6 Seed Herbivory Study. CCBER conducted a separate seed herbivory study at BLEA, KCO, and P66-west with funds from the Traditional Section 6 Grant. In this study, they deployed Nipomo Mesa lupine seeds in small, shallow boxes with mesh bottoms. The treatments included caged experimental plots and uncaged experimental plots. The uncaged boxes were positioned either within stands of veldt grass, or far (2.7 m [9 ft]) from stands of veldt grass. They monitored the seed boxes continuously with motion sensor cameras for 10,800 hours and got approximately 4.3 hours of observations capturing wildlife interactions with the seed boxes (CCBER 2024, p. 10).

The camera data showed evidence of birds and rodents foraging inside the seed boxes and eating seeds within both the caged plots and uncaged plots. Birds and rodents ate Nipomo Mesa lupine seeds within the uncaged plots, both within stands and far from veldt grass. The cameras also captured motions from larger mammals, including badger (*Taxidea taxus*), bobcat (*Lynx rufus*), cottontails (*Sylvilagus audubonii*), deer (*Odocoileus* sp.), and brush rabbit (*S. bachmani*), and lizards within the uncaged plots, both within and far from veldt grass. However, these taxa were not observed interacting directly with the seed boxes, and simply appeared within the camaras' fields of view. Lastly, the cameras detected a brush rabbit eating Nipomo Mesa foliage at uncaged plots both within and far from veldt grass. The cameras detected ants and other insects within caged and uncaged plots, both within stands and far from veldt grass. CCBER was unable to determine how these taxa interacted with Nipomo Mesa lupine seeds and foliage because of their small size (CCBER 2024, p. 10; Cadogan 2023, pp. 4–8). Caging did not eliminate seed herbivory but did reduce it. Seed herbivory was highest in uncaged plots compared to the caged. Of the uncaged plots, seed herbivory was only slightly higher in uncaged plots within veldt grass compared to those uncaged plots far from veldt grass (CCBER 2024, p. 10; Cadogan 2023, p. 3). Results from the study confirm that seed herbivory is a threat affecting Nipomo Mesa lupine and indicated that it may account for as much as five percent seed loss per day. However, other inherent effects from wind may be a confounding variable and likely accounts for some of the observed seed loss across all

treatments because seeds probably blew out of the boxes and likely got buried by sand (CCBER 2024, p. 10; Cadogan 2023, p. 7).

Clethodim Herbicide Study. Clethodim is a grass-specific herbicide widely used throughout the Guadalupe-Nipomo Dunes complex to manage veldt grass. ODSVRA maintains a California Endangered Species Act 2081(a) Management Permit (2081 permit) issued by CDFW to implement invasive species controls for Nipomo Mesa lupine recovery. Their 2081 permit authorizes them to conduct Clethodim applications at P66-west and implement other manual weed and treated thatch removal activities. In past years, CDFW required 100-ft avoidance buffers around areas occupied by Nipomo Mesa lupine where aerial Clethodim applications could not be sprayed. ODSVRA thus had to use manual techniques in buffer areas while avoiding the Nipomo Mesa lupine growing season. This was labor intensive, and the buffer areas were too large to be managed effectively. The buffers resulted in veldt grass islands that adversely affected the species and undermined treated areas by rapidly spreading seed back out into them. In 2020, ODSVRA proposed to amend their 2081 permit to reduce the size of the avoidance buffers.

CDFW raised concerns that Clethodim may adversely affect Nipomo Mesa lupine growth, reproduction, and development. To address this, ODSVRA contracted CCBER to evaluate effects of Clethodim, applied either aerially or directly sprayed, on Nipomo Mesa lupine seedlings and reproductive individuals in a greenhouse setting (CCBER 2024, p. 2). CCBER also collected seeds from the treated individuals and germinated them to investigate potential effects of Clethodim on seed viability. CCBER found no significant effects from the Clethodim treatments on Nipomo Mesa lupine growth, reproduction, plant vigor, seed production, or seed viability (CCBER 2020b, p. 4–11). By November of 2022, CDFW reduced the width of the Nipomo Mesa lupine avoidance buffers to 7.6 m (25 ft), but no less than 4.6 m (15 ft). CDFW also permitted direct Clethodim treatments in areas previously occupied by the species but where it was not observed for five years or more. These changes allow ODSVRA to conduct invasive species controls for Nipomo Mesa lupine recovery more easily and efficiently at P66-west.

Arthropod Surveys. Motta et al. (2022) conducted arthropod surveys in the Nipomo Mesa lupine population on Phillips 66 lands to better understand potential pollination, herbivory, or seed predation. They monitored plants within established plots for a total of 48 hours during 24 site visits in March and May of 2017. The researchers captured any floral visitors possible and made incidental observations of arthropods they were unable to capture. Motta et al. also collected a single Nipomo Mesa lupine inflorescence from each monitoring plot at the end of each survey. They later dissected the inflorescences in their laboratory and identified all collected arthropods to the lowest possible taxonomic level. The researchers observed a total of 351 arthropod individuals interacting with Nipomo Mesa lupine from 22 unique morphospecies from eight orders and 17 families. They were unable to detect obvious Nipomo Mesa lupine pollinators, but they did record a high number of potential incidental pollinators that could inadvertently pollinate Nipomo Mesa lupine while feeding on pollen or other plant resources. Motta et al. concluded that if pollination is occurring, it is likely occurring via incidental pollinators. They also observed arthropod herbivory, which may negatively affect Nipomo Mesa lupine reproduction (Motta et al. 2022, pp. 1, 3–6).

Threats:
When we listed Nipomo Mesa lupine in 2000, we identified one primary threat to the species: the uncontrolled invasion of aggressive, nonnative weeds, especially veldt grass, and the resulting displacement of the species (Service 2000, p. 14890). We expanded the list of threats to Nipomo Mesa lupine in the 2009 5-year review to include development activities related to oil extraction and refinement, facilities maintenance, agriculture, and other infrastructure, suburban, and residential development, herbivory and grazing activities, stochastic events, and climate change. Nonnative, invasive weeds (especially veldt grass) continued to threaten the species (Service 2009, p. 7–11).

In the 2019 5-year review we clarified that we considered seed predation (as opposed to general herbivory) as a threat. We no longer considered herbivory and grazing to be threats because the effects of such appeared more neutral. Herbivores may kill Nipomo Mesa lupine, but herbivore evacuations (dens) can enhance seeding and facilitate persistence of sandy, open areas required by the species. Similarly, cattle grazing can trample individuals, but the suppression of nonnative, invasive weeds, and mechanical breaking up of thatch by cattle grazing likely outweigh these effects (Service 2019, pp. 12–15).

All the threats described in the 2019 5-year review continue to negatively impact the species (Service 2019, p. 12–15). Threats to Nipomo Mesa lupine resulting from development have increased since 2019, and we included more information about this threat below.

Development Threats. Current threats to Nipomo Mesa lupine from development increased because the Phillips 66 property is for sale. This property supports the largest and only remaining natural population of the species that is not a result of outplanting (Service 2019, p. 12–15). VFWO and other Nipomo Mesa lupine recovery partners have had a positive working relationship with Phillips 66 for many years. They have allowed us and partners to access the site for annual monitoring and numerous other Nipomo Mesa lupine research endeavors. Phillips 66 also worked with us and partners to maximize beneficial effects of grazing on Nipomo Mesa lupine and its habitat for nonnative, invasive weed management purposes. If the Phillips 66 private property is sold, we may not be able to access it or have as positive of a working relationship with the new owners.

Phillips 66 applied to San Luis Obispo County Planning and Building (County Planning) to demolish and remediate the Santa Maria Oil Refinery facility onsite. Consultants identified Nipomo Mesa lupine within the 88-hectare (218-acre) project footprint, and implementation of the project has potential to impact Nipomo Mesa lupine and its habitat (County Planning 2024, website; MRS Environmental 2024, pp. 4.4-28–35). Implementation of the project will likely require Phillips 66 to obtain an 2081(b) Incidental Take Permit from CDFW if the potential impacts to the species cannot be avoided. The Service does not issue take of plants under the federal Endangered Species Act ([Act]; 16 U.S.C. 1531–1544), and we do not yet know if there is a federal nexus for Phillips 66 to consult with us through Section 7, or if the project will require a Habitat Conservation Plan permit process through Section 10 of the Act. Negative impacts to Nipomo Mesa lupine and its habitat would be detrimental to persistence of the species because the total area currently occupied by it is so small. For these reasons, we consider current threats to the species from development increased.

Evaluation of Recovery Criteria:
We developed the following downlisting criteria for Nipomo Mesa lupine in the 2021 Recovery Plan (Service 2021, p. 6):

1. At least three resilient occurrences display stable or increasing population trends averaged over 10 consecutive years;

2. Each of the three resilient occurrences is protected from habitat loss, including development activities;

3. Each of the three resilient occurrences is being managed in a way that will support continued existence of Nipomo lupine and its coastal dune scrub habitat, including management of non-native, invasive species;

4. Management is effective as shown by monitoring for 10 consecutive years; and

5. An *ex-situ* permanent conservation seedbank is established in a Center for Plant Conservation-affiliated botanic garden that reflects the breadth of the species' genetic diversity.

We have not fully met any of the downlisting criteria established for the species. While we now have three EOs, the datasets we have for Nipomo Mesa lupine abundance are incomplete. Therefore, we cannot assess their population trends and whether they are resilient. Two of the EOs (EO 10 and 3; CNDDB 2024b, website) are protected from habitat loss, including development activities, because these sites (BLEA and KCO) are owned and managed for conservation by LCSLO. However, EO 1 is not protected from habitat loss and is vulnerable to development threats. Furthermore, the effectiveness of management is yet to be determined because management programs have not yet been implemented for 10 consecutive years. BLEA, KCO, and P66-west are actively managed for Nipomo Mesa lupine recovery. The rest of the Phillips 66 site is not actively managed. Lastly, we have increased accessions of Nipomo Mesa lupine seed for conservation. However, we do not know if these accessions reflect the full breadth of the species' genetic diversity because not all colonies within EO 1 have seed accessions, and because researchers have not completed any genetic studies on the species.

We did not evaluate the delisting criteria for Nipomo Mesa lupine because the downlisting criteria have not been met, and because the identified threats all continue to negatively impact the species.

Summary:
Nipomo Mesa lupine is currently known from three EOs (CNDDB 2024b, website), and 15 geo-referenceable herbarium specimens from CCH2 (CCH2 2024, website). We confirmed that all three of the EOs are extant in spring of 2024. We are not able to ascertain the status of Nipomo Mesa lupine at the CCH2 documented locations. We also lack complete census information about the species abundance throughout its range and are unable to assess any trends about population status, even at the spatial scale of individual EOs. Invasive species (veldt grass), development activities, seed predation (specifically, as opposed to general herbivory), stochastic loss and extinction, and climate change are the primary threats currently affecting Nipomo Mesa lupine. In 2024, threats from development increased because the Phillips 66 site is for sale and the currently proposed demolition and remediation project has

potential to affect the species and its habitat. Lastly, none of the downlisting or delisting criteria established in the species' Recovery Plan have been met.

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

RECOMMENDATIONS FOR FUTURE ACTIONS

1. Conduct comprehensive annual surveys of abundance, assess the overall status of the species, and evaluate current threats at each of the three EOs. Include estimates of the total number of Nipomo Mesa lupine individuals present at each location, using uniform methodologies suitable for trend analyses, and map the total occupied area. Collect other pertinent ecological and demographic data including co-occurring and co-dominant species, estimate of bare sand cover, presence and abundance of nonnative, invasive species, timing of phenology, effective population size, and continue observations of any potential insect pollinators, and seed and foliage herbivory.

2. Conduct experimental research to determine the most effective management techniques for occupied Nipomo Mesa lupine sites to ensure persistence and expansion of the species. We recommend evaluating the use of grazing and other disturbance techniques designed to manage nonnative, invasive weeds (especially veldt grass) to stimulate seed germination, to maintain sandy, open spaces required by the species, and to expand potentially suitable habitats immediately adjacent to occupied areas.

3. Conduct genetics research on Nipomo Mesa lupine to quantify the genetic diversity within the species and establish other important genetic baseline metrics for conservation.

4. Obtain conservation easements or acquire other sites within the species current range to introduce the species to new locations that have long-term management strategies to ensure success and persistence of the species. Refine existing protocols for propagation of the species from seed.

5. Continue making conservation seed bank accessions of Nipomo Mesa lupine seed. Conduct additional seed bulking activities to ensure an ample supply of seed for recovery efforts and for insurance in the event of stochastic loss or 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: 2024.08.29 12:20:40 -07'00'

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APPENDIX A

Table A-1. Data for all known California Natural Diversity Database (CNDDB) Element Occurrences (EO) of Nipomo Mesa lupine (*Lupinus nipomensis*).

CNDDB Element Occurrence Number	Number of Polygons Mapped within Occurrence	Occurrence Name/ Geographical Reference	Land Ownership	Last Known Date Observed	Reference	Status
1	37	Santa Maria Oil Refinery, Phillips 66 Petroleum Company	Private/Caltrans District 5	2024	VFWO	Extant
3	1	Kathleen's Canyon Overlook	LCSLO/Private	2024	VFWO	Extant
10	2	Black Lake Ecological Area	LCSLO	2024	VFWO	Extant

Table A-2. Data for all known occurrences of Nipomo Mesa lupine (*Lupinus nipomensis*), Consortium of California Herbaria Data Portal occurrences (CCH2 2024, website).

CCH2 Specimen Number	Geographical Reference	Habitat	Collection Date	Collector	Institution
72733	Jack Lake, Guadalupe Dunes	Flats, dry sand	1967	Hoover	SBBG
192564	Jack Lake	Dry sandy places, scattered on sandy flat among shrubs	1965	Hoover	OBI
192565	Jack Lake	Dry sand-flats	1967	Hoover	OBI

CCH2 Specimen Number	Geographical Reference	Habitat	Collection Date	Collector	Institution
192566	Jack Lake	Dry sand-flats	1967	Hoover	OBI
3502391	Jack Lake	Dry sand flats at lake	1967	Hoover	UCJEPS
3510693	Highway 1, just south of Union Oil Coking Plant (Area just north of PG and E substation), Nipomo Mesa	Sandy soil	1987	Riggins	UCJEPS
3542226	Nipoma Mesa	–	1940	Eastwood	UCJEPS
5210185	PG and E's Callendar Switching Station, Nipomo Mesa, southwest corner of intersection of Willow Road and Winterhaven Way	–	1985	Walters	OBI
5210186	PG and E's Callendar Switching Station, near Nipomo	–	1985	Walters	OBI
5210187	PG and E's Callendar Switching Station, near Nipomo, northeast corner	–	1985	Walters	OBI
5210188	PG and E's Callendar Switching Station, near Nipomo	–	1985	Walters	OBI

CCH2 Specimen Number	Geographical Reference	Habitat	Collection Date	Collector	Institution
5210190	PG and E's Callendar Switching Station, near Nipomo, inside station compound	–	1985	Walters	OBI
5210191	PG and E's Callendar Switching Station, near Nipomo	–	1985	Walters	OBI
5210192	PG and E's Callendar Switching Station, near Nipomo, inside enclosure in bare sand, east population	–	1985	Walters	OBI
5210203	PG and E's Callendar Switching Station, near Nipomo, south population	–	1985	Walters	OBI

Institutions: Consortium of California Herbaria Portal; Santa Barbara Botanic Garden (SBBG); Robert F. Hoover Herbarium, Cal Poly State University, San Luis Obispo (OBI); University and Jepson Herbaria, University of California, Berkeley (UCJEPS).