

Pogogyne nudiuscula
(Otay Mesa mint)
5-Year Review:
Summary and Evaluation



Photograph of *Pogogyne nudiuscula* (Otay mesa mint)
Photo by Jon Martin (USFWS)

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

December 6, 2021

ACKNOWLEDGEMENT

This 5-year Status Review was prepared by Karah Jaffe during her fellowship at the Carlsbad Fish and Wildlife Office for the Directorate Fellows Program in 2021. To complete this assessment, Karah conducted a literature review, updated occurrence data, coordinated with the U.S. Fish and Wildlife Service and external partners, assessed current threats to the species, and identified priority research and conservation tasks.

5-YEAR REVIEW

Pogogyne nudiuscula (Otay mesa mint)

GENERAL INFORMATION

Species: *Pogogyne nudiuscula* (Otay mesa mint), a plant species

Date listed under the Endangered Species Act: August 3, 1993

Federal Register citation: USFWS 1993 (58 FR 41384-41392)

Classification: Endangered

Recovery Plan: Final, September 3, 1998. Recovery Plan Clarification, October 1, 2019.

Recovery Priority Number: 2C

BACKGROUND

Under the Endangered Species Act of 1973, as amended (Act; 16 U.S.C. 1531 *et seq.*), the U.S. Fish and Wildlife Service's (USFWS), referred to as "we" in this document, maintain lists of endangered and threatened wildlife and plant species (referred to as the List) in the Code of Federal Regulations (CFR) at 50 CFR 17.11 (for wildlife) and 17.12 (for plants). Section 4(c)(2)(A) of the Act requires us to review each listed species' status at least once every 5 years.

Most recent status review: USFWS [U.S. Fish and Wildlife Service]. 2010. *Pogogyne nudiuscula* (Otay mesa mint); 5-year Review: Summary and Evaluation. Carlsbad Fish and Wildlife Office, Carlsbad, CA. 41 pp.

We initiated a status review for *Pogogyne nudiuscula* in 2010. The review was finalized on September 1, 2010 and recommended no change in listing status.

Federal Register notice announcing this status review: On May 20, 2021 we published a *Federal Register* notice announcing initiation of the 5-year review of this species, and the opening of a 60-day comment period to receive information (USFWS 2021, 86 FR 27462-27464). We received no information about *Pogogyne nudiuscula*.

Species Overview and Habitat: *Pogogyne nudiuscula* is an annual herb in the *Lamiaceae* (mint family) that is restricted to vernal pools in southern San Diego County, California. Plants can reach 30 centimeters (1 foot) or more in height with purple flowers arranged in whorls that typically bloom from May or June through early July. The plants usually give off a strong, turpentine, mint odor. In the past, *P. nudiuscula* has been misidentified as *P. abramsii* (San Diego Mesa Mint), which also occurs in San Diego County. Historically, *P. nudiuscula* was known to exist from Otay Mesa in San Diego County to immediately south of the international border in Baja California, Mexico.

Vernal pools and vernal swales are often clustered into pool “complexes” (Bauder 1986, Appendix 1, 4; Keeler-Wolf *et al.* 1998, pp. 60–61, 63–64), and may form dense, interconnected mosaics of small pools, or a sparse scattering of larger pools. Vernal pool complexes that support from one up to many distinct vernal pools are often interconnected by a shared watershed. Both the pool basin and the surrounding watershed are essential for a functioning vernal pool system (Hanes and Stromberg 1998, p. 48).

ASSESSMENT

Information acquired since the last status review

This 5-year review was conducted by the USFWS Carlsbad Fish and Wildlife Office. Data for this review were solicited from the public and interested parties through a *Federal Register* notice announcing this review on May 20, 2021 (USFWS 2021, pp. 27462–27464). We also contacted State and Federal partners and species experts to request any data or information we should consider in our review including the City of San Diego. Additionally, we conducted a literature search and a review of information in our files.

SUMMARY OF NEW INFORMATION SINCE 2010

Distribution

We have new information regarding the distribution of *Pogogyne nudiuscula* collected from 2010 to 2021 through annual monitoring at sites managed by the City of San Diego, California Department of Transportation (Caltrans), and Helix Environmental Planning, Inc. Based on this new information we have updated the *P. nudiuscula* occurrence table and added additional occurrences that were not considered in the 2010 5-year review (Figure 1; Table 1).

Table 1 is a compilation of information from the California Natural Diversity Database (CNDDDB), preserved herbarium specimens (CCH2 2021), the U.S. Fish and Wildlife Service’s Recovery Plan for Vernal Pools of Southern California (USFWS 1998, Appendix E), the City of San Diego’s Vernal Pool Inventory (City of San Diego 2019, Appendix B), and biologists’ observations. In the listing rule, use of the term “population” for places where *Pogogyne nudiuscula* occurred implied a biological context that is unproven. For convenience in this review, occurrences attributable to a single geographic location are grouped together often in association with an existing Element Occurrence (EO) reference number attributed to the CNDDDB. The CNDDDB assigns different EO numbers to occurrences that are more than a quarter mile (400 meters) apart. In Table 1, our larger, more broadly described areas (e.g., Otay Mesa West) may include more than one EO. An occurrence is considered extant if the species was observed within the last 10 years. If the species was not observed in the last 10 years but suitable habitat is present, the occurrence is presumed extant. If the species was not observed for over 10 years or the habitat is degraded or partially developed, the occurrence is considered possibly extirpated. If the species has not been observed for greater than 20 years and the habitat is no longer suitable, we consider the occurrence to be extirpated.

Suitable habitat for *Pogogyne nudiuscula* is limited to vernal pools in San Diego County, California. Vernal pools are seasonal, depression-type wetlands that form when an impervious subsurface creates the perched water table. Vernal pool complexes are defined as a series of vernal pool groups that are hydrologically connected with similar soil types and species compositions. Vernal pools have been mapped and named using various methods in San Diego County, including an alphanumeric system originally described in Bauder (1986, p. 46) and in the City of San Diego's Vernal Pool Habitat Conservation Plan (City of San Diego 2019a, p. 3-21). Most of the vernal pool complexes within the range of *P. nudiuscula* are known within the "J" series of the Bauder identification and are grouped into four general geographic locations on Otay Mesa in southern San Diego County: Otay Mesa West, Otay Mesa East, Otay Mesa South, and Otay Mesa Northeast (Table 1).

Historically, *Pogogyne nudiuscula* was considered to be found beyond Otay Mesa near University Heights (EO 04), Mission Valley (EO 04), Balboa Park, and Linda Vista (CNDDDB 2021). Herbarium records verified the specimens collected at University Heights and Balboa Park to be *P. abramsii*. Identification of collections from Carroll Canyon and Mission Valley are still questionable and possibly erroneous. All four occurrences were extirpated at listing. We consider the current distribution of *P. nudiuscula* to be limited to southern San Diego County.

Based on current updates, there are 24 *Pogogyne nudiuscula* locations (Figure 2, Table 1): 17 are extant, 2 are presumed extant, 3 are historically extirpated, and 2 have questionable identification. There are five new occurrences since the 2010 5-year review and no locations have been extirpated since listing. It is possible that *P. nudiuscula* occurs at other locations that have not been surveyed. Extirpated occurrences and possibly erroneous records in central San Diego County are not included in Figure 1.

New locations of *Pogogyne nudiuscula* were reported at Topsail parcel [series to be determined (TBD)], Hidden Trails parcel (series TBD), Dennery West (J31), West Otay B (J32), and West Otay C (J32). Additional vernal pools with *P. nudiuscula* were reported at Cal Terraces North and Otay Mesa Road Parcel (J2) vernal pool complex and the Clayton Parcel (J2W). *Pogogyne nudiuscula* occurrences at Arnie's Point (J15) and at the Shinohara Vernal Pool Restoration Site at San Diego National Wildlife Refuge (SDNWR; S-series) were known prior to the 2010 5-year review but these location records were not captured in the previous review. The status of *P. nudiuscula* at Arnie's Point (J15) has been changed from extant to presumed extant as the species was last observed in 2008 during maintenance and monitoring efforts (Helix Environmental Planning, Inc. 2008).

We have new information about the status of *Pogogyne nudiuscula* locations from local monitoring efforts, which occur annually at several sites. The City of San Diego monitors several vernal pool complexes including Cal Terraces North and Otay Mesa Road Parcel (J2), Robinhood Ridge (J4-5), Cal Terraces South (J14), Dennery West and Hidden Trails (J31), and West Otay Mesa A-C (J32) as described in the Vernal Pool Habitat Conservation Plan (VPHCP) and the Vernal Pool Monitoring and Management Plan. Biologists record occupancy at occurrences, percent cover, and provide notes at multiple locations (City of San Diego 2019b, p. 553). The occurrence table (Table 1) has been updated to reflect the current status of *P. nudiuscula*

locations resulting from these monitoring efforts [e.g., changing Cal Terraces North and Otay Mesa Road Parcel (J2) and Cal Terraces South (J14) from partially and possibly extant to extant due to recent detections].

The East Otay A (J23–25) vernal pool complexes are not monitored due to previous ammunition testing at the formerly used defense site and safety concerns associated with unexploded ordnances and discarded military munitions. Because the area cannot be monitored or managed, the status of *Pogogyne nudiuscula* has been changed from extant to presumed extant as the species was last observed in 1990 at five pools with approximately 2,000 individuals.

The status of vernal pool complex East Otay B (J26) has been updated from partially extant to extant. Specimens of *Pogogyne nudiuscula* were collected in 2013 and 2015 by Amanda Everett, student at San Diego State University (CCH2 2021). This vernal pool complex is a former conservation site managed by The Environmental Trust. Unfortunately, The Environmental Trust declared bankruptcy and funding for the conservation easement was lost. The future conservation status of the location is uncertain.

In summary, the species is extant or presumed extant at 19 locations including the 5 recent records described above. Three historically extirpated records remain extirpated, and two records are considered potentially erroneous due to questionable identification. Overall, the species distribution remains restricted to southern San Diego County as described in our 2010 5-year status review and this information does not alter our understanding of the distribution of *Pogogyne nudiuscula*.

Genetics

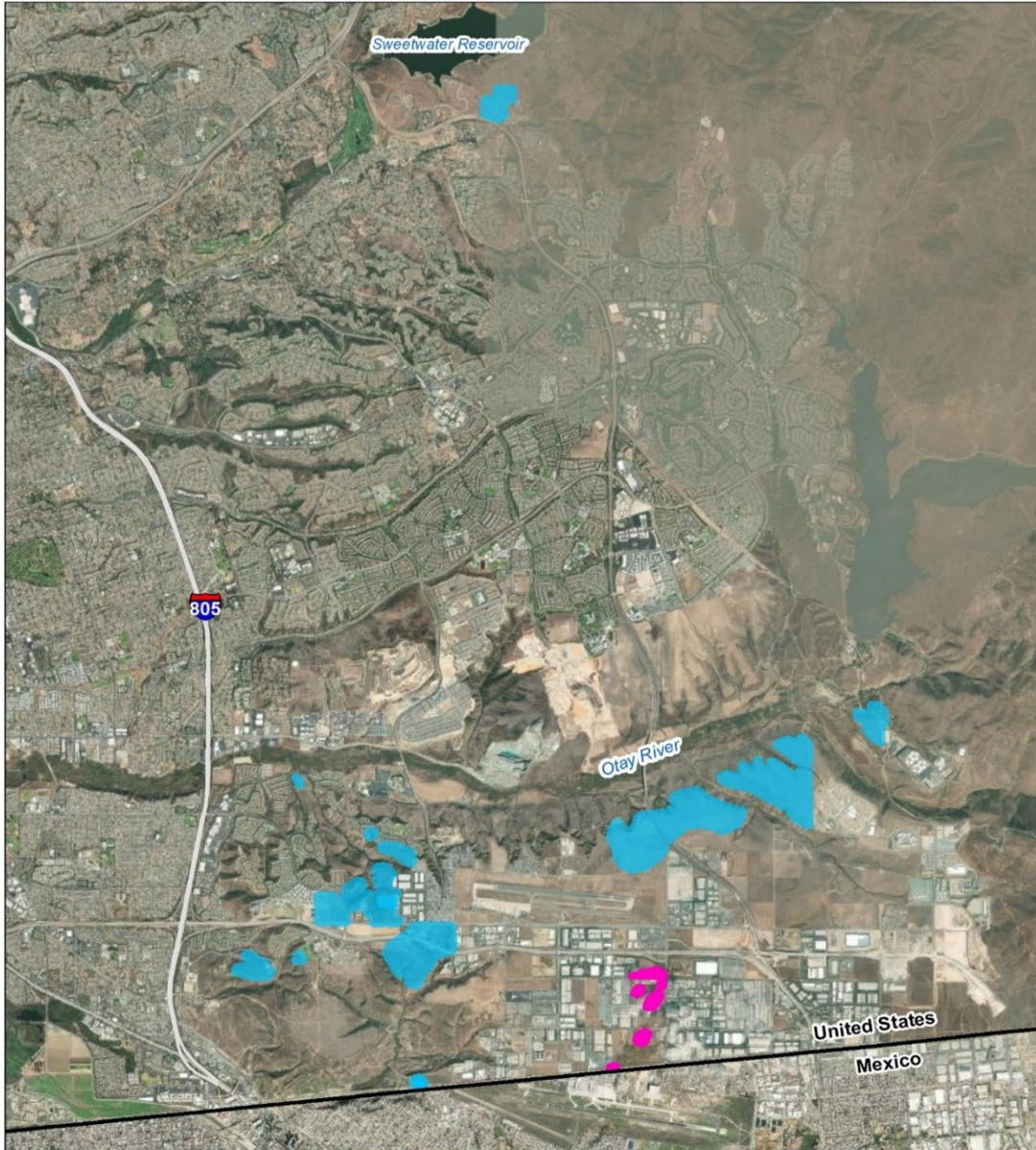
Two studies have been published on the phylogeny of *Pogogyne* since the 2010 5-year review that improves our understanding of the listed species. Research conducted by San Diego State University found that the members of *Pogogyne* have rapidly diversified in response to specialized habitats and vernal pools ecosystems separated by geographic area (Silveira and Simpson 2013, p. 14). Specimens of *P. abramsii* and *P. nudiuscula* were found to form a clade. These two geographically proximate species have long been thought to be close relatives, differing in pubescence and number of flowers per leaf axil.

A *Pogogyne* collection from Baja California, Mexico was not recovered in the clade with *P. abramsii* and *P. nudiuscula*, and was considered a unique taxon (Silveira and Simpson 2013, p. 792). Subsequent research by San Diego State University supports the conclusion that the Mexico record is unique (Everett 2017, p. 39) and that the 2017 record of *P. nudiuscula* from Valle de las Palmas, Baja California, Mexico, will be described as a separate taxon (CCH2 2021; Simpson 2021, pers. comm.).

2021 5-year Review for *Pogogyne nadiuscula*





U.S. Fish & Wildlife Service
Otay Mesa Mint (*Pogogyne nadiuscula*)



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Data: U.S. Fish and Wildlife Service, CDFW
Basemap: ESRI World Imagery
Date: 7/27/2021
S:\stem\Jacob\DFP\PONU_Zoomed.mxd

 General area of vernal pools with extant occurrences of PONU
 Extirpated occurrences of PONU

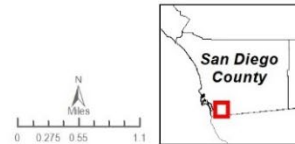


Figure 1. Current range of *Pogogyne nadiuscula*, showing the status of the species at vernal pool complexes locations within San Diego County.



U.S. Fish & Wildlife Service
 Otay Mesa Mint (*Pogogyne nudiuscula*)

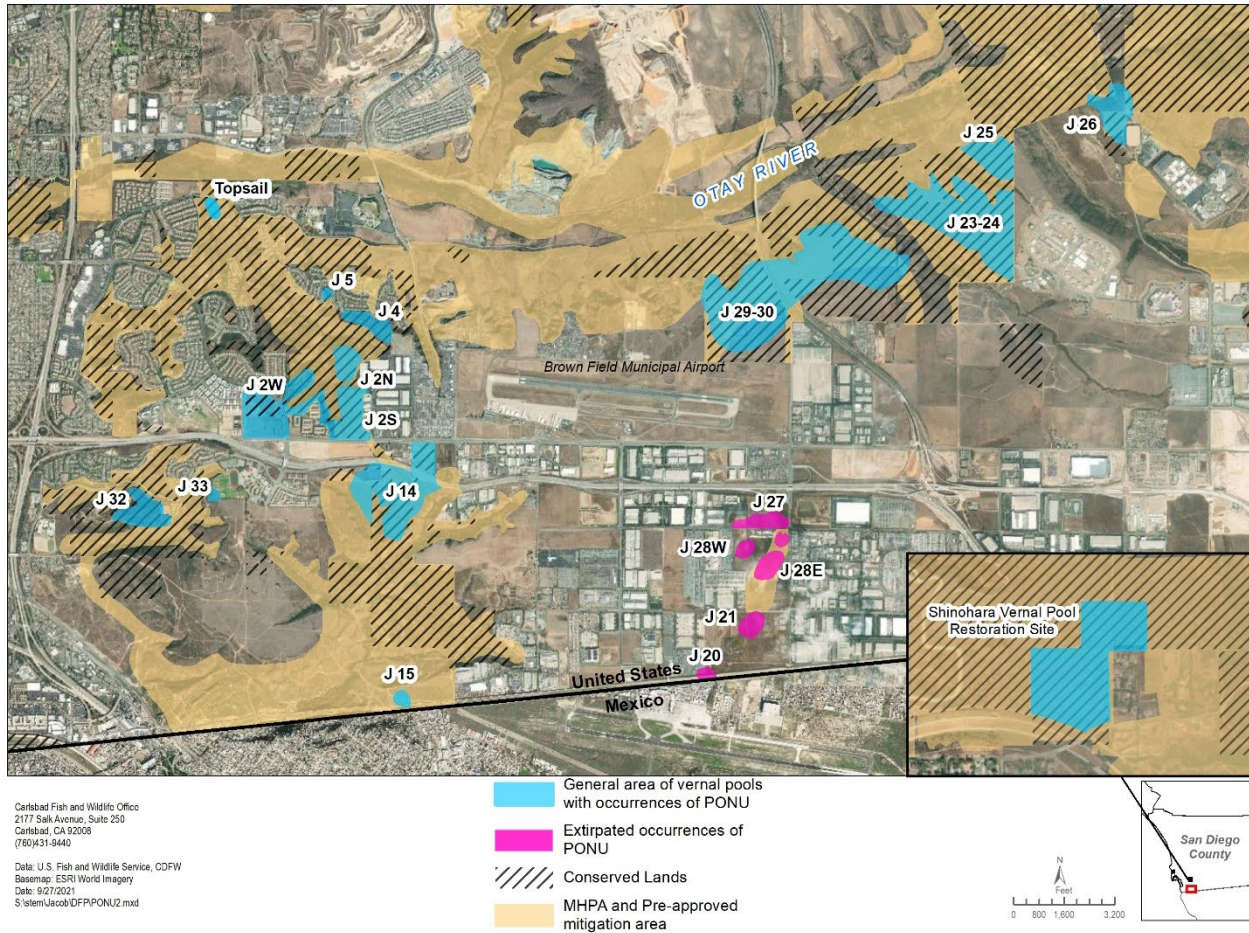


Figure 2. Map of *Pogogyne nudiuscula* occurrences, showing the vernal pool complex ID, currently conserved lands, and conservation planning under the City of San Diego’s Multi-Habitat Planning Area (MHPA).

Table 1. Occurrence Table for *Pogogyne nudiuscula* including Status, Land Ownership, and Conservation.

Area and Occurrence	Location Name	Land Ownership	Status at Listing	2010 Status	2021 Status	2021 Conservation
Otay Mesa – West J2 (EO 13)	Cal Terraces (North) Otay Mesa Road Parcel	Private/ City of San Diego/ Caltrans	Extant	Partially Extant	Extant	Partially Conserved*
Otay Mesa – West TBD (EO TBD)	Topsail	City of San Diego	-	-	Extant	Conserved
Otay Mesa - West J4-5 (EO 13)	Robinhood Ridge	Private/ City of San Diego	Extant	Extant	Extant	Conserved
Otay Mesa – West J14 (EO 17)	Cal Terraces (South)	City of San Diego	Extant	Presumed Extant	Extant	Conserved
Otay Mesa – West J14 (EO 8)	Anderprises	Caltrans	Extant	Presumed Extant	Extant	Conserved
Otay Mesa – West J31 (EO TBD)	Dennery West	Caltrans	-	-	Extant	Conserved
Otay Mesa – West J31 (EO TBD)	Hidden Trails	City of San Diego	-	-	Extant	Conserved
Otay Mesa – West J32 (EO 15)	West Otay A	Caltrans/ California Department of Fish and Wildlife	Extant	Extant	Extant	Conserved

2021 5-year Review for *Pogogyne nudiuscula*

Area and Occurrence	Location Name	Land Ownership	Status at Listing	2010 Status	2021 Status	2021 Conservation
Otay Mesa – West J32 (EO 15)	West Otay B	City of San Diego	-	-	Extant	Conserved
Otay Mesa – West J32 (EO 15)	West Otay C	City of San Diego	-	-	Extant	Conserved
Otay Mesa - West J33 (EO 14)	Sweetwater High School	Sweetwater High School	Extant	Extant	Extant	Conserved
Otay Mesa – South J15 (EO 16)	Arnie’s Point	Border Patrol	Not Present	Extant**	Presumed Extant	Conserved
Otay Mesa – East J23-25 (EO 3)	East Otay A	San Diego County	Extant	Extant	Presumed Extant	Conserved
Otay Mesa – East J26 (EO 1)	East Otay B	Private	Extant	Partially Extant	Extant	Partially Conserved*
Otay Mesa - Northeast J29 (EO 5)	Lonestar W	Caltrans	Extant	Extant	Extant	Conserved
Otay Mesa - Northeast J30 (EO 5)	Lonestar E	Caltrans	Extant	Extant	Extant	Conserved

2021 5-year Review for *Pogogyne nudiuscula*

Area and Occurrence	Location Name	Land Ownership	Status at Listing	2010 Status	2021 Status	2021 Conservation
Otay Mesa – Northeast J30 (EO 5)	Johnson Canyon	Caltrans	Extant	Extant	Extant	Conserved
Sweetwater Reservoir S series(EO TBD)	Shinohara Vernal Pool Restoration Site	San Diego National Wildlife Refuge	Not Present	Extant**	Extant	Conserved
Otay Mesa – West J1	West Otay D	Private	Extirpated	Extirpated	Extirpated	Developed
Otay Mesa – South J20, J21, J27, J28 (EO 6, EO 7)	South Otay	Private	Extant	Extirpated	Extirpated	Future Restoration Project
Linda Vista***	Linda Vista	Unknown	Extirpated	Extirpated	Extirpated	Developed
Carroll Canyon EO 11	Carroll Canyon	City of San Diego	Questionable identification	Extirpated	Extirpated	Developed
Mission Valley EO 4	Mission Valley	Private	Questionable identification	Extirpated	Extirpated	Developed

* Partially Conserved is defined as an area that is both within conserved lands and an area not planned to be conserved within the Multi-Habitat Planning Area (MHPA).

** Present in 2010 – not captured in 2010 5-year review.

*** Herbarium specimen was verified to be *Pogogyne nudiuscula* (USFWS 2010, p. 9). There is another herbarium specimen from this general area, and it was confirmed to be *P. abramsii*. It is not possible to determine if *P. nudiuscula* and *P. abramsii* co-occurred because of the lack of exact location data associated with the collections.

Threats

Threats to *Pogogyne nudiuscula* identified in the listing rule included habitat loss and degradation due to urban and agricultural development, grazing, off-highway vehicle use (OHVs), trampling, invasion from weedy nonnative plants, and other factors (USFWS 1993, p. 41384). Our 2010, 5-year review discussed threats to *Pogogyne nudiuscula* from habitat loss associated with development, road projects, OHVs, altered hydrology, and compaction of soil (Factor A), and threats from competition with nonnative plants, human disturbance, fire suppression measures, reduced populations, climate change and drought (Factor E) (USFWS 2010, pp. 10–25). We believe the threats discussed in the 2010 status review are still relevant and acting upon populations of *P. nudiuscula*. Updates to threats in this status review are discussed under the following headings: development, altered hydrology, compaction of soils, road projects, OHVs (Factor A), and nonnative plants, human disturbance, and fire and fire suppression (Factor E).

The threats of small population size, drought, and climate change were discussed in 2010 and remain the same as conditions in 2010; therefore, those threats will not be updated below. Table 2 below describes the current threats to *Pogogyne nudiuscula* locations with corresponding lettering to the five-factor analysis described in section 4(a)(1) the Act.

The threats analysis relies on monitoring and management conducted by the City of San Diego within the VPHCP (City of San Diego 2019a, Appendix B). We do not have current information regarding threats at the following sites: Arnie’s Point (J15), Cal Terraces South and Anderprises (J14), East Otay A (J23-25), East Otay B (J-26), West Otay A-C (J32), and Sweetwater High School (J33). While no new threats have been identified in the 2021 5-year review, threats discussed in the 2010 5-year review are still ongoing. Due to existing management and monitoring provided by the City of San Diego and other partnering agencies, we believe that while these threats are still on the landscape, the threats have been ameliorated to some degree and therefore have a lesser magnitude of impact to *Pogogyne nudiuscula*.

Development

Planned and ongoing development projects throughout the range of *Pogogyne nudiuscula* was described as a primary threat in the listing rule (USFWS 1993, p. 41387). Urban development may result in: (1) destruction of watersheds and the hydrology that support vernal pools; (2) compaction of soils that support vernal pools; (3) road projects; and (4) OHV use. In 2010, we reported that development was a substantial threat, impacting *P. nudiuscula* habitat at 7 of the 14 extant vernal pool complex occurrences (USFWS 2010, p. 10). Since 2010, 17 of the 19 extant *P. nudiuscula* occurrences have been conserved or are planned for future conservation under the City of San Diego’s Multi-Habitat Conservation Plan [MHPA; Cal Terraces North and the Otay Mesa Road Parcel (J2), Robinhood Ridge (J4-5), Cal Terraces South and Anderprises (J14), Dennery West and Hidden Trails (J31), and West Otay A (J32)]. The status of the East Otay B (J26) vernal pool complex is uncertain due to the loss of funding associated with the bankruptcy of The Environmental Trust, but we believe the threat of development is low due to the previous recording of a conservation easement onsite. Cal Terraces North and the Otay Mesa Road Parcel

(J2) may be at risk of development and is not completely within the MHPA. Therefore, development remains a partial threat at just 1 of the 20 occurrences (Table 2).

Altered hydrology

The listing rule identified altered hydrology, including impacts to the vernal pool watersheds, as a threat to *Pogogyne nudiuscula* habitat. The extant occurrences are a mix of natural undisturbed vernal pools, restored vernal pools, and degraded vernal pools, primarily from considerable off-road damage which has resulted in changes in hydrologic connection, flow patterns, and inundation characteristics. Since the 2010 5-year review, altered hydrology impacts pose a threat to 1 of the 19 occurrences [East Otay B (J26)] in southern San Diego County. This threat has been ameliorated by excluding OHV access with the installation of fencing and signage at four of the six vernal pools with extant *P. nudiuscula* populations managed by the City of San Diego.

Compaction of Soils

The listing rule described trampling by humans and livestock as a threat to *Pogogyne nudiuscula* habitat (USFWS 1993, p. 41387). Human foot traffic and livestock grazing within occupied pools can lead to compaction of soils, which reduces habitat suitability for *P. nudiuscula*. Continued threat of compaction of soils from foot traffic is expected to be minimal and ameliorated at four of the six vernal pool complexes with known fencing in place. No known livestock grazing occurs at extant occurrences.

Road Projects

Road project development posed a threat to *Pogogyne nudiuscula* habitat at Cal Terraces South and Anderprises (J14), Lonestar West (J29), Lonestar East (J30), Johnson Canyon (J30) in the 2010 5-year review. Road projects at the locations listed have since been completed and appropriate mitigation has been implemented. No additional projects have been implemented since the last review, and we believe the threat of road projects has been reduced.

Off-Highway Vehicles

At the time of listing, OHV use was described as an ongoing threat to *Pogogyne nudiuscula* on Otay Mesa (USFWS 1993, p. 41387). Impacts from OHV use include deep ruts, compact soil, bury seeds, and altered pool hydrology (Bauder 1986, p. 209). OHV impacts fall into three categories: those associated with recreational activity (often unauthorized) on private or public property, those resulting from Border Patrol vehicles, and those caused by emergency response vehicles. Since listing and in 2010, impacts from OHV activity have occurred at all occurrence areas except East Otay A (J23–25) and East Otay B (J26), thereby altering hydrology and degrading habitat. Since the 2010 5-year review, OHV use continues to threaten *P. nudiuscula* at Cal Terraces North and the Otay Mesa Road Parcel (J2), and at Anderprises (J14). Exclusion of OHVs by the installation and maintenance of fencing and signage have ameliorated the threat at four of the six properties managed by the City of San Diego.

Nonnative Plants

Nonnative plant competition was a historical threat and is an ongoing threat at all vernal pool complexes. The greatest threat is the competition with nonnative plants species, such as *Glebionis coronaria* (crown daisy), *Tamarix* spp. (salt cedar), and nonnative grasses (City of San Diego 2020, p. Appendix B). Potential impacts include competition for space, resources, and pollinators. The City of San Diego and SDNWR currently manages for nonnative plants thereby reducing the magnitude of this impact, but competition with nonnative plants remains a primary threat to the species.

Human Disturbance

Human disturbance was a historical threat and is an ongoing threat at all vernal pool complexes, except for the formerly used defense sites at East Otay A (J23-25) and the Shinohara Vernal Pool Restoration Site (S-series). The greatest threat to *Pogogyne nudiuscula* is trampling from unauthorized access, unauthorized dumping, and edge effects including development, adjacent nonnative landscaping, and litter. The impacts are minimized at four of six properties managed by City of San Diego through installation of perimeter fencing.

Fire and Fire Suppression

Vernal pool species have evolved with the natural fire regime and are not expected to be extirpated by wildfire. However, whether *Pogogyne nudiuscula* might be affected by unnatural fire regimes (e.g., increased fire frequency or severity) is unknown. Vernal pool locations near structures may also be disturbed by fire suppression activities in the event of a wildfire. While fire and fire suppression were listed as a threat in the 2010 status review (USFWS 2010, p. 23) and is recognized as a threat by the City of San Diego at some occupied locations (see Figure 2), we lack information regarding the likelihood and magnitude of this threat.

Threats Summary

We believe the threats discussed in the 2010 status review are still relevant and acting upon populations of *Pogogyne nudiuscula*, including development, nonnative plants, human access and disturbance, and fire and fire suppression. The number of vernal pool complexes threatened by development, compaction of soils, altered hydrology, road projects, human disturbance, and OHVs have decreased due to land conservation and restoration efforts (Table 2). Competition with nonnative plants remains a threat at many occurrences and is managed to some degree by partners.

Conservation

Since listing, efforts have been made to conserve and restore high quality habitat supporting *Pogogyne nudiuscula*. Efforts have also been made to ameliorate threats associated with habitat loss and degradation to improve species viability. In 1998, the Service published the Recovery Plan for Vernal Pools of Southern California, outlining a recovery objective to conserve and enhance southern California vernal pool ecosystems, with specific emphasis on stabilizing

existing populations of *P. nudiuscula* and other listed species so that they may be reclassified from endangered to threatened status (USFWS 1998, pp. 153). A recovery plan clarification for the Vernal Pools of Southern California was published in 2019 amending the 1998 recovery plan by providing more specific terminology (USFWS 2019, p. 2).

Vernal pool conservation of *Pogogyne nudiuscula* is primarily implemented through the City of San Diego’s MHPA; however, additional parcels are designated for long-term conservation through the City’s VPHCP, the County of San Diego’s Pre-Approved Mitigation Areas (PAMA), and California Department of Transportation (Caltrans) management. The newly documented *P. nudiuscula* occurrences at the Shinohara Vernal Pool Restoration Site (S-series) and Arnie’s Point (J15) are preserved in their entirety within the SDNWR and lands owned by the U.S. Border Patrol, respectively.

Table 2. Summary of threats to *Pogogyne nudiuscula* locations in 2010 and 2021.

Area and Occurrence	Location Name	2010 Threats	2021 Threats
Otay Mesa –West J2 (EO 13)	Cal Terraces (North) Otay Mesa Road Parcel	A. Development, OHV use E. Nonnative plants human access and disturbance, fire, and fire suppression	A. Development, OHV use E. Nonnative plants, human access and disturbance, fire, and fire suppression, climate change
Otay Mesa –West TBD (EO TBD)	Topsail	(Not analyzed in 2010)	E. Nonnative plants, human access and disturbance, fire, and fire suppression, climate change
Otay Mesa –West J4-5 (EO 13)	Robinhood Ridge	A. Development E. Nonnative plants, fragmentation, human access and disturbance	E. Nonnative plants, human access and disturbance, fire, and fire suppression, climate change
Otay Mesa –West J14 (EO 17)	Cal Terraces (South)	A. Development, OHV use, road projects E. Nonnatives plants, human access and disturbance, fire and fire suppression	E. Nonnative plants, human access and disturbance, fire, and fire suppression, climate change
Otay Mesa –West J14 (EO 8)	Anderprises	A. Development, OHV use, road projects E. Nonnatives plants, human access and disturbance, fire and fire suppression	A. OHV use E. Nonnative plants, human access and disturbance, fire, and fire suppression, climate change
Otay Mesa –West J31 (EO TBD)	Dennery West	(Not analyzed in 2010)	No information available
Otay Mesa –West J31(EO TBD)	Hidden Trails	(Not analyzed in 2010)	E. Nonnative plants, human access and disturbance, fire, and fire suppression, climate change

2021 5-year Review for *Pogogyne nudiuscula*

Area and Occurrence	Location Name	2010 Threats	2021 Threats
Otay Mesa–West J32 (EO 15)	West Otay A (Caltrans, California Department of Fish and Wildlife)	A. Development, altered Watershed E. Nonnative plants, human access and disturbance	E. Nonnative plants, human access and disturbance, climate change
Otay Mesa –West J32 (EO TBD)	West Otay B	(Not analyzed in 2010)	E. Nonnative plants, human access and disturbance, fire, and fire suppression, climate change
Otay Mesa –West J32 (EO TBD)	West Otay C	(Not analyzed in 2010)	E. Nonnative plants, human access and disturbance, fire, and fire suppression, climate change
Otay Mesa - West J33 (EO 14)	Sweetwater High School	A. Development, altered Watershed E. Nonnative plants, human access and disturbance	E. Nonnative plants, human access and disturbance, climate change
Otay Mesa -South J15 (EO 16)	Arnie’s Point	(Not analyzed in 2010)	E. Nonnative plants, human access and disturbance, fire, and fire suppression, climate change
Otay Mesa – East J23-25 (EO 3)	East Otay A	E. Nonnative plants	E. Nonnative plants, climate change
Otay Mesa – East J26 (EO 1)	East Otay B	A. Altered watershed, compaction and erosion of soil E. Nonnative plants, human access and disturbance	A. Altered watershed, compaction and erosion of soil E. Nonnative plants, human access and disturbance, climate change
Otay Mesa – Northeast J29 (EO 5)	Lonestar W	A. OHV use, road projects E. Nonnative plants, human access and disturbance, fire and fire suppression	E. Nonnative plants, human access and disturbance, fire and fire suppression, climate change
Otay Mesa – Northeast J30 (EO 5)	Lonestar E	A. OHV use, road projects E. Nonnative plants, human access and disturbance, fire and fire suppression	E. Nonnative plants, human access and disturbance, fire and fire suppression, climate change
Otay Mesa – Northeast J30 (EO 5)	Johnson Canyon	A. OHV use, road projects E. Nonnative plants, human access and disturbance, fire and fire suppression	E. Nonnative plants, human access and disturbance, fire and fire suppression, climate change
Sweetwater Reservoir S (EO TBD)	Shinohara Vernal Pool Restoration Site	(Not analyzed in 2010)	E. Nonnative plants, climate change

California Botanical Garden

In the 2010 5-year review, we recommended establishing a seed bank for *Pogogyne nudiuscula* according to Center for Plant Conservation guidelines. The California Botanical Garden now manages a *P. nudiuscula* seed bank (Birker and Fraga 2021, pers. comm.). A 30-year germination test on the largest collection in 2020 resulted in 96 percent germination (Birker and Fraga 2021, pers. comm.).

City of San Diego

Within the City of San Diego VPHCP, all vernal pools occupied with *Pogogyne nudiuscula* are conserved. In 2019, the VPHCP documented the occurrence of 398 vernal pools with *P. nudiuscula* within the City of San Diego and San Diego County. Of the 398 pools, 370 are fully conserved, 23 pools are planned to be conserved within the multi-habitat planning area, and 5 pools were outside City of San Diego jurisdiction and planning (i.e., J33 at Sweetwater High School) (City of San Diego 2019a, pp. 251–252).

Future conservation projects within the City’s VPHCP include plans to create and restore *Pogogyne nudiuscula* populations at currently unoccupied vernal pool complexes including J16–18, J20, J21, J27, J28W, and J28E (City of San Diego 2019b, pg. 5-31; Allen *et al.* 2021, pers. comm.). Restoration will occur at specific vernal pool complexes to establish populations of covered species, consistent with the Recovery Plan (USFWS 1998, Appendix F). Restored populations will also be conserved consistent with the VPHCP (City of San Diego 2019a, Appendix C) and managed following the conditions outlined in the City of San Diego Vernal Pool Management and Monitoring Plan (City of San Diego 2020, p. 326).

Shinohara Vernal Pool Restoration Site

The Shinohara vernal pool restoration site was established on the SDNWR in 2007. SDNWR staff have been working to restore approximately 30 acres [ac; 0.4 hectares (ha)] of vernal pool habitat on the parcel, located about half a mile (700 m) south of Sweetwater Reservoir in San Diego County (Figure 1). The parcel includes a portion of the “S” series of vernal pools described by Bauder (1986, p. 4-22). *Pogogyne nudiuscula* was introduced via hand-broadcast seeds at pools in November 2010. The species has grown abundantly every year since 2011 and expanded its distribution onsite into pools in which it was not initially seeded (USFWS 2014, p. 4). Effective weed control has been implemented and will be necessary for the foreseeable future.

Arnie’s Point Mitigation Site

Arnie’s Point (J15) was established as mitigation for the U.S.-Mexico International Border Fence Project. This site is a 20-ac (8.1 ha) vernal pool restoration and enhancement project located on Otay Mesa approximately 8.25 miles (13.3 kilometers) east of the Pacific Ocean and several hundred feet (100 m) north of the U.S.-Mexico border (Figure 1). The construction of the border infrastructure system through the Otay Mesa region of San Diego resulted in a loss of vernal pool habitat. As compensation for the loss, a vernal pool restoration and enhancement plan was

prepared by RECON and implemented in fall 2002 by Helix Environmental Planning, Inc. and Ecological Restoration Service (Helix 2008, p. 1). In 2004, the *Pogogyne nudiuscula* was observed at six pools in Area A and two pools in Area B (Helix 2004, pp. 15–16). In 2008, *P. nudiuscula* was not observed in any Area B pools (Helix 2008, p. 12). However, 15 vernal pools are currently occupied by *P. nudiuscula* at this site that cover 0.38-ac (0.15 ha; City of San Diego 2019b).

Johnson Canyon and Lonestar Preserve Parcels

The Johnson Canyon and Lonestar Preserve mitigation sites (J29, J30) are managed by the Caltrans to offset impacts associated with the construction of SR-11 and SR-125 South, respectively (Caltrans 2019, p. 1). Caltrans developed a Long-term Management Plan for these parcels including 383 ac (155 ha; Caltrans 2019, pp. 3–4). As of August 2019, Caltrans owns all of properties described within the Johnson Canyon/Lonestar Long-Term Management Plan. Caltrans intends to transfer ownership of the Lonestar and Johnson Canyon properties to the SDNWR, or another appropriate land manager, upon resource agencies approval (Caltrans 2019, p. 17).

Johnson Canyon Area 2 consists of 12 ac (4.9 ha) of restored and preserved vernal pool habitat. *Pogogyne nudiuscula* was seeded at Johnson Canyon Area 2 in 2006. *Pogogyne nudiuscula* was detected in 74 of 103 restored pools in 2010 and in 40 of 103 pools at Johnson Canyon Area 2 in 2014 (Caltrans 2019, pp. 44–45). Lonestar Area 1 consists of 163 ac (66 ha) of restored vernal pool, enhanced coastal sage scrub, and enhanced grassland habitat. Approximately 17 *P. nudiuscula* plants were observed in a single pool east of Lonestar Area 1 during surveys conducted by Helix Biologists in 2007 (Caltrans 2019, p. 45). Before weeding and grading of the site began in the summer of 2011, *P. nudiuscula* was not identified onsite. Seed was collected from nearby donor pools on the Otay Mesa and dispersed in 130 pools in 2013. In 2017, *P. nudiuscula* was observed in 125 pools totaling approximately 16,500 individuals (Caltrans 2019, p. 45).

CONCLUSION

Since 2010, we received new information regarding the distribution, genetics, threats, and conservation of *Pogogyne nudiuscula*. We updated the status of the vernal pool complexes based on this information. After reviewing the best available scientific information, we conclude that *P. nudiuscula* remains an endangered species. The evaluation of threats affecting the species under the factors in 4(a)(1) of the Act in our 2010 status review remains largely the same, although threats associated with development have been ameliorated due to conservation actions, as described above. No change in the listing status is recommended at this time.

RECOMMENDATIONS FOR FUTURE ACTIONS

The recommended actions listed below were identified in the 2010 status review (USFWS 2010, p. 29). The actions were intended to reduce threats to *Pogogyne nudiuscula* and provide information to better understand the biological and physical factors limiting the population growth and distribution. We recognize that conservation of *P. nudiuscula* will require cooperation and coordination with partners to minimize impacts from current threats, aid future

2021 5-year Review for Pogogyne nudiuscula

restoration, and maximize effectiveness of limited funding. We continue to believe the actions described in 2010 are relevant to the conservation of *P. nudiuscula*.

1. Support continued conservation and management of vernal pool habitat that supports *Pogogyne nudiuscula*, with emphasis on complexes that are not currently conserved and those within the Stockpen soil association.
2. Develop and implement a long-term monitoring program to describe population trends to better understand the resiliency of the different vernal pool complexes, including monitoring of restored and enhanced habitat to determine if vernal pool restoration projects continue to be viable through time (e.g., artificial clay layer remains stable and supports adequate ponding).
3. Identify a new conservation easement holder and land manager for the J26 complex.
4. Conduct research to determine life history traits most vulnerable to threats discussed in the five-factor analysis.
5. Develop a dynamic, threats based, species-specific recovery plan based on analysis of current knowledge of the species.

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