Pogogyne abramsii
(San Diego mesa mint)

5-Year Review:
Summary and Evaluation

Pogogyne abramsii (San Diego mesa mint).
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U.S. Fish and Wildlife Service
Carlsbad Fish and Wildlife Office
Carlsbad, California
August 2023

5-YEAR REVIEW

Pogogyne abramsii
(San Diego mesa mint)

GENERAL INFORMATION

Species: *Pogogyne abramsii* (San Diego mesa mint), a plant species
Date listed under the Endangered Species Act: September 29, 1978
Federal Register citation: Service 1978 (43 FR 44810-44811)
Classification: Endangered
Recovery Plan: Final, September 3, 1998. Recovery Plan Clarification, October 1, 2019.
Recovery Priority Number: 8C

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 (Service), 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: Service 2010. *Pogogyne abramsii* (San Diego mesa mint) 5-year Review: Summary and Evaluation. Carlsbad Fish and Wildlife Office, Carlsbad, CA. 45 pp.

We initiated a status review for *Pogogyne abramsii* 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 (Service 2021, pp. 27462–27464). We received no information about *Pogogyne abramsii.*

Species Overview and Habitat: *Pogogyne abramsii* (San Diego mesa mint) is an annual herb in the *Lamiaceae* (mint) family restricted to hardpan vernal pools with Redding soils in San Diego County. Plants can reach 30 centimeters (1 foot) or more in height with purple, bell shaped flowers arranged in whorls that typically bloom from May or June through early July. The plant may be branched and gives off a strong, sweet mint odor. In the past *P. abramsii* has been misidentified as *P. nudiuscula* (Otay mesa mint) but can be differentiated by the number of flowers per node (two), a hairy calyx, and thin bracts subtending each flower. *Pogogyne abramsii's* northern limit is on Del Mar Mesa and occurs south throughout Mira Mesa and Kearny Mesa with a few scattered populations in Tierrasanta. Most occurrences of *P. abramsii* are found on Marine Corps Air Station Miramar (MCAS Miramar).

Vernal pools and vernal swales are often clustered into pool "complexes" (Bauder 1986, pp. 1-1, 4-1–4-31; 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 Service' Carlsbad Fish and Wildlife Office. Information for this review was solicited from the public and interested parties through a *Federal Register* notice announcing this review on May 20, 2021 (Service 2021, pp. 27462–27464). We also contacted Federal partners and species experts to request data or information to consider in our review including the City of San Diego and MCAS Miramar. Additionally, we conducted a literature search and a review of information in our files.

SUMMARY OF NEW INFORMATION SINCE 2010

Genetics

Two studies have been published on the phylogeny of *Pogogyne* since the 2010 5-year review that improve our understanding of the listed species. In 2013, Silveira and Simpson (entire) examined DNA sequence data from all seven extant species of *Pogogyne* to infer phylogenetic relationships. Researchers 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. 793). Specimens of *P. abramsii* and *P. nudiuscula* were found to form a clade (Silveira and Simpson 2013, p. 791). These two geographically proximate species have long been thought to be close relatives, differing in pubescence and number of flowers per leaf axil. Additionally, a *Pogogyne* specimen collected from Baja California, Mexico (identified as *P. sp.*) was not recovered in the clade with *P. abramsii and P. nudiuscula* and was suspected to be a unique taxon (Silveira and Simpson 2013, p. 792). In 2017, follow up research supported the conclusion that the Baja California specimen is unique (Everett 2017, p. 39) and the 2017 collection of "*P. sp.*" From Baja California, Mexico, will be described as a separate taxon (Simpson 2021, pers. comm.).

Distribution and Occurrence Status

To update *Pogogyne abramsii* occurrence[1] status, we reviewed Element Occurrence (EO) data from the California Natural Diversity Database (CNDDB), and monitoring data from the City of San Diego, California Department of Transportation (Caltrans), MCAS Miramar, San Diego Management and Monitoring Program (SDMMP), and Helix Environmental Planning Inc. Based on this new information we updated the *P. abramsii* occurrence table and added additional occurrences that were not considered in the 2010 5-year review (Black and Clark 2023).

In this review, occurrences attributable to a single geographic location are grouped together by existing site name[2], vernal pool complex group or series, and corresponding CNDDB EO reference number(s). The CNDDB assigns different EO numbers to occurrences that are more

[1] The California Natural Diversity Database (CNDDB) is an inventory of the status and locations of rare plants and animals in California. The CNDDB assigns "Element Occurrence" (EO) numbers to unique locations of rare taxa that are greater than 0.40 kilometers (0.25 miles) apart. In this document, we use the term "occurrence" to refer to occurrences based on a general geographic location which may include more than one CNDDB EO.

[2] For occurrences where there are no pre-existing site names, we used the general location names used in the 2010 5-year review.

than a quarter mile (400 meters; m) apart. In **Table 1**, our larger, more broadly described occurrences (e.g., MCAS Miramar) 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 abramsii* 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 Beauchamp (1979 pp. 3-12), expanded on by Bauder (1986, p. 1-1), and with site names provided in the City of San Diego's Vernal Pool Habitat Conservation Plan (VPHCP). Most of the vernal pool complexes within the range of *P. abramsii* are known within MCAS Miramar in the "A", "AA", "EE", "F", "HH", "I", "RR", "U", "V", "X" and "Z" complex series of the Bauder identification (USMC 2018, p. 4-10).

The Recovery Plan (1998) identifies the northern distribution for *Pogogyne abramsii* as Del Mar Mesa. It occurs south on Mira Mesa, MCAS Miramar, and Kearny Mesa with a few scattered populations in western Tierrasanta. This distribution range remains accurate as of this review (**Figure 1**). Historically, *P. abramsii* was found near University Heights, Balboa Park, and Linda Vista but were initially believed to be *P. nudiuscula* (CDFW 2022). Herbarium records verified the specimens collected at University Heights and Balboa Park to be *P. abramsii* instead of *P. nudiuscula*. All three occurrences were extirpated at listing. We consider the current distribution of *P. abramsii* to be limited to southern San Diego County.

New survey information since the previous 5-year review has allowed us to split certain *Pogogyne abramsii* occurrences that were lumped together in the 2010 occurrence table. For example, the 2010 occurrence table combined vernal pool complex series "EE1" "EE2" and "GG1" as one entry, whereas we now distinguish them in the current 5-year review as two separate entries "EE1-2" and "GG1". This allows us to describe and monitor the nuanced conditions among proximal vernal pool complex series more accurately. The previously lumped vernal pool complex series "AA1 east, AA1 south, AA1 west, and AA2" are now distinguished as four separate entries in our updated occurrence table (**Table 1**). Similarly, the occurrence table in the 2010 5-year review combined the Teledyne Ryan (N1-4) site, a site last documented containing *P. abramsii* in 1998, with the Montgomery Field (N6) site, a site containing 129 occupied vernal pools. This lumped entry is now differentiated as two entries in the current occurrence table.

In the past, MCAS Miramar biologists have grouped basins and seasonally ponded features near the MCAS Miramar landfill as the 'LF' pool group. A single pool in the 'LF' pool group was observed in 2008, and the species was seen incidentally within the past 10 years. Under the direction of Charles Black (MCAS Miramar), we have added observations at this location to our occurrence table in RR1-RR2 because of its proximity to those pool groups (Black 2023b).

Based on current updates from 2010, there are 43 distinct *Pogogyne abramsii* locations still potentially occupied (**Figure 1**, **Table 1**), of which 36 are extant and 7 are presumed extant. There are 25 *Pogogyne abramsii* locations that are considered extirpated or possibly extirpated, of which 22 are extirpated and 3 are possibly extirpated. A total of 22 locations have been extirpated since listing (3 occurrences that were historically occupied were considered extirpated prior to listing) and several past occurrences from the 2010 5-year review have been split into new, more specific occurrences. Vernal pool restoration sites MV-22 and Del Mar Mesa – Zamudio represent new occurrences for the species that did not exist during the 2010 5-year review. It is also possible that *P. abramsii* occurs at other locations that have not been surveyed or detected.

We have new information about the status of *Pogogyne abramsii* locations from local monitoring efforts, which occur annually at several sites. The City of San Diego monitors several vernal pool complexes including Carroll Canyon (D5-8), Del Mar Mesa (H1-10, 13-15, 18-26), Greystone Torrey Highlands (H39), Lopez Ridge (B7-8), and Montgomery Field (N5-6) as described in the VPHCP and associated the Vernal Pool Monitoring and Management Plan. Biologists record occupancy at occurrences, percent cover, and provide notes at multiple locations (City of San Diego 2021, pp. 1-3). The occurrence table (**Table 1**) has been updated to reflect the current status of *P. abramsii* locations resulting from these monitoring efforts.

In summary, the species is extant or presumed extant at 43 locations and a total of 25 locations are considered extirpated or possibly extirpated. 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 abramsii*.

Table 1: 2023 Occurrence Table for *Pogogyne abramsii*.[1]

Site Name/ Location	Pool Group	EO	Plant Observations from Listing Until 2010	Plant Observations Since 2010	2010 Status	2023 Status	2023 Ownership	2023 Threat Update	2023 Conservation Status
Tierrasanta	A4	8	1979; 1981 (10,000+); 1982 (>1000); 1986	2013; 2019	Extant	Extant	MCAS Miramar	A: Military activities, nonnative plants	DoD Level I Management Area
Miramar	AA1 East	5	2008; 2010	2013; 2014; 2015; 2016; 2017; 2018; 2019; 2020; 2021; 2022; 2023	Lumped previously (as Extant)	Extant	MCAS Miramar	A: Military activities, nonnative plants	DoD Level I Management Area
Miramar	AA1 South	5	2003; 2010	2013; 2014; 2015; 2016; 2017; 2018; 2019; 2020; 2021; 2022; 2023	Lumped previously (as Extant)	Extant	MCAS Miramar	A: Military activities, nonnative plants	Well fenced; DoD Level I Management Area
Miramar	AA1 West	5	2008; 2010	2016; 2017; 2018; 2019; 2020; 2021; 2022; 2023	Lumped previously (as Extant)	Extant	MCAS Miramar	A: Military activities	DoD Level I Management Area
Miramar	AA10	53	1979; 1986; 2008; 2010	~2017	Extant	Extant	MCAS Miramar	A: Military activities, nonnative plants	Fenced; DoD Level I Management Area

Site Name/ Location	Pool Group	EO	Plant Observations from Listing Until 2010	Plant Observations Since 2010	2010 Status	2023 Status	2023 Ownership	2023 Threat Update	2023 Conservation Status
Miramar	AA11	7	2010	~2015	Extant	Extant	MCAS Miramar	A: Military activities, nonnative plants	DoD Level I Management Area
Miramar	AA12	11	1979; 2008; 2010	Not seen since 2010; difficult to access	Extant	Presumed Extant	MCAS Miramar	A: Military activities, nonnative plants	Not fenced but military activities prevent human access; DoD Level I Management Area
Miramar	AA13	7	2005	2013	Extant	Presumed Extant	MCAS Miramar	A: Military activities	Partially fenced but not anticipated to have human access threats due to proximity to freeway; DoD Level I Management Area
Miramar	AA2	5	2010	Not seen since 2010	Lumped previously (as Extant)	Presumed Extant	MCAS Miramar	A: Military activities, nonnative plants	DoD Level I Management Area

Site Name/ Location	Pool Group	EO	Plant Observations from Listing Until 2010	Plant Observations Since 2010	2010 Status	2023 Status	2023 Ownership	2023 Threat Update	2023 Conservation Status
Miramar	AA3	7	2010; 2008	2013; Not checked since 2013 because it's extremely hard to access (Black, C. 2023).	Extant	Presumed Extant	MCAS Miramar	A: Military activities, nonnative plants	Very well protected by natural geography and fence; DoD Level I Management Area
Miramar	AA4-7	7	2008	2013; 2022	Extant	Extant	MCAS Miramar	A: Military activities, nonnative plants	DoD Level I Management Area
Miramar	AA8	12	1979; 1986; 2008	2013	Extant	Presumed Extant	MCAS Miramar	A: Military activities, altered hydrology, nonnative plants	DoD Level I Management Area
Miramar	AA9	6	1979; 1982; 1986; 2010	2013; 2014; 2015; 2016; 2017; 2018; 2019; 2020; 2021; 2022; 2023	Extant	Extant	MCAS Miramar	A: Military activities, nonnative plants	Fenced; DoD Level I Management Area

Site Name/ Location	Pool Group	EO	Plant Observations from Listing Until 2010	Plant Observations Since 2010	2010 Status	2023 Status	2023 Ownership	2023 Threat Update	2023 Conservation Status
Mesa Norte	B11	36	2003; 2005	2020; 2023	Extant	Extant	Private (managed by City of San Diego)	A: Nonnative plants, illegal dumping E: Human access and disturbance	VPHCP Level 1 and site-specific management plan
	B12	37	1979; 1986	Not applicable	Extirpated	Extirpated	Unknown, developed	Not applicable, developed	Completely developed
	B1-4, B9-10	35	1979	Not applicable	Extirpated	Extirpated	Private	Not applicable, developed	Completely developed
Lopez Ridge (California Department of Fish and Wildlife (CDFW))	B6	54	1986; 1992; 2004	Within past 5 years	Lumped previously (as Extant)	Extant	CDFW	A: off-highway vehicle use E: Human Access and Disturbance	VPHCP Level 1; fenced; on ecological reserve that is not available to the public
Lopez Ridge (City)	B7-8	54	1992; 2003	2014; 2015; 2016; 2017; 2019; 2020; 2021	Lumped previously (as Extant)	Extant	City of San Diego Environmental Services Department	A: Nonnative plants	VPHCP Level 1; Fenced
Kearny Mesa - South of Miramar	BB	7	Unknown	None	Extirpated	Extirpated	Private		

Site Name/ Location	Pool Group	EO	Plant Observations from Listing Until 2010	Plant Observations Since 2010	2010 Status	2023 Status	2023 Ownership	2023 Threat Update	2023 Conservation Status
Del Mar Mesa - Deer Canyon	Blank from previous 5-yr	38	Not applicable	Not applicable	Extirpated	Extirpated	Unknown	Unknown	Unknown
	Blank on previous 5-yr	42	1979	Not applicable	Extirpated	Extirpated	Private	Not applicable, developed	Not applicable
	Blank on previous 5-yr	43	1979	Not applicable	Extirpated	Extirpated	Private	Not applicable, developed	Not applicable
Kearny Mesa	Blank on previous 5-yr	45	Not applicable	Not applicable	Extirpated	Extirpated	Unknown, mostly developed	A: Development, road projects	None
Mission Valley - Mesa South	Blank on previous 5-yr	46	Not applicable	Not applicable	Extirpated	Extirpated	Private	Not applicable, developed	Completely developed
Tecolote Canyon (Linda Vista Area)	Blank on previous 5-yr	44	Based on 1894, 1921, and 1938 observation	None	Extirpated	Extirpated	Unknown	Not applicable	Not applicable
Winterwood	C10-16	24	2003	2019	Extant	Extant	School District	A: Nonnative plants, dumping E: human access and disturbance	Contains Site Specific Restoration Plan administered by Recon
Fieldstone	C17-18	24	2003	2023	Extant	Extant	Private	No threats	Fenced, but no management; high abundance of individuals

Site Name/ Location	Pool Group	EO	Plant Observations from Listing Until 2010	Plant Observations Since 2010	2010 Status	2023 Status	2023 Ownership	2023 Threat Update	2023 Conservation Status
	C19	23	1979	Not applicable	Extirpated	Extirpated	Private	Not applicable, developed	Completely developed
	C1-9, 20-26	24	Unknown	Not applicable	Extirpated	Extirpated	Private	Unknown	Unknown but likely the same as 2010
Mira Mesa Market	C27	36	2003	Not applicable	Extirpated	Extirpated	Private	Not applicable	Conserved; one pool remains fenced; no management under VPHCP
	C28	36	Not applicable	Not applicable	Extirpated	Extirpated	SD Unified School District	Not applicable	
	D1-4	27			Extirpated	Extirpated			
Carroll Canyon	D5-8	27	2003	2014 (432); 2015 (1966); 2016 (5000); 2017 (2000); 2018; 2019; 2020; 2021	Extant	Extant	City of San Diego	A: Nonnative plants, illegal dumping	Fenced; VPHCP Level 1
Kearny Mesa	E1-4	7			Extirpated	Extirpated	Unknown		
Miramar	EE1 and EE2	7	1998; 2003; 2005; 2010	2011; 2012; 2013; 2014; 2015; 2016; 2017; 2018; 2019; 2020; 2021; 2022; 2023	Extant	Extant	MCAS Miramar	A: Military activities, nonnative plants	Fenced; within flightline; DoD Level I Management Area

Site Name/ Location	Pool Group	EO	Plant Observations from Listing Until 2010	Plant Observations Since 2010	2010 Status	2023 Status	2023 Ownership	2023 Threat Update	2023 Conservation Status
Miramar	GG1	7	None	None	Not included (lumped in with EE1 and EE2 in previous 5 year, but GG1 was likely extirpated then)	Extirpated	MCAS Miramar		
Miramar	F north, F16-17	7	1998; 2005	2013; ~2017	Extant	Extant	MCAS Miramar	A: Military activities, Nonnative plants	DoD Level I Management Area
Murphy Canyon	G1, G2	3	1979; 1980; 1981; 1982; 1986; 1989; 2001; 2010	2011; 2019 (~2,070); 2022	Extant	Extant	DoD-Navy	A: Military activities, nonnative plants, fire and fire suppression	Fenced; this site is included in INRMP for Naval Base San Diego
Miramar	GA	7	Unknown	None	Extirpated	Extirpated	MCAS Miramar		
Del Mar Mesa - City Owned	H 1-10, 13-15, 18-26	38	2003	2018; 2019; 2020; 2021	Extant	Extant	City of San Diego	A: Off-highway vehicle use, nonnative plants, altered hydrology; E: Human access and disturbance	Fenced but needs repairs; VPHCP Level 1

Site Name/ Location	Pool Group	EO	Plant Observations from Listing Until 2010	Plant Observations Since 2010	2010 Status	2023 Status	2023 Ownership	2023 Threat Update	2023 Conservation Status
Del Mar Mesa - County Owned	H 1-10, 13-15, 18-26	38	2003	Not applicable	Extant	Possibly Extirpated	County	Unknown	No Management under VPHCP
Rhodes	H 18-23	38	2003	2022	Extant	Extant	Private	A: Nonnative plants	7-year restoration plan (currently in year 6 as of this report)
Del Mar Mesa - CDFW Owned	H 1-10, 13-15, 18-26	38	2003	2022; 2023	Extant	Extant	CDFW	A: Nonnative species, off-highway vehicle use; E: Human access and disturbance	VPHCP Level 1
Del Mar Mesa - Privately Owned	H24-26*	38			Extirpated	Extirpated			
Greystone Torrey Highlands	H39	38	Not applicable	2018; 2019; 2020; 2021	Extant	Extant	City of San Diego	A: Nonnative species	VPHCP Level 1 and site-specific management plan; fenced and signage installed
Miramar	HH1+	19	1979; 1982; 1986; 2008; 2004; 2005	2011; 2019 (~500)	Extant	Extant	MCAS Miramar	A: Military activities, nonnative plants	Fenced and signage installed around 2010; DoD Level I Management Area

Site Name/ Location	Pool Group	EO	Plant Observations from Listing Until 2010	Plant Observations Since 2010	2010 Status	2023 Status	2023 Ownership	2023 Threat Update	2023 Conservation Status
Arjons	I1	27	1986; 2003	2023	Extant	Extant	Private, California Native Plant Society (CNPS) manages the site as of fall 2022; not formally conserved yet	A: Development, off-highway vehicle use; E: Human access and disturbance	Fenced, but not formally conserved (no easement); CNPS took over management in fall 2022; CNPS seeks to conserve site and progress is being made
Ford Leasing/Bob Baker	I6B	1	2003	2023	Extant	Extant	Private	A: Nonnative plants, off-highway vehicle use, altered hydrology; E: Human access and disturbance	Conserved; unfenced
Facilities Development - Eastgate Miramar Associates (Bob Baker 2 or Kiffman)	I6C	1	2003	2023	Extant	Extant	Private/City Easement	A: Nonnative plants	Conserved; fenced

Site Name/ Location	Pool Group	EO	Plant Observations from Listing Until 2010	Plant Observations Since 2010	2010 Status	2023 Status	2023 Ownership	2023 Threat Update	2023 Conservation Status
Miramar	I7	7	2008	2023	Extant	Extant	MCAS Miramar	A: Military activities, nonnative plants; E: Human access and disturbance	DoD Level I Management Area
La Mesa - Amaya Drive	LL	49	1985; 1986	2017	Extirpated	Presumed Extant	Unknown	A: Development, illegal dumping, nonnative plants; E: Human access and disturbance	Fenced
Montgomery Field	N5-6	4	2003	2019; 2020; 2021	Extant	Extant	City of San Diego	A: Development, off-highway vehicle damage (plane crashes), nonnative plants, dumping	VPHCP Level 1; fenced; vernal pool habitat restoration to occur soon
General Dynamics	N8	4	2003	None	Extant	Possibly Extirpated	Private	A: Nonnative Plants	VPHCP Level 1; fenced; City is responsible for enforcing management

Site Name/ Location	Pool Group	EO	Plant Observations from Listing Until 2010	Plant Observations Since 2010	2010 Status	2023 Status	2023 Ownership	2023 Threat Update	2023 Conservation Status
Miramar	RR1, RR2	7	2008	~2013	Extant	Presumed Extant	MCAS Miramar	A: Military activities, nonnative plants	DoD Level I Management Area
Teledyne Ryan	N1-4	4	1998	Not applicable	Extirpated	Extirpated	Private	A: Development, off-highway vehicle use, illegal dumping, nonnative plants E: Human access and disturbance	Fenced but not conserved
Miramar (Miramar Mounds)	U North	7	1899; 2007	2011; 2012; 2013; 2014; 2015; 2016; 2017; 2018; 2019; 2020; 2021; 2022; 2023	Extant	Extant	MCAS Miramar	A: Military activities, nonnative plants	Fenced but access is possible, although it does not seem to be a threat; DoD Level I Management Area
Sander	U15 - Private Owned	7	2003	2020; 2021; 2022	Not included	Extant	City of San Diego	A: Nonnative plants	Management Level 1 under VPHCP

Site Name/ Location	Pool Group	EO	Plant Observations from Listing Until 2010	Plant Observations Since 2010	2010 Status	2023 Status	2023 Ownership	2023 Threat Update	2023 Conservation Status
Sander	U15 - MCAS Miramar Owned	7	1998	2022	Extant	Extant	MCAS Miramar	A: Military activities E: Human access and disturbance	Partially fenced since cubic removed their fence in 2022; DoD Level I Management Area
Cubic	U19 - Private Owned	7	2003	Not applicable	Extant (was lumped with MCAS Miramar)	Possibly Extirpated	Private	A: Nonnative plants	Management Level 1 required with development under VPHCP, although no management activities are occurring
Cubic	U19 - MCAS Miramar Owned	7	1998; 2003	Not observed since 2003	Extant	Extirpated	MCAS Miramar	A: Military activities, nonnative plants E: Human access and disturbance	DoD Level I Management Area
Miramar	V	7	2009 or earlier	Observed within past 5 years	Extant	Extant	MCAS Miramar	A: Military activities	DoD Level I Management Area

Site Name/ Location	Pool Group	EO	Plant Observations from Listing Until 2010	Plant Observations Since 2010	2010 Status	2023 Status	2023 Ownership	2023 Threat Update	2023 Conservation Status
Miramar	W1-2	7	Not applicable	Not applicable	Extirpated	Extirpated	MCAS Miramar	A: Military activities, nonnative plants	Fenced
Miramar	W3	7	Not applicable	None	Extant	Extirpated	MCAS Miramar	A: Military activities, nonnative plants	DoD Level I Management Area
Miramar	X1–4	1	2005 (10,000s)	2011; 2023	Extant	Extant	MCAS Miramar	A: Military activities	DoD Level I Management Area
Miramar	Z1-3	32	1998; 2003	2023	Extant	Extant	MCAS Miramar	A: Military activities, nonnative plants	DoD Level I Management Area
Miramar	Z6-7	31	Couldn't find	2011; 2023	Extant	Extant	MCAS Miramar	A: Military activities, nonnative plants	Highly disturbed; majority of basins lack signs
Miramar - MV-22	None - South of A11	7	Not applicable	2015 (497); 2016 (1,591); 2017 (2,371); 2018 (2,407); 2019 (11.007); 2020 (10,075); 2021 (4,400); 2022 (6,000); 2023	Not applicable	Extant	MCAS Miramar	A: Military activities, nonnative plants	DoD Level I Management Area

Site Name/ Location	Pool Group	EO	Plant Observations from Listing Until 2010	Plant Observations Since 2010	2010 Status	2023 Status	2023 Ownership	2023 Threat Update	2023 Conservation Status
Del Mar Mesa – Zamudio	Near H1-15	38	Not applicable	2019	Not applicable	Extant	Caltrans	None	Conserved and fenced

[1] For plant observations, numbers of plants are provided when count data are available; otherwise, the year(s) of observation is given. Current threats to *P. abramsii* occurrences are preceded by letters corresponding to the five-factor analysis described in section 4(a)(1) the Act. The Shaw Lorenze occurrence was included in previous 5-year report erroneously and thus, it is not included in this table.

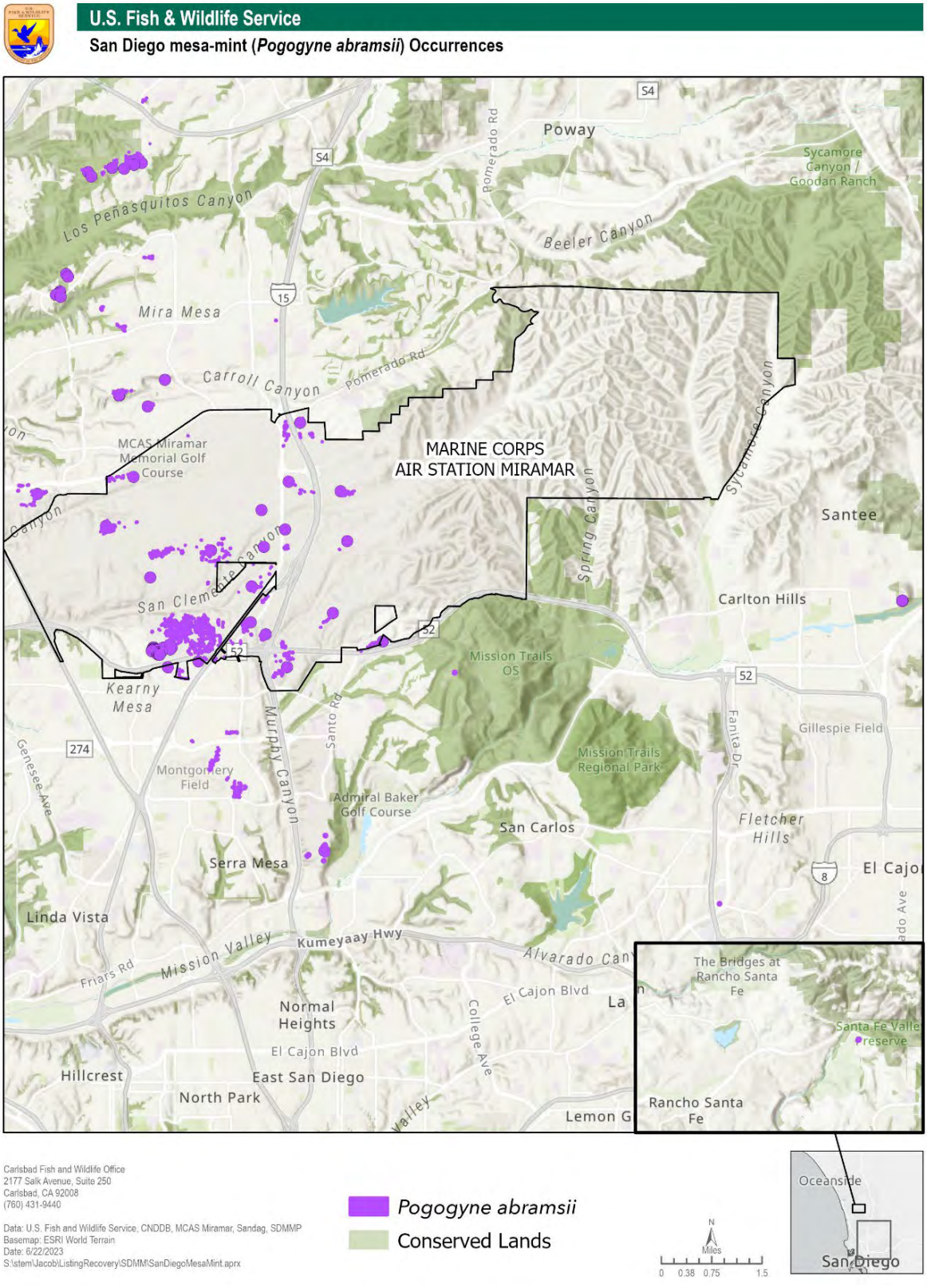

Figure 1: Extant and Presumed Extant Occurrences of *Pogogyne abramsii* and Conserved Lands.

Threats:

Threats to *Pogogyne abramsii* identified in the listing rule included habitat loss and degradation due to urban and agricultural development, grazing, off-highway vehicle use, trampling, invasion from weedy nonnative plants, and other factors (Service 1993, p. 41384). In the 2010 5-year review, we discussed Factor A threats (present or threatened destruction, modification, or curtailment of habitat or range) to *P. abramsii* from habitat loss associated with urban development, road widening, off-highway vehicle use, military activities, altered hydrology, illegal dumping, and nonnative plants. We also discussed Factor E threats (other natural or manmade factors affecting a species' continued existence) from competition with nonnative plants, human disturbance, fire suppression measures, reduced populations, climate change and drought (Service 2010, pp. 10–25).

In this review, we have new information about the Factor A threats of development, altered hydrology, compaction of soils, road projects, off-highway vehicle, climate change, and the Factor E threats of nonnative plants, human disturbance, and fire and fire suppression. The threat of small population size was discussed in 2010 and remains the same as conditions in 2010; therefore, this threat is not updated below. **Table 1** describes the current threats to *Pogogyne abramsii* locations with corresponding lettering to the five-factor analysis described in section 4(a)(1) the Act.

Our threats analysis relies on monitoring and management conducted by the City of San Diego through implementation of their VPHCP (City of San Diego 2022, pp. 6–20) and formal and incidental observations made by MCAS Miramar biologists (Black 2023b). We do not have current information regarding threats at several privately-owned sites, including General Dynamics (N8), as well as the Del Mar Mesa (County, H 1-10, 13-15, 18-26) site. While no new threats have been identified in the 2023 5-year review, threats discussed in the 2010 5-year review are still ongoing. However, due to improved and more regular management and monitoring provided by the City of San Diego through their VPHCP, as well as continued management and monitoring through the Depart of Defense's (DoD) Integrated Natural Resources Management Plan (INRMP), we believe that these threats have been ameliorated to some degree and therefore are having less of an impact to *Pogogyne abramsii*, compared to listing.

Development

In the listing rule, we discussed planned and ongoing development as a primary threat (Service 1978, p. 44810), and impacts from this threat continue to threaten *Pogogyne abramsii* habitat. Urban development may result in: (1) destruction of watersheds and the hydrology that support vernal pools; (2) barriers to dispersal such that pollination and reproductive output may be inhibited; and (3) increased fragmentation and potential for road projects. In the 2010 5-year review, we reported that development continued to be a substantial threat, impacting 12 EOs containing 14 occurrences (Service 2010, p. 11). Since 2010, only 3 of the 43 extant and presumed extant occurrences are currently considered to be threatened by development. We believe that the threat to *P. abramsii* from development has been reduced since the previous 5-year review primarily due to increased conservation, management, and monitoring efforts to vernal pools through the City of San Diego's VPHCP.

Altered Hydrology

The listing rule identified altered hydrology, including impacts to the vernal pool watersheds, as a threat to *Pogogyne abramsii* 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 3 of the 43 occurrences in southern San Diego County. This threat has been ameliorated by excluding off-highway vehicle access with the installation of fencing and signage at many of the *P. abramsii* populations managed by the City of San Diego, and the well-fenced nature of most occurrences within MCAS Miramar.

Road Projects

Road project development, such as the extension of Camino Del Sur through vernal pool habitat in Del Mar Mesa (EO 38, H18-23), posed an indirect threat to *Pogogyne abramsii* habitat in the form of edge effects in the 2010 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, off-highway vehicle use was described as an ongoing threat to *Pogogyne abramsii* (Service 1978, p. 44811). Sources of continued off-highway vehicle impacts fall into three categories: recreational (often unauthorized) on private or public property, military activities, and emergency response actions. Impacts from off-highway vehicle use include deep ruts, compact soil, bury seeds, and alter pool hydrology (Bauder 1987, p. 209). Off-highway vehicle use was considered a threat to at least eight occurrences and as a predominant threat on Del Mar Mesa in the 2010 5-year review (Appendix). Since then, installation and maintenance of fencing and signage have helped to reduce impacts from off-highway vehicles, by reducing access, to off-highway vehicles at 6 of 43 occurrences deemed threatened by off-highway vehicle users. However, additional work is needed to help protect *P. abramsii* habitat from ongoing impacts.

Military Activities

MCAS Miramar continues to support the largest contiguous block of habitat and highest number of occupied vernal pools within the range of *Pogogyne abramsii*. The number of vernal pool basins and other seasonally ponded features that contain *P. abramsii* have increased from 2011 to 2016 (**Table 2**) (USMC 2018, p. 5-4). The majority (99 percent) of all vernal pool basins (and seasonally ponded features) containing *P. abramsii* are designated as Level I Management Areas, receiving the highest conservation priority on-base. Some management activities include fencing, posting signs, and developing education programs to create and maintain awareness of the values of vernal pool habitat (USMC 2018, p. 5-2).

Although most vernal pools occupied by *Pogogyne abramsii* on MCAS Miramar receive the highest conservation priority, the military must maintain the flexibility to adapt the defense mission to political and technological developments (Department of Defense Instruction 4715.3

para. F.1. i(4)). For this reason, vernal pool sites on military lands are not considered fully protected, though threats to *P. abramsii* habitat are managed or ameliorated under implementation of the MCAS Miramar INRMP. As of March 30, 2023, we do not anticipate that training activities or military maneuvers will negatively impact *P. abramsii* in the near future (Black 2023a and Black and Clark 2023); however, military activities are considered an ongoing potential threat to all occurrences found on MCAS Miramar and Murphy Canyon in the event that unforeseen circumstances necessitate changes in vernal pool management.

Table 2: Vernal Pool Habitat and *Pogogyne abramsii* Occupancy in MCAS Miramar

***Pogogyne abramsii* Occupancy**	**2016 Totals**	**2011 Totals**
Number of Vernal Pool Basins	4,974	4,825
Number of Other Seasonally Ponded Features	2,761	2,706
Total Number of Vernal Pool Basins and Other Seasonally Ponded Features	7,735	7,531
Total Number of Vernal Pool Basins and Seasonally Ponded Features Occupied by *P. abramsii*	1,165	1,112

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 abramsii* might be affected by unnatural fire regimes (e.g., increased fire frequency or severity) is unknown. Of all extant and presumed extant occurrences, wildfire is only mentioned as a potential threat at the Murphy Canyon vernal pool complex. Vernal pool locations near structures may also be disturbed by fire suppression activities in the event of a wildfire. Fire suppression can affect succession. Complete fire exclusion may lead to *Pogogyne abramsii* being outcompeted for space by plants allowed to mature unabatedly from absence of natural fire regimes. While fire and fire suppression were listed as a potential threat in the 2010 status review (Service 2010, p. 24), we lack information regarding the likelihood and magnitude of this threat.

Human Access and Disturbance

Human access and disturbance (including illegal dumping and trampling) can result in direct crushing of *Pogogyne abramsii*, reducing the survivability of individuals in the basin. Human access through vernal pools also raises the likelihood of spreading nonnative plant species to the area as people can unknowingly carry and deposit seeds lodged in shoes and clothing to the vernal pool. Trampling from pedestrians and bicycle use can also impact the hydrology of vernal pools through soil compaction, which can disrupt water infiltration and weaken the natural integrity of impacted pools. Mountain biking continues to threaten vernal pools in Del Mar Mesa

canyon. Human access and disturbance threaten *P. abramsii* at 10 of the 43 extant and presumed extant sites.

Nonnative Plants

Nonnative plant competition was a historical threat and is an ongoing threat at most occurrences, with 34 of the 43 extant or presumed extant sites being considered threatened by nonnative plants. The greatest threat is the competition with nonnative plant species, primarily nonnative grasses such as *Lythrum hysoppifolia* and *erodium* spp. (City of San Diego 2021, pp. 94, 107, 231, 236, 238, 259, and 266). Potential impacts include competition for space, resources, and pollinators. The City of San Diego currently manages for nonnative plants thereby reducing the magnitude of this impact for applicable sites, but competition with nonnative plants remains a primary threat to the species that requires ongoing management.

Climate Change

The term "climate change" refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2013, p. 1450). Downscaled projections under several future climate scenarios are available for the range of *Pogogyne abramsii*.

Temperature Changes

Southern California has already experienced a warming trend from 1951 to 2006 (Hall *et al.* 2018, p. 9). In San Diego County, Cal-Adapt models project increases in annual average maximum and minimum temperatures between a baseline period (1961 to 1990) and an end of century period (2070 to 2099) (CEC 2023, pp. 2–4). Specifically, between 2070 and 2099, annual average maximum temperatures are projected to increase by 2.7 degrees Celsius (°C) [5.0 degrees Fahrenheit (°F)] under Representative Concentration Pathway (RCP) 4.5, and by 4.5°C (8.2°F) under RCP 8.5 (CEC 2023, p. 3). The frequency, duration, and intensity of heat waves are also expected to increase (Hall *et al.* 2018, p. 12; Kalansky et al. 2018, p. 21).

Precipitation Changes

Climate change has already altered, and will continue to alter, the water cycle. Changes in the water cycle include: (1) changes in precipitation patterns and intensity; (2) changes in the incidence of drought; (3) widespread melting of snow and ice; (4) increasing evaporation; and (5) changes in soil moisture and runoff (USGCRP 2009, p. 41).

Precipitation in southern California is highly variable from year to year (Hall *et al.* 2018, p. 12; Kalansky *et al.* 2018, p. 24). Models of future precipitation generally project small mean changes relative to the historical variability, and the overall direction of future precipitation is unclear (Hall *et al.* 2018, p. 13). Models do project increases in extreme precipitation frequency and intensity (Polade *et al.* 2017, p. 7; Swain *et al.* 2018, p. 428), including increases in the frequency of atmospheric-river storms, which deliver intense precipitation and can cause severe flooding (Dettinger 2011, p. 519). However, droughts are also projected to become more frequent and intense and will be exacerbated by higher temperatures (Kalansky *et al.* 2018, p.

25). As a result, the average annual precipitation will likely not change significantly between baseline observations (1961–1990) and the end of century period (2070–2099); however, precipitation will likely occur during more intense storms and over a shorter rain season. Furthermore, dry years will be more likely to occur consecutively, increasing drought risk (CEC 2023, p. 5).

Potential Effects of Climate Change on *Pogogyne abramsii*

As discussed in the 2010 5-year review, rainfall and temperature both affect the germination rate of and successful reproduction of *Pogogyne abramsii*. We also discussed five factors associated with climate change that may affect the long-term viability of *P. abramsii* occurrences: (1) drier conditions may result in fewer suitable pool complexes, a lower percent germination and smaller population sizes, fewer and less reliable recovery cycles of abundant individuals; (2) higher temperatures may inhibit germination, speed desiccation of pools, affect pollinator services; (3) a shift in the timing of the annual rainfall may favor nonnative species; (4) the timing of pollinator life-cycles may become out-of-sync with timing of flowering *P. abramsii*; and (5) drier conditions may result in increased fire frequency, making the ecosystems in which *P. abramsii* currently grows more vulnerable to the threats of subsequent erosion and nonnative/native plant invasion.

We still lack adequate information to make accurate predictions regarding the effects of climate change to specific sites containing *Pogogyne abramsii*. However, we believe it is likely that changes in temperature and precipitation will exacerbate identified threats and may introduce new additional threats. Continued monitoring of occupied sites and sharing information between scientists, land managers, and decision makers will increase our ability to address these threats moving forward.

Summary of Threats

Nonnative plants are considered the most wide-spread threat to *Pogogyne abramsii* as of this report, followed by military activities, human access and disturbance (including dumping and mountain biking), off-highway vehicle use, altered hydrology, and development. Threats from development, altered hydrology, and off-highway vehicle use appear to have been reduced in intensity since the previous 5-year review, from increased management and monitoring through implementation of the VPHCP. Military activities continue to pose a potential threat to the species on MCAS Miramar, though most vernal pools containing *P. abramsii* are afforded the highest level of protection under the INRMP. Human access and disturbance (including dumping) reportedly increased since the previous 5-year review, which may be a result of increased monitoring of city-owned and managed sites through the VPHCP.

Conservation

Since listing, efforts have been made to conserve and restore high quality habitat supporting *Pogogyne abramsii*. 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. abramsii* and other listed species so that they may be reclassified from endangered to threatened status (Service 1998, p. 153). Appendix F within the recovery plan identifies 19 vernal pool complexes within management areas deemed as necessary to stabilize *P. abramsii*. Of these 19 areas, 16 are considered extant or partially extant, 1 area is presumed extant, 1 area we have no information on, and 1 area is mostly extirpated. The majority of these 19 complexes are conserved and receive ongoing management and monitoring through INRMPs and the VPHCP. Appendix G within the recovery plan identifies 10 vernal pool complexes within management areas deemed as necessary to reclassify *P. abramsii*. In total, 1 complex is considered fully extant, 1 complex is presumed extant, 1 complex has a mix of extant and extirpated occurrences, and 6 complexes are considered extirpated. The remaining complex (F 28) was unable to be precisely located on available vernal pool maps, although it is associated with a larger pool group that is considered occupied by the species (USMC 2018, p 4-10). This complex will require further investigation in the next review of the species. 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 for delisting (Service 2019, p. 2).

Vernal pool conservation of *Pogogyne abramsii* is primarily implemented through the City of San Diego's VPHCP and MCAS Miramar's INRMP[3], of which MCAS Miramar contains more vernal pools occupied by the species than anywhere else.

San Diego Vernal Pool Habitat Conservation Plan

Implementation of the VPHCP will preserve a network of vernal pool habitat in a matrix of open space; protect the biodiversity of these unique wetlands; and define a formal strategy for their long-term conservation, management, and monitoring. Within the City of San Diego VPHCP, all City-owned vernal pools occupied with *Pogogyne abramsii* are conserved and managed. Approximately 368 vernal pools contain *P. abramsii* and occur within the VPHCP Planning Units (**Figure 2**). Of the 368 pools, 337 are within the City of San Diego's jurisdiction and are subject to management under the VPHCP, and 31 pools are outside the City of San Diego's jurisdiction and are not subject to management under the VPHCP (City of San Diego 2019, pp. 251–252).

MCAS Miramar Integrated Natural Resources Management Plan

The MCAS Miramar INRMP continues to guide conservation and management of special status species (including *Pogogyne abramsii*), vernal pool habitat, and other resources on the installation. The INRMP has been updated since the previous 5-year review and is currently in the 2018 iteration, where major changes include updated survey data and an updated inventory of the vernal pools and seasonally ponded features on-site (USMC 2018, p. 1-2).

The implementation of management actions under the INRMP is contingent upon the availability of funding, which varies annually. Some activities are performed on a regular basis, such as yearly removal of invasive plants in upland areas, surveys for federally listed birds and butterflies, annual educational programs on-site regarding sensitive natural resources, and more. Other management actions are carried out as the need arises or opportunistically, including fence

[3] Technically the vernal pools within MCAS Miramar are not legally conserved, but ongoing management and monitoring occur at occupied vernal pools subject to available funding.

and signage repair and informal observations of listed plant species. However, due to budgetary constraints, regular invasive plant removal within vernal pools and focused surveys of listed plant species are not currently feasible. Nonetheless, MCAS Miramar biologists have expressed their intent to establish a more formalized approach to recording their observations of listed vernal pool species in the future (Black 2023c).

In 2013, the Memorandum of Understanding for a Cooperative Integrated Natural Resource Management Program on Military Installations was agreed to by Service, DoD, and the Association of Fish and Wildlife Agencies. This memorandum primarily identified areas where Service can support DoD in the ongoing implementation of their INRMPs, such as through offering staff expertise on natural resources, as well as through cooperative agreements (USMC 2018, pp. 1-2 – 1-3).

Naval Base San Diego Integrated Natural Resources Management Plan

The Naval Base San Diego (NBSD) INRMP guides the conservation and management of natural resources on the installation, including *Pogogyne abramsii*. Murphy Canyon (G1, G2) is the only site on the installation that contains *P. abramsii*, and it is currently managed through the 2021 iteration of the NBSD INRMP. Currently, surveys and trash pickup at the Murphy Canyon vernal pool complex are ongoing, and invasive plant removal occurs dependent on funding availability (U.S. Navy 2021, pp. 8-93–8-94)).

Figure 2: Map of the City of San Diego's Vernal Pool Habitat Conservation Plan (VPHCP) Planning Unit Areas (copied from the VPHCP (City of San Diego 2019, figure 2-1, p. 2-2)).

CONCLUSION

Since 2010, we received new information regarding the distribution, genetics, threats, and conservation of *Pogogyne abramsii*. We updated the status of the vernal pool complexes based on this information. After reviewing the best available scientific information, we conclude that *P. abramsii* 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 some threats associated with development have been ameliorated due to conservation actions, as described above. Though no change is the listing status is recommended at this time, recent conservation efforts (i.e., adoption of the VPHCP) may warrant initiation of a Species Status Assessment in the future to help evaluate new information and inform future recommendations for the species.

RECOMMENDATIONS FOR FUTURE ACTIONS

The recommended actions listed below are to be initiated over the next 5 years. Successful implementation of these actions will reduce threats and provide a better understanding of *Pogogyne abramsii* population health and habitat requirements. We recognize that conservation of this taxon will require cooperation and coordination with partners to minimize impacts from current threats and aid future restoration efforts. The recommended actions listed below include actions from the previous 5-year review and new actions that are relevant to the conservation of *P. abramsii*.

Work with partners to identify opportunities for conservation or preservation of *Pogogyne abramsii* occurrences on private lands. Support land acquisition to meet Habitat Conservation Plan goals. Work with local, State, and Federal partners to identify and leverage funding (i.e., section 6) to acquire *P. abramsii* habitat.

1. Adaptively manage *Pogogyne abramsii* occurrences to maintain, enhance, or restore habitat and reduce threats.

    a. Manage nonnative species in vernal pool habitat.

    b. Coordinate with partners to develop a nonnative species prevention and eradication program for all vernal pool habitat where *P. abramsii* is extant.

    c. Ensure the correct species pallet from a nearby source is being selected for areas during restoration projects inside and outside of the known range for *P. abramsii*.

2. Monitor occurrences (evaluate habitat quality, and threats) and assess management effectiveness.

    a. Conserve *Pogogyne abramsii* seed in an off-site seed bank.

    b. Monitor restored/enhanced habitat to determine their suitability and impact in furtherance of recovery of *Pogogyne abramsii*.

c. Identify the conditions and areas necessary to support all the necessary biotic interactions (e.g., pollination, seed dispersal, population movement) for *Pogogyne abramsii*.

3. Formalize *Pogogyne abramsii* monitoring on MCAS Miramar consistent with the methodology used in the City of San Diego Vernal Pool HCP so that data can be analyzed across the range of the species.

4. Help locate funding to support nonnative plant removal activities within vulnerable vernal pool groups where *Pogogyne abramsii* occurs (i.e., MCAS Miramar).

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FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

☒ Approved

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