

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
Carlsbad, CA**

September 1, 2010

5-YEAR REVIEW
Pogogyne abramsii
(San Diego mesa mint)

I. GENERAL INFORMATION

Purpose of 5-Year Reviews:

The U.S. Fish and Wildlife Service (Service) is required by section 4(c)(2) of the Endangered Species Act of 1973, as amended (Act), to conduct a status review of each listed species at least once every 5 years. The purpose of a 5-year review is to evaluate whether or not the species' status has changed since it was listed (or since the most recent 5-year review). Based on the 5-year review, we recommend whether the species should be removed from the list of endangered and threatened species, be changed in status from endangered to threatened, or be changed in status from threatened to endangered. Our original listing of a species as endangered or threatened is based on the existence of threats attributable to one or more of the five threat factors described in section 4(a)(1) of the Act, and we must consider these same five factors in any subsequent consideration of reclassification or delisting of a species. In the 5-year review, we consider the best available scientific and commercial data on the species, and focus on new information available since the species was listed or last reviewed. If we recommend a change in listing status based on the results of the 5-year review, we must propose to do so through a separate rule-making process defined in the Act that includes public review and comment.

Species Overview:

Pogogyne abramsii (San Diego mesa mint) is an annual herb in the Lamiaceae (mint family) that is restricted to vernal pools in southern California. Plants can reach 30 centimeters (1 foot) or more in height and flowers are arranged in whorls that typically bloom from May or June through early July. *Pogogyne abramsii* was federally listed as endangered under the Act in September 1978 and by the California Endangered Species Act (CESA) in 1979. The listing rule stated that collections of *P. abramsii* are from mesas of western San Diego County, California (USFWS 1978, p. 44810). *Pogogyne abramsii*'s northern limit was on Del Mar Mesa and occurred south throughout Mira Mesa and Kearny Mesa and to the west with a few scattered populations in Tierrasanta. Most occurrences of *P. abramsii* are found on Marine Corps Air Station Miramar (MCAS Miramar). The listing occurred after the Service determined that the existence of *P. abramsii* was threatened by past degradation of and future loss of habitat (USFWS 1978, p. 44810).

Methodology Used to Complete This Review:

This review was prepared by Jennifer McCarthy at the Carlsbad Fish and Wildlife Office (CFWO), following the Region 8 guidance issued in March 2008. We used information from the Recovery Plan, survey information from experts who have been monitoring various localities of this species, and the California Natural Diversity Database (CNDDDB) maintained by the California Department of Fish and Game. The Vernal Pool Recovery Plan, the City of San

Diego's Vernal Pool Inventory, GIS analysis, and personal communications with experts were our primary sources of information used to update the species' status and threats. We received one response from the public in response to our Federal Register notice initiating this 5-year review and information relevant to the taxon being reviewed here is incorporated (L. Hering, U.S. Department of the Navy, *in litt.* 2009; USFWS 2009, pp. 12878–12883). This 5-year review contains updated information on threats to the species and an assessment of that information compared to that known at the time of listing. We focus on current threats to the species that are attributable to the Act's five listing factors. The review synthesizes all this information to evaluate the listing status of the species and provide an indication of its progress towards recovery. Finally, based on this synthesis and the threats identified in the five-factor analysis, we recommend a prioritized list of conservation actions to be completed or initiated within the next 5 years.

Contact Information:

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Lead Field Office: Jennifer McCarthy and Bradd Baskerville-Bridges, Carlsbad Fish and Wildlife Office; (760) 431-9440.

Federal Register (FR) Notice Citation Announcing Initiation of This Review:

A notice announcing initiation of the 5-year review of this taxon and the opening of a 60-day period to receive information from the public was published in the Federal Register on March 25, 2009 (74 FR 12878–12883). One response was received and information relevant to *Pogogyne abramsii* is incorporated in this review.

Listing History:

Original Listing

FR Notice: 43 FR 44810–44811

Date of Final Listing Rule: September 28, 1978

Entity Listed: *Pogogyne abramsii* (San Diego mesa mint), a plant species

Classification: Endangered

State Listing

Pogogyne abramsii was listed by the State of California as endangered in 1979.

Associated Rulemakings: None

Review History:

The Service initiated a status review of *Pogogyne abramsii* on December 8, 1983 (USFWS 1983, p. 55100). The results of the review were published in the Federal Register on July 22, 1985 (USFWS 1985a, p. 29900). No change in status was recommended. A second status review was

initiated on July 22, 1985 (USFWS 1985b, p. 29901) and the results were published in the Federal Register on July 7, 1987 (USFWS 1987, p. 25522). No change in status was recommended. The Service initiated a third 5-year review on November 6, 1991. The status review was completed on September 4 1992 and recommended no change in status. All information and discussion in this 5-year review is based on the date of listing because of the lack of discussion in the 1985, 1987, and 1991 5-year reviews.

Species' Recovery Priority Number at Start of 5-Year Review:

The recovery priority number for *Pogogyne abramsii* is 8C according to the Service's 2009 Recovery Data Call for the Carlsbad Fish and Wildlife Office, based on a 1-18 ranking system where 1 is the highest-ranked recovery priority and 18 is the lowest (USFWS 1983a, pp. 43098-43105). This number indicates that the taxon is a species that faces a moderate degree of threat and has a high potential for recovery. The "C" indicates conflict with construction or other development projects or other forms of economic activity.

Recovery Plan or Outline:

Name of Plan or Outline: Recovery Plan for Vernal Pools of Southern California
Date Issued: September 3, 1998

II. REVIEW ANALYSIS

Application of the 1996 Distinct Population Segment (DPS) Policy:

The Endangered Species Act defines "species" as including any subspecies of fish or wildlife or plants, and any distinct population segment (DPS) of any species of vertebrate wildlife. This definition of species under the Act limits listing as distinct population segments to species of vertebrate fish or wildlife. Because the species under review is a plant, the DPS policy is not applicable, and the application of the DPS policy to the species' listing is not addressed further in this review.

Information on the Species and its Status:

Little background information for *Pogogyne abramsii* was provided in the original listing rule. Therefore, the following sections on the habitat requirements, biology and life history, distribution, abundance, and genetics include information available at the time of listing as well as more recent information.

Species Description

Pogogyne abramsii (San Diego mesa mint), is an annual herb in the Lamiaceae (mint family) that is restricted to vernal pools in southern California. Plants can reach 30 centimeters (1 foot) or more in height and flowers are arranged in whorls that typically bloom from May or June through early July. The plants usually give off a strong, sweet mint odor. In the past *P. abramsii* has been misidentified as *P. nudiuscula*, which also occurs in San Diego County. There are

several distinct differences between the two species: *P. abramsii* usually has two flowers per node while *P. nudiuscula* has six or more; the vegetative portions of *P. abramsii* develop a reddish tinge during maturation, while *P. nudiuscula* doesn't develop this reddish tinge until after the flowering period; *P. abramsii* has a hairy calyx, while *P. nudiuscula* has a smooth calyx; and the bracts and leaves of *P. abramsii* are narrower than *P. nudiuscula* (Howell 1931, p. 120; Munz 1974, p. 532; USFWS 1998a, pp.11-14).

Habitat

Pogogyne abramsii is found in vernal pool (seasonal depression wetlands) habitat in San Diego County. Little species-specific data exists detailing *P. abramsii* habitat requirements other than it is found exclusively associated with vernal pools. It is often found with *Eryngium aristulatum* var. *parishii* (San Diego button-celery) and the San Diego fairy shrimp (*Branchinecta sandiegonensis*). Vernal pools containing *P. abramsii* typically occur on gravelly loams that are saturated or inundated seasonally, subsequently dry out and remain dry for about 6 to 8 months through the summer. The surface substrates are underlain by a subsoil of clay, or by a silica-cemented hardpan layer that prohibits drainage and creates a perched water table that forms the vernal pool. Vernal pools that support *P. abramsii* are found on Redding soils, the second most common of the five pool-supporting soils in San Diego County (Beauchamp 1979, p. 26; Bauder and McMillan 1998, pp. 61–62). These are well-drained gravelly loams that have gravelly clay subsoil and a hardpan (USDA 1973, p. 71). Soil moisture late in the season is probably as important as is actual duration of standing water for this species as “poor tolerance of drought may play an important role in restricting the species to pool basins where soils are saturated for longer periods and retain water in the spring” (Bauder 1989, p. 1087).

Vernal pools form in swales, shallow drainages, and depressions that are part of an undulating landscape where soil mounds are interspersed with basins, all above water-impervious soil layers. This landscape is called “mima-mound” topography (Cox 1984, p. 1397). Historically, for convenience of reference, groups of vernal pools are sometimes referred to as vernal pool complexes that may include two to several hundred individual vernal pools (Keeler-Wolf et al. 1998). Pools range in size from 10 to 164 feet (3 to 50 meters) across (Zedler 1987, p. 1). In recent history, more and larger pools existed, but most of this habitat has been developed. Vernal pools within a complex are generally hydrologically connected such that water flows over the surface from one vernal pool to another or water flows and collects below ground, saturating the soil and filling the pool with water (Hanes et al. 1990, p. 51). Vernal pool complexes are best described from a watershed perspective, which includes all areas needed to collect rainfall and adequately fill the vernal pools within the complex. Hydrology (movement and distribution of water) is an important factor in the natural history of a vernal pool and is directly related to the pool's capacity to sustain a diversity of biota. Some pools in a complex have substantial watersheds that contribute to filling the vernal pools, while others fill almost entirely from direct rainfall (Hanes et al. 1990, p. 53; Hanes and Stromberg 1998, p. 38). Subsurface inflows from surrounding soils may be an important factor in filling some vernal pools (Hanes et al. 1990, p. 51; Hanes and Stromberg 1998, p. 48). Surface and subsurface lateral flows between vernal pools and the surrounding uplands influence the onset and level of inundation, and the seasonal drying of vernal pools (Hanes and Stromberg 1998, p. 46). The inundation/drying cycles of the pool dictate the distribution and phenology of vernal pool species as well as the colonization of

upland and wetland vegetation (Bauder 2005, p. 2130). Changes to this hydrology caused by development or other disturbance can impact the capacity of the pool to support various taxa. Vernal pools support unique vegetation and a diversity of rare species including *Pogogyne abramsii*. Typically vernal pool species require a certain amount and duration of inundation each year. The vernal pool habitat is neither terrestrial nor aquatic, but rather a combination of both (Bauder 2000, p. 44; Zedler 1987, p. 1). *Pogogyne abramsii* is considered an obligate wetland species (found almost always in wetland areas), but is more tolerant of the inundation/drying cycles of vernal pool habitat than a true wetland plant. Our definition and understanding of *P. abramsii* habitat has not significantly changed since listing. It is adapted to a natural hydrological regime consisting of seasonal inundation and drying of the vernal pool or the vernal pool complex.

Species Biology and Life History

Pogogyne abramsii seeds germinate depending on the inundation and drying cycles of vernal pools. For many vernal pool plant taxa, temperature and moisture affect the timing of plant germination (Myers 1975, p. 67). The link between the onset of germination, temporal conditions associated with vernal pool inundation, temperature, and moisture are critical to the germination, maturation, flowering, and fruiting of *Pogogyne abramsii*. The interaction of these factors provides the plants favorable conditions in the spring rather than in the summer, autumn, or winter. Natural differences in the precipitation and the inundation/drying time of vernal pools from year to year may influence the distribution and abundance of *P. abramsii*. These environmental factors make it difficult to obtain an accurate measure of the population. Additionally, a portion of the population is represented by seeds remaining in the seed bank and is not accounted for each year.

Pogogyne abramsii usually blooms in May and June when water is absent from the vernal pool (Munz 1974, p. 531). The plants produce fruit, dry out, and senesce in the hot, dry summer months. Pollination of *P. abramsii* was described by Schiller et al. (2000, p. 392) by monitoring insect visitors to individual plants on Del Mar Mesa. They found the Eurasian honey bee (*Apis mellifera*) and two anthophorid bees (*Exomalopsis nitens* and *E. torticornis*) to be the most common and likely pollinators of *P. abramsii*. They also documented that *P. abramsii* is self-fertile but has greater seed set when cross-pollinated (Schiller et al. 2000, p. 393).

Zedler and Black (1992, p. 4) found that *Pogogyne abramsii* seeds germinated and grew from pellets of brush rabbits and Audubon's cottontail rabbits (*Sylvilagus bachmani* and *S. auduboni*), which were collected from vernal pools on Del Mar Mesa and Miramar Mesa. They postulated that rabbit movement may be a potential mechanism for dispersal and genetic mixing of vernal pool obligate species. In addition *P. abramsii* seeds float, which may result in limited dispersal opportunities when pools interconnect or lakes fill their basins in years of greater than average precipitation (Scheidlinger 1981, p. 54).

Spatial Distribution

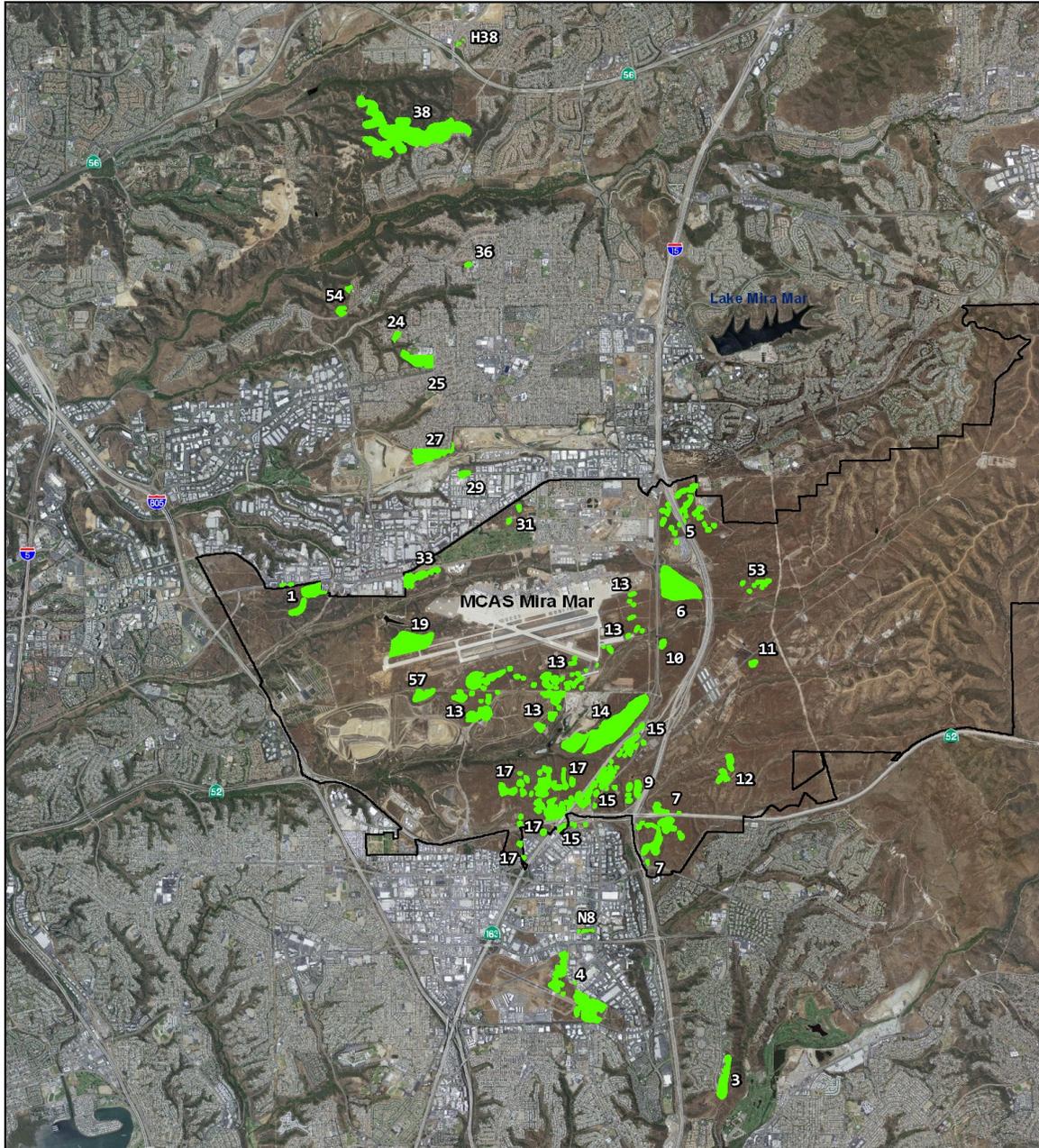
The listing rule describes collections of *Pogogyne abramsii* as being from vernal pools on mesas of western San Diego County, CA; specific occurrence and range information was not included

(USFWS 1978, p. 44810). 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 (Figure 1). Examination of occurrence data from the time of listing (Bauder 1986a; CNDDDB 2010) suggests that the distribution of *Pogogyne abramsii* has decreased since its listing in 1978. *Pogogyne abramsii* was extirpated from pool complexes in the most southern and northern extremities of its range (EOs 49, 56); *Pogogyne abramsii* was extirpated from at least one pool complex in 12 of the 13 geographic areas where it was known to occur since listing (Appendix 1). No new extant occurrences have been detected since the time of listing, though it has been restored at multiple mitigation sites (Appendix 1). Historically, outside of *Pogogyne abramsii*'s current range, it is thought to have occurred around Linda Vista, the vicinity of Balboa Park, Normal Heights, and the area surrounding San Diego State University (USFWS 1998a, p. 12; Zedler et al. 1979), however some confusion has existed regarding *P. abramsii*'s historical range due to misidentified herbarium specimens (identified as *Pogogyne nudiuscula*) and vague references regarding collection sites.

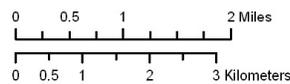
The California Natural Diversity Data Base (CNDDDB), maintained by the California Department of Fish and Game (CDFG), has been a repository for information on the location and the status of rare taxa in California, including *Pogogyne abramsii*, for over 30 years. The data are chronologically and cumulatively recorded by localities that are assigned element occurrence (EO) reference numbers. The CNDDDB currently recognizes 42 separate element occurrences (EOs) for *P. abramsii* (CNDDDB 2010). Appendix 1 lists the distribution of *P. abramsii* occurrences throughout its known range. We grouped elemental occurrences that are geographically and hydrologically connected in the discussions in this review and in Appendix 1. Also, as these occurrences may include several vernal pool complexes with unique threats, we discuss these more specific threats to *P. abramsii* in terms of vernal pool complexes identified by Bauder (1986a) and the City of San Diego's Vernal Pool Inventory (2004, p. 8).

Abundance

No estimate of numbers of *Pogogyne abramsii* plants was included in the listing rule. Local site conditions, rainfall, and fresh water pooling likely influence numbers of standing plants and their local distribution (Schiller et al. 2000, pp. 386–387). Like most annual plants, the germination success of *P. abramsii* differs annually depending, on temperature, timing, and rainfall. The number of individuals may differ at each site for any year because it also depends, upon reproductive success of previous cohorts, the number of seeds deposited in the soil seed bank, and the survivorship of the annual seedling cohort in the year the survey was conducted. Little data exists describing the abundance and population trends of *P. abramsii*. In 2003 the City of San Diego conducted a survey of vernal pools within their jurisdiction; this did not include occurrence data from MCAS Miramar, which is where most of the known extant occurrences of *Pogogyne abramsii* are found. *Pogogyne abramsii* was found in 373 of the 1142 vernal pools surveyed, with a mean percent cover per pool of 6.2 percent (City of San Diego 2004, p. 11).



PRODUCED BY GIS SERVICES
CARLSBAD FIELD OFFICE
MAP DATE: 8/17/10
DATA SOURCE: FWS, CNDDB, CITY OF SAN DIEGO
IMAGE SOURCE: NAIP 2009
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 Vernal pools with extant occurrences of *Pogogyne abramsii*
 MCAS Mira Mar



Figure 1: Distribution of extant occurrences of *Pogogyne abramsii* (San Diego mesa mint); produced for the FY2010 5-year review.

Changes in Taxonomic Classification or Nomenclature

Neither the taxonomic classification nor the nomenclature of *Pogogyne abramsii* has changed since listing.

Genetics

The genetic variation and diversity of the genus *Pogogyne* has recently been investigated as part of the Master's project of Michael Silveira at San Diego State University (M. Silveira pers. comm. 2009). The research was conducted on all seven extant species throughout their ranges and found that *P. abramsii* and *P. nudiuscula* are the most closely related of all the *Pogogyne* species. Additionally, his results support previous suggestions of a new and undefined species in northern Baja California, Mexico near Villa de Las Palmas. This research was unable to more clearly distinguish the historical range of *P. abramsii* and *P. nudiuscula* in the central part of San Diego County. The herbarium samples collected from Linda Vista, Balboa Park, and Mission Valley were too old to extract viable genetic material.

Species-specific Research and/or Grant-supported Activities

The only species-specific research on *Pogogyne abramsii* is described above in the Genetics section.

Vulnerability Factors

Species may be vulnerable to threats for a variety of reasons. Primack (2006, p. 159) outlined five categories of species considered most vulnerable to extinction as:

- 1) Species with very narrow geographical ranges;
- 2) species with only one or a few populations;
- 3) species in which population size is small (identified as one of the best predictors of species extinction rate);
- 4) species in which population size is declining; and
- 5) species that are hunted or harvested by people.

Consideration of these categories and its life history traits can provide a vulnerability profile for *Pogogyne abramsii*. Fiedler and Ahouse (1992, p. 32) consider ecology, biotic competition, population dynamics, reproductive biology, and genetics among the factors affecting the rarity of a plant taxon, which would be reflected in numbers two and three above. These traits may render the species more vulnerable to the threats discussed below and must be considered in management actions. Vulnerability factors for *P. abramsii* include the following:

- 1) The species is an obligate vernal pool species.
- 2) The range of the species is naturally discontinuous.
- 3) *Pogogyne abramsii* is distributed on approximately 19.2 acres (ac) (7.8 hectares (ha)) of vernal pool basins on MCAS Miramar, and approximately 0.8 ac (0.3 ha) outside

the boundary of MCAS Miramar (U.S Marine Corp 2006 p. 5-4; City of San Diego 2004, p. 11).

Life history and habitat specificity traits create natural limitations for *Pogogyne abramsii*. The threats described below in the five-factor analysis exacerbate the vulnerabilities described above.

Five-Factor Analysis

The listing rule reported road-widening, development, off-highway vehicles (OHVs), and illegal dumping as threats to *Pogogyne abramsii*. New Factor A threats to *P. abramsii* identified since listing include military activities, alteration of hydrology, and nonnative plants. The following five-factor analysis describes and evaluates the threats attributable to one or more of the five listing factors outlined in section 4(a)(1) of the Act.

FACTOR A: Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range

The listing rule described several road-widening projects as threats to habitat occupied by *Pogogyne abramsii* (Miramar Road, Highway 163, Highway 52), as well as housing development, OHV use, and illegal dumping. The rule also stated that some of the historical habitat at Otay mesa was in agricultural use (USFWS 1978, p. 44811). While a number of vernal pools on Del mar Mesa were lost to tomato fields, agriculture no longer appears to impact habitat and is not considered a current threat to *P. abramsii*. Impacts from development include more than building of homes and will be discussed under the broader term urban development. Military activities, altered hydrology and nonnative plants are new threats identified since listing. The magnitude of threats to habitat where *P. abramsii* occurs is discussed below under the categories of road widening, urban development, OHVs, military activities, alteration of hydrology, illegal dumping, and nonnative plants.

Road Widening

The listing rule stated that widening Miramar Road and Highway 163 and construction of Highway 52 would destroy vernal pools in the Miramar Mounds National Natural Landmark (vernal pool complexes U15, BB, U north, and U19 on Kearny Mesa at EOs 17 and 18). These and other projects have since been completed (Miramar Road, Highway 163, and Highway 52) and did adversely impact *Pogogyne abramsii* (Appendix 1). Vernal pools that were impacted within these complexes (clearing of natural vegetation and discing of surfaces) were restored (Black and Zedler 1998, p. 195). The individual vernal pools within these complexes that were destroyed were mitigated offsite with the purchase of portions of the vernal pool complexes in the A, B, and H series (Bauder 1986a, p. 20). In 1999-2000 MCAS Miramar restored about 170,000 square feet of vernal pool surface in the Miramar Mounds National Natural Landmark to mitigate for the Base Realignment and Closure of MCAS Miramar (USFWS 1996, p. 3; U.S. Marine Corps 2006, p. 7-22). Additionally, since listing, the pool complexes on Kearny Mesa along the Highway 163/Highway 805 interchange (EO 45) and pools along Miramar Road in Rose Canyon (EO 1, Highway 52; pool complex I 6A) were extirpated (Appendix 1). Pool complex LL (EO 49) on Amaya Road and complexes in Mission Valley-Mesa South, which

represent the most southerly and easterly occurrences, were extirpated from roads and development.

Since listing, road projects have continued to impact *Pogogyne abramsii* occurrences. Though future work on Highway 163, Highway 52, Interstate 15, or Miramar Road could impact *P. abramsii* habitat, we don't currently consider road widening projects a direct threat. Camino Del Sur is being extended through vernal pool habitat in Del Mar Mesa (EO 38, H18-23) and while no direct impacts from the road are expected to impact *P. abramsii*, indirect impacts such as edge effects are possible (S. Wynn, 2010, pers. obs.). Edge effects to *P. abramsii* are evident as a result of road widening projects, creating outer bands of habitat distant from the center but immediately proximal to a different type of habitat, thus providing a different species composition and abundance divergent from the interior of the habitat (Forman and Gordon 1986, p. 108). These edges may allow *P. abramsii* to be in closer proximity to disturbed areas, which may facilitate the incursion of invasive, nonnative plants. Edge effects degrade extant interior habitat and create an island of the protected habitat/reserve through isolation and decrease the effective size and serviceability of a conservation area (Diamond and May 1976, pp. 228–252). Characteristics of habitat islands include less resistant habitat, more disturbed habitat, areas more susceptible to invasive species, areas with native species less resistant to disturbance, and higher seed immigration (Meyers and Bazely 2003, pp. 34-50). Further development of the roads mentioned above and surrounding areas would exacerbate these impacts.

Urban Development

Housing development at the end of Mira Mesa road was described as a primary threat in the listing rule (USFWS 1978, p. 44810) and impacts from this threat (now termed urban development) continue to threaten *Pogogyne abramsii* habitat at 12 EOs containing 14 vernal pool complexes (Appendix 1). Urban development and associated activities including filling, grading, discing, leveling, and other activities may result in the destruction and modification of vernal pools and their watersheds. Such development can result in direct impacts to *P. abramsii* habitat and isolation of pools and fragmentation of pool systems; this may create barriers to dispersal, such that pollination and reproductive output may be inhibited (Schiller et al 2000, p. 395). Development can also cause alterations in the hydrology of adjacent pools that may cause disruption of hydrological systems. Biotic and abiotic habitat factors including potential means of seed dispersal (rabbits, floating seeds) (Zedler and Black 1992, p. 2) may also be impacted. Whenever development impacts vernal pools in a complex, some degree of fragmentation occurs within and among complexes. Habitat degradation and alteration may therefore result in a population decline because *P. abramsii* has specific habitat requirements (e.g. soil type, water depth).

Impacts from urban development have decreased since listing, because of protections afforded under the Act and the Clean Water Act, and in more recent years because of protection and conservation measures associated with regional Habitat Conservation Plans (HCPs). Appendix 1 shows that 13 of the 17 vernal pool complexes containing *Pogogyne abramsii* that are not on military lands are considered conserved (through section 7 consultations (see Factor D) prior to the San Diego Multiple Species Conservation Program (MSCP)). Sites are designated conserved according to the following criteria: because they occur on land covered by a conservation

easement, dedicated in fee title to the City for mitigation purposes, or designated City open space (CSD 2004, p. 8). The Service and CDFG approved the MSCP in July 1997. With regard to vernal pool habitat, the subregional MSCP and its component subarea plans established a conservation program to conserve approximately 171,990 acres (ac) (69,602 hectares (ha)) of land in San Diego County, including 3254 ac (1,317 ha) of vernal pool habitat. All vernal pool complexes containing *Pogogyne abramsii* that lie within the MSCP, fall within the jurisdiction of the City of San Diego Subarea Plan. The MSCP and City of San Diego Subarea Plan require conservation of vernal pool habitat to ensure no net loss of acreage and habitat functions and values, and require avoidance of impacts to vernal pools to the maximum extent practicable both inside and outside of the preserve planning areas. Also, impacts that cannot be avoided are minimized and mitigated to the maximum extent practicable (USFWS 1998a, p. 51). Under provisions of the MSCP, 9 of 11 pool complexes within the MSCP are at least partially conserved and protected from most threats attributable to Factor A. Outside of the MSCP, four of six vernal pool complexes containing *P. abramsii* are conserved. *Pogogyne abramsii* occurrences on MCAS Miramar are currently protected from direct effects of urbanization and this is further discussed under Factor D. No development projects on MCAS Miramar are currently planned which would impact *P. abramsii* habitat (Kassebaum, MCAS Miramar, pers. comm. 2010).

On April 20, 2010, the City of San Diego surrendered permit coverage for seven vernal pool species as a result of litigation (*Center for Biological Diversity v. Bartel*, 98-CV-2234 (S.D.Cal.)). The City is currently revising its subarea plan to restore coverage for those species (see Factor D section for further explanation). The Service accepted the City's relinquishment of coverage for vernal pool species in the MSCP and on May 14, 2010, issued a revised permit covering 78 listed and unlisted species. *Pogogyne abramsii* is no longer a covered species under the Federal permit for the City of San Diego's Subarea Plan under the MSCP. However we are assisting the City with the development of a new vernal pool species HCP that will protect vernal pool species and their habitat within the City. Because known occupied pools have already been conserved, these will not be affected by the relinquishment of coverage. In addition, the state permit is still in effect as are the City's Environmentally Sensitive Lands Ordinance.

Since listing, many *Pogogyne abramsii* occurrences impacted by approved development have been restored, partially restored (may include reshaping the basin, transplantation of inoculum containing *P. abramsii* seeds), or pools have been created to mitigate unavoidable losses (Appendix 1). These mitigation efforts are designed to help offset impacts from development of vernal pool habitat and are required under the MSCP; however, the long-term viability of such efforts remains unclear (Black and Zedler 1998). While restructured and inoculated pools (which represents the most intensive of restoration treatments) present a much more "natural" appearance than disturbed pools, the degree to which these pools resembles the original pools is unknown (Black and Zedler 1998, p. 197). Black and Zedler (1998, p. 205) also state that "there is no assurance of success, and restored pools, unless restored from only minor disturbance, do not have the same historic and scientific interest as undisturbed pools." Successful restoration must include long-term maintenance and monitoring to ensure that the *P. abramsii* and other vernal pool species persist. Development continues to threaten *Pogogyne abramsii*, and will not, in the foreseeable future, be reduced as a threat until sufficient private land supporting vernal pools has been conserved or purchased for reserves.

Off-Highway Vehicles (OHVs)

At the time of listing, OHV use was described as an ongoing threat to *Pogogyne abramsii* (USFWS 1978, p. 44811). Sources of continued OHV impacts fall into three categories: recreational (often illegal) on private or public property, military activities, and emergency response actions. Since listing, OHV activity has impacted several pool complexes containing *P. abramsii* by altering hydrology and degrading habitat. Appendix 1 lists 11 pool complexes known to be threatened by OHV use, however, more occurrences are likely impacted due to unreported, unpermitted activity. Most of these accounts are of recreational vehicles trespassing on protected property despite efforts of landowners or land managers to deter them by installing fencing and signage. To a lesser degree, OHV use for emergency response (e.g., fire suppression and aviation emergencies), law enforcement and military actions may impact *P. abramsii* habitat. In 2009, pool complex HH1+ (EO 19) on MCAS Miramar was negatively impacted by unpermitted OHV use (Kassebaum, pers. comm. 2010). Signs and fencing have been put up to deter future OHV use, and repairs have been made; the number of *P. abramsii* plants appears to be increasing within basins of this complex. Additionally, recreational OHV use may have contributed to the extirpations of *P. abramsii* on Del Mar Mesa, at Los Penasquitos Canyon, and at Rose Canyon North (Appendix 1).

OHV use remains a threat to at least eight EOs including (11 vernal pool complexes), and is a predominant threat on Del Mar Mesa (Appendix 1). Installation and maintenance of fencing and signage are needed to help protect *P. abramsii* habitat from the impact of OHV users.

Military Activities

While not identified as a threat at listing, military activities may negatively impact *Pogogyne abramsii* habitat and are considered a current threat to 15 EOs identified in Appendix 1. Over 70 percent of the remaining vernal pool complexes occur on lands within military jurisdiction (USFWS 2008, p. 16). On MCAS Miramar there is an estimated 7531 pool basins covering approximately 94.7 ac (38 ha) (Kassebaum 2010, pers. comm.). MCAS Miramar supports the largest contiguous block of habitat and the highest number of occupied vernal pools within the range of *P. abramsii* (25 complexes with an estimated 1,112 pools containing *P. abramsii*) (Kassebaum 2010, pers. comm.) (Appendix 1). Military activities may include but are not limited to: construction and maintenance of installation infrastructure (roads, runways, and buildings, etc.) in correlation to increased use of training areas, military maneuvers, construction of military facilities, and training. *Pogogyne abramsii* habitat is found on the military facility MCAS Miramar (U.S Marine Corps) and Murphy Canyon Heights (U.S Navy). The Base Closure and Realignment Act (BRAC) (U.S. Marine Corp 1996) is one such example that impacted *P. abramsii* habitat (EO 13). Mitigation efforts to vernal pools affected by BRAC included preservation at a 1:1 ratio, restoration at a 2:1 ratio, monitoring, and site evaluation. Conservation and management of vernal pool habitat on MCAS Miramar is critical to the persistence of this species, and the five other endangered and threatened species that co-occur on this facility.

Provisions under the Integrated Natural Resources Management Plan (INRMP) guide conservation and management of *Pogogyne abramsii* habitat on MCAS Miramar (see Factor D for further discussion). 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 ameliorated under the INRMP. As of July 2010, no training activities or military maneuvers are planned that are expected to negatively impact *P. abramsii* in the near future (Kassebaum pers. comm. 2010); however military activities are considered a potential threat to all extant occurrences found on MCAS Miramar in the event that unforeseen circumstances necessitate changes in vernal pool management.

Alteration of Hydrology

Alteration of hydrology is an indirect, potential threat to all occurrences otherwise threatened by development, road widening, OHVs, military activities, and illegal dumping. These activities and modifications to upland areas surrounding a vernal pool can negatively affect the pool's hydrology, even if such modifications occur outside the pool's surface watershed. For example, grading cuts near pools can accelerate the flow of water out of the subsoil (Bauder 1986b, p. 210). As such, graded slope-cuts adjacent to the watersheds of depressional features may result in "leakage" of water out of the watersheds thereby altering the timing, frequency, and duration of vernal pool inundation as well as water temperature. Because *Pogogyne abramsii* is dependent on the timing and length of inundation, alterations like that just described may prevent plants from germinating and establishing populations. Additionally, altered hydrology may allow runoff from adjacent developments to introduce pollutants that could alter aspects of water chemistry such as pH, alkalinity, and salinity and make a vernal pool inhabitable by *P. abramsii*. Evidence suggests that run-off provides an increased nutrient load that may allow algal mats to flourish, thereby inhibiting vernal pool plants or altering competitive interactions (Kneitel and Lessen 2009, p. 7).

Although altered hydrology continues to impact this species at six EOs (six vernal pool complexes), the Service has been successful in ensuring implementation of measures to reduce this threat through section 7 consultations. For example, the use of best management practices reduces the amount of runoff entering vernal pool watersheds, and restoration projects are designed to minimize water draining off impervious surfaces into vernal pool watersheds. However, the specific impact runoff has on *Pogogyne abramsii* is unknown because site specific monitoring has not been conducted. Preserved pools should be monitored for these runoff impacts to identify remediation where feasible and prevent further damage to vernal pool systems.

Illegal Dumping

Illegal dumping was identified as a threat at listing and continues to impact *Pogogyne abramsii* habitat at Carroll Canyon (EO 27), Del Mar Mesa - Deer Canyon (EO 38, 41; H 17), and Rose Canyon (EO 1) (Appendix 1). Additionally, pool complexes in Murphy Canyon (EO 3) have served as dump sites for domestic refuse in the past (Black and Zedler 1998, p. 203). Trash and other materials can decrease the amount of space available to vernal pool species, disturb the

soils, and release toxic substances and pollutants which may make vernal pools inhospitable to *P. abramsii*. Fencing and monitoring may decrease the impact of this threat on protected lands, however illegal dumping and deterrence on private lands are difficult to control making this a continuing threat to *P. abramsii*.

Nonnative Plants

Impacts from nonnative plants has been identified as a threat to *Pogogyne abramsii* in 19 EOs including 32 pool complexes (Appendix 1). More occurrences and pool complexes may face this threat, but the threat has not been reported. Invasive nonnative plants have long been considered a concern in vernal pool habitat (Holland 1988, p. 1014). Invasive plants have the potential to alter vernal pool habitat by lowering extant water tables and altering rates of sedimentation and erosion by altering soil chemistry, nutrient levels and physical structure of soil. Some of these biological impacts include competition with *Pogogyne abramsii* for water, soil nutrients, space above and below ground, and usurpation of natural pollinators.

Nonnative species of grasses and forbs invade many plant communities often as an indirect result of habitat disturbance. Invasive nonnative plants that may impact habitat where *Pogogyne abramsii* occurs are divided into three groups: (1) upland species with less tolerance for inundation, (2) plants with inundation tolerance comparable to native vernal pool species, and (3) marsh or wetland species that require a long inundation period (USFWS 1993, p. 41389; Bauder 1996, p. 2). Altered hydrology can change the inundation period of an area and indirectly affects species that are less or more water tolerant than native vernal pool species, resulting in elimination from or invasion into vernal pool habitat (Bauder 1986b, p. 210). Alternatively, if natural hydrology persists, the number of nonnatives able to invade may be limited by the inundation period (Bauder 1996, p. 2). Additionally, run-off and manure dumping can change soil chemistry and facilitate invasives in normally unfavorable areas. These alterations lead to a greater likelihood of invasion by nonnative species (Bauder 2005, p. 2134).

Development and other threats that disturb vernal pool habitat allow certain invasive nonnative plants, such as those discussed above, to invade and replace *Pogogyne abramsii*. Invasive nonnatives pose the biggest threat to *P. abramsii* and other vernal pool obligates on MCAS Miramar (Kassebaum pers. comm. 2010), specifically, invasive grasses and bromes (e.g *Agrostis* spp. and *Bromus* spp.) which outcompete *P. abramsii* at the drier edges of vernal pools. Therefore, we consider invasive nonnative plants to be a continuing threat to *P. abramsii*.

Summary of Factor A

In summary, road widening and maintenance, urban development, OHV use, military activities, alteration of watershed, and illegal dumping, all continue to threaten habitat that supports *Pogogyne abramsii* at 11 of the 12 geographic locations it occurs. Impacts from invasive species is the prominent rangewide threat to *P. abramsii* populations and is exacerbated by disturbance associated with other threats (e.g. development, OHV use). While the impacts of development and altered hydrology have decreased, these remain the prominent threats to *P. abramsii*. Military activities remain a threat to most occurrences on MCAS Miramar, though most vernal pools containing *P. abramsii* are afforded the highest level of protection under the base INRMP.

Destruction, modification, and curtailment of *P. abramsii* habitat may continue, especially in areas where urbanization is expected to expand.

FACTOR B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Overutilization for commercial purposes was not known to be a factor in the 1978 final listing rule (USFWS 1978, p. 44811). Overutilization for any purpose does not appear to be a threat at this time.

FACTOR C: Disease or Predation

Disease or predation was not known to be a threat at the time of listing (USFWS 1978, p. 44811) and does not appear to be a threat at this time.

FACTOR D: Inadequacy of Existing Regulatory Mechanisms

At the time *Pogogyne abramsii* was listed as endangered under the Act, it was not protected by any other regulatory mechanisms. In the listing rule inference was made to potential protections under the California Native Plant Protection Act (NPPA) passed in 1977 (USFWS 1978, p. 44811); however, at the time *P. abramsii* was not recognized by the State as rare or endangered.

The following discussion describes State and Federal laws and regulations relevant to conservation of *Pogogyne abramsii*. These measures have greatly reduced or eliminated the threat of destruction of plants and habitat of *P. abramsii*.

State Protections

State laws potentially providing protection to *Pogogyne abramsii* include CESA, NPPA, California Environmental Quality Act (CEQA), and the Natural Communities Conservation Planning (NCCP) Act enacted in 1991. *Pogogyne abramsii* was not a State-listed species at the time it was federally listed.

California Endangered Species Act (CESA) and Native Plant Protection Act (NPPA)

Protections have been afforded to *Pogogyne abramsii* since the species was listed as endangered by the State in 1979. Both the NPPA and CESA include prohibitions forbidding the “take” of State-listed species (Chapter 10, Section 1908 and Chapter 1.5, Section 2080, CFG code). With regard to prohibitions of unauthorized take under NPPA, landowners are exempt from this prohibition for plants to be taken in the process of habitat modification. Where landowners are notified by the State that a rare or endangered plant is growing on their land, the landowners are required to notify CDFG 10 days in advance of changing land use in order to allow salvage of listed plants. Sections 2081(b) and (c) of CESA allow CDFG to issue incidental take permits for State-listed threatened and endangered species if:

- 1) The authorized take is incidental to an otherwise lawful activity;
- 2) the impacts of the authorized take are minimized and fully mitigated;
- 3) the measures required to minimize and fully mitigate the impacts of the authorized take are roughly proportional in extent to the impact of the taking of the species, maintain the applicant's objectives to the greatest extent possible, and are capable of successful implementation;
- 4) adequate funding is provided to implement the required minimization and mitigation measures and to monitor compliance with and the effectiveness of the measures; and
- 5) issuance of the permit will not jeopardize the continued existence of a State-listed species.

California Environmental Quality Act (CEQA)

CEQA is the principal statute mandating environmental assessment of projects in California. The purpose of CEQA is to evaluate whether a proposed project may have an adverse effect on the environment and, if so, to determine whether that effect can be reduced or eliminated by pursuing an alternative course of action or through mitigation. CEQA applies to projects proposed to be undertaken or requiring approval by State and local public agencies (http://www.ceres.ca.gov/topic/env_law/ceqa/summary.html). CEQA requires disclosure of potential environmental impacts and a determination of "significant" if a project has the potential to reduce the number or restrict the range of a rare or endangered plants, including *Pogogyne abramsii*; however, projects may move forward if there is a statement of overriding consideration. If significant effects are identified, the lead agency has the option of requiring mitigation through changes in the project or to decide that overriding considerations make mitigation infeasible (CEQA section 21002). Protection of listed species through CEQA is, therefore, dependent upon the discretion of the lead agency involved.

The Natural Community Conservation Planning (NCCP) Act

The NCCP program is a cooperative effort between the State of California and numerous private and public partners with the goal of protecting habitats and species. An NCCP program identifies and provides for the regional or area-wide protection of plants, animals, and their habitats, while allowing compatible and appropriate economic activity. The program began in 1991 under the State's NCCP Act (CFG Code 2800-2835). The primary objective of the NCCP program is to conserve natural communities at the ecosystem scale while accommodating compatible land uses (<http://www.dfg.ca.gov/nccp/>). Regional NCCPs provide protection to federally-listed species by conserving native habitats upon which the species depend. Many NCCPs are developed in conjunction with HCPs prepared pursuant to the Act. The City of San Diego Subarea Plan under the Multiple Species Conservation Program (MSCP) is discussed below under the Act.

Federal Protections

National Environmental Policy Act (NEPA)

NEPA (42 U.S.C. 4371 *et seq.*) provides some protection for listed species that may be affected by activities undertaken, authorized, or funded by Federal agencies. Prior to implementation of such projects with a Federal nexus, NEPA requires the agency to analyze the project for potential impacts to the human environment, including natural resources. In cases where that analysis reveals significant environmental effects, the Federal agency must propose mitigations that could offset those effects (40 C.F.R. 1502.16). These mitigations usually provide some protection for listed species. However, NEPA does not require that adverse impacts be fully mitigated, only that impacts be assessed and the analysis disclosed to the public.

Clean Water Act (CWA)

Under section 404, the U.S. Army Corps of Engineers (Corps) regulates the discharge of fill material into waters of the United States, which include navigable and isolated waters, headwaters, and adjacent wetlands (33 U.S.C. 1344). In general, the term “wetland” refers to areas meeting the Corps’ criteria of hydric soils, hydrology (either sufficient annual flooding or water on the soil surface), and hydrophytic vegetation (plants specifically adapted for growing in wetlands). Any action with the potential to impact waters of the United States must be reviewed under the CWA, NEPA, and the Act. These reviews require consideration of impacts to listed species and their habitats, and recommendations for mitigation of significant impacts.

At the time of listing, the Corps Los Angeles District (Corps LAD) generally took jurisdiction over all vernal pool habitat, regardless of whether it consisted of road pools (ephemeral pools inhabited by San Diego fairy shrimp or other vernal pool fauna, formed inadvertently by human activities such as vehicle use) or other unvegetated pools that were found within historical vernal pool habitat. However, recent Supreme Court rulings have called into question the Corps’ regulation of vernal pools based on the definition of “waters of the United States” in the CWA: *Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers* (531 U.S. 159) (2001) (*SWANCC*) and *Rapanos v. United States*, 126 S. Ct 2208, U.S. (2006)). In these cases, the Court adopted a more restrictive view of “waters of the United States.” Following these rulings, Corps regulatory oversight of vernal pools is in doubt because of their “isolated” nature, and the Corps has made determinations regarding regulation of such wetland areas (including vernal pools) on a case-by-case basis. In response to the Supreme Court decisions, the Corps and the U.S. Environmental Protection Agency (USEPA) have recently released a memorandum providing guidelines for determining jurisdiction under the CWA. Recent Corps guidance indicates that wetlands adjacent to navigable-in-fact waters of the United States are subject to regulation under the CWA, as are non-adjacent wetlands that are shown to have a significant nexus to navigable waters. The guidelines provide for a case-by-case determination of a “significant nexus” standard that may protect some, but not all, vernal pool habitat where the species is found.

Endangered Species Act of 1973, as amended (Act)

Since listing, the Act is the primary Federal law that may provide protection for *Pogogyne abramsii*. The Service's responsibilities include administering the Act, including sections 7, 9, and 10. Section 7(a)(2) of the Act requires Federal agencies, including the Service to ensure that actions they fund, authorize, or carry out do not "jeopardize" a listed species or result in the "destruction or adverse modification" of habitat in areas designated by the Service to be "critical." Critical habitat has not been proposed for this taxon. A jeopardy determination is made for a project that is reasonably expected, either directly or indirectly, to appreciably reduce the likelihood of both the survival and recovery of a listed species in the wild by reducing its reproduction, numbers, or distribution (50 C.F.R. § 402.02).

Under Section 9(a)(2) of the Act, with respect to endangered plant taxa, it is unlawful to remove and reduce to possession (i.e., collect) any such taxon from areas under Federal jurisdiction; maliciously damage or destroy any such taxon on any such area; or remove, cut, dig up, or damage or destroy any such species on any other area in knowing violation of any law or regulation of any State or in the course of any violation of a State criminal trespass law.

Under Section 10(a)(1)(A) of the Act, there are provisions for collection of plants or plant parts for scientific purposes or to enhance the propagation and survival of the species. Under section 10(a)(1)(B) of the Act, the Service may issue "incidental take" (take is defined in section 3(18) of the Act) permits for listed animal species to non-Federal applicants. Take and therefore incidental take protections are not extended to plants. "Incidental take" refers to taking of listed species that results from, but is not the purpose of, carrying out an otherwise lawful activity by a Federal agency or applicant (50 CFR 402.02). To qualify for an incidental take permit, applicants must develop, fund, and implement a Service-approved HCP that details measures to [avoid] minimize and mitigate the project's adverse impacts to listed species including listed plants. Issuance of an incidental take permit by the Service is subject to section 7 of the Act; thus, the Service is required to ensure that the actions proposed in the HCP are not likely to jeopardize the species or result in the destruction or adverse modification of critical habitat. Although section 10(a)(1)(B) allows for exemptions to take prohibitions under section 9 for animals, it does not allow for similar exemptions for plants. Many NCCPs are developed in conjunction with HCPs prepared pursuant to the Act. The City of San Diego MSCP Subarea Plan is discussed below.

San Diego Multiple Species Conservation Plan (MSCP)

In southwestern San Diego County, the MSCP planning area encompasses more than 582,000 acres and includes the County of San Diego, City of San Diego, 10 other city jurisdictions, and several independent special districts. Under the broad umbrella of the MSCP, each participating jurisdiction prepares a subarea plan that implements the goals of the MSCP within that jurisdiction. The MSCP provides for the assembly and establishment of approximately 171,000 ac (69,202 ha) of preserve areas to provide conservation benefits for 85 federally listed and sensitive species, including *Pogogyne abramsii*, over the permit term. The MSCP anticipates the conservation of at least 88 percent of vernal pool habitat, requires avoidance of impacts to the

Pogogyne abramsii and its habitat to the maximum extent practicable, mitigation for impacts deemed unavoidable, and management to protect habitat against edge effects to *P. abramsii*.

As discussed above under “Clean Water Act,” the Corps LAD generally took jurisdiction over all *Pogogyne abramsii* habitat (including road pools) both prior to *SWANCC* and at the time the City’s permit was issued. Therefore, the Service anticipated individualized review of projects impacting *P. abramsii* habitat under section 404 of the Clean Water Act and section 7 of the Act to insure compliance with the Environmental Protection Agency’s Clean Water Act, 404(b)(1) guidelines, and the Federal policy of “no net loss of wetland function and values”. However, the *SWANCC* decision has rendered future CWA jurisdiction over vernal pools uncertain. Additionally, a 2006 Federal district court ruling in *Center for Biological Diversity v. Bartel*, 98-CV-2234 (S.D.Cal.) enjoined the incidental take permit issued to the City of San Diego as applied to *P. abramsii* and six other vernal pool species. The court held that the City’s Subarea Plan does not provide adequate protection for *P. abramsii* as a result of plan deficiencies and in light of *SWANCC*. As a result, the City surrendered permit coverage for seven vernal pool species on April 20, 2010. The Service accepted the City’s relinquishment of coverage for vernal pool species in the MSCP and on May 14, 2010, issued a revised permit covering 78 listed and nonlisted species. *Pogogyne abramsii* is no longer a covered species under the City of San Diego’s Subarea Plan under the MSCP, however with the relinquishment of coverage, the San Diego City Council authorized the preparation of a new HCP that addresses the District Court’s concerns regarding conservation of the seven vernal pool species and the acceptance of the grant funds for preparation of the new HCP. The City is currently working with the Service to revise and improve the management plan for *P. abramsii* under the MSCP and is updating their wetland ordinance. Also, the Service is working with the City to conserve more restorable habitat. Despite the City’s relinquishment of their permit, 40% of the 0.68 ac of vernal pool habitat that contains *P. abramsii* within the subregional MSCP is considered conserved (City of San Diego 2004, p. 12). The City continues to monitor and manage vernal pools in support of the MSCP.

The Sikes Act

The Sikes Act (16 U.S.C. 670) authorizes the Secretary of Defense to develop cooperative plans for conservation and rehabilitation programs, and to establish outdoor recreation facilities on military installations. The Sikes Act also provides for the Secretaries of Agriculture and the Interior to develop cooperative plans for conservation and rehabilitation programs on public lands under their jurisdiction. While the Sikes Act of 1960 was in effect when *Pogogyne abramsii* was listed, it was not until 1997 when the Sikes Act Improvement Act was enacted, that the Department of Defense (DOD) installations were required to prepare Integrated Natural Resource Management Plans (INRMPs). An INRMP provides for the management of natural resources on military lands consistent with the use of military installations to ensure the readiness of the Armed Forces. Management under an INRMP may include surveying, monitoring, and restoration of natural resources. Implementation of INRMPs is subject to funding availability and does not preserve any military lands in perpetuity, as ultimately those lands may be necessary for National Security.

The INRMP for MCAS Miramar provides significant protection for *Pogogyne abramsii* (U.S. Marine Corps 2006, pp. 7-1–7-36). To accomplish the conservation strategies and prioritize the

conservation actions in the INRMP, MCAS Miramar has divided its land into Management Areas (1-V). Nearly all (99.3 %) of the vernal pool basins containing *P. abramsii* on MCAS Miramar fall within Management Area 1, which receives the highest conservation priority at the facility. Specific management actions for vernal pools within these Level 1 Management Areas include: posting signs and fencing, identifying potential impacts from activities by lessees and right-of-way holders, developing procedures to respond to and fix accidental impacts on vernal pool habitat and Special Status Species, developing education programs to create and maintain awareness of the values of vernal pool habitat, trash removal (more than 250 tons have been removed), a Vernal Pool Burn Study (2000-present), contracted work to identify areas suitable for habitat restoration and re-establishment, a study of *Agrostis avenacae* occurrence in vernal pools and options for control, and vernal pool surveys (~1989-2007, 2009).

The two occupied vernal pool complexes at the Murphy Canyon Housing area managed by the U.S. Navy are not covered by an INRMP. These complexes were restored to offset project impacts as part of section 7 consultations (RECON 1998; USFWS 1995, 2003). While we expect the majority of the pool complexes in the Murphy Canyon Housing area to be protected by the Navy, some of the pools may be impacted in the future, such as at a proposed site for a Child Development Center. Recreational activities, illegal dumping, and nonnative species may also continue to impact the habitat at these sites. However, the Navy is working to complete revisions of the Naval Base San Diego INRMP that will address *Pogogyne abramsii* and these vernal pools.

National Natural Landmark

A portion of the distribution of *Pogogyne abramsii* on MCAS Miramar lies within Miramar Mounds National Natural Landmark designated in 1972, prior to listing. Reference to this is in the listing rule (USFWS 1978, p. 44811). The National Natural Landmarks are administered by the National Park Service. There are no specific resource management actions or conservation provisions required for this or other Landmarks. However, generally efforts are undertaken to preserve the resources for which the Landmark was designated. In addition the National Park Service may participate as a partner in conservation efforts. In 2003 a restoration plan for the vernal pool habitat was developed at the landmark and identified 124 vernal pool habitats that were suitable for restoration. The plan includes performance criteria and annual reporting requirements (U.S. Marine Corps 2006, p. 7-22).

Summary of Factor D

In summary, the Act provides the greatest regulatory protection to *Pogogyne abramsii*. Habitat conservation plans, and the related conservation actions arising from the Act have contributed to short and long term conservation of *P. abramsii*. The INRMP at MCAS Miramar has created policy mechanisms and partnerships that have restored and conserved vernal pool habitat. Additional potential protection provided by other Federal, State, and local laws and ordinances is discretionary, incomplete, subject to funding availability and changing missions, and largely dependent on the federally listed status of *P. abramsii*. As a result, regulatory mechanisms provided by other Federal, State, and local laws and ordinances do not independently or collectively provide adequate regulatory protection to *P. abramsii*.

FACTOR E: Other Natural or Manmade Factors Affecting Its Continued Existence

The listing rule did not identify any threats to *Pogogyne abramsii* attributable to Factor E (USFWS 1978, p. 44811). However, since listing a number of threats to *P. abramsii* have been identified. These are discussed below under the headings human access and disturbance, drought and climate change, small population size, and fire control.

Human Access and Disturbance

Separation of *Pogogyne abramsii* occurrences through habitat loss and fragmentation is often accompanied by effects associated with human access or disturbance associated with adjacent development. These include trampling, OHV-activity, pedestrian introduction of nonnatives, and trash dumping. This can directly impact *P. abramsii* by crushing, shading, or releasing toxic substances that harm individual plants. Human access and disturbance has been identified as a threat to seven EOs containing nine vernal pool complexes. Trampling by pedestrians and OHVs may damage or kill plants. Pool complex C28 (EO 36) on Mira Mesa was extirpated partly as a result of human access and disturbance, more specifically OHV damage and trampling (City of San Diego 2004). Pool complex H 39 (Greystone Highlands, EO 41) on Del Mar Mesa is vulnerable to human trampling from adults and children trespassing from the nearby residential development (City of San Diego, 2006, p. 34).

Protective fencing is used in many conserved occurrence areas to protect vernal pool complexes (Appendix 1). Though implementing this protective measure has lessened the impacts of human access and disturbance, such effects still threaten *Pogogyne abramsii*. Occurrences on private, non-conserved lands remain vulnerable to this threat.

Drought and Climate Change

Rainfall and temperature both affect the germination rate and successful reproduction of *Pogogyne abramsii*. Currently, drier conditions and drought threaten all occurrences of *P. abramsii*, and is thought to be exacerbated by climate change. There is a broad consensus among scientists that the earth is in a warming trend caused by anthropogenic greenhouse gases such as carbon dioxide (IPCC 2007). Models are not yet powerful enough to predict what will happen in localized regions such as southern California, but many scientists believe warmer, wetter winters and warmer, drier summers will occur within the next century (Field et al. 1999, pp. 2-3, 20). Climate-related changes in California have been documented (Croke et al. 1998, pp. 2128, 2130; Breashears et al. 2005, p. 15144). Predictions for California indicate prolonged drought and other climate-related changes will continue in the future (Field et al. 1999, pp. 8-10; Lenihen et al. 2003, p. 1667; Hayhoe et al. 2004, p. 12422; Breshears et al. 2005, p. 15144; Seager et al. 2007, p. 1181; IPCC 2007, p. 9). The impacts on species like *P. abramsii*, which depend on specific hydrological regimes, may be more severe (Graham 1997, p. 2).

Five factors associated with a changing climate may affect the long-term viability of *Pogogyne abramsii* occurrences in its current habitat configuration: (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. In a changing climate, conditions could change in a way that would allow both native and nonnative plants to invade the habitat where *P. abramsii* occurs (Graham 1997, p. 10).

While we recognize that climate change is an important issue with potential effects to listed species and their habitats, we lack adequate information to make accurate predictions regarding its effects to particular species (including *Pogogyne abramsii*) or sites at this time. Although we cannot predict the exact effects of climate change on *P. abramsii*, it is likely that it will exacerbate identified threats and may introduce new additional threats. A changing climate with spatial and temporal shifting of temperature and precipitation may cause this species specific adaptations to climate to work against its survival. A changing climate may also provide advantages to other native and nonnative plant species. Sharing information between scientists, land managers, and decision makers will increase our ability to address these threats. Increasing the success with which we address current threats to *P. abramsii* will increase our success of handling the uncertain effects of future climate change.

Small Population Size

The restricted range and small population of *Pogogyne abramsii* pose a threat as it increases the possibility that urban development or other activities near remnant pool ecosystems could destroy a significant portion of the species' remaining population and habitat (USFWS 1993, p. 41390). *Pogogyne abramsii* is distributed on approximately 19.2 ac (7.8 ha) of vernal pool habitat on MCAS Miramar, and approximately 0.8 ac (0.3 ha) outside the boundary of MCAS Miramar (U.S Marine Corp 2006, p. 5-4; City of San Diego 2004, p. 11). Stochastic events outside the natural range of frequency and severity, such as floods, fires, contamination, or drought, can substantially reduce or eliminate species, such as *P. abramsii* with a restricted range and small population, and increase the likelihood of extinction (Lande 1993, p. 912).

Genetic effects may further influence population demography via inbreeding depression and genetic drift (Barrett and Kohn 1991, pp. 3-30; Menges 1991, pp. 58 – 61). Allee (1931, pp. 17-50) suggested small, single populations are vulnerable to extirpation when opportunities for reproduction diminish because of reduced opportunity of individuals to reproduce (Allee effect or depensation) (Courchamp et al. 2008, pp. vi – 216). Stephens et al. (1999, pp. 185 -190), Dennis (2002, pp. 389 - 401) and Courchamp et al. (2008, pp. vi – 216) suggest that the Allee effect is a density-dependent event that is inversely related to population size. The isolated vernal pool complex on Los Pensacitos Canyon (EO 54, complex B5-8) and on Mira Mesa (EO 36, complex B11) are all that remain in both of these areas making *P. abramsii* susceptible to random events here.

Fire control

Fire control has been identified as a potential threat to *Pogogyne abramsii* at two of the 28 extant EOs (four vernal pool complexes) listed in Appendix 1. The ecological effects of fire exclusion in the habitat of southern California has not been specifically detailed for vernal pool habitat, however the processes and structure of fire ecology is comparable to other ecosystems (Keane et al. 2002, pp. 3–11; D’Antonio and Vitousek 1992, pp. 63 - 87). Fire exclusion may affect the natural regulation of succession via selecting and regenerating plants. Species that are adapted to light fire (such as *P. abramsii* during the dry season) are replaced by species that are able to out compete for growing resources in the absence of fire (Keane et al. 2002, pp. 3 - 11).

While complete fire exclusion may result in *Pogogyne abramsii* being outcompeted for space, the alternative may pose an equal threat as fires at critical times can eliminate populations of *P. abramsii* by killing individual plants, overheating soil to create hydrophobic conditions, or intense heat which kills or eliminates the seed bank (Agee 1993, pp. 1–493; Keane et al. 2002, pp. 3–11; Keeley 2001, pp. 81–94; Arno and Fiedler 2005, pp. 7-38). The severity of fires may be exacerbated by a greater fuel load provided by nonnatives (Bauder 1996, p. 3), and a higher density of established native upland species that have not been disturbed by fires in the past (MALGBC 2007, p. 7). Fire suppression has been identified as a threat at Del Mar Mesa which could act as a staging ground for fire control activities if a fire began (City of San Diego 2006, pp. 37, 42). Currently a burn study is being conducted on MCAS Miramar to determine how fire impacts vernal pool species. Initial observations show that there is no difference between species composition between burned and unburned vernal pools (Kassebaum pers. comm. 2010).

Summary of Factor E

In summary, impacts associated with human access and disturbance, small population size and drought and climate change continue to threaten *Pogogyne abramsii* at 10 of the 12 geographic locations where it is extant. Climate change impacts to habitats and associated species, such as vernal pools, are expected to intensify. Although climate change data specific to *P. abramsii* is currently limited, adverse impacts to *P. abramsii* and its habitat are probable. The narrow range of *P. abramsii* makes it particularly vulnerable to all threats. Therefore, we believe that these natural and man-made factors continue to threaten *P. abramsii*.

III. RECOVERY CRITERIA

Recovery plans provide guidance to the Service, States, and other partners and interested parties on ways to minimize threats to listed species, and on criteria that may be used to determine when recovery goals are achieved. There are many paths to accomplishing the recovery of a species and recovery may be achieved without fully meeting all recovery plan criteria. For example, one or more criteria may have been exceeded while other criteria may not have been accomplished. In that instance, we may determine that, over all, the threats have been minimized sufficiently, and the species is robust enough, to downlist or delist the species. In other cases, new recovery approaches and/or opportunities unknown at the time the recovery plan was finalized may be more appropriate ways to achieve recovery. Likewise, new information may change the extent that criteria need to be met for recognizing recovery of the species. Overall, recovery is a

dynamic process requiring adaptive management, and assessing a species' degree of recovery is likewise an adaptive process that may, or may not, fully follow the guidance provided in a recovery plan. We focus our evaluation of species status in this 5-year review on progress that has been made toward recovery since the species was listed by eliminating or reducing the threats discussed in the five-factor analysis. In that context, progress towards fulfilling recovery criteria serves to indicate the extent to which threat factors have been reduced or eliminated.

Recovery strategy for *Pogogyne abramsii* and vernal pool species concentrated on “*eliminating and reducing the primary existing threats to their habitats. Specifically, these threats are; habitat destruction and modification, alteration of wetland hydrology, off-road vehicle activity, cattle grazing and competition from nonnative species*” (USFWS 1998a, p. 58).

Recovery criteria cooperatively prepared for the Service by Dr. E. Bauder (San Diego State Univ.), A. Kreager (USFWS), and S. McMillan (USFWS) in 1998 were developed for four plant species (including *Pogogyne abramsii*) and two animal species (USFWS 1998a, p. iii). Recovery criteria were not threat-based, as addressing ecosystem function and integrity was the *modus* for recovery plans developed during the 1990s (Clark et al. 2002, pp. 1510-1519). Recovery criteria for vernal pool ecosystems, which include *Pogogyne abramsii* focused on stabilizing the current status of the species. These were listed as:

- 1) “*Existing vernal pools and their associated watersheds...should be secured from further loss and degradation. Habitat functions and species viability... must be ensured... Maintaining habitat function and species viability (as determined by prescribed research tasks)*”;
- 2) *The existing vernal pools and their associated watersheds contained within the complexes...are secured in a configuration that maintains habitat function and species viability (as determined by recommended research);*
- 3) *Secured vernal pools are enhanced or restored such that population levels of existing species are stabilized or increased;*
- 4) *Population trends must be shown to be stable or increasing for a minimum of 10 consecutive years prior to consideration for reclassification. Monitoring should continue for a period of at least 10 years following reclassification to ensure population stability*” (USFWS 1998a, p. iv-vi).

Action items necessary to achieve these tasks included:

- 1) “*Conduct surveys and research essential to the conservation of these species;*
- 2) *Secure the existing vernal pools and their associated watersheds;*
- 3) *Where necessary reestablish vernal pool habitat to the historical structure;*
- 4) *Manage and monitor habitat and listed species*”(USFWS 1998a, p. vi).

Considerable amounts of vernal pool habitat has been acquired and secured since *Pogogyne abramsii* was listed (Appendix 1). Protection afforded this taxon through MSCP, INRMP, and mitigation from section 7 consultations has created a matrix of protected habitat for *Pogogyne abramsii*. Because of additional listed vernal pool species, *Pogogyne abramsii* benefits by additional concentration of scrutiny used to conserve, protect, and restore vernal pool habitat throughout the species range. Much extant vernal pool habitat is likely to persist for the species

to the foreseeable future, however anthropogenic threats still persist. Climate change will likely impact some sites through alteration of when drying occurs and potential changes to the amount of annual precipitation necessary to inundate pools for sufficient time, per pool complex. Maintaining “*habitat function and species viability*” was not defined in the recovery plan, however the body of conservation biology literature developed since then (e.g. Groom et al. 2006, pp. 432-435) have established standards by which the Service could ascertain if each conserved pool and complex has achieved habitat function needs for *Pogogyne abramsii*. Development of a population viability analysis with species-specific information, and establishing sideboards of scientific rigor could roughly determine lambda, species viability, and extinction probability based on the current land management configuration, watershed protection schemes, and cumulative effects of anthropogenic action.

There has been considerable progress toward the recovery of *Pogogyne abramsii* since it was listed. Land acquisition and conservation under the San Diego MSCP as well as management efforts under the MCAS Miramar INRMPs have contributed to this goal. However, as yet none of the four recovery criteria noted above has been met. Conditions for measuring and maintaining habitat functionality and species viability have not, as yet, been developed. In addition, the criterion regarding population trends may be considered ambiguous (e.g. relative to the species range, relative to a pool complex, within a pool) or undeterminable for a plant with a metapopulation structure (i.e. one with natural local extinctions and recolonizations among pools).

IV. SYNTHESIS

Pogogyne abramsii has been affected by anthropogenic activities, which is estimated to have reduced the range and available habitat of the species by an estimated 95-97% (Oberbauer and Vanderwier 1991, p. 210). *Pogogyne abramsii* and other obligate vernal pool species are conservation dependent species, which will require monitoring and management in perpetuity, because of the occurrence of their habitat range in urbanized southern California.

The original threats which led to the species being listed were past degradation of and future loss of habitat from housing development, road widening projects, illegal dumping, and OHV use. Since listing, additional threats to *Pogogyne abramsii* include military activities, altered hydrology, nonnative plants, human access and disturbance, small population size, drought and climate change, and fire control. Because of the protections afforded by or stemming from the Act, and corresponding cooperative endeavors with private landowners, universities, and local and State governments, several of the more manageable original threats, including road widening projects, urban development, altered hydrology, and illegal dumping, have been reduced or ameliorated.

Since listing, *Pogogyne abramsii* has persisted in all geographic locations throughout its range. Though some vernal pool complexes have been lost, usually the result of approved development, other complexes have been enhanced or created. Outside of urbanization, climate change may have the longest lasting potential for degrading the species long-term retention, setting back potential recovery, or causing extinction. The status of *P. abramsii* as endangered is appropriate, due to the suite of past, current, and expected threats, which affect its short and long-term

demographic and genetic existence. The direct and indirect effects of urbanization include loss and degradation of habitat, and associated alteration of hydrological regimes of vernal pool landscapes, increases in persistent sources for invasive nonnative plants, increases in incidental OHV impacts and human access and disturbance. Several of the persisting threats to this taxon may be considered rangewide, including: nonnative plants, drought and climate change, and small population size. Nonnative plants have been identified as the greatest threat to the species and may be the most difficult to manage. Extirpations at the limits of *P. abramsii*'s range make it increasingly vulnerable to stochastic events and genetic effects associated with small population size. Therefore we find that *P. abramsii* still meets the definition of endangered and do not recommend a change in status at this time.

V. RESULTS

Recommended Listing Action:

- Downlist to Threatened
- Uplist to Endangered
- Delist (indicate reason for delisting according to 50 CFR 424.11):
 - Extinction*
 - Recovery*
 - Original data for classification in error*
- No Change

New Recovery Priority Number and Brief Rationale: No Change

VI. RECOMMENDATIONS FOR ACTIONS OVER THE NEXT 5 YEARS

1. Support continued conservation, management and monitoring of *Pogogyne abramsii* habitat to include acquisition of occupied sites.
2. Develop a coordinated interagency invasive species prevention and eradication program for all vernal pool habitat where *Pogogyne abramsii* is extant.
3. Identify the conditions and areas necessary to support all of the necessary biotic interactions (e.g. pollination, seed dispersal, population movement) for *Pogogyne abramsii*.
4. Monitor restored/enhanced habitat to determine their suitability and impact in furtherance of recovery of *Pogogyne abramsii*.

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Appendix 1: Current Range of *Pogogyne abramsii* (San Diego mesa mint) occurrences in San Diego, CA; prepared for the 2010 5-year review.

General Location	EO #	Complex #	Owner	Threats	Status	Conservation Status
Carroll Canyon	27	D1-4			Extirpated	
		D5-8	CSD	A: Development, altered hydrology illegal dumping, nonnative plants E: Human access and disturbance	Extant	Conserved, partially in MHPA, mitigation site, 119 pools (CSD 2004, p. 35)
	29	11 Arjons, S. of Carroll Canyon	Private	A: Development (Graded since listing) E: Human Access and Disturbance (S. Wynn 2010, pers. obs.)	Extant	Conserved, not in MHPA, fenced (CSD 2004, p. 37)
Del Mar Mesa – Deer Canyon	38	H1-15	CSD, USFWS, CDFG	A: OHV use, nonnative plants E: Human access and disturbance, fire suppression	Extant	Conserved, in MHPA, mitigation site for SR 52, (CSD 2004, pp. 15-17)
		H 17 – Shaw Lorenze	Private	A: Development, OHV use, nonnative plants E: Human access and disturbance, fire suppression	Extant	Partially conserved, in MHPA portions approved for development; remainder mitigation site (USFWS 2006)
		H18-23- Rhodes vernal pool site according to CSD 2004, p. 15	CDFG, USFWS	A: Development, altered hydrology, OHV use, nonnative plants E: Fire suppression	Extant	Partially conserved, partially in MHPA, conservation easement in progress (CSD 2004, p. 15)
		H 24-26	Private			Extirpated

General Location	EO #	Complex #	Owner	Threats	Status	Conservation Status
Del Mar Del Mar Mesa – Deer Canyon	41	H 34			Extirpated	
		H 38 (Greystone Torrey Highlands)	Private	A: Development, altered hydrology, nonnative plants E: Human access and disturbance	Extant	Conserved and fenced, in MHPA, mitigation site, (CSD 2004, p. 14), partially developed (USFWS 2000)
	42				Extirpated	Not conserved, not in MHPA
	43				Extirpated	Not conserved, not in MHPA
	56				Extirpated	Not conserved, not in MHPA
Kearny Mesa	15	F north, F1-27	DOD-NAVY	A: Development, Road Projects	Extant	DOD Level I Management Area (U.S. Marine Corps 2006, p.5-3)
	16	E1-4	DOD-NAVY		Extirpated	Not conserved, not in MHPA, fully developed (Bauder (1986a, p. 15)
	45		DOD-NAVY		Extirpated	Not conserved, fully developed along SR 163 at the SR 163/ Interstate 805 split

General Location	EO #	Complex #	Owner	Threats	Status	Conservation Status
Kearny Mesa (South of Miramar)	17	U15 (Sander)	MCAS Miramar/ CSD	A: Development, military activities, nonnative plants	Extant	DOD Level I Management Area/Not conserved, not in MHPA. Previous section 7 consultations conducted (U.S. Marine Corps 2006, p.5-3, S. Wynn 2010, pers. obs.)
		U19	MCAS Miramar/ private	A: Military activities, nonnative plants E: Human access and disturbance	Extant	DOD Level I Management Area/ Not conserved, not in MHPA (CSD 2004, p. 48); Directly adjacent to pools on Miramar (U.S. Marine Corps 2006)
		U north	MCAS Miramar	A: Military Activities, nonnative plants E: Fire suppression	Extant	DOD Level I Management Area. Partial Restoration site (U.S. Marine Corps 2006)
	18	BB			Extirpated	Completely developed
La Mesa	49	LL (Amaya Dr)			Extirpated	Completely developed

General Location	EO #	Complex #	Owner	Threats	Status	Conservation Status
Los Penasquitos Canyon	35	B1-4, 9-10	Private		Extirpated	Completely developed
	37	B12			Extirpated	Completely developed
	54	B5-8 (Lopez Ridge)	Caltrans, Private, CSD	A: Development, nonnative plants	Extant	Partially conserved, partially in MHPA, mitigation site, (CSD 2004, p. 26). Mostly conserved on Brown Parcel – CSD – remaining piece will be conserved as part of Crescent Heights (S. Wynn 2010, pers. obs.)
Los Penasquitos Canyon – South	23	C19		A: Development	Extirpated	Completely developed
	24	C17-18 (Fieldstone)	Private	A: Development, Altered Hydrology	Extant	Conserved, in MHPA, fenced (CSD 2004, p. 9, 28, USFWS 1989)
	25	C1-9,20-26	Private	A: Development, Altered Hydrology	Extirpated	Not conserved, nearly all of the occurrence site is developed
		C10-16 (Winterwood)	CSD	A: Development, Altered Hydrology	Extant	Partially conserved, partially in MHPA (CSD 2004, p. 30); will be conserved

General Location	EO #	Complex #	Owner	Threats	Status	Conservation Status
Mira Mesa	36	B11	Private	A: Nonnative plants E: Human Access and Disturbance	Extant	Conserved and fenced, not in MHPA; 45 vernal pools created and restored by 1998 as mitigation for Mira Mesa Market Center (CSD 2004, p. 24, USFWS 1998b)
		C27	Private		Extirpated	Conserved, one pool remains fenced (CSD 2004, p.31)
		C28	SD Unified School District		Extirpated	Not conserved (CSD 2004) HCP being developed that will impact site (S. Wynn 2010, pers. obs.)
Miramar	5	AA1 East, AA1 South, AA1 West, AA2	MCAS Miramar	A: Road Projects, Military activities, nonnative plants	Extant	DOD Level I Management Area (U.S Marine Corps 2006)
	6	AA9	MCAS Miramar	A: Military activities, nonnative plants	Extant	DOD Level I Management Area, restored to Offset BRAC (U.S Marine Corps 2006, C. Cobb 2008, pers. comm.)

General Location	EO #	Complex #	Owner	Threats	Status	Conservation Status
Miramar	7	AA3	MCAS Miramar	A: Military activities, nonnative plants	Extant	DOD Level I Management Area (U.S. Marine Corps 2006)
		AA4-7	MCAS Miramar	A: Military Activities Highway Development, OHV use	Extant	DOD Level I Management Area, restored to offset BRAC (C. Cobb 2008, pers. comm.)
	8	A4 (Tierrasante)	MCAS Miramar	A: Military Activities Highway Development, OHV use	Extant	DOD Level I Management Area (U.S. Marine Corps 2006)
	9	AA13	1986	A: Military Activities Highway Development, OHV use	Extant	DOD Level I Management Area (U.S. Marine Corps 2006)
	10	AA11	MCAS Miramar	A: Military activities, nonnative plants	Extant	DOD Level I Management Area (U.S. Marine Corps 2006)
	11	AA12	MCAS Miramar	A: Military activities, nonnative plants	Extant	DOD Level I Management Area (U.S. Marine Corps 2006)
		AA12 north+	MCAS Miramar	A: Military activities, nonnative plants	Extant	DOD Level I Management Area (U.S. Marine Corps 2006)
		AA12 south	MCAS Miramar	A: Military activities, nonnative plants	Extant	DOD Level I Management Area (U.S. Marine Corps 2006)

General Location	EO #	Complex #	Owner	Threats	Status	Conservation Status
Miramar	12	AA8	Marine Corps	A: Military activities, nonnative plants	Extant	DOD Level I Management Area restored to offset BRAC (U.S. Marine Corps 2006, C. Cobb 2008, pers. comm.)
	13	EE1, EE2, GG1	MCAS Miramar	A: Military activities, nonnative plants	Extant	DOD Level I Management Area partially BRAC impacted and restored. Includes former EO #'S 20, 21, 50 (U.S. Marine Corps 2006, C. Cobb 2008, pers. comm.)
		V	MCAS Miramar	A: Military activities, nonnative plants	Extant	DOD Level I Management Area (U.S. Marine Corps 2006)
		W1-2	MCAS Miramar	A: Military activities, OHV damage, nonnative plants	Extirpated	DOD Level I Management Area (U.S. Marine Corps 2006)
	14	RR1, RR2	MCAS Miramar	A: Military activities, nonnative plants	Extant	DOD Level I Management Area (U.S. Marine Corps 2006)
	19	HH1+	MCAS Miramar	A: Military activities, OHV damage, nonnative plants	Extant	DOD Level I Management Area. Unpermitted OHV use in 2009, now fenced and monitored (U.S. Marine Corps 2006, Kassebaum pers. comm. 2010)

General Location	EO #	Complex #	Owner	Threats	Status	Conservation Status
Miramar	31	Z6-7	MCAS Miramar	A: Military activities, nonnative plants	Extant	DOD Level V Management Area :10% impacted, 90% restored (U.S. Marine Corps 2006).
	33	Z1-3	MCAS Miramar	A: Military activities, nonnative plants	Extant	DOD Level I Management Area, restored to offset BRAC (DOC) (U.S. Marine Corps 2006, C. Cobb 2008, pers. comm.)
	48	GA	MCAS Miramar		Extirpated	
	53	AA10	MCAS Miramar	A: Military activities, nonnative plants	Extant	DOD Level I Management Area, restored to offset BRAC (U.S. Marine Corps 2006, C. Cobb 2008, pers. comm.)
	57	W3	MCAS Miramar	A: Military activities, nonnative plants	Extant	DOD Level I Management Area (U.S. Marine Corps 2006)
		I7	MCAS Miramar	A: Military activities, nonnative plants	Extant	DOD Level I Management Area (U.S. Marine Corps 2006)
Mission Valley - Mesa South	46				Extirpated	Completely developed

General Location	EO #	Complex #	Owner	Threats	Status	Conservation Status
Mission Valley - North (Murphy Canyon)	3	G1, G2	DOD-NAVY	A: Development, OHV damage, nonnative plants	Extant	Not conserved, INRMP being developed. Partially restored/mitigation
Montgomery Field – East	4	N1-4, 6	CSD	A: Development, OHV damage, nonnative plants	Extant	Not conserved, in MHPA, fenced around airstrip Some of the highest quality pools in the City, also largest in City, majority of the site is restricted from development.
	General Dynamics	N8	Private	A: Nonnative plants	Extant	Conserved, in MHPA, fenced mitigation site (CSD 2004, p. 52); in MHPA
		Teledyne	Private	A: Development, illegal dumping E: Human Access and Disturbance	Extirpated	Not conserved, defense company, has been abandoned, may have contaminant issues.

General Location	EO #	Complex #	Owner	Threats	Status	Conservation Status
Rose Canyon - North	1 (52)	I 6A	Private		Extirpated	Conserved, not in MHPA
		I 6B (Bob Baker)	Private	A: Development (grading), OHV use, altered hydrology E: Human Access and Disturbance	Extant	Conserved, not in MHPA, via an old USFWS Biological Opinion, unfenced
		I 6C (Bob Baker 2 also known as Kiffman)	Private/ City Easement	A: Development, Trash dumping (CSD 2004, p. 41) E: Human Access and Disturbance	Extant	Conserved, fenced via a consent decree issued as part of an enforcement action by EPA (CSD 2004, p. 41-42); Not in MHPA.
		X1-4	MCAS Miramar	A: Military Activities, fire protection measures, nonnative plants	Extant	DOD Level I Management Area, restored to offset BRAC (U.S. Marine Corps 2006, C. Cobb 2008, pers. comm.)
Tecolote Canyon	44				Extirpated	

Appendix 1 lists the distribution of historical and current *Pogogyne abramsii* (San Diego mesa mint) occurrences throughout its known range. This Appendix is a compilation of information from CNDDDB (CNDDDB 2010), preserved herbarium specimens (CCH 2010; California Academy of Sciences (CAS) 2010), USFWS's Vernal Pool Recovery Plan (USFWS 1998), the CSD's Vernal Pool Inventory (CSD 2004) and biologist's observations. Some occurrences may have multiple reference support. For convenience occurrences attributable to a single geographic location are grouped together often in association with an existing EO reference number. The CNDDDB assigns different EO numbers to occurrences that are more than a quarter mile (400 meters) apart. We grouped occurrences that are geographically and hydrologically connected in the discussions in this review and in Appendix 1. Bauder identification numbers (Bauder 1986a) are used to identify specific vernal pool complexes within an EO. Vernal pool complexes that were not recognized by the original survey were assigned a Bauder-type identification number in the CSD Vernal Pool Inventory (2004) and the Recovery Plan for Vernal Pools in Southern California (1998) in the following manner: Sites located adjacent to Bauder complexes were included in the existing designation, while isolated sites were assigned to the nearest complex and given a series number subsequent to those historical designations.

**U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW**

Pogogyne abramsii (San Diego mesa mint)

Current Classification: Endangered

Recommendation Resulting from the 5-Year Review:

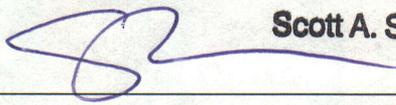
- Downlist to Threatened
- Uplist to Endangered
- Delist
- No change needed

Review Conducted By: _____ Carlsbad Fish and Wildlife Office _____

FIELD OFFICE APPROVAL:

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

ACTING



Scott A. Sobiech

Approve _____ Date _____

SEP 01 2010