Pogogyne nudiuscula
(Otay mesa mint)

5-Year Review:
Summary and Evaluation

Photograph of *Pogogyne nudiuscula* (Otay mesa mint).
Photo credit Mr. Fred M. Roberts Jr.

U.S. Fish and Wildlife Service
Carlsbad Fish and Wildlife Office
Carlsbad, CA

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5-YEAR REVIEW
Pogogyne nudiuscula (Otay 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 nudiuscula (Otay mesa mint), is an annual herb in the Lamiaceae (mint family) that is restricted to vernal pools on Otay Mesa in southern San Diego County, California. *Pogogyne nudiuscula* was listed by the State of California as an endangered species in January 1987 and federally listed as an endangered species in August 1993. At the time of Federal listing, *P. nudiuscula* was known to occur at four locations on Otay Mesa. It is currently extant at three locations on Otay Mesa. Historically, *P. nudiuscula* occurred in Mexico at the eastern edge of the City of Tijuana; it is believed to be extirpated from its Mexican locations. The primary threats at listing were habitat loss and degradation due to urban and agricultural development, grazing, off-road vehicle use, trampling, invasion from weedy nonnative plants, alteration of the watershed, trash dumping and drought.

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 monitored various localities of this species, and the California Natural Diversity Database (CNDDB) maintained by the California Department of Fish and Game (CDFG). The Recovery Plan (USFWS 1998a), the City of San Diego's Vernal Pool Inventory (City of San Diego 2004), and personal communications with experts on the species and its habitat were our primary sources of information used to update the species' status and threats. This 5-year review contains updated information on threats to the species and an assessment of the species' current listing status, 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. These actions are designed to alleviate persisting threats to the taxon.

Contact Information:

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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 (USFWS 2009, pp. 12878–12883). No information was received during the open comment period relevant to the taxon being reviewed here.

Listing History:

Original Federal Listing
FR Notice: 58 FR 41384–41392
Date of Final Rule: August 3, 1993
Entity Listed: *Pogogyne nudiuscula* (Otay mesa mint), a plant species
Classification: Endangered

Listing by the State of California
Date: January 1987
Classification: Endangered

Associated Rulemakings: None

Review History: No previous status reviews have been completed for this species.

Species' Recovery Priority Number at Start of This 5-Year Review: The recovery priority number for *Pogogyne nudiuscula* is 2C according to the Service's 2009 Recovery Data Call for CFWO, based on a 1-18 ranking system where 1 is the highest-ranked recovery priority and 18 is the lowest (USFWS 1983, p. 43104). This number indicates that the taxon is a species that faces a high 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 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 nudiuscula* was provided in the original listing rule. Therefore, the following sections include information available at the time of listing and recently on the species biology and life history, distribution, abundance and population trends, genetics, and habitat requirements.

Species Description

Pogogyne nudiuscula, is an annual herb in the Lamiaceae (mint family). Plants can reach 30 centimeters (cm) (1 foot (ft)) or more in height with flowers arranged in whorls that typically bloom from May or June through early July. The plants usually give off a strong, turpentine mint odor. Leaves are spatulate, obtuse and subglabrous, and are approximately 1 to 2 cm (approximately 1 inch (in)) long with short petioles. In the past, *P. nudiuscula* has been misidentified as *P. abramsii* (San Diego Mesa Mint), which also occurs in San Diego County. There are several distinct differences between the two species: *P. nudiuscula* usually has 6 flowers per node (occasionally more) while *P. abramsii* has only two, the vegetative portions of *P. nudiuscula* develop a reddish tinge after the flowering period while *P. abramsii* develops this reddish tinge during maturation, *P. nudiuscula* has a smooth calyx while *P. abramsii* has a hairy calyx, and the bracts and leaves of *P. nudiuscula* are wider than *P. abramsii* (Howell 1931, p. 120; Munz 1974, p. 532; USFWS 1998a, pp. 11–14).

Species Biology and Life History

Pogogyne nudiuscula seeds germinate depending on the inundation and drying cycles of vernal pools, which is the habitat type this species is restricted to. 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 *P. nudiuscula.* The interaction of these factors provides the plants favorable conditions to complete its life cycle in the spring rather than in the summer, autumn, or winter. Natural

differences in the precipitation and the inundation/drying time of the vernal pool from year to year may result in significant differences in *P. nudiuscula* distribution and abundance, making 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 that surveys occur.

Pogogyne nudiuscula usually bloom in May and June when water is absent from the vernal pool (Munz 1974, p. 531). The plants then produce fruit, dry out, and senesce in the hot, dry summer months. There is little documented information regarding pollination and seed dispersal mechanisms of *P. nudiuscula*. Observations in the field suggest that native syrphid flies (Syrphidae) and bee flies (Bombyliidae) are the most common pollinators (S. McMillan, EDAW pers. comm. 2010). Eurasian honeybees (Apidae) have also been seen pollinating *P. nudiuscula* (McMillan, pers. comm. 2010). Research on the similar species *Pogogyne abramsii* show that it is self-fertile but has greater seed set when cross-pollinated (Schiller *et al.* 2000, p. 393); further research is necessary to determine if this is the case for *P. nudiuscula*.

Zedler and Black (1992, p. 4) found that *Pogogyne abramsii* seeds germinated and grew from pellets of brush rabbits (*Sylvilagus bachmani*) and Audubon's cottontail rabbits (*S. auduboni*) that were collected from vernal pools on Del Mar Mesa and Miramar Mesa. Zedler and Black (1992, p. 2) postulated that rabbit movement may be a potential vector for seed dispersal and genetic mixing of vernal pool obligate species including *P. abramsii*. They concluded that rabbit dispersal explains the "anamolous occurrence of vernal pool plants in newly excavated artificial pools (1992, p. 8)." Additionally, *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). It is possible that these dispersal mechanisms also apply to *P. nudiuscula*; however, data do not exist to support this assumption.

Habitat

Pogogyne nudiuscula is found in vernal pool (seasonal depression wetlands) habitat on Otay Mesa in San Diego County. As previously stated, little species-specific data exist detailing *P. nudiuscula's* habitat requirements other than it is found exclusively associated with vernal pools. It is often found with other federally listed species, including *Eryngium aristulam* var. *parishii* (San Diego button-celery), *Orcuttia californica* (California Orcutt grass), and Riverside fairy shrimp (*Streptocephalus wootoni).* Vernal pools that support *P. nudiuscula* are found on Huerero or Stockpen soils (Beauchamp 1979, p. 26). Beauchamp (1979, p. 31) lists 10 soil types that have historically supported vernal pools in San Diego County, with Stockpen soils (which are derived from sandy marine sediments (Bauder and McMillan 1998, pp. 61–62)) being the fourth most common, although considerably less frequent that the next most common. Of the five soil types that still support vernal pools today, Stockpen soils are the least common (Bauder and McMillan 1998, pp. 61–62).

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). 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, p. 2). These vernal pool complexes were given identification numbers by Bauder (1986a) and updated by the City of San Diego's Vernal Pool Inventory (2004, p. 8). This five-year review uses these vernal complex identification numbers when discussing threats to *Pogogyne nudiuscula* occurrences.

Vernal pools range in size from 10 to 164 ft (3 to 50 meters (m)) in diameter (Zedler 1987, p. 1). In recent history, more and larger pools existed, but most of this habitat has been developed (Oberbauer and Vanderwier 1991, p. 210). 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). The subsurface soil layers are therefore important in influencing species composition as the characteristics of the materials that make up these layers controls the drainage of the vernal pools. In southern California, these impervious subsurface layers are typically clay or clay loam (Cox 1984, p. 1397).

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 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 within a watershed influence the onset and level of inundation, and the seasonal drying of vernal pools (Hanes and Stromberg 1998, p. 46). Smaller pools may fill for only a couple of weeks, and only on the heaviest rainfall years. Larger ponds may remain filled for three to five months, but in years of sparse precipitation, may fail to pond at all. Water levels rise and fall during the rainy season, and soils of pool basins may be exposed and re-inundated a number of times before drying in late spring. This ephemeral inundation/drying cycle of the pool dictate the distribution and phenology of vernal pool endemic 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 pools to support various taxa.

Vernal pools are dynamic in nature and support unique vegetation. Vernal pool species are not as water-tolerant as true wetland vegetation, but typically 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). This specialized habitat supports a diversity of rare species. *Pogogyne nudiuscula* is considered an obligate wetland species (found almost always in wetland areas), but is more tolerant of the ephemeral inundation of vernal pool habitat than a true wetland plant. However, more typical wetland plants can also occur in the pools. Our definition and understanding of *P. nudiuscula* habitat has not significantly changed since listing. It is adapted to the seasonal inundation and drying of this habitat and relies on the hydrology of the vernal pool or the vernal pool complex.

Spatial Distribution

At the time of listing, we considered *Pogogyne nudiuscula* to be extant at four locations on Otay Mesa in southern San Diego County: Otay Mesa West, Otay Mesa East, Otay Mesa South, and Otay Mesa Northeast (Appendix 1) (USFWS 1993, p. 41387). Historically *P. nudiuscula* was found beyond Otay Mesa and occurred at 10 locations in southern San Diego County (Appendix 1). Herbarium records indicate that *P. nudiuscula* historically occurred further north near University Heights, Balboa Park, and Mission Valley (CNDDB 2010, Element Occurrence (EOs) 4, 9, and 10, respectively). Also, *P. nudiuscula* occurred in Mexico at the eastern edge of the city of Tijuana; however, it was believed to be extirpated from its Mexican locations prior to listing (Bauder and McMillan 1998, p. 65; USFWS 1993, p. 41385). Currently, *P. nudiuscula* is found at three locations on Otay Mesa: Otay Mesa West, Otay Mesa East, and Otay Mesa Northeast (Appendix 1).

Pogogyne nudiuscula's range was originally described by Gray in 1876 and included all areas of San Diego County. It was not until 1931 that Howell determined a new species of *Pogogyne* and determined that all populations north of Mission Valley are *P. abramsii* and all populations on Otay Mesa are *P. nudiuscula* (Howell 1931, p. 120). It is not clear which species was present on San Diego Mesa, which is located between Mission Valley and Otay Mesa, as herbarium records before 1931 are unclear in species determination (all are labeled *P. nudiuscula*), and are vague in locality (almost all herbarium collections that might prove useful in determining historical range are given as "mesas, San Diego;" "San Diego;" or "mesas near San Diego" (Howell 1931, p. 119, 121)). While it is difficult to determine the historical range of both *Pogogyne* species, ranges are not thought to overlap (Howell 1931, p.120); however, examination of herbaria vouchers from one location, Linda Vista, indicate presence of both species.

CNDDB has been a repository for information on the location and the status of rare taxa in California, including *Pogogyne nudiuscula,* for over 30 years. The data are chronologically and cumulatively recorded by localities that are assigned element occurrence (EO) reference numbers. The CNDDB currently recognizes nine EOs for *P. nudiuscula* (CNDDB 2010). Appendix 1 lists the distribution of historical and current *P. nudiuscula* occurrences throughout its known range. We grouped occurrences that are geographically and hydrologically connected in the discussions in this review as well as in Appendix 1, and we discuss *P. nudiuscula* occurrences in terms of these broader occurrence locations on Otay Mesa. Also, as these occurrence locations may have several vernal pool complexes with unique threats, this review discusses *P. nudiuscula* occurrences in terms of vernal pool complexes as identified by Bauder (1986a) and the City of San Diego's Vernal Pool Inventory (2004, p. 8) (Appendix 1).

The distribution of *Pogogyne nudiuscula* has decreased since it was listed in 1993 (Figure 1). It may now be extant at only three locations on Otay Mesa rather than four. Surveys conducted as part of the City of San Diego's Vernal Pool Inventory (2004) failed to find *P. nudiuscula* in vernal pool complexes on Otay Mesa South (specifically those labeled as J21, J27, J28E, and J28W). Bauder (1986a) also did not find *P. nudiuscula* or any other vernal pool species in one of these vernal pool complexes (i.e., J21), noting the presence of dense nonnatives in the vernal pools. The other three vernal pool complexes (i.e., J27, J28E, and J28W) at Otay Mesa South were lost due to agriculture and altered hydrology (Wynn, pers. obs. 2010).

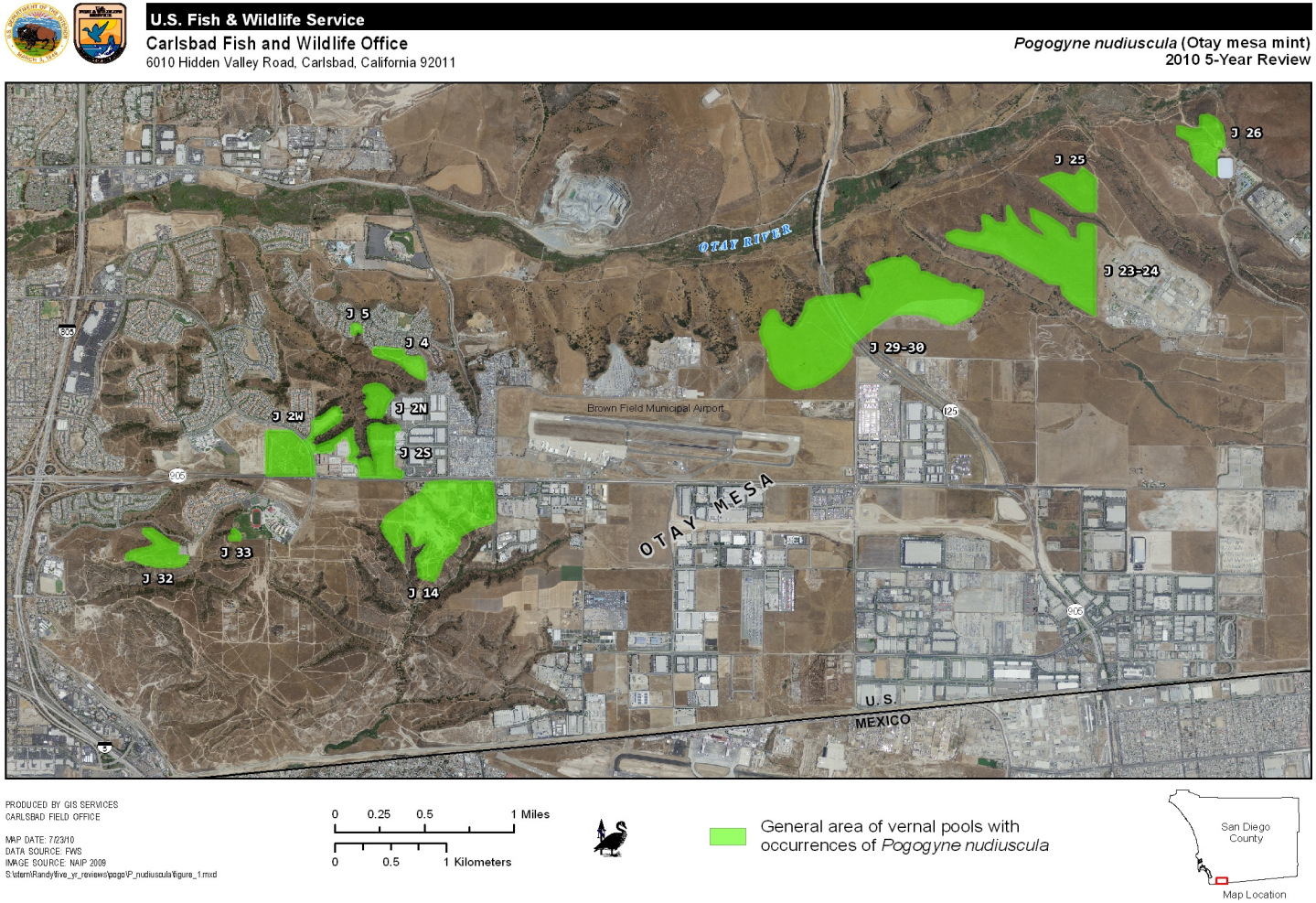

Figure 1: Current Distribution of *Pogogyne nudiuscula* within Vernal Pool Complexes on Otay Mesa, San Diego County, CA; developed for FY2010 5-year review.

On Otay Mesa West, J14 is the only vernal pool complex that remains from natural occurrences at this location since listing; however, whether a viable population of *Pogogyne nudiuscula* exists within the complex is questionable (McMillan, pers. comm. 2010) (Appendix 1); further examination is necessary to validate this theory. Second, *P. nudiuscula* may be absent from individual vernal pools at one local (i.e., J26) at Otay Mesa East where *P. nudiuscula* was once observed; no new naturally extant occurrences have been identified since the time of listing. It is possible that *P. nudiuscula* occurs at other locations that have not been surveyed.

Abundance

No estimate of numbers of *Pogogyne nudiuscula* plants was included in the listing rule. This is likely due to the difficulty of measuring temporal abundance at each occurrence. 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. nudiuscula* differs annually depending, in part, on temperature, timing, and amount of rainfall. The number of individuals may differ at any site for any year because it also depends, in part, upon reproductive success of previous cohorts, the number of seeds deposited in the 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. nudiuscula*.

In 2003, the City of San Diego conducted a survey of vernal pools within their jurisdiction; revealing that of the 1,142 vernal pools surveyed, *Pogogyne nudiuscula* was found in 376 with a mean percent cover per pool of 18 percent (City of San Diego 2004, p. 11). Although we stated in the listing rule that the species had been drastically reduced (USFWS 1993, p. 44811), this was likely associated with habitat loss rather than a measure of direct loss of numbers of standing plants.

Changes in Taxonomic Classification or Nomenclature

Neither the taxonomic classification nor the nomenclature of *Pogogyne nudiuscula* has changed since listing. However, questions remain as to the determinations on some herbarium specimens of *P. nudiuscula* and *P. abramsii.*

Genetics

The genetic variation and diversity of the genus *Pogogyne* has recently been investigated as part of a graduate research study conducted by Michael Silveira at San Diego State University (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, Silveira's results support previous suggestions of a new and undefined species near Villa de Las Palmas in Baja California North, Mexico. Silveira 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 specimens 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 nudiuscula* is by Michael Silveira, as described above in the Genetics section.

Five-Factor Analysis

Threats to *Pogogyne nudiuscula* and the other three vernal pool taxa included in the listing rule include habitat loss and degradation due to urban and agricultural development, grazing, off-road vehicle use (OHVs), trampling, invasion from weedy nonnative plants, and other factors (USFWS 1993, p. 41384). Impacts to *P. nudiuscula* from some of these threats have lessened, but most of these threats continue to persist (Appendix 1). The following five-factor analysis describes and evaluates the threats known at the time of listing and any threats identified since listing that are 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 stated that the vernal pools supporting *Pogogyne nudiuscula* and the three other species covered in the rule were vulnerable to habitat disturbances from urban and agricultural development, OHV use, cattle trampling, human trampling, road development, military activities, and water management activities (USFWS 1993, p. 41387). Destruction of vernal pool habitat for the four species was also attributed to alteration of the watershed upon which the vernal pools depend. Specific threats to habitat supporting *P. nudiuscula* from OHVs and development were also noted in the listing rule (USFWS 1993, p. 41387). The current threats to *P. nudiuscula* habitat are discussed below and include: urban development, road projects, alteration of watershed hydrology, compaction and erosion of soil, and OHVs.

Urban Development

Planned and ongoing development projects throughout *Pogogyne nudiuscula*'s range were described as a primary threat in the listing rule (USFWS 1993, p. 41387). Urban development may result in: (1) the loss or damage of vernal pools by filling, grading, discing, leveling, and other activities; and (2) destruction of watersheds and the hydrology that support vernal pools; (3) isolation of vernal pools; (4) fragmentation of vernal pool systems. Destruction of watersheds and disruption of hydrological systems can create further impacts by creating barriers to dispersal, such that pollination and reproductive output may be inhibited (Schiller *et al.* 2000, p. 395). Potential means of seed dispersal (e.g., 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. Because *P. nudiuscula* has specific habitat requirements (e.g., soil type, water depth), habitat degradation and alteration likely result in population decline.

Since listing, vernal pool complexes on Otay Mesa West and Otay Mesa South (which is now extirpated) have been impacted by urban development (Appendix 1). The extent of threat from

urban development to known occurrences of *Pogogyne nudiuscula* has lessened since listing due to protection and conservation measures associated with regional Habitat Conservation Plans (HCPs). However, this does not protect vernal pool habitat that does not contain *P. nudiuscula* populations which may be suitable for future restoration (this is particularly relevant to areas on Otay Mesa West where restorable areas may be lost to future development (Wynn, pers. obs. 2010). Protection of suitable habitat from development may help to expand *P. nudiuscula's* range and reduce impacts associated with small population size (see Factor E).

The Service and CDFG approved the Multiple Species Conservation Program (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 3,254 ac (1,317 ha) of vernal pool habitat. All subarea plans within the MSCP 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 1998, p. 51). Within the MSCP is the Multi-Habitat Planning Area (MHPA) that was designated as prime habitat. This area of restricted development is considered crucial to the preservation of sensitive species within the MSCP. The City of San Diego's Vernal Pool Inventory indicates that within the MHPA, all vernal pool complexes containing *Pogogyne nudiuscula* (319 of the 321 individual pool basins that contain *P. nudiuscula)* are at least partially conserved (City of San Diego 2004, p. 12). Under provisions of the MSCP, pool complexes that are conserved are protected from most threats attributable to Factor A.

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 nudiuscula* is no longer a covered species under the City of San Diego's Subarea Plan under the MSCP; however, the Service is 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 and the new HCP, it is *P. nudiuscula* vernal pool habitat suitable for restoration that may be lost.

Since listing, a number of vernal pools containing *Pogogyne nudiuscula* have been restored (new basins within historical habitat) or enhanced (may include reshaping the pool or transplantation of inoculum containing *P. nudiuscula* seeds) (Appendix 1). These mitigation efforts are designed to help offset impacts from approved development of vernal pool habitat and were required as conditions of biological opinions, as represented by the following examples. Vernal pool complexes J1, and portions of J2N/W/S were impacted by the construction of California Terraces (RECON 1997). The J1 vernal pool complex was completely lost. These impacts were mitigated through the restoration and enhancement of vernal pools onsite. Reintroduction of *P. nudiuscula* was included as part of the restoration plan. The vernal pool complexes J2, J2N/W/S were restored and fenced and are now entirely conserved (City of San Diego 2004, p. 110). Vernal pool complex J4–5 was partially impacted by the development of the Robinhood Ridge

Residential Project (USFWS 1998b); the resulting mitigation included the creation of the Robinhood Ridge Vernal Pool Preserve that restored/enhanced and conserved 65 pools that contain *P. nudiuscula* and three other sensitive species.

While *Pogogyne nudiuscula* populations have become established in restored pools (J2, J4, and J29–30), the long-term success is unknown. Reestablishing the complex ecological interactions presents a challenge. Additionally, the specific habitat requirements (e.g., soil type, hardpan layer characteristics) of *P. nudiuscula* and other vernal pool species combined with urbanization and increased development limit areas suitable for vernal pool restoration. Black and Zedler (1998, p. 204) found that for the similar species *P. abramsii*, there are no known instances where this species colonized a created pool that was not adjacent to a natural pool containing the species. If this holds true for *P. nudiuscula*, then this will limit the areas where restored pools will allow for the successful establishment of new *P. nudiuscula* populations. Successful restoration must include long-term maintenance and monitoring to ensure that the *P. nudiuscula* and other vernal pool species persist. For these reasons it is critical to work with landowners to try to conserve restorable vernal pool habitat (e.g., Stockpen and Huerero soils) whenever possible.

San Diego is one of the fastest growing counties in the nation and is estimated to have a population of approximately 3.6 million people by the year 2020 (California Department of Finance 2004). Urbanization and development will likely continue to pose threats to *Pogogyne nudiuscula* habitat. Additionally, as *P. nudiuscula* occurrences are found in areas that experience a high volume of foot traffic between Mexico and the United States (see Factor E section for further discussion), future development of border security measures may threaten vernal pool habitat along the international border.

Road Projects

Road projects are a type of development that pose a threat to *Pogogyne nudiuscula* habitat at Otay Mesa West, Otay Mesa South, and Otay Mesa Northeast (Appendix 1). First, the listing rule identified State Route 125 construction on Otay Mesa as a project that could impact *P. nudiuscula* habitat. This project was completed and directly impacted vernal pool basins on the Otay Mesa Northeast occurrence (i.e., J29–30); however, vernal pools containing *P. nudiuscula* were avoided in one pool and seeds were collected and used to reestablish populations within their mitigation site which encompass J29–30 (Wynn, pers. obs. 2010). Second, the construction associated with Interstate 905 and Otay Mesa Road (J14) did not directly impact *P. nudiuscula*; however, indirect impacts in the future in the form of edge effects (see below) are possible. Third, State Route 11 (associated with a new U.S./Mexico border crossing) is planned southeast of State Route 125 on Otay Mesa. Though habitat is present, *P. nudiuscula* was not detected and Caltrans anticipates future potential edge effects to vernal pools if they are discovered in the area (USDOT and Caltrans 2008, p. 3.20-11–3.20-15).

Edge effects to *Pogogyne nudiuscula* 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. nudiuscula* to be in

closer proximity to disturbed areas, which may facilitate the incursion of invasive, nonnative plants that can outcompete *P. nudiuscula* for space (see also Factor E discussion). 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.

Alteration of Watershed (Hydrology)

The listing rule identified altered vernal pool watersheds and hydrology as a threat to *Pogogyne nudiuscula* habitat. Modifications to the uplands surrounding a vernal pool can negatively affect the pool's hydrology, even if such modifications occur outside the pool's surface area. For example, grading cuts near pools can accelerate the flow of water out of the subsoil (Bauder 1986b, p. 210). Similarly, graded slope-cuts upslope and adjacent to the watersheds of vernal pools may result in curtailment of water into the vernal pools. Development can alter the timing, frequency, duration, and depth of vernal pool inundation as well as water temperature. Because *P. nudiuscula* is dependent on the timing and length of inundation, alterations like those just described may prevent establishment or negatively impact the persistence of plant populations. Additionally, altered hydrology may allow runoff from adjacent developments to introduce or concentrate pollutants that could alter aspects of water chemistry (e.g., pH, alkalinity, and salinity) and make a vernal pool inhabitable by *P. nudiuscula*. Also, recent evidence suggests that run-off with an increased nutrient load may allow algal mats to flourish, inhibiting vernal pool plants or altering competitive interactions (Kneitel and Lessen 2009, p. 7).

Impacts associated with altered hydrology have continued since *Pogogyne nudiuscula* was listed and pose a threat to three of the four occurrences on Otay Mesa. In the spring and summer of 2009, water from the Otay Water District pump flowed over the road and into the J26 vernal pool complex within the Otay Mesa East occurrence. A 300 ft (91 m) stretch of land where the water was flowing from the pump into the preserve became overgrown with willows, mule fat, and cattails. By November 2009, the vernal pool affected by the flow had about 6 in (15 cm) of standing water and was overgrown by cattails. Previously, this vernal pool had one the highest known densities of *P. nudiuscula*. In the spring of 2010, no vernal pool species were observed in this pool, including *P. nudiuscula* (McMillan, pers. comm. 2009, 2010). Other vernal pools in the complex appeared unaffected. On Otay Mesa West, runoff from a neighbouring baseball field has been observed at the mitigation pools adjacent to Sweetwater High School (i.e., J32–33). This only affected one or two basins in the complex and has been stopped.

Altered hydrology may also affect sites considered for future restoration. Land that previously harbored vernal pool complexes at the now extirpated Otay Mesa South occurrence (J21, 27, 28E, 28W) south of Brown Field airport is being considered for flood control projects as a drainage holding area in order to decrease the amount of storm run-off flowing into Mexico, which resulted from urbanization and development on Otay Mesa (Kimley-Horn 2007, pp. 14–15; Wynn, pers. obs. 2010). These pools were originally lost to agriculture (this is not

considered a current threat to *Pogogyne nudiuscula*) and are included in the recovery plan as one area considered necessary for stabilization of the species (USFWS 1998, Appendix F, p. F5). If developed into a drainage holding area, this location will no longer be a potential restoration site for *P. nudiuscula*. Portions of these pool complexes are located within the MHPA, and through the City's amendment, the Service is looking to add more area to the preserve and is developing a plan that addresses the flooding and maintains the vernal pools (Wynn, pers. obs. 2010).

Although altered hydrology continues to be a threat to the species, the Service has been successful in ensuring implementation of measures to reduce this threat through section 7 consultations. For example, best management practices reduce 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 nudiuscula* 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.

Compaction and Erosion of Soil

The listing rule described trampling by humans and livestock as a threat to *Pogogyne nudiuscula* habitat. Soil may become compacted or eroded, and water may be impacted with sediment by trampling (Gifford and Hawkins 1978, p. 305). Otay Mesa is a common area for travel from Mexico to the United States, although impacts associated with travel by humans is expected to be minimal. Cattle and horses were seen entering the J26 vernal pool complex within the Otay Mesa East occurrence during spring/summer of 2009 through an opening in the fence around the complex and trampling areas inundated by the water pooling from the Otay Mesa Pump (see discussion on alteration of watershed) (McMillan, pers. comm. 2010). While the protective fence has been repaired, observers described no vernal pool species (including *P. nudiuscula*) in at least one vernal pool in the J26 complex where trampling was concentrated (McMillan, pers. comm. 2010). This current known amount of livestock trampling is not a high or consistent threat to *P. nudiuscula.*

Recent studies suggest that trampling associated with limited livestock grazing in the watershed may benefit some vernal pool species by increasing the inundation period of the pools through reduction of vegetation (particularly nonnative grass) in the watershed and compaction of the soil, which reduces infiltration (Marty 2005, p. 1630). Grazing may also increase the duration of vernal pool inundation by altering soil properties and modifying the rate of evapotranspiration from plants, thus counteracting the potential decrease in precipitation brought about by climate change to some degree (Pyke and Marty 2005, p. 1623). However, it is unknown if *Pogogyne nudiuscula* or vernal pool habitat in San Diego County benefit from low levels of trampling.

Off-Highway Vehicles (OHV)

At the time of listing, OHV use was described as an ongoing threat to *Pogogyne nudiuscula* on Otay Mesa (USFWS 1993, p. 41387). Impacts from OHV use can cause deep ruts, compact soil, bury seeds, and alter pool hydrology (Bauder 1987, p. 209). Currently, OHV impacts fall into three categories: those associated with recreational activity (often illegal) on private or public

property, those resulting from Border Patrol vehicles, and those caused by emergency response vehicles. Since listing, impacts from OHV activity have occurred at all occurrence areas except Otay Mesa East thereby altering hydrology and degrading habitat (Appendix 1). Most instances are from recreational vehicles illegally trespassing on protected property, despite efforts of landowners to deter them. Also, the vicinity of *P. nudiuscula* occurrences to the international border with Mexico make the species vulnerable to Border Patrol OHV activities that create many unauthorized roads (City of San Diego 2006, pp. 136–140). These roads are often used and expanded by recreational OHV users. OHV use by emergency response (e.g., fire suppression and aviation emergencies) and law enforcement agents may also impact *P. nudiuscula* habitat. Despite attempts to deter unauthorized OHV use by fencing and signage, OHV activity remains a threat to *P. nudiuscula*. For example, the J14 vernal pool complex in the Otay Mesa West occurrence has been severely impacted by recreational OHV use (McMillan, pers. comm. 2010). Since the building of Interstate 905, patrolling of this complex has occurred and lessened OHV use, but whether *P. nudiuscula* remains a viable population is in question (McMillan, pers. comm. 2010). However, Caltrans has recently purchased the site and it is hoped that the vernal pools complexes will be restored and protected from OHV use.

Since listing, OHV continues to threaten *Pogogyne nudiuscula*, especially from recreational and Border Patrol activities (see Appendix 1). Installation and maintenance of fencing and signage are needed to help protect *P. nudiuscula* habitat from these impacts.

Summary for Factor A

Urban development, alteration of hydrology, road projects, and OHVs (which were known to threaten *Pogogyne nudiuscula* at the time of listing) continue to threaten the species. Loss of habitat associated with various types of development activities has decreased since listing as a result of conservation measures associated with individual projects and acquisition by Caltrans as well as the installation of protective fencing and signage; some of these threats remain an ongoing threat to vernal pool complexes in all occurrences. The Service stresses avoidance of occupied vernal pools when analyzing development projects with a Federal nexus during section 7 consultations. Impacts to *P. nudiuscula* habitat are typically minimized through preservation and enhancement of existing vernal pools, or restoration of complex areas that once supported vernal pools. Impacts of development and altered hydrology have lessened and many occurrences have been restored or partially restored, however, these remain the prominent threats to *P. nudiuscula*. Additionally, further research is necessary to determine if restored pools provide for the long term success of *P. nudiuscula*. In addition to direct loss of habitat, road projects may pose indirect impacts in the form of edge effects. Compaction and erosion of soils associated with unpermitted grazing has occurred at one pool complex since listing, but is not considered a major threat. OHV use continues to threaten *P. nudiuscula* as a result of recreational activities and Border Patrol. Threats attributable to Factor A are identified for the occurrences listed in Appendix 1. Because these threats continue to persist, we believe that the destruction, modification, and curtailment of habitat continue to threaten *P. nudiuscula*.

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

Overutilization for commercial purposes was not known to be a factor in the 1993 final listing rule (USFWS 1993, p. 41388). Unrestricted collection was mentioned in the listing rule as a potential impact to *Pogogyne nudiuscula* associated with increased publicity associated with listing this species under the Act; however, we have no information to indicate that this was or is likely to become a threat to the species. Overutilization for any purpose does not appear to be a threat at this time.

FACTOR C: Disease or Predation

Disease and predation were not known to be a threat at the time of listing (USFWS 1993, p. 41388). There was only one reported incident of grazing affecting *Pogogyne nudiuscula* since listing, where cattle grazed at the Otay Mesa East occurrence (specifically the J26 vernal pool complex). The existence of cattle trails suggests that this occurred repeatedly; however, cattle were observed during the winter period when plants had already senesced (McMillan, pers. comm. 2009). Whether this occurred when the plants were mature in the spring/summer is unknown or whether the cattle were grazing specifically on *P. nudiuscula* plants or other vernal pool vegetation. The fence protecting the vernal pools at this complex has been repaired and prevents cattle from entering the area (McMillan, pers. comm. 2010). Disease and predation are not considered persistent or rangewide threats to *P. nudiuscula*.

FACTOR D: Inadequacy of Existing Regulatory Mechanisms

At the time of listing, regulatory mechanisms that provided some protection for *Pogogyne nudiuscula* included: (1) the Act in cases where *P. nudiuscula* co-occurred with a listed species; (2) California Endangered Species Act (CESA); (3) California Environmental Quality Act (CEQA); (4) implementation of conservation plans pursuant to the Natural Community Conservation Planning (NCCP) Act; (5) land acquisition and management by Federal, State, or local agencies or by private groups and organizations; and (6) local laws and regulations. The listing rule analyzed the potential level of protection provided by these regulatory mechanisms (USFWS 1998, p. 54947). The following discussion describes State and Federal laws and regulations that are relevant to conservation of *Pogogyne nudiuscula* and contribute to its conservation. These measures, most enacted in the past 30 to 40 years, have greatly reduced or eliminated the threat of habitat destruction for this plant.

State Protections in California

State laws potentially providing protection to *Pogogyne nudiuscula* include CESA, Native Plant Protection Act (NPPA), CEQA, and the NCCP Act enacted in 1991. *Pogogyne nudiuscula* was State-listed in 1987.

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

Both the CESA and NPPA 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 affect 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 plant or animal; 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 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 MSCP and County of San Diego Subarea Plan under the MSCP are 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 nudiuscula*. 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 animal or plant species or result in the destruction or adverse modification of critical habitat. Therefore, HCPs may provide an additional layer of regulatory protection to animals as well as plants. 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. The City of San Diego MSCP Subarea Plan, and County of San Diego MSCP Subarea Plan are discussed below.

San Diego Multiple Species Conservation Plan (MSCP)

In southwestern San Diego County, the MSCP planning area encompasses more than 582,000 ac and includes the County of San Diego, City of San Diego, ten 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 69,202 ha (171,000 ac) of preserve areas to provide conservation benefits for 85 federally listed and sensitive species, including *Pogogyne nudiuscula*, over the permit term. The MSCP anticipates the conservation of at least 88 percent of vernal pool habitat, requires avoidance of impacts to *P. nudiuscula* and its habitat to the maximum extent practicable, mitigation for impacts deemed unavoidable, and management to protect habitat against edge effects to *P. nudiuscula*.

As discussed above under "Clean Water Act," the Corps LAD generally took jurisdiction over all *Pogogyne nudiuscula* 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. nudiuscula* habitat under section 404 of the CWA and section 7 of the Act to insure compliance with the USEPA's CWA, 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. nudiuscula* and six other vernal pool species. The court held that the City's Subarea Plan does not provide adequate protection for *P. nudiuscula* 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 City is currently revising its subarea plan to restore coverage for those species. 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 nudiuscula* 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. nudiuscula* under the MSCP and is updating their wetland ordinance. Despite the City's relinquishment of their permit, 99.6 percent of the 0.64 ac of vernal pool habitat that contains *P. nudiuscula* is within the subregional MSCP and is considered conserved (City of San Diego 2004, p. 12). The Service is working with the City to conserve more suitable habitat for future restoration and potential reestablishment of *Pogogyne nudiuscula* populations, which is necessary if the species' range is to expand. The City continues to monitor and manage vernal pools in support of the MSCP.

Mexican Law

The Service is not aware of any existing regulatory mechanisms that would protect *Pogogyne nudiuscula* or its habitat if it were found again in Mexico. *Pogogyne nudiuscula* is not protected or listed under Mexican endangered species law (NOM–059–ECOL–2001*),* and we know of no laws that protect vernal pool habitat.

Summary for Factor D

Since listing in 1993, the Act is the primary law that provides protection for *Pogogyne nudiuscula* on Federal lands or in instances where there is a Federal nexus. Nearly all

occurrences of *P. nudiuscula* are conserved under the San Diego's MSCP; however, coverage for this species and six other vernal pool species was removed from the City of San Diego Subarea Plan in April 2010. The Service accepted the City's relinquishment of coverage for vernal pool species; thus, *P. nudiuscula* is no longer a covered species under the subarea plan. However, the City of San Diego is currently working with the Service to revise and improve the management plan for *P. nudiuscula* under the MSCP. Other Federal and State regulatory mechanisms provide discretionary protections for the species based on current management direction, but do not guarantee protection for the species absent its status under the Act. However, once a revised subarea plan is completed that provides coverage for *P. nudiuscula*, the Act will likely provide the most effective protection for the species.

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

The listing rule identified introduction of nonnative plants and competition with invading species (combined below as "competition with invasive, nonnative plants"), trash dumping, fire and fire suppression activities, drought and low numbers of vernal pool habitats and their scattered distributions (now termed "small population and restricted range") as threats to *Pogogyne nudiuscula* (USFWS 1993, pp. 41389–41390). Pedestrian and livestock trampling, pedestrian introduction of nonnatives, and OHV activity were not explicitly listed in the final rule as threats to the plants; rather, they were discussed in Factor A as threats to the species habitat. These Factor E threats, along with trash dumping, will be grouped together and discussed below as human access and disturbance effects. Newly identified threats associated with climate change were not described in the final listing rule but will be described with drought. Impacts from these Factor E threats are discussed below under the following headings: Competition with Invasive Nonnative Plants, Human Access and Disturbance Effects, Fire and Fire Suppression Activity, Drought and Climate Change, and Small Population Size and Restricted Range.

Competition with Invasive, Nonnative Plants

The listing rule stated that nonnative species of grasses and forbs invade many plant communities often as an indirect result of habitat disturbance (USFWS 1993, p. 41389). At listing, many vernal pools on Otay Mesa were dominated by the nonnative *Lolium perenne* (perennial ryegrass). This nonnative perennial displaced *Pogogyne nudiuscula* in many vernal pools because it is more tolerant of inundation and capable of outcompeting *P. nudiuscula* for space. The listing rule cited a nonnative, weedy grass (which was not named in the rule) that was introduced as a forage species for livestock grazing as partially explaining two extirpations of *P. nudiuscula* (USFWS 1993, p. 41389); nonnatives may also be introduced by pedestrians.

Invasive, nonnative plants that may impact *Pogogyne nudiuscula* 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 affect 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 invasive species to occupy otherwise unfavorable areas. These alterations lead to a greater likelihood of invasion by nonnative species (Bauder 2005, p. 2134).

Bauder (2005, p. 2133) states that *Agrostis avenaca* and *Polypogon monspeliensis* are present in San Diego County vernal pools, and that research in the field and under controlled conditions indicates *"both grasses negatively affect native pool species in a variety of ways, ranging from survivorship to reproductive success."* These two plant taxa are tracked by the California Invasive Plant Council (Cal-IPC) as invasive plants that impact vernal pools and wetlands (CNPS, accessed March 16, 2010). Prevention of plant invasions and immediate removal of invasive plants has been noted as important to address and control nonnative species introduction and competition (Vitousek *et al.* 1997, pp. 1–16; Batten 2008, pp. 1–8). Because of lack of site management, and ubiquitous nonnative plants in and near vernal pool ecosystems, invasive species pose increase the extinction threat to *Pogogyne nudiuscula*, and other vernal pools plants under climate change scenarios.

Depending upon conditions, certain invasive, nonnative plants (such as the grasses discussed above) may replace *Pogogyne nudiuscula*. Therefore, we consider invasive, nonnative plants to be a continuing rangewide threat to all extant occurrences of *P. nudiuscula.*

Human Access and Disturbance Effects

Human access or disturbance associated with adjacent development, including: trampling, OHV activity, pedestrian introduction of nonnatives, and trash dumping often result damage or death to *Pogogyne nudiuscula* plants. These conditions often result in increased separation between *P. nudiuscula* occurrences. Since listing, impacts associated with human access and disturbance have been documented at all *P. nudiuscula* occurrences, with the exception of the vernal pool complexes J23–J25 at the Otay Mesa East occurrence (Appendix 1). Trampling by pedestrians, OHV use, and trash dumping may damage or kill plants. Trash dumping can also directly impact *P. nudiuscula* by crushing or shading plants and releasing toxic substances that harm *P. nudiuscula* plants, which has been a reoccurring problem at the Otay Mesa West occurrence (Wynn, pers. obs. 2010). The benefits of limiting human access to vernal pool species is evident at the J23–J25 vernal pool complexes, which are one of the most extensive and least disturbed vernal pool complexes on Otay Mesa (EDAW 2007, pp. 51–52). This area was historically used as an ammunition testing and training ground and access remains prohibited. Human access necessary to restore these pools and make them safe by clearing remaining bombing materials is likely to further disturb vernal pool species, such as *P. nudiuscula*. Recent observations indicate that there may be an increase in the number of *P. nudiuscula* plants within the pools that border the non-accessible area (McMillan, pers. comm. 2010).

Protective fencing is used in several conserved areas to protect vernal pool complexes and has been successful in significantly decreasing the impact of trampling and OHV use in the J29–30 vernal pool complex at Otay Mesa Northeast and J2 N/W/S vernal pool complex at Otay Mesa West (City of San Diego 1997, p. 299, 316). Though implementing this protective measure has lessened the impacts of human access and disturbance, such effects still threaten *Pogogyne nudiuscula* occurrences. The J32 complex in the Otay Mesa West occurrence may be the most

severely impacted by trampling due to foot traffic by immigrants, transients, Border Patrol, and OHV use (City of San Diego 1997, p. 236). Fencing was installed and stolen (City of San Diego 1997, p. 236) indicating that monitoring is critical in reducing the impacts of human access and disturbance.

Fire and Fire Suppression Activity

Fire and fire suppression were identified as potential threats to *Pogogyne nudiuscula* in the listing rule. The ecological effects of fire exclusion have not been specifically detailed for vernal pool habitat in southern California; 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. nudiuscula* during the dry season) are replaced by species that are able to outcompete for growing resources in the absence of fire (Keane *et al.* 2002, pp. 3–11).

While complete fire exclusion may result in *Pogogyne nudiuscula* being outcompeted for space, the alternative may pose an equal threat as fires at critical times can eliminate populations of *P. nudiuscula* by killing individual plants, overheating soil to create hydrophobic conditions, or intense heat that 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), or a higher density of established native upland species that have not been disturbed by fires in the past (MALBGBC 2007, p. 7).

The listing rule stated that fire in the summer of 1992 burned 25 percent of the *Pogogyne nudiuscula* population on Otay Mesa (does not specify occurrence areas or pool complexes), which may have resulted in extensive damage to the seed bank (USFWS 1993, p. 41389). The rule also stated that a fire break likely impaired the dispersal of seeds from the burned to unburned areas. Data does not indicate a fire footprint overlapping with any of the *P. nudiuscula* occurrences in 1992; therefore, it is difficult to assess the impacts. This particular fire was probably a small brush fire that did not impact the persistence of the species in that area. Additionally, recent fire footprints from 2003 and 2007 in the Otay Mesa area did not overlap with any current occurrences.

Fire and fire suppression have been identified as a current potential threat at three of the four occurrences (vernal pool complexes J2, J2 N/W/S, J28, J14, and J29–30), with the exception of the Otay Mesa East occurrence. These areas may serve as a staging area in the event of a fire if defensible structures are developed in the vicinity (City of San Diego 1997).

Drought and Climate Change

The listing rule stated that impacts from drought threaten *Pogogyne nudiuscula* (USFWS 1993, p. 41389). Drier conditions and drought remain a threat to all occurrences of *P. nudiuscula* and are 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). However, climate-related changes in California have been documented (Croke *et al.* 1998; pp. 2128, 2130; Breshears *et al.* 2005, p. 15144). Predictions for California indicate prolonged drought and other climate-related changes will continue in the future (e.g., 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. nudiuscula* which depend on specific hydrological regimes may be more severe (Graham 1997, p. 2).

Rainfall and temperature both affect the germination rate, survival and successful reproduction of *Pogogyne nudiuscula*. Five factors associated with a changing climate may affect the long-term viability of *P. nudiuscula* occurrences in its current habitat configuration: (1) Drier conditions may result in a lower percent germination and smaller population sizes; (2) higher temperatures may inhibit germination; (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. nudiuscula*; and (5) drier conditions may result in increased fire frequency, making the ecosystems in which *P. nudiuscula* currently grows more vulnerable to the threats of subsequent erosion and invasive species. In a changing climate, conditions could change in a way that would allow both native and nonnative plants to invade the habitat where *P. nudiuscula* currently 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 nudiuscula* or sites at this time. However, it is likely that impacts from existing threats could increase and new threats may arise. Sharing information between scientists, land managers, and decision makers will increase our ability to address and manage these threats.

Small Population Size

The listing rule identified the restricted range and scattered distribution of *Pogogyne nudiuscula* as 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). Genetic exchange among vernal pool complexes is naturally limited; however, loss of intervening pool complexes can artificially further reduce genetic exchange and in some instances virtually eliminate the potential. *Pogogyne nudiuscula* is limited by its inherent ecological tolerances and by past and current anthropogenic activities that occur within a vernal pool, in proximity to vernal pool complexes, or within a watershed of a vernal pool complex. Stochastic events outside the range of natural variability, such as floods, fires, contamination, or drought, can substantially reduce or eliminate small populations and increase the likelihood of extinction (Lande 1993, p. 912).

Genetic effects may further influence population demography of *Pogogyne nudiuscula* 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 find each other (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. *Pogogyne nudiuscula* is currently found at only three locations on Otay Mesa and has been extirpated from vernal pool complexes within these three locations (Appendix 1). As the range of *P. nudiuscula* continues to decrease, reproductive opportunities and genetic exchange among vernal pool complexes also decreases. This illuminates the need to conserve areas of future suitable *P. nudiuscula* habitat in order to expand the range and decrease the threat of a small population size.

Since listing, *Pogogyne nudiuscula's* range has decreased and there have been no new occurrences of the species. Therefore, restricted range and small population size continue to threaten *P. nudiuscula* at all of its occurrences.

Summary for Factor E

In summary, impacts associated with competition from invasive nonnative plants, human access and disturbance, fire and fire suppression, climate change, and small population size and restricted range continue to threaten *Pogogyne nudiuscula*. Since listing, human access and disturbance effects associated with adjacent development are documented to occur at all of the *P. nudiuscula* occurrences, and certain invasive nonnative plants may replace *P. nudiuscula* if conditions are appropriate. Climate change impacts to habitats and associated species such as vernal pools may intensify. Although climate change data specific to *P. nudiuscula* is currently unavailable, adverse impacts to *P. nudiuscula* and its habitat are probable. The narrow ecological and geographical range of *P. nudiuscula* makes it particularly vulnerable to all threats. Therefore, we believe that these natural and man-made factors continue to threaten *P. nudiuscula*.

III. RECOVERY CRITERIA

Pursuant to section 4(f) of the Act, recovery plans are developed to 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. Recovery plans are required to contain objective, measurable criteria, which, when met, would result in a determination that the species be delisted. Conservation (i.e., recovery) is defined in section 3 of the Act as the "use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this Act are no longer necessary." In accordance with section 4(a)(1) of the Act, we determine if any species is an endangered or threatened species because of any of the five threat factors identified in the Act and evaluated in this 5-year review. Therefore, we revise the listed status of a species based on the outcome of an analysis of these five factors.

Although recovery plans are not regulatory documents, they provide a guide on how to achieve recovery based on information available at the time the recovery plan is finalized. Recovery criteria describe measurable projected outcomes or an estimated species response to a reduction

or removal of the threats to a species as described in a five-factor analysis. However, reduction or removal of threats may occur without meeting all recovery criteria contained in a recovery plan, as there are many paths to accomplishing 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 other cases, recovery opportunities may have been recognized that were not known at the time the recovery plan was finalized. Likewise, we may learn information about the species or threats that was not known at the time the recovery plan was finalized. 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.

Consistent with section 4 of the Act, determinations whether any federally listed species should be: (i) removed from the list; (ii) changed in status from endangered to threatened; or (iii) changed in status from threatened to endangered will be made in accordance with an analysis of the five factors. Therefore, although we expect at the time a recovery plan is published that recovery criteria will be met, the actual determination of appropriate listing status is not based solely on whether recovery criteria have been met. Rather, progress towards fulfilling recovery criteria serves to indicate the extent to which threats have been reduced or eliminated. In absence of meeting recovery plan criteria, the Service may judge in some cases that overall the threats have been reduced sufficiently and the species is sufficiently robust to either reclassify the species from endangered to threatened, or delist the species.

The criteria to assess recovery of *Pogogyne nudiuscula* provided in the 1998 Recovery Plan does not reflect the most current information available. The recovery criteria are not threats-based, which is current policy for recovery plan development, but the criteria speak indirectly to the threats outlined in the five-factor analysis section of this review and the final listing rule. Overall, progress is being made toward satisfying the recovery criteria, although, as written in the 1998 Recovery Plan, none can be fully achieved. The Recovery Plan should be revised and updated to provide threats-based recovery criteria and address the other shortcomings of the Recovery Plan discussed within this review.

The Recovery Plan for Vernal Pools of Southern California outlines four criteria for the recovery of *Pogogyne nudiuscula* (USFWS 1998, p. v–vi). The recovery criteria for stabilizing and delisting *P. nudiuscula* are as follows:

Criteria 1–2: *All the existing vernal pools and their watersheds identified in Appendix F and G of the Recovery Plan should be secured from further loss and degradation in a configuration that maintains habitat function and viability (as determined by prescribed research tasks).*

This recovery criterion does not explicitly address any of the threat factors identified in the five-factor analysis in the listing rule or in the above discussion. Moreover, achievement of this criterion as written is complicated by the fact that some pool basins within the complexes identified in Appendices F and G have been developed or preserved in accordance with provisions of regional HCPs since the completion of the Recovery Plan. However, working toward the goals in this criterion will reduce the threats discussed above under Factors A and E. Securing vernal pool complexes physically, legally, and ecologically would reduce threats posed

by development (e.g., habitat loss and alterations of hydrology) and discussed under Factor A and E above.

As discussed in Factor A, all of the extant occurrences of *Pogogyne nudiuscula*, are partially or completely conserved and those that are only partial conserved have been mitigated in another area of suitable habitat (Appendix 1). These protections generally extend to direct loss and not necessarily indirect loss of habitat through degradation. These lands are under conservation easements or protected in perpetuity, conserved through mitigation, or have some sort of protection from development (Appendix 1). Pools within these areas meet the criterion in the Recovery Plan as "secured legally" from further habitat loss. In the Recovery Plan, Appendix F lists the vernal pool occurrences that are necessary to stabilize the proposed and listed vernal pool species (USFWS 1998, p. F1). Appendix G of the Recovery Plan lists vernal pool occurrences identified as necessary to secure in order to reclassify the proposed and listed vernal pool species (USFWS 1998, p. G1). Appendix G broadly lists complex J (undescribed) and J–3 and J–22. *Pogogyne nudiuscula* is found throughout the J complex and portions of this complex have been conserved partially or fully and other areas have been extirpated and mitigated. Although some of these occurrences are considered secure from development, they are not all guaranteed monitoring or maintenance in perpetuity.

Although it is not possible to specifically identify every complex in Appendices F and G of the Recovery Plan, development and impacts on complexes listed in Appendices F and G that contain *P. nudiuscula* should be avoided. Additionally, the Service is working towards conserving these complexes.

Criterion 3: *Secured vernal pools must be enhanced or restored such that population levels of existing species are stabilized or increased.*

This criterion does not directly address any of the threats discussed above in the five-factor analysis. Rather, it uses a measure of stability that is not easily assessed for *Pogogyne nudiuscula*. As discussed in the abundance section of this 5-year review, the population numbers for *P. nudiuscula* are not easily measured. Because methods of measurement are not standardized and *P. nudiuscula* does not germinate every year, population abundance is not a good indicator for the species. However, restoration and management do provide a measure of protection against threats to the species.

Additionally, the CFWO issues biological opinions associated with consultations under section 7 of the Act for *Pogogyne nudiuscula.* These opinions detail avoidance and minimization measures to prevent jeopardizing the species' continued existence and can include restoration of *P. nudiuscula* habitat. Many of these opinions lead to successful restoration and protected populations of *P. nudiuscula*. Some pools are being restored and therefore meet the outlined goals of Criterion 3 in the Recovery Plan.

Criterion 4: *Population trends must be shown to be stable or increasing for a minimum of 10 consecutive years prior to consideration for reclassification.*

This criterion does not directly address any threats outlined in the five-factor analysis. In order to stabilize or increase the population, threats would have to be reduced. Reducing the threats discussed above in Factors A and E would help us provide the conditions needed to work toward the goal in this criterion, but vernal pool habitat has been reduced by human-induced conversion (Bauder and McMillan 1998, p. 66). As yet, however, it is difficult to assess the abundance of *Pogogyne nudiuscula* in the absence of standardized sampling methods and population trends for vernal pool annuals are often difficult to detect. Therefore, we are unable to address this criterion.

IV. SYNTHESIS

Pogogyne nudiuscula was listed in 1993 primarily due to the threats associated with development throughout the range of the species. By that time, vernal pool habitat in San Diego County had reportedly been reduced by an estimated 97 percent (Baskin 1994, p. 384). At the time the listing rule was written, *P. nudiuscula* was extirpated from all but four locations on Otay Mesa. The impacts of development on *P. nudiuscula* and its habitat have been greatly reduced by the protection afforded the species by the Act, especially the MSCP and associated HCPs. Since listing, *P. nudiuscula* continues to be extant at three locations on Otay Mesa. However, it has been extirpated from Otay Mesa South and has been impacted at Otay Mesa East (J14) and Otay Mesa West (J26). No new extant occurrences (does not include restored pools, rather naturally occurring *P. nudiuscula* occurrences) have been identified and it is difficult to determine the current status and abundance at occurrence sites. While *P. nudiuscula* occurs in areas that are partially conserved or mitigated, occurrences are not all afforded maintenance or monitoring.

The primary threat of direct habitat loss via development has been greatly reduced since listing, though some historical and newly identified threats continue to impact *Pogogyne nudiuscula* and its habitat (alteration of the watershed, habitat fragmentation, OHV use, trampling, road projects, human access and disturbance, fire and fire suppression, and climate change). As San Diego is expected to increase in population, and urbanization is unavoidable, the threats to *P. nudiuscula* and its habitat will likely persist. Lack of evidence of additional occurrences since listing and the suspected extirpations on Otay Mesa South indicate that *Pogogyne nudiuscula's* range may be decreasing. The small range and narrow habitat tolerances of *P. nudiuscula* make this species particularly vulnerable. The threats associated with development (restorable habitat), nonnative plants, and climate change are essentially rangewide. Therefore, we believe that *P. nudiuscula* still meets the definition of endangered, and recommend no status change 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*
__X_ 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 vernal pool habitat that supports *Pogogyne nudiuscula*, including monitoring of restored/enhanced habitat to determine if vernal pool restoration projects continue to be viable through time (e.g., artificial clay layer remains stable and supports adequate ponding).

2. Work with the Otay Mesa Water District to address inundation of pools in J26 from the Otay Mesa water pump. Implement measures to ensure that water does not flow over the road and into the pools.

3. Conduct research to determine life history traits most vulnerable to threats discussed in the five factor analysis.

4. Develop a dynamic, threats based, species-specific recovery plan based on analysis of current knowledge of the species.

5. Establish a seed bank for *Pogogyne nudiuscula* according to Center for Plant Conservation guidelines.

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

Pogogyne nudiuscula
(Otay Mesa Mint)

Current Classification: Endangered

Recommendation Resulting from the 5-Year Review:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
__x__ No change needed

Review Conducted By: Carlsbad Fish and Wildlife Office

FIELD OFFICE APPROVAL:

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

ACTING

Approve _____ Scott A. Sobiech Date SEP 01 2010

Appendix 1. Historic and Current Range of *Pogogyne Nudiuscula* in San Diego, CA.

AREA and OCCURRENCE		POOL COMPLEX	OWNER	STATUS AT LISTING	CURRENT STATUS	MAJOR THREATS	CURRENT CONSERVATION
Carroll Canyon	EO11		City of San Diego	Extirpated. Questionable identification (Heckard #1824, May 7, 1968)	Extirpated	A. Development	
University Heights*	EO4		Private	Extirpated. Questionable identification (Alderson #998 DS, May 15, 1895)	Extirpated	A. Development	
Balboa Park*	EO9		City of San Diego	Questionable identification (Gander # 198.5, May 4, 1935)	Extirpated	A. Development	
Mission Valley	EO10		Private	Questionable identification (Brandegee,T.S., June 6, 1894)	Extirpated	A. Development	
Otay Mesa - West	EO8	J1	Private	Extirpated	Extirpated	A. Development	Developed (USFWS1997b, RECON 1997).

Otay Mesa West (continued)		J2, J2N/W/S, (Calterraces)	Private/City of San Diego/ Cal Trans	Extant	Partially extant	A. Development, OHV use E. Nonnative plants, human access and disturbance, fire and fire suppression	Partial conservation, restoration, mitigation pools (Helix 1997, RECON 1997, USFWS 1997, 2004b).
		(J4-5) Robinhood Ridge)	Private/City of San Diego	Extant	Extant	A. Development E. Nonnative plants, fragmentation, human access and disturbance	Partially developed, remainder conserved and restored, planned mitigation (USFWS 1998b).
		J14	Private	Extant	Possibly extirpated	A. Development, OHV use, road projects E. Nonnatives plants, human access and disturbance, fire and fire suppression	Partially conserved. Possible future restoration (RECON 1997, USFWS 2004a).
		J32-33	Sweetwater Union High School/ CFG/Private	Extant	Extant	A. Development, altered Watershed E. Nonnative plants, human access and disturbance	Partially conserved/restored. Mitigation Site (Helix 2008, USFWS 2000).
Otay Mesa - East	EO1	J26	TET/Otay Water District	Extant	Partially Extant	A. Altered watershed, compaction and erosion of soil, E. Nonnative plants, human access and disturbance	Partially conserved/restored, unsure of future (USFWS 1996).
	EO3	J23-25	County of San Diego	Extant	Extant	E. Nonnative plants	Not conserved but previous ammunitions testing makes it non-accessable (EDAW 2007).

Otay Mesa - South	EO6	J21, J27, J28E, J28W	Private	Extant	Extirpated	A. Development, road projects, altered watershed, OHV use E. Nonnative plants, human access and disturbance, fire and fire suppression	May be used as a drainage area potential for future restoration (Kimley-Horn 2007, Wynn, pers. obs. 2010),
Otay Mesa - Northeast	EO5	J29-30	SANDAG/ Caltrans/Private	Extant at listing	Extant	A. OHV use, road projects E. Nonnative plants, human access and disturbance, fire and fire suppression	Conserved, partially fenced, will be restored (City of San Diego 1997 2004, 2006, Wynn, pers. obs. 2010)
Linda Vista**				M.F. Spencer May 5, 1921. Herbarium specimen POM15001.	Extirpated	A. Development	
Tijuana, Baja California, Mexico				Extirpated	Extirpated		

This Appendix is a compilation of information from CNDDB (CNDDB 2010), preserved herbarium specimens (CCH 2010), the Service's Recovery Plan for Vernal Pools of Southern California (USFWS 1998), the City of San Diego's Vernal Pool Inventory (City of San Diego 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 CNDDB assigns different EO numbers to occurrences that are more than a quarter mile (400 meters) apart. In Appendix 1 our larger, more broadly described areas (e.g., Otay Mesa West) may include more than one EO. In the listing rule, use of the term "population" for places where *P. nudiuscula* occurred implied a biological context that is unproven.

* Herbarium specimens were verified to be *Pogogyne abramsii*. There are no herbarium specimens from this area for *Pogogyne nudiuscula*.

** Herbarium specimen was verified to be *Pogogyne nudiuscula*. There is another herbarium specimen from this area and it was confirmed to be *Pogogyne abramsii*. It is not possible to determine if they co-occurred because of the lack of exact location data.