Eryngium aristulatum var. *parishii*
San Diego button celery

5-Year Review:
Summary and Evaluation

Eryngium aristulatum var. *parishii* (San Diego button-celery). Photo credit Susan Wynn, (USFWS 2010).

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

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5-YEAR REVIEW
Eryngium aristulatum var. *parishii* (San Diego button celery)

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 (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. 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:

Eryngium aristulatum var. *parishii* (San Diego button-celery) is a small, low-spreading, green-flowered bi-annual herb in the Apiaceae (parsley/carrot family). It is restricted to southern coastal California, with few occurrences in northern Baja California, Mexico. The species, *Eryngium aristulatum*, and this variety are closely associated with ephemeral vernal pool habitat on clay soils. The majority (97 percent) of vernal pool habitat was lost prior to listing throughout the range of this variety (USFWS 1993, pp. 41384–41392). Many existing complexes are remnant colonies of once larger populations and are subject to various forms of authorized and unauthorized disturbance (USFWS 1993, pp. 41384–41392; Reiser 1994, p. 1). *Eryngium aristulatum* var. *parishii* was federally listed as endangered on August 3, 1993 (USFWS 1993, p. 41391) and at that time was found in Riverside County at Santa Rosa Plateau, in San Diego County at Otay Mesa, Kearny Mesa, Del Mar Mesa, Marine Corps Air Station (MCAS) Miramar, and Marine Corps Base (MCB) Camp Pendleton, and in northern Baja California, Mexico. By 1998, *E. a.* var. *parishii* continued to exist in approximately 61 vernal pool complexes in the United States (USFWS 1998, pp. 1-100). *Eryngium a.* var. *parishii* is variously associated with other federally listed vernal pool taxa including *Orcuttia californica* (California Orcutt grass), *Pogogyne abramsii* (San Diego mesa mint), *Pogogyne nudiuscula* (Otay mesa mint), *Navarretia fossalis* (spreading navarretia), San Diego fairy-shrimp (*Branchinecta sandiegonensis)*, and Riverside fairy-shrimp (*Streptocephalus woottoni).*

Methodology Used to Complete This Review:

This review was prepared by 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 landowners and managers, and the California Natural Diversity Database (CNDDB) maintained by the California Department of Fish and Game (CDFG). We received one response from the public in response to our Federal Register notice initiating this 5-year review and information relevant to the taxon being reviewed here is incorporated (L. Hering, U.S. Department of the Navy, *in litt.* 2009; USFWS 2009, pp. 12878–12883). This 5-year review contains updated information on the species' biology and threats, and an assessment of this information compared to that known at the time of listing. We focus on current threats to the species that are attributable to the Act's five listing factors. The review synthesizes all this information to evaluate the listing status of the species and provide an indication of its progress towards recovery. Finally, based on this synthesis and the threats identified in the five-factor analysis, we recommend a prioritized list of conservation actions to be completed within the next 5 years.

Contact Information:

Lead Regional Office: Larry Rabin, Deputy Division Chief for Listing, Recovery, and Habitat Conservation Planning, Region 8; (916) 414–6464.

Lead Field Office: Bradd Baskerville-Bridges, Recovery Branch Chief, Carlsbad Fish and Wildlife Office; (760) 431–9440.

Federal Register (FR) Notice Citation Announcing Initiation of This Review: A notice announcing initiation of the 5-year review of this taxon and the opening of a 60-day period to receive information from the public was published in the Federal Register on March 25, 2009 (USFWS 2009, pp. 12878–12883). One response was received and information relevant to *Eryngium aristulatum* var. *parishii* is incorporated in this review.

Listing History:

Original Listing
FR Notice: 58 FR 41384
Date of Final Listing Rule: August 3, 1993
Entity Listed: *Eryngium aristulatum* var. *parishii* (San Diego button celery), a plant variety.
Classification: Endangered

State Listing
Eryngium aristulatum var. *parishii* was listed by the State of California as endangered in July 1979.

Associated Rulemakings: None

Review History: No previous taxon specific reviews have been conducted.

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

The recovery priority number for *Eryngium aristulatum* var. *parishii* is 9C 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, pp. 43098–43105). This number indicates that the taxon is a variety that faces a moderate degree of threat and has a high recovery potential. 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 1998

II. REVIEW ANALYSIS

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

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

Information on the Species and its Status:

Species Description

Eryngium aristulatum var. parishii (San Diego button celery; coyote thistle) is a biennial or longer lived perennial gray-green herb that has a storage tap-root. It has a spreading shape and reaches a height of 40 centimeters (16 inches) (Constance 1993, pp. 146–147). The stems and lanceolate leaves give the plant a prickly appearance. It is a clay soil, surface and non-surface hard pan, vernal pool obligate and relies on ephemerally wet conditions to reproduce; blooming from April to June. It is an outcrossing taxon that reproduces exclusively by seeds.

Eryngium aristulatum var. *parishii* is one of three varieties of *Eryngium aristulatum* (Constance 1993, p. 147). *Eryngium aristulatum* var. *parishii* is separated from *Eryngium aristulatum* var. *aristulatum* (common) by having styles in fruit that are about the same length as the calyx (outer whorl of protective structures around the flower) and is separated from *Eryngium aristulatum* var. *hooveri* (Hoover's button-celery) by having bractlets (modified leaves) without callused margins (Constance 1993, pp. 147–148).

Some populations once identified as *Eryngium aristulatum* var. *parishii* on MCB Camp Pendleton are in fact *Eryngium pendletonensis* (Pendleton's eryngo; Marsden and Simpson 1999, pp. 61–64). *Eryngium aristulatum* var. *parishii* is distinguished from *Eryngium pendletonensis* by a combination of leaf and flower characteristics (Marsden and Simpson 1999, pp. 61–64; Jepson Interchange 2009, pp. 1–4).

Species Biology and Life History

Eryngium aristulatum var. *aristulatum* is insect pollinated (Gauduel and Till-Bottraud 2004, pp. 711–721), and *E. a.* var. *parishii* is presumably insect-pollinated (Zedler 1987, pp. 61–64), potentially by bee flies (Bombyliids) (Schiller *et al.* 2000, pp. 386–396) and solitary bees (Apoidea), as are many vernal pool species (Thorpe 2007, pp. 51–57). Currently, the level of synecological relationships between pollinators and *E. a.* var. *parishii* is unknown. If a close ecological relationship exists with *E. a.* var. *parishii* and its pollinators, conservation of the pollinators at all life stages in habitat proximal to the vernal pool may be needed to preserve the efficiency of the pollination service (Thorp 2007, pp. 51–57). Numerous plant species in vernal pools have co-evolved with specialist solitary bees or other insect pollinators; pollinator groups can exert significant influence on the site retention of plant taxa (Moldenke 1976, pp. 305–361; Thorp 1976, pp. 36–40; Joris 2006, pp. 1–87; Thorp 2007, pp. 51–57). Local and widespread insect extirpations and extinctions have been neglected, and are only rarely documented (Dunn 2005, pp. 1030–1036). Specialist bee pollinators of vernal pool flowering plants have been well documented in California vernal pools (Thorp 1989, pp. 109–122; Thorp and Leong 1995, pp. 3–7; Thorp 1998, pp. 169–179; Thorp 2007, pp. 51–57, Thorp 2009 pp. 1–9). Diversity of insects, and insect pollinator presence and diversity in and near California vernal pools within the range of *E. a.* var. *parishii* is virtually unknown.

Eryngium aristulatum var. *parishii* seems more tolerant of peripheral vernal pool habitat than most obligate vernal pool species. It is specifically adapted to surviving in vernally wet conditions due to the presence of aerenchyma tissue (air channels in the roots) that facilitates necessary gas exchange in submerged plants (Keeley 1998, pp. 121–175).

Spatial Distribution

At the time of listing, *Eryngium aristulatum* var. *parishii* was considered extant in Riverside County at Santa Rosa Plateau, in San Diego County at Otay Mesa, Kearny Mesa, Del Mar Mesa, Marine Corps Air Station (MCAS) Miramar, and Marine Corps Base (MCB) Camp Pendleton, and in northern Baja California, Mexico (USFWS 1993, p. 41385).

The historical distribution of *Eryngium aristulatum* var. *parishii* habitat included a coastal swath from Mesa de Colonet and San Quintin in Baja California, Mexico, north to Los Angeles County, California in the United States. Two specimens were collected in Los Angeles County prior to 1902, including one from Redondo [Beach]; these were mentioned in a regional flora of the time (Davidson and Moxley 1923, p. 260) and were verified as *E. a.* var. *parishii* by Sheikh (1978, p. 144). Another floristic treatment indicates that the taxon may have ranged into Ventura County or possibly San Luis Obispo County (Munz 1935, p. 350); however, specimens representing the latter occurrence are now considered likely a different variety (i.e., *E. a.* var.

hooveri Sheikh). Likewise, the specimen that likely served as the basis for the Ventura County report was a misidentified herbarium specimen of *E. vaseyi* (coyote thistle; G. Wallace, USFWS, pers. obs. 2009). The current extent of the range of *E. a.* var. *parishii* is therefore less than that known from historical records. The northernmost range of the variety on the Pacific coast is at MCB Camp Pendleton. Additionally, two northern populations exist in inland vernal pool complexes on the Santa Rosa Plateau within the Santa Ana Mountain Range in Riverside County, California.

Eryngium aristulatum var. *parishii* currently occurs in 14 geographic areas in Riverside and San Diego Counties. There were collection records of *E. a.* var. *parishii* document occurrences in six areas of Riverside County at listing; however, there are now only four sites on the Santa Rosa Plateau (Western Riverside County MSHCP 2003, pp. 47–51). The majority of the occupied range of the taxon in the United States occurs in ten regional locations in San Diego County including MCB Camp Pendleton, Carlsbad, San Marcos, Ramona, Del Mar Mesa, Carmel Mountain, Mira Mesa, MCAS Miramar, Otay Lakes, and Otay Mesa (Figure 1). Current status of the species in Mexico is unknown. Records of 81 specimens representing 67 separate collections collected in California and later collated electronically by the Consortium of California Herbaria (CCH) include early collections from 1875 to 2005 (CCH 2009, *Eryngium aristulatum* var. *parishii,* pp. 1–10). These curated specimens include individual plants collected at vernal pool habitats in San Diego and Riverside counties.

Fahrig (2002, pp. 346–353) indicated that while fragmentation can affect the extinction threshold of species in landscapes, other factors related to the quality of the habitat as affected by edge effect (such as landscape heterogeneity, amount of available habitat, and reproductive success) may have a greater effect. Holman *et al.* (2004, pp. 1547–1553) showed for vernal pool species critical thresholds between the amount of habitat available and probability of occurrence. They further found a disproportionate population decline as habitat was lost. Loss of vernal pool species per pool and complex, through time, are inevitable from smaller vernal pools due to edge effect impacting proportionally more habitat, and extant direct and indirect threats that in some instances, may only be countered by site specific intensive management. Adverse ecological relationships via edge effect also affect population and extinction thresholds; i.e., invasive plants affecting the extinction rate through harm with native species thereby reducing long term fitness and retention, *"patterns of the invasion of nonnative species generally fit the species-area relationship on which island biogeography theory is based…"* (Meyers and Bazely 2003, pp. 34–50). Extant vernal pools and complexes show reduced species/area relationships per their diminutive presence on the landscape contrasted to historical levels where there was approximately 520 square kilometers (200 square miles) (USFWS 1998, p. 45); i.e., 23,840 hectares (ha) (58, 910 acres (ac)) in San Diego County alone (Oberbauer and Vanderwier 1991, p. 210).

Abundance

Eryngium aristulatum var. *parishii* can be locally abundant in remnant vernal pools; however, the distribution of this variety has been dramatically reduced due to loss of most (95 to 97 percent) of the vernal pool habitat in San Diego County (USFWS 1998, p. iii). Little data relative to population counts and trends are extant. In 2003, the City of San Diego conducted a

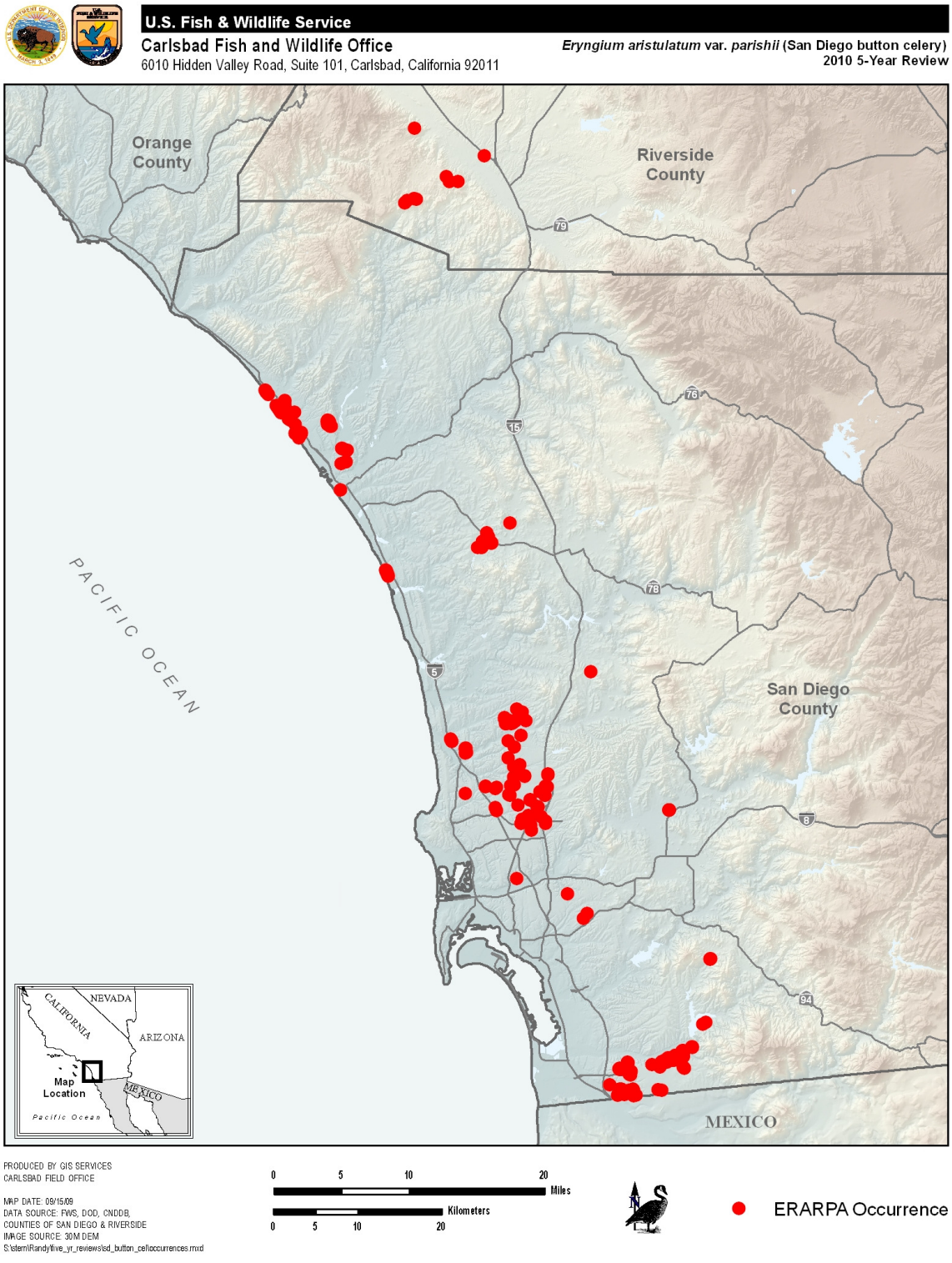

Figure 1: Distribution of *Eryngium aristulatum var. parishii* occurrences; developed for FY2010 5-year review.

survey of vernal pools within their jurisdiction; these surveys revealed that of the 69 sites surveyed, 28 contained *E. a.* var. *parishii*; the taxon was found on 8.1 of 14.5 ha (20 of 36 ac) of basin habitat (City of San Diego 2004). Based on survey data at MCAS Miramar that incorporates survey efforts since 1993, *E. a.* var. *parishii* was found in 20 of 45 vernal pool complexes located on the installation (Black 2004, pp. 1–16; Black 2007, pp. 1–25).

Discussion of the distribution of biota associated with vernal pools should take into account the fact that vernal pools have a spatial and temporal dynamic that may have been captured by different surveys at different times. Some surveys were local, describing one or a few pools and their status, other surveys attempted to provide a broader view of the vernal pool landscape conditions in particularly in San Diego County. Vernal pools are vital habitat for several listed plant and animal taxa, each with different patterns of distribution among the pools and pool complexes. Names for vernal pools in close proximity became pool complexes, and alpha-numeric references were adopted by some. There was no set pattern for determination of how many pools constitute a pools complex and as new pools were detected they likely were either considered to be part of an existing complex, or given a new alpha-numeric reference, often out of sequence or interjected in an existing identifying system. At least for Riverside County occurrences, this has led to considerable difficulty in translating information regarding local pools or complexes into regionally relevant views on the condition of the pools and their biota. However, Bauder (1986) standardized the numbering of vernal pools and vernal pool complexes in San Diego County. In the discussion below and in Appendix 1, we attempt to address conditions and distributions of pools and pool complexes as we do for other biota that is with the broader scale system of Element Occurrences used by CDFG.

Habitat or Ecosystem

Eryngium aristulatum var. *parishii* is a vernal pool obligate taxon. Vernal pools are formed by the inundation and accumulation of water on top of an impervious soil layer(s) (USFWS 1998, p. 22) such as clay pan or hard pan, resulting in a temporary but perched water table (except for those pools that are ephemeral basins). These temporary pools are formed in depressions, which are often only centimeters to less than a meter deep. Hydrophytic plants (i.e., a plant that grows partly or wholly in water), such as *E. a.* var. *parishii,* tend to grow in the seasonally inundated area of vernal pools. This inundation creates sticky clay surfaces that make walking difficult, and which result in avoidance by humans and livestock. When the inundation dissipates, the previously submerged ecosystems are exposed, often suggesting xeric playas or otherwise open and degraded landscapes.

Vernal pool ecosystems or complexes in southern California are comprised of anywhere between 2 to over 100 pools. Each pool and complex is potentially annually and temporally inundated, and retains precipitation in the form of standing water (Colburn 2004, p. 5). They experience typical wet season/dry season regime of the Mediterranean climate common to southern California; pools are often dry after spring inundation until the following year or for longer during drought cycles. Physical soil structure containing high clay content forms an impermeable/semi-permeable bottom to the pools from which little water will percolate (USFWS 2008, p. 8).

Most of southern California's vernal pool complexes were reportedly lost or severely degraded due to development prior to listing. Prior to the listing of *Eryngium aristulatum* var. *parishii,* Bauder (1987, p. 209) described specific threats to vernal pool ecosystems in San Diego and noted that by 1986, only 7 percent of over 11,572 ha (28,595 ac) of vernal pool habitat identified in 1979 in San Diego County remained. Bauder (1987, p. 209) stated that 62 percent of the vernal pools on private lands were lost between 1978 and 1986; 7 percent of those on publicly owned lands were lost during the same period. Many of the remaining vernal pools were threatened by anthropogenic activities and altered hydrology (Bauder 1987, p. 209). Oberbauer and Vanderwier (1991, p. 210) later indicated that 97 percent of an estimated 23,840 ha (58,910 ac; twice that of the original estimate of vernal pool habitat for San Diego County) of vernal pools had been lost by 1991 in San Diego County. Current detailed information regarding the taxon's extant existence is lacking over much of its range (with the exception of the City of San Diego area as a result of inventories conducted by the City of San Diego (City of San Diego 2004)), as is original species richness and ecological relationships between competitors and pollinators within vernal pool basins.

Changes in Taxonomic Classification or Nomenclature

Eryngium parishii was described by Coulter and Rose (1900, p. 57). This taxonomic treatment was supported by Wolff (1913, p. 166). Jepson considered the taxon at the varietal rank and published the name *E. jepsonii* Coulter and Rose var. *parishii* (Coulter and Rose) Jepson (Jepson 1922, p. 107). Mathias and Constance (1941, p. 386) realigned the variety and published the currently accepted name *Eryngium aristulatum* var. *parishii*. This is the name in use in current regional floras (Munz 1974, pp. 75–76; Constance 1993, pp. 147).

Genetics

No contemporary genetic analysis has been completed for *Eryngium aristulatum* var. *parishii*. Sheikh (1978, p. 53) reported *E. a.* var. *aristulatum* can be found in teraploid (four sets of chromosomes) and octoploid (eight sets of chromosomes) populations. He further suggests that populations of *Eryngium* in southern California have been found to be tetraploid (Sheikh 1978, p. 54).

Small populations suggest that loss of genetic variation, genetic drift, and potential inbreeding depression might occur over prolonged periods of time. See Factor E for analysis for discussion of this phenomenon.

Species-specific Research and/or Grant-supported Activities

In 1999, Marsden and Simpson (1999, pp. 61–64) described a new species, *Eryngium pendletonensis*, which was detected during surveys on MCB Camp Pendleton. Additionally, monitoring surveys conducted by the City of San Diego were supported by funding from the Service (City of San Diego 2004). Since that time, no species specific research or rigorous detailed adaptive monitoring, *sensu* Lindenmayer and Likens (2009, p. 482) has been completed.

The City received funds from a 2007 Transnet grant to carry out restoration activities at conserved vernal pool sites. Restored sites need long term management to maintain the conservation benefit.

Five-Factor Analysis

The following five-factor analysis describes and evaluates the threats attributable to one or more of the five listing factors outlined in section 4(a)(1) of the Act. The listing rule discussed and analyzed threats to *Eryngium aristulatum* var. *parishii* on a more regional scale than that used in the present review. Some threats were clearly not rangewide (e.g., military activities) while others were discussed in a rangewide context (e.g., development). Our current analysis examines all known occupied habitat at the most appropriate scale possible.

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

The City of San Diego and environs has been among the fastest growing metropolitan areas in the United States, and corresponding urbanization and agricultural development has resulted in the elimination of most historical vernal pool complexes (Bauder 1987, pp. 209–213; USFWS 1997). Habitat loss has shown to result in a high rate of extinctions of vernal pool crustacean assemblages (King 1998, p. 121), which is attributed to the fact that the organisms are limited to vernal pools and tend to be rare and sporadic in their distributions. The following threats attributable to Factor A were discussed in the listing rule: urban and agricultural development, off-road vehicular traffic (OHVs), habitat trampling associated with humans or cattle, mowing or plowing, highway construction, drainage or watershed alterations, and military activities (USFWS 1993, p. 41388). These threats were described as impacting vernal pool habitat associated with the collective distribution of three vernal pool plants and the Riverside fairy shrimp included in the listing rule. In some instances threats were considered to impact vernal pool habitat in general with no specific reference to *Eryngium aristulatum* var. *parishii* because plants could be present in different pools at different times. Only occasionally was a particular place singled out for reference or discussion (e.g., Brown Field and Otay Mesa). Currently, one or more of these threats continue to impact *E. a.* var. *parishii* at most sites, and impacts from development and OHVs have the potential to be rangewide.

Habitat Loss from Urbanization and Agricultural Development

Habitat loss remains as the primary threat to occurrences of *Eryngium aristulatum* var. *parishii*. Loss of habitat from development is considered a primary contributor to vernal pool loss throughout California (Holland 1988, p. 1013; Barbour *et al.* 2007, p. 7), and specifically to vernal pools in southern California (Bauder 1986, p. 9-4; Bauder 1987, pp. 209–213). When *E. a.* var. *parishii* was listed in 1993, it was estimated that approximately 97 percent of vernal pool habitat in San Diego County had been destroyed (Oberbauer and Vanderwier 1991, p. 210). Similar losses of vernal pool habitat are extant throughout the species range. However, since listing, conservation provisions of regional Habitat Conservation Plans (HCPs) (e.g., the Western Riverside County Multiple Species Habitat Conservation Plan (Western Riverside County MSHCP) and the San Diego Multiple Species Conservation Program (San Diego MSCP)) have

significantly reduced the threat of habitat loss from urbanization and agricultural development. There is potential for additional habitat conservation under the San Diego MSCP and its subarea plans. The City of San Diego recently relinquished its permit for coverage of vernal pool species as a result of litigation; however, the Service is working with the City to revise their management and monitoring strategy and is expected to continue to provide conservation benefits to vernal pool complexes within their jurisdiction. Vernal pool complexes considered conserved under the San Diego MSCP are indicated in Appendix 1. Areas in the San Diego MSCP conservation areas (i.e., Multiple Habitat Planning Area (MHPA)) meant to be of primary consideration for conservation are also noted in Appendix 1. These conservation efforts have occurred and are expected to continue, resulting in significant conservation of *E. a.* var. *parishii* in MHPA areas of San Diego County identified in the listing rule that are covered by the San Diego MSCP (i.e., Otay Mesa, Kearny Mesa, and Del Mar Mesa). Under provisions of the San Diego MSCP, pools or pool complexes that are conserved are protected from most threats attributable to Factor A. Those pools and pool complexes that are in the MHPA may be entirely or partially conserved currently or at some future date. There is no certainty nor is there any likelihood that pools or pool complexes that fall outside the MHPA will ultimately be conserved; these areas are still subject to development pressures. Information on known conservation status of pools and pool complexes is provided in Appendix 1.

Generally, lands subject to management provisions of an Integrated Natural Resources Management Plan (INRMP) are protected from urbanization. This includes pools and pool complexes that occur on MCB Camp Pendleton and MCAS Miramar. Exceptions to this development threat could include construction of base housing (see also "Military activities" section below).

Bauder (1987, p. 209) indicated that "habitat fragmentation (edge effects)" was a suspected threat to vernal pools. Edges are outer bands of habitat distant from the center, but immediately proximal to a different type of habitat; edge effects provide a different species composition and abundance divergent from the interior of the habitat (Forman and Godron 1986, p. 108). Murcia (1995, pp. 58–62) described the implications of edge effect on novel landscapes to include abiotic, direct biological, and indirect biological effects. Abiotic and biotic factors affect the width and degradation caused by the effect on a patchy ecosystem. Edge effects have been shown to be a degrading effect to conserved parcels of land such as vernal pools, and to plants and animals that depend on ecosystem services proximal to their immediate microclimate (Bauder 1987, pp. 209–213). An overview of the distribution of extant vernal pools throughout the range of *Eryngium aristulatum* var. *parishii* suggests habitat loss has resulted in further fragmentation of vernal pool habitat. What was once a large, relatively unbroken expanse of patchy but interconnected pool habitat, has become remnant "islands" of vernal pools within an expanse of varying levels of anthropogenic disturbance, and permanently altered landscape (e.g., pools at N 8 General Dynamics site on Kerney Mesa, I 6C Bob Baker 2 on Mira Mesa, and C17–18 on Mira Mesa; see Appendix 1).

Off-road Vehicle (OHV) Use

OHV use was discussed in the listing rule as impacting the habitat of *Eryngium aristulatum* var. *parishii* as well as that of the other three taxa in the rule (USFWS 1993, p. 41387). The threat

was considered general and essentially rangewide and no pool grouping was considered exempt from OHV impacts (Bauder 1987, p. 209). Damage can be caused by motorcycles, quads, mountain bicycles, and four-wheel drive vehicles. Bauder (1987, p. 209) indicated that some impacts from OHVs were considered vandalism, while other damage occurred in the course of legitimate activities including fire fighting, security patrols, and military maneuvers. "*Vehicles cause deep ruts, compact soil, bury seeds, crush plants and alter pool hydrology"* (Bauder 1987 p. 209). Altered pool hydrology may favor invasion of nonnative plants by allowing nonnatives to encroach in areas where the hydrological conditions had been altered by OHVs; vehicles can also break through the clay hard pan, causing hydrological damage that may not be repaired.

The use of OHVs causes fragmentation, degradation, and destruction of vernal pools (Hilty *et al.* 2006, p. 157; Forman *et al.* 2003, pp. 113–138; Wilcove *et al.* 1998, pp. 607–615). Transportation corridors have the potential to spread disease, drain or damage pools, and facilitate the invasion of nonnative species (Hilty *et al.* 2006, p. 157) as well as mixing of otherwise naturally separated native species and genotypes (e.g., fairy shrimp lineages). To date, there are no recent clear assessments enumerating vernal pools where *Eryngium aristulatum* var. *parishii* are impacted by OHV use. On Otay Mesa, populations of previously surveyed *E. a.* var. *parishii* on a private parcel were extirpated because of OHV use (Wynn, USFWS, pers. obs. 2009). OHV use was also reported to cause extensive damage to several vernal pools at MCAS Miramar (Kassebaum 2008; Kassebaum 2009, pp. 1–8); numerous vernal pools identified as extant have been transformed to rutted tracks of roads (City of San Diego 2004, pp. 16, 17, 22–24, 40, 54, 97). Bauder (1988, pp. 2–21) examined methods to repair damage caused by OHVs and nonnative species to improve the quality of vernal pools. She (Bauder 1988, p. 19) found that hand weeding, decompaction, and recontouring of pool soils increased the pool quality; however, fencing and preventing OHV vehicles from accessing vernal pool habitat in the first place is the best way to maintain the delicate habitat, i.e., *"the most important element of their recovery is protection from future vehicle trespass."*

It is likely that OHV use continues to be a nearly rangewide threat to *Eryngium aristulatum* var. *parishii* and its habitat. The pools are small and often isolated and difficult to monitor at an effective frequency even on lands protected under existing HCPs or management guidelines of INRMPs.

Habitat Trampling Associated with Cattle and Human Access

Habitat destruction associated with livestock and human access was considered to be a threat to *Eryngium aristulatum* var. *parishii* at listing (USFWS 1993, p. 41388) and in the Recovery Plan (USFWS 1998, p. 47). Impacts from this threat include soil compaction and erosion, though this is not a predominant threat. Destruction of *E. a.* var. *parishii* habitat from cattle is dramatically reduced, though some vernal pools continue to be impacted by livestock, such as horses in the J26 vernal pool complex in Otay Mesa (Wynn, pers. comm. 2010).

Mowing or Plowing

Mowing and plowing/discing of habitat has been used to reduce fire hazards and to shorten vegetative cover for birds to reduce bird air-strike hazards and bird air mortality hazards (U.S.

Marine Corps 2006, pp. 7-1–7-36; U.S. Marine Corps 2007, pp. F-47–F-49). Restrictions of these activities where there is a Federal or State nexus via INRMP site management plans and overarching MSHCPs have reduced the loss of habitat due to mowing or plowing; however, impacts from this threat have yet to be quantified.

Highway Construction

Road development and inter-related actions were classified as a threat to *Eryngium aristulatum* var. *parishii* when it was listed. Roads are closely associated to habitat fragmentation (loss) due to urban and agricultural development. Vernal pools and associated habitat proximal to basins have been eliminated by road and highway construction. Mitigation for roadway development has included the restoration of vernal pool habitat and introduction of key vernal pool species. Restoration of vernal pools has had some degree of success in the short term; however, the long term effectiveness of this mitigation approach is still being studied (Black and Zedler 1998, pp. 195–205). Road development and related construction activities are still a primary threat to the variety. Mitigation in the form of conservation planning and habitat protection has been used to offset damages to vernal pools and develop conservation approaches for the variety (DiGregoria *et al.* 2005, pp. 101–110).

Drainage or Watershed Alterations

Watershed alterations, such as soil waterlogging was determined to impact *Eryngium aristulatum* var. *parishii* when it was listed. Seasonality (phenology) of vernal pools requires annual hydrologic input during the spring months to moisten and fill pools and basins. Strong correlation exists between the total amount of precipitation and the length of inundation of pools (Bauder 2005, pp. 2129–2135). Existence of vernal pool plants in pools is related to inundation time, and hence depth of pool and distance from the area of pool that is inundated the longest (related to the moisture gradient) (Bauder 2000, pp. 43–61). Mediterranean ecosystems often have seasonal rains in the winter/spring months, followed by dry to extremely dry (no fog, low clouds, or nighttime moisture) conditions for the remainder of the year.

Due to urbanization, hydrologic cycles have been affected near vernal pool complexes (Bauder 1987, pp. 209–213). However, impacts from this threat to *Eryngium aristulatum* var. *parishii* appear to have decreased since the time of listing due to development standards that are intended to prevent runoff from entering vernal pool basins (Wynn, pers. obs. 2009).

Military Activities

Military activities were considered to be a threat to *Eryngium aristulatum* var. *parishii* at listing (USFWS 1993, p. 41388). Impacts to vernal pool sites resulted from large equipment (e.g., tanks) and civilian use on base (USFWS 1993 p. 41388). Training activities near and adjacent to vernal pool habitat have resulted in site-specific impacts to vernal pool species, such as rutting of pools. Approximately 70 percent of the remaining vernal pool complexes occur on lands within military jurisdiction (USFWS 2008, p. 16). These sites have, in the past, been affected by regulated and unregulated military activity. Since listing, conservation efforts on military lands

have been in place due to implementation of the Sikes Act and the Sikes Act Improvement Act described below under Factor D, which require military installations to develop INRMPs.

Activities on MCAS Miramar and MCB Camp Pendleton military installations are covered by INRMPs, which address habitat conservation and listed species protection (U.S. Marine Corps 2006, pp. 7-1–7-36; U.S. Marine Corps 2007, pp. F-47–F-49). Activities associated with increased use of training areas will likely adversely impact *Eryngium aristulatum* var. *parishii* occupied sites. However, conservation measures prescribed include avoidance of mapped vernal pool habitat by personnel, tanks, and other associated military OHVs. While accidents (fixed and rotary winged aircraft crashes, fuel spills) might occur, military responses to those incidents work to reduce and eliminate potential damage to vernal pool species. Current habitat restoration of *E. a.* var. *parishii* by the military at MCAS Miramar has been among the best efforts with numerous acres restored; further work to note presence/absence of the variety and affirm potential for long term retention have been accomplished at MCAS Miramar (U.S. Marine Corps 2006, pp. 7-1–7-36).

Military activities currently do not appear to pose a consistent, wide-ranging threat to *Eryngium aristulatum* var. *parishii.* Provisions of the INRMPs for the two military installations and the monitoring and restoration at MCAS Miramar provide conservation value to the taxon. Under provisions of the INRMPs, the remaining vernal pools with *E. a.* var. *parishii* on MCAS Miramar and MCB Camp Pendleton are currently protected from widespread threats attributable to military activities.

Summary of Factor A

Loss and modification of vernal pool habitat continues to impact *Eryngium aristulatum* var. *parishii*. Acquisition of land and conservation easements have preserved vernal pool habitat, but some loss of vernal pool habitat has continued. Threats associated with OHVs continue throughout the range of the variety, including on preserve lands, (e.g., Santa Rosa Plateau) or on conserved lands (e.g., some sites within the jurisdiction of the San Diego MSCP). Threats associated with mowing and trampling associated with humans and cattle have been reduced. Road construction in urbanized southern California will likely continue to pose some level of threat to vernal pool habitat. Watershed alterations near vernal pool habitat have caused changes in the hydrological structure and function of some vernal pool habitat. While still a threat throughout the range of the variety, impacts of hydrological alterations have decreased in some areas due to development standards that control run-off and water use. Though military activities have continued to impact habitat occupied by *E. a.* var. *parishii,* much vernal pool habitat has been restored through cooperation with MCAS Miramar and MCB Camp Pendleton via provisions in the INRMPs.

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

Overutilization for any purpose was not listed as a Factor B threat during the listing of the species, nor is there a threat due to overutilization or a threat to the variety at this time (USFWS 1993, pp. 41384–41392).

FACTOR C: Disease or Predation

Eryngium aristulatum var. *parishii* was not known to be affected by disease at the time of listing and is not considered a threat at the present time (USFWS 1993, p. 41388). Predation was not identified as a threat at listing, but insect herbivory of *E. a.* var. *parishii* was later considered a disturbance concern in the recovery plan and remains a potential threat to the taxon (USFWS 1993, p. 41388; USFWS 1998, p. 67). This can have considerable effects on plant population dynamics, and may include: (1) Damage to roots, leaves, flowers, and developing seeds; and (2) ultimately reduce living plant fitness and reproductive success in the presence of native and nonnative competitors (Louda 1994, pp. 118–138).

FACTOR D: Inadequacy of Existing Regulatory Mechanisms

The following State and Federal laws and regulatory mechanisms were discussed in the listing rule and considered inadequate to reduce losses of *Eryngium aristulatum* var. *parishii*: 404 of the Clean Water Act (CWA), California Endangered Species Act (CESA), and the City of San Diego vernal pool preservation program (USFWS 1993, pp. 41388–41389). The discussion below addresses these regulatory mechanisms, as well as several other regulatory mechanisms either not in existence at the time of listing or otherwise not discussed in the listing rule. Additional State regulatory mechanisms include the California Environmental Quality Act (CEQA), the Natural Communities Conservation Planning (NCCP) Act, and the California Porter-Colonge Act. Mexican regulatory mechanisms are also noted. Additional Federal regulatory mechanisms discussed below include National Environmental Policy Act (NEPA), the Act, and the Sikes Act.

State Protections

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

In 1979, the California Fish and Game Commission listed *Eryngium aristulatum* var. *parishii* as endangered under the Native Plant Protection Act (NPPA (Division 2, chapter 10, section 1900 *et seq.* of the California Fish and Game Code (CFG)) and CESA (Division 3, chapter 1.5, section 2050 *et seq.* of the CFG). Both the NPPA and CESA include prohibitions forbidding the "take" of *E. a.* var. *parishii* (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.

California Porter-Cologne Act

The primary law regulating water quality in California is the California Porter-Cologne Act of 1969 (section 13000 *et seq.*, California Water Code). This Act designates authority over surface water and groundwater quality to the State Water Resources Control Board and the nine Regional Water Quality Control Boards. Additionally, this Act regulates the discharge of fill into waters of the state (section 13260 *et seq.*, California Water Code). "Waters of the state" are defined as "any surface water or groundwater, including saline waters, within the boundaries of the state," and includes vernal pools (Section 13050-13051 *et seq*., California Water Code). While this Act affords some protection to *Eryngium aristulatum* var. *parishii* habitat, automatic waivers of discharge requirements are granted if the Regional Boards do not respond to applications within 120 days. The San Diego Regional Water Board has taken an active role in developing and implementing mitigation requirements for vernal pools.

Natural Communities 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. *Eryngium aristulatum* var. *parishii* has been treated as a covered species and thus provided some level of protection under two regional NCCP/HCPs, including the Western Riverside County MSHCP and the San Diego MSCP (the City of San Diego recently relinquished its permit as a result of litigation and is currently in the process of revising its conservation plan for vernal pool species, as discussed below under the Act).

Local Laws and Regulations

The local jurisdictions in San Diego County have enacted a local ordinance for wetland resources, including vernal pools that may be inhabited by *Eryngium aristulatum* var. *parishii,* and requires avoidance of vernal pools to the maximum extent practicable. The ordinance does not cover road pools or other unvegetated, disturbed pools. The City of San Diego continues to approve projects that may completely surround vernal pools with development and directly impact road pools occupied by the *E. a.* var. *parishii*. However, local laws and regulations have the potential to provide some protection to *E. a.* var. *parishii* and its habitat.

Federal Protections

National Environmental Policy Act (NEPA)

NEPA generally provides some protection for *Eryngium aristulatum* var. *parishii*. For activities undertaken, authorized, or funded by Federal agencies (i.e., projects with a Federal nexus), NEPA requires the project be analyzed for potential impacts to the human environment prior to implementation (42 U.S.C. 4371 *et seq*.). For instances where that analysis reveals significant environmental effects, the Federal agency must identify appropriate mitigation to offset those effects (40 CFR 1502.16). However, NEPA is a procedural statute, and while it requires disclosure and analysis of significant impacts and mitigation alternatives, it does not require that such impacts be mitigated. Actions taken by private landowners that lack a Federal nexus are not required to comply with this Act.

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.

Endangered Species Act of 1973, as Amended (Act)

Since listing, the Act is the primary Federal law that may provide protection for *Eryngium aristulatum* var. *parishii*. 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). A non-jeopardy opinion may include reasonable and prudent measures that minimize the amount or extent of incidental take of listed species associated with a project. The Service works with Federal, State, and local agencies, and with private project proponents, to minimize project effects to listed vernal pool species, and to compensate for the loss of habitat by preservation, restoration, and/or enhancement of vernal pool habitat, through section 7 consultations. Impacts to *E. a.* var. *parishii* habitat, and other impacts not quantifiable in terms of acreages, have occurred from projects covered by these consultations. Typically, the projects have incorporated both avoidance and minimization of impacts, such as by preservation, restoration, and enhancement measures, to reduce or offset impact to the species and its habitat.

Under Section 9(a)(2) or 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 and 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. As noted above, *Eryngium aristulatum* var. *parishii* is listed as endangered by the State of California. Therefore, this species is afforded protections under section 9 of the act on non-Federal lands.

Section 10 provides protection for *Eryngium aristulatum* var. *parishii* through the implementation of Service-approved HCPs that detail measures to minimize and mitigate the potential impacts of take resulting from a project to the maximum extent practicable. Section 10 of the Act affords no exemption to section 9 prohibitions regarding plants except in cases where the State issues an incidental take permit under section 2081(b) and (c) of CESA. Therefore, violation of take or other prohibitions afforded to State listed plants, including *E. a.* var. *parishii,* constitutes violation of section 9 of the Act as noted above. 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) 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.

Under section 7 of the Act, the Service is required to ensure that the actions proposed in an 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 both animals and plants. *Eryngium aristulatum* var. *parishii* is a "covered species" under most existing and planned regional HCPs in southern California, including those in San Diego and Riverside counties, which cover all of the taxon's current known range. As a covered species in these HCPs, *E. a.* var. *parishii* would be afforded an additional layer of regulatory protection, even if it were to be delisted. 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 two most significant regional HCPs for *E. a.* var. *parishii* are the Western Riverside County MSHCP and the San Diego MSCP.

Western Riverside County Multiple Species Habitat Conservation Plan (Western Riverside County MSHCP)

Eryngium aristulatum var. *parishii* is a "covered" species in the Western Riverside County MSHCP. *Eryngium a.* var. *parishii* is fully and permanently protected on vernal pools on the Santa Rosa Plateau in the Santa Ana Mountains of Riverside County. All four remaining populations are located at (two each) Mesa de Colorado and Mesa de Burro within the Santa Rosa Plateau Ecological Preserve, which are areas protected by the Riverside County Regional Park and Open-Space District**.** As a result, the taxon is afforded two layers of Federal regulatory protection even if it were to be delisted: protection as a "covered" species under the Western Riverside County MSHCP, and protection within the Santa Rosa Plateau Ecological Preserve.

San Diego Multiple Species Conservation Plan (San Diego 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, 10 other city jurisdictions, and several independent special districts. Under the broad umbrella of the San Diego MSCP, each

participating jurisdiction prepares a subarea plan that implements the goals of the MSCP within that jurisdiction. The San Diego 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 *Eryngium aristulatum* var. *parishii*, over the permit term. The San Diego MSCP anticipates the conservation of at least 88 percent of vernal pool habitat, requires avoidance of impacts to *E. a.* var. *parishii* and its habitat to the maximum extent practicable, mitigation for impacts deemed unavoidable, and management to protect habitat against edge effects to *E. a.* var. *parishii*.

As discussed above under "Clean Water Act," the Corps LAD generally took jurisdiction over all *Eryngium aristulatum* var. *parishii* habitat (including road pools) both prior to *SWANCC* and at the time the City's permit was issued for the City of San Diego Subarea Plan under the San Diego MSCP. Therefore, the Service anticipated individualized review of projects impacting *E.* var. *parishii* habitat under section 404 of the CWA and section 7 of the Act to ensure 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 *E. a.* var. *parishii* and six other vernal pool species. The court held that the City of San Diego Subarea Plan does not provide adequate protection for *E. a.* var. *parishii* 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. *Eryngium aristulatum* var. *parishii* is no longer a covered species under the City of San Diego 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 *E. a.* var. *parishii* under the San Diego MSCP and is updating their wetland ordinance. The Service is also working with the City to conserve more restorable habitat. Despite the City's relinquishment of their permit, as of 2006, the City reported that approximately 54 percent, or 1,369 pools, of all currently identified vernal pool habitat within the boundaries of the City of San Diego Subarea Plan were conserved by covenant of easement, conservation easement, or dedication in fee title to the City (City of San Diego 1997, 2006). The City continues to monitor and manage vernal pools in support of the San Diego MSCP.

The City of San Diego Subarea Plan is also an approved NCCP under the State of California's NCCP Act, and the NCCP has not been challenged, so the City's obligations under the NCCP to avoid impacts to vernal pool species, including *Eryngium aristulatum* var. *parishii*, to the maximum extent practicable, and to monitor and manage vernal pools, remains in place notwithstanding the Federal injunction.

The Sikes Act

The Sikes Act (16 U.S.C. 670) authorizes the Secretary of Defense to develop cooperative plans for conservation and rehabilitation programs, and to establish outdoor recreation facilities on military installations. The Sikes Act also provides for the Secretaries of Agriculture and the Interior to develop cooperative plans for conservation and rehabilitation programs on public lands under their jurisdiction. While the Sikes Act of 1960 was in effect at the time of the *Eryngium aristulatum* var. *parishii* listing, it was not until 1997 when the Sikes Act Improvement Act was enacted that Department of Defense (DOD) installations were required to prepare INRMPs. An INRMP provides for the management of natural resources on military lands consistent with the use of military installations to ensure the readiness of the Armed Forces. Management under an INRMP may include surveying, monitoring, and restoration of natural resources. Implementation of INRMPs is subject to funding availability and does not preserve any military lands in perpetuity, as ultimately those lands may be necessary for National Security. Since listing, INRMPs have been adopted at MCAS Miramar and MCB Camp Pendleton and afford substantial protection to *E. a.* var. *parishii* (U.S. Marine Corps 2006, p. 7–1–7–36, U.S. Marine Corps 2007, p. F-47–49).

On MCAS Miramar, which encompasses much of the extant habitat occupied and suitable for *Eryngium aristulatum* var. *parishii*, vernal pool conservation and management is guided by an INRMP that was initially developed in 2000 and updated in 2006 (U.S. Marine Corps 2006a). MCAS Miramar's strategy for conservation and management of *E. a.* var. *parishii* is to limit activities, minimize development, and compensate for actions in areas supporting high densities of vernal pool habitat.

On MCB Camp Pendleton, the Marine Corps adopted an INRMP for the base in 2001, which was further revised in 2007 (U.S. Marine Corps 2007). The MCB Camp Pendleton INRMP includes measures to conserve *Eryngium aristulatum* var. *parishii* and its habitat, and provide a benefit to the species. These measures involve management and control of activities that may impact occupied vernal pools. Like other INRMPs, it is largely ecosystem-based except where biological opinions under section 7 of the Act direct species-specific actions. The Service and the Marine Corps are currently consulting under section 7 of the Act on the Marine Corps' plan to programmatically avoid and minimize the effects of the Marine Corps' activities on federally listed upland and wetland species, including *E. a.* var. *parishii* on MCB Camp Pendleton. Conservation measures resulting from this section 7 consultation are expected to be incorporated into future revisions of the INRMP and to provide specific direction to guide management and monitoring of *E. a.* var. *parishii*. Pending completion of this consultation, the Marine Corps has incorporated interim management and conservation measures for *E. a.* var. *parishii* within MCB Camp Pendleton's INRMP (U.S. Marine Corps 2006, pp. 7-1–7-36; U.S. Marine Corps 2007, pp. F-47–F-49).

Mexican Federal Law

The Service is not aware of any existing regulatory mechanisms that would protect *Eryngium aristulatum* var. *parishii* or its habitat where it occurs in Baja California, Mexico.

Summary of Factor D

In summary, the Act provides the greatest regulatory protection to *Eryngium aristulatum* var. *parishii*. HCPs and the related conservation actions arising from the Act have contributed to short and long term conservation of *E. a.* var. *parishii.* Additionally, INRMPs at MCB Camp Pendleton and MCAS Miramar have created policy mechanisms and partnerships that have restored and conserved vernal pool habitat. However, rangewide threats remain and, absent the protections of the Act, the existing regulatory mechanisms (CESA, NPPA, CEQA, California Porter-Cologne Act, NCCP, NEPA, and CWA) do not provide adequate regulatory protections to provide for the long term persistence of *E. a.* var. *parishii*.

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

Nonnative species, trash dumping, fire, fire suppression, and drought were discussed as threats under Factor E in the listing rule (USFWS 1993, p. 41389). Incidents of trash dumping are rare on a rangewide basis and will not be covered further in this review. Drought is discussed in this review in conjunction with climate change below. The vernal pool species in the listing rule were also considered vulnerable to extinction due to stochastic events because of the limited numbers of pools and distribution of habitat. This threat is discussed below in the section on small population size. Human trampling was noted in the listing rule under Factor A to impact the habitat and plants; impacts associated with the habitat are discussed under Factor A and impacts to individual plants are discussed below. Threats identified since listing include: small population size, loss of pollinators, and climate change. These threats and conditions of those known at the time of listing are discussed below under the following headings: nonnative plants, fire suppression, small population size, trampling, loss of pollinators, and climate change.

Nonnative plants

Introduction of nonnative species and competition with invading species was considered to be a threat to *Eryngium aristulatum* var. *parishii* in the listing rule (58 FR 41384) and in the Recovery Plan (USFWS 1998, p. 47). The California Native Plant Society also considered invasive plants to be a threat to the *E. a.* var. *parishii* (CNPS 2009, p. 2). Bauder (1996, p. 3) speculated that *"extensive stands of exotics may be altering many of the relationships among animals and the vernal pool biota by providing an abundant food supply for fossorial rodents, ants, and rabbits."* Transportation features such as roadways and trails facilitate nonnative species incursion (Hilty *et al.* 2006, pp. 157–158) into patches of remaining vernal pool habitat. Meyers and Bazely (2003, pp. 34–50) highlight species area relationships in noting the number, diversity, and success of invasive plants in most ecosystems. They also indicated that *"increases in human visitation increases exotic species richness"* (Meyers and Bazely 2003, pp. 34–50).

San Diego County and the range of *Eryngium aristulatum* var. *parishii* are in a mild, Mediterranean climate zone that makes the potential and rate for nonnative species incursion high. Nonnative plants are documented to alter natural landscapes and available habitat in San Diego County (Bauder 1987, pp. 209–213). Invasive, nonnative plants have long been considered a concern in vernal pool habitat (Holland 1988, p. 1014). Some of these biological impacts include competition with *E. a.* var. *parishii* for water, soil nutrients, space above and below ground, and displacement of natural pollinators. When the period of standing water

increases to about 7 weeks, the percentage of nonnative plants present decreases (Bauder 1987, p. 210). This implies that outlier shallower pools in a watershed may have a higher degree of threat from nonnative plants. As such, invasive species can often out-compete native species such as *E. a.* var. *parishii*. Additionally, invasive plants may alter fire impacts by altering fire frequencies, seasonal timing, size, and intensity.

Bauder (2005, p. 2133) states that *Agrostis avenaca* (Pacific bentgrass) and *Polypogon monspeliensis* (rabbitsfoot grass) 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 (CIPC 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).

Invasive species may increase the extinction threat to *Eryngium aristulatum* var. *parishii* and other vernal pools plants, especially under climate change scenarios, because nonnative plants are abundant in and near vernal pool ecosystems. Because of the persistent sources of nonnative plants, the threat from nonnative plants may be considered rangewide even in the presence of local or regional conservation and management measures. However, no quantification of negative impacts has been made, and the role and extent of impacts of nonnative plants on the local persistence of *Eryngium aristulatum* var. *parishii* is unknown.

Fire and Fire Suppression

Fire was not considered a severe threat to *Eryngium aristulatum* var. *parishii* in the listing rule (USFWS 1993, pp. 41384–41392); however, our understanding of fire in meadow and grassland habitat has changed since the listing of the species in 1993 (Dyer 2002, pp. 101–111). Fire is a natural component for regeneration and maintenance in *E. a.* var. *parishii* habitat (Bauder 1996, p. 2). However, the taxon faces two seemingly diametrically opposed forces: lack of fire, and re-introduction of fire (accidental and purposeful) to an altered landscape. The recent San Diego County wildfires of 2003 and 2007 exemplify these dual threats.

The effects of fire exclusion in the habitat of southern California has not been specifically detailed for vernal pool habitat; however, the processes and structure of fire ecology is comparable to other ecosystems (Keane *et al.* 2002, pp. 3–11; D'Antonio and Vitousek 1992, pp. 63–87). Fire exclusion in southern California habitat affects: (1) nutrient recycling, (2) natural regulation of succession via selecting and regenerating plants, (3) biological diversity, (4) biomass, (5) insect and disease populations, (6) interaction between plants and animals, and (7) biological and biogeochemical processes (i.e., soil property alteration) (Keane *et al.* 2002, pp. 3–11). Fire in areas where *Eryngium aristulatum* var. *parishii* exist can remove vegetation cover that would otherwise aid in controlling erosion post fire. This may in turn result in local sedimentation of the pools or otherwise disrupt vernal pool ecology. Species that occur in vernal pools are usually associated with grassland or chaparral associations and are therefore likely adapted to light fire (such as *E. a.* var. *parishii* during the dry season) are replaced by species that are able to out compete for growing resources in the absence of fire (Keane *et al.* 2002, pp. 3–11). Nonnative plants have exacerbated fire danger to vernal pool habitat by creating greater

fuel loads that increase risk of more intense fires (see MALGBC 2007, p. 7). However, intense fires have also burned habitat, exposing areas where old vernal pools were overgrown by chaparral (e.g., the Copp parcel is now "covered with *Eryngium aristulatum* var. *parishii"* following a recent fire that reduced chaparral (Wynn, pers. obs. 2009)); therefore, in some instances, fire may be used to re-claim vernal pools overgrown with chaparral.

Although habitat occupied by *Eryngium aristulatum* var. *parishii* is dependent upon some form of disturbance to set back succession (e.g., periodic fire and annual inundation), fires at critical times can eliminate populations of *E. a.* var. *parishii* by killing individual plants or seed banks through intense heat, or overheating soil to create hydrophobic conditions (Agee 1993, pp. 1–493; Keane *et al.* 2002, pp. 3–11; Keeley 2001, pp. 81–94; Arno and Fiedler 2005, pp. 7–38). Historically, this would not have been a problem since there were likely more adjacent populations that could recolonize depopulated sites.

Wildfires pose the largest single stochastic/single event risk to the remaining concentrations of *Eryngium aristulatum* var. *parishii* in southern California. In the current context of global climate change (McKenzie and Peterson 2005, pp. 8–12; Flannigan *et al.* 2009, pp. 483–507), small escaped fires in the San Diego area could turn into large wildfires due to wind, weather, lack of prescribed fires, invasive vegetation, and wildfire control/prevention response. However, because this taxon is located in urbanized areas, wildfires are not likely to be left unchecked.

There is an increased rangewide threat to *Eryngium aristulatum* var. *parishii* from wildfire since listing; the occurrence and potential for large-scale wildfires is documented (e.g., 2003 and 2007) in the taxon's range. Any differences between impacts from these fires compared to those that might have taken place on a more natural time, size, and intensity scale are unknown. There is also likelihood that strategic response to fire events has changed to the potential detriment of native plant habitats.

Small Population Size

Genetic exchange among vernal pool complexes is naturally limited; however, losses of intervening pool complexes can artificially further reduce genetic exchange. A more refined understanding of small and declining population biology and genetics than was available at the time of listing suggests that reduction of extant numbers through stochastic processes may accelerate extinction of the subspecies population, with no evolutionary relief (Foley 1994, pp. 124–137; Bell and Gonzalez 2009, pp. 942–948).

Eryngium aristulatum var. *parishii* 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 or complex. Events outside the range of natural influence or frequency 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). Small populations are more vulnerable to natural catastrophes and stochastic demographic, genetic, and environmental events (Barrett and Kohn 1991, pp. 3–30).

Genetic effects may further influence population demography via inbreeding depression and genetic drift (Barrett and Kohn 1991, pp. 3–30; Menges 1991, pp. 58–61). Allee (1931, pp.

17–50) suggested small, single populations are vulnerable to extirpation when opportunities for reproduction diminish because of reduced opportunity of individuals to reproduce (Allee effect or depensation) (Courchamp *et al.* 2008, pp. vi–216). Stephens *et al.* (1999, pp. 185–190), Dennis (2002, pp. 389–401) and Courchamp *et al.* (2008, pp. vi–216) suggest that the Allee effect is a density-dependent event that is inversely related to population size.

Trampling by Humans and Livestock

Trampling of *Eryngium aristulatum* var. *parishii* plants was believed to occur via human immigrant travel through habitat of *E. a.* var. *parishii* (USFWS 1993, p. 41387). This factor has not been quantified, and to date is only suspected to cause a threat to *E. a.* var. *parishii* via direct mortality. The border fence and additional staffing by the Border Patrol since 2005 has probably lessened the likelihood of this threat. Grazing within *E. a.* var. *parishii* habitat continues in Ramona, although overall, livestock trampling does not seem to be a rangewide concern today because livestock are predominantly absent from the areas where the taxon occurs.

Loss of Pollinators

Eryngium aristulatum var. *parishii* is believed to be insect pollinated; the species is known to be visited and possibly pollinated by wasp-like bees from the family Colletidea (i.e., *Hylaeus episcopalis episcopalis, Hylaeus polifolii, Hylaeus conspicuous, and Hylaeus mesillae cressoni*), leafcutting bees from the family Megachilidae (i.e., *Heriades occidentalis, Ashmeadiella cactorum basalis,* and *Megachile brevis onobrychidis*), and bumble or honey bees from the family Apidea (i.e., *Anthophora urbana urbana* and *Ceratina acanthi*) (Krombein *et al.* 1979, Volume 2, pp. 1761, 1765–67, 2008, 2025, 2052, 2164, 2181; Krombein *et al.* 1979, Volume 3, pp. 2683).

Cumulative effects of habitat loss, drought, and urbanization on native pollinators contribute to an extant and future threat to *Eryngium aristulatum* var. *parishii*. The National Research Council of the National Academies (2007, pp. 73–74) indicated that *"some pollinators in North America representing a diversity of taxa are, in fact, in decline."* When native pollinators are diminished, redundancies in pollinator systems may be disrupted thus impacting the reproductive output of the variety.

Drought/Climate Change

Drought was noted as a threat to *Eryngium aristulatum* var. *parishii* at the time of listing; however, its relationship to climate change has been derived since listing. Periodic and successive droughts are considered an underestimated ecological stress and selection factor that impact biological diversity, shaped by species-specific ability to withstand these effects (Gutschick and BrassiriRad 2003, p. 37; Archaux and Wolters 2006, p. 645). The current extended drought effecting southern California may be having deleterious effects on *E. a.* var. *parishii*, comparable to other aquatic species (Rahel *et al.* 2008, pp. 551–561).

Climate change has already impacted natural environments and is no longer viewed as a postulated event (Karl *et al.* 2009, pp. 13–152; Alder *et al.* 2009, pp. 1–6). Climate change is

expected to affect plants and wildlife in southern California and throughout the world by expediting alterations of naturalized conditions in which the species have evolved, and by creating conditions where invasive species may out-compete the endemics (Field *et al.* 1999, pp. 17–42; CEPA 2006 p. 33; IPCC 2007, pp. 2–18). For example, in other ecosystems, climate change will be a disturbance event that *"can affect forests by altering the frequency, intensity, duration, and timing of fire, drought, introduced species, insect and pathogen outbreaks, hurricanes, windstorms, ice storms, or landslides* (Dale *et al.* 2001, p. 723). Climate change also makes conserving endangered species cumulatively more difficult (Kostyack and Rohlf 2008, pp. 10203–10213). Climate change related effects have not been studied yet for vernal pool ecosystems, or are otherwise directly attributed to causing impacts on site-specific adaptations of species and endemic terrestrial biodiversity. To date, vernal pool species lack specific climate change related research; however, climate change effects to a wide range of species are being experienced in other locations where they are studied (Strain and Thomas 1995, pp. 121–139; McDonald and Brown 1992, pp. 410–414; Boggs and Murphy 1997, pp. 39–48; Parmesan and Yohe 2003, pp. 37–41; Parmesan 2006, pp. 638–656; Schwartz *et al.* 2006, pp. 1611–1615; Thomas *et al.* 2004, pp. 145–148; Thomas *et al.* 2006, pp. 415–416). From an ecological context, current models and scientific thought suggest that southern California likely will be adversely affected by global climate change through prolonged seasonal droughts, and rainfall coming at unusual periods and different amounts (Pierce 2004, pp. 1–33; Cayan *et al.* 2005 pp. 3–7; CEPA 2006, p. 33).

Current climate change predictions for terrestrial areas in the Northern Hemisphere indicate warmer air temperatures, more intense precipitation events, unpredictable precipitation timing and amounts, and increased summer continental drying (Field *et al.* 1999, pp. 17–42; Cayan *et al.* 2005, pp. 3–7; IPCC 2007, pp. 2–18; Karl *et al.* 2009, pp. 13–152; Rockström *et al.* 2009, pp. 472–475). Predictions of short and long term climatic conditions for smaller sub-regions such as California remain uncertain. It is unknown at this time to what extent climate considerations in coastal California will change and if a change in climate in California will result in a warmer trend with localized drying, higher precipitation events, or more frequent El Niño or La Niña events (Pierce 2004, p. 31).

The effects of an unpredictable precipitation regime on vernal pools, and on vernal pool species will have consequential effects on short and long term persistence of most if not all pools within basins (Bauder 2005, pp. 2129–2135). Ecosystem communities in California are expected to be 'reshuffled' due to climate disruption (Stralberg *et al.* 2009, pp. 1–8). We recognize that climate change is an important issue with potential effects to listed species and their habitats; however, information to make precise oceanographic and atmospheric predictions regarding its immediate effects to vernal pool species, including *Eryngium aristulatum* var. *parishii* and its habitat, is lacking.

Bauder (2005, p. 2134) indicated *"Climate changes would be expected to alter pool hydrology and in turn the distributions, population dynamics and interactions of these vernal pool plants and animals. Less obvious threats are related to the loss of structural habitat diversity and the concomitant impacts of such losses on hydrological diversity and in turn species responses."* Climate change will have subtle and major effects on vernal pool species composition due to *"climate, topographic relief, watershed connections and pool morphology"* (Bauder 2005, p.

2134; Vitousek *et al.* 1997, pp. 1–16). Current trends based on demographic and meteorological information suggest climate change have already affected the inland island habitat by droughts and unpredictable precipitation, El Niño cycles, and in the future may cause worse droughts or extended dry periods on southern California via lessened low stratus cloud regime and hydrologic effects of reduced fog delivery, (Fischer *et al*. 2006, 2007, pp. 783–799; NOAA 2009). It has been shown unequivocally that climate change is affecting coastal and inland habitat in the United States (Karl *et al.* 2009, pp. 13–152). Severe drought in southern California, in addition to increased heating of the ocean and surrounding terrestrial habitat may therefore impact extant vernal pool ecology in the range of the variety through excessive drying of pools, shorter inundation times, and crowding of nonnatives tolerant of such drought conditions.

The existence of vernal pool biota is fixed to the co-occurrence of geological and climatic conditions (i.e., impervious layers in shallow basin formations and periodic rainfall to fill the pools). Floras or certain species in the flora may be able to respond to shifts in rainfall resulting from changes in regional climate by shifting their geographical range through dispersal to keep up with spacial movement of their ecological range. This will likely not be the case for taxa constrained by specific soil characteristics or ecological conditions (e.g., taxa endemic to specific local soil types or taxa restricted to bogs or vernal pools. Changes in hydrological conditions associated with climate change would likely be rangewide for the taxon because of the relatively narrow range of the plant.

Summary of Factor E

Threats identified at listing and new threats continue to impact *Eryngium aristulatum* var. *parishii* (USFWS 1993, pp. 41384–41392). Small population size and Allee effects caused by fragmentation has potential to affect genetic continuity and maintenance of remnant populations. Nonnative species both have the potential to and are known to be displacing available habitat, causing competition that *E. a.* var. *parishii* has not evolved with, as well as increasing the risk for wildfire events that may impact *E. a.* var. *parishii.* Fire and fire suppression activities are the most hazardous stochastic risk to the species, with increasing wildfire size and intensity represented in the WUI that can impact vernal pool ecosystems. Extended drought and climate change are potentially rangewide threats to all vernal pool taxa; threats may decrease the long term viability of small to medium-sized vernal pools through loss of rainfall over several to many years.

III. RECOVERY CRITERIA

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

more appropriate ways to achieve recovery. Likewise, new information may change the extent that criteria need to be met for recognizing recovery of the species. Overall, recovery is a dynamic process requiring adaptive management, and assessing a species' degree of recovery is likewise an adaptive process that may, or may not, fully follow the guidance provided in a recovery plan. We focus our evaluation of species status in this 5-year review on progress that has been made toward recovery since the species was listed (or since the most recent 5-year review) by eliminating or reducing the threats discussed in the five-factor analysis. In that context, progress towards fulfilling recovery criteria serves to indicate the extent to which threat factors have been reduced or eliminated.

The recovery strategy for *Eryngium aristulatum* var. *parishii* and vernal pool species is concentrated on eliminating and reducing the primary existing threats to their habitats (USFWS 1998, p. 58). Specifically, these threats include: habitat destruction and modification, alteration of wetland hydrology, OHV activity, cattle grazing, and competition from nonnative species (USFWS 1998, p. 58).

Recovery criteria cooperatively prepared for the Service by Dr. E. Bauder (San Diego State University), A. Kreager (USFWS), and S. McMillan (USFWS) in 1998 were developed for four plant species (including *Eryngium aristulatum* var. *parishii*) and two animal species (USFWS 1998, p. iii). Recovery criteria were not threat-based, as addressing ecosystem function and integrity was the approach for recovery plans developed during the 1990's (Clark *et al.* 2002, pp. 1510–1519). Recovery criteria for vernal pool ecosystems, which include *Eryngium aristulatum* var. *parishii* were listed as:

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

Action items necessary to achieve these tasks included:

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

Considerable amounts of vernal pool habitat have been acquired and secured since the species was listed (Appendix 1). Conservation measures implemented as a result of section 7 consultations and implementation of management plans such as the Western Riverside County MSHCP, San Diego MSCP, and INRMPs have created a matrix of protected habitat for *Eryngium aristulatum* var. *parishii.* Because of additional listed vernal pool species in areas where *E. a.* var. *parishii* occurs, the taxon benefits by additional concentration of scrutiny used to conserve, protect, and restore vernal pool habitat throughout the species range. Much extant vernal pool habitat, barring stochastic events, is likely to persist for the species to the foreseeable future. Anthropogenic threats still persist. Climate change will likely impact some sites through alteration of when drying occurs and potential changes to the amount of annual precipitation necessary to inundate pools for sufficient time, per pool complex. Maintaining *"habitat function and species viability"* was not defined in the recovery plan; however, the body of conservation biology literature developed since then (e.g., Groom *et al.* 2006, pp. 432–435) has established standards by which the Service could ascertain if each conserved pool and complex has achieved habitat function needs for *E. a.* var. *parishii*. Development of a population viability analysis with species-specific information could improve the current land management configuration and watershed protection schemes.

Clarifying presence/absence of *Eryngium aristulatum* var. *parishii* at historically or recently restored pools does not greatly assist efforts to qualify and quantify the effectiveness or *in situ* conservation actions. The Recovery Plan provides guidelines for the conservation of *E. a.* var. *parishii.*

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

IV. SYNTHESIS

At the time of listing, all sites occupied by *Eryngium aristulatum* var. *parishii* were considered to be under threat of development or other impacts. The original threats which led to the species being listed include urban development, damage caused by OHVs, trampling, highway construction, watershed alterations, military activities, trash dumping, nonnatives, small population size, fire, and drought. Overall, *Eryngium aristulatum* var. *parishii* has maintained its population and distribution since the time of listing. Though threats remain, impacts from trampling associated with immigrant travel, road development and construction activities, and mowing and plowing of extant habitat have been minimized as threats to *E. a.* var. *parishii*. Outside of continued urbanization, climate change and fire may have the longest lasting impact for degrading the species long term retention, setting back potential recovery. As a habitat

endemic this plant is more susceptible to rangewide threats (e.g., fire, hydrological alterations by nonnative plants, or hydrological impacts associated with climate change). The dense concentrations of vernal pools on military bases will be protected from most development, but may be subject to OHV activity, trampling impacts, and potential habitat impacts if MCB Pendleton or MCAS Miramar requires a change in the military mission.

Much progress has been made to conserve vernal pool habitat where *E. a.* var. *parishii* occurs. Land acquisition and conservation under the Western Riverside County MSHCP and San Diego MSCP, as well as management efforts under the MCAS Miramar and MCB Camp Pendleton INRMPs, have reduced or ameliorated many of the original threats. HCPs and the related conservation actions arising from the Act have contributed to short and long term conservation of *E. a.* var. *parishii.* Additionally, INRMPs at MCB Camp Pendleton and MCAS Miramar have created policy mechanisms and partnerships that have restored and conserved vernal pool habitat. Though *E. a.* var. *parishii* is found to be locally abundant at sites where habitat has been conserved or where management of anthropogenic activities has protected the vernal pool site, impacts from current threats remain. Therefore, we find that *E. a.* var. *parishii* still meets the definition of endangered and do not recommend a change in status at this time.

V. RESULTS

Recommended Listing Action:

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

New Recovery Priority Number and Brief Rationale: 12C. *Eryngium aristulatum* var. *parishii* is a taxon that faces a moderate degree of threat. Due to the amount of vernal pools that have been destroyed in the range of *E. a.* var. *parishii,* the taxon has become a conservation dependent species that has a low recovery potential.

VI. RECOMMENDATIONS FOR ACTIONS OVER THE NEXT 5 YEARS

1) Conduct rangewide monitoring using species-specific protocol to ascertain distribution and abundance; assimilate monitoring data into a standardized database available to all cooperators, researchers, public, and regulators. Publish results in peer reviewed journal(s).
2) Develop a coordinated interagency invasive species prevention and eradication program for all vernal pool habitat where *Eryngium aristulatum* var. *parishii* is extant.
3) Identify *Eryngium aristulatum* var. *parishii* pollinators, their required habitat, and implement measures to ensure their maintenance throughout the range of *E. a.* var. *parishii.*
4) Conduct hydrological monitoring and modeling to ascertain vulnerability of pools and complexes to likely altered hydrological conditions associated with climate change.
5) Determine the utility of enhanced and artificially created vernal pools to the conservation of the species and standardize methods of site selection, selection of propagation materials, outplanting protocols, success criteria, and remediation methods.
6) Coordinate with partners, such as MCAS Miramar and MCB Camp Pendleton, to help manage and protect vernal pool habitat.

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Appendix 1: Occurrences of *Eryngium aristulatum* var. *parishii*, Riverside and San Diego Counties, California; prepared for FY2010 5-year review.

Regional Location	Location	CNDDB Occurrence # and/or pool complex	Threats	Owner	Status	Extant at Listing (Source)
RIVERSIDE COUNTY						
Santa Rosa Plateau	Mesa de Colorado	EO 7 (includes former EO 67 and Beauchamp pools C 1 and C 4)	A: Adjacent development	TNC: Santa Rosa Preserve and Private	Presumed extant	Present on Santa Rosa Plateau (RP 1998, p. E15)
		EO 8 (includes former EO 63; includes pool C 3 and W edge C 2)		TNC: Santa Rosa Preserve	Presumed extant	Present on Santa Rosa Plateau (RP 1998, p. E15)
	Mesa de Burro	EO 62 (incl pools B 1, B 2, B 3)		TNC: Santa Rosa Preserve	Presumed extant	Present on Santa Rosa Plateau (RP 1998, p. E15)
		EO 66 (includes former EO 85; pools B 6, B 8)		TNC: Santa Rosa Preserve	Presumed extant	Present on Santa Rosa Plateau (RP 1998, p. E15)
Skunk Hollow	Skunk Hollow			Private	Protected by existing agreements, may be impacted by upcoming projects	Present 1 pool (RP 1998, p. E14)

Regional Location	Location	CNDDB Occurrence # and/or pool complex	Threats	Owner	Status	Extant at Listing (Source)
SAN DIEGO COUNTY						
MCB Camp Pendleton	Bluff Las Flores to Aliso Ck	EO 53 (includes former EO 54)		MCB Camp Pendleton	Presumed extant	
	Bluff N Las Flores Ck	EO 55	A: Greatly disturbed in 1979	MCB Camp Pendleton	Presumed extant	
		EO 75		MCB Camp Pendleton	Presumed extant	
	Wire Mtn Tuley Canyon	EO 64	A: Proposed military housing	MCB Camp Pendleton	Present (RECON 2007 Figure 10)	
	N end upper Stuart Mesa	EO 74		MCB Camp Pendleton	Present (RECON 2007 Figure 10)	
	S end Upper Stuart Mesa	no EO		MCB Camp Pendleton	Presumed extant	
	Stuart Mesa Rd	EO 76		MCB Camp Pendleton	Presumed extant	
	Stuart Mesa Rd N.	EO 77		MCB Camp Pendleton	Presumed extant	
	Wire Mtn N end	EO 78	A: Expansion of military housing	MCB Camp Pendleton	Present pool group 124 (RECON 2001, Table 8). Present (RECON 2007 Figure 10)	
	Wire Mtn W of Tuley Canyon	EO 79	A: Expansion of military housing	MCB Camp Pendleton	Present pool groups 1, 10, and 12 (RECON 2001 Table 8). Present (RECON 2007, Figure 10)	
	N San Luis Rey River	EO 93	A: Expansion of military housing; mowing and disking	MCB Camp Pendleton	Present in pool groups 3 and 5 (RECON 2001 Table 8). Present (RECON 2007, Figure 10)	

Regional Location	Location	CNDDB Occurrence # and/or pool complex	Threats	Owner	Status	Extant at Listing (Source)
Carlsbad	Poinsettia Lane Train Station	EO 92	E: Pedestrians and dogs	Private		
		JJ1	A: Habitat fragmentation E: Nonnative plants	Poinsettia Train Station	Partially impacted, partially restored, conserved	Present (RP 1998, p. E13)
		JJ4 ++ Manzanita Partners	A: Habitat fragmentation E: Nonnative plants	Manzanita Partners	Partially impacted, partially restored, Conserved, Mitigation	
San Marcos	SW of Palomar College	EO 51 (includes former EO 52; Beauchamp pools L 1-10)	A: Industrial development; road grading; OHVs; dumping; altered hydrology. E: Nonnative plants			
		L 1-6 (Upham)	A: Development	Private	Partially impacted	Present (RP 1998 p. E13)
		L 9-10 (Superior Ready Mix, Universal Boot)	A: Development	Private; City of San Marcos		Present (RP 1998 p. E13)
	San Marcos	EO 91 (includes pools L 11-13 and Hogan parcel 219-33)	A: Development E: trespass			
	W Palomar College	EO 90	A: Grading; clearance for fire safety			
		L18+ Mission/Las Posa		Private	Impacted	Extirpated (RP 1998, p. E13)
	S Palomar College, N SR 78	EO 65	A: Clearance for fire safety			

Regional Location	Location	CNDDB Occurrence # and/or pool complex	Threats	Owner	Status	Extant at Listing (Source)
Ramona	Ramona	Tc, La Brea & Kalbaugh (SE)	A: Habitat fragmentation E: Nonnative plants	Private	Conserved as mitigation for post office	Present (RP 1998, p. F5)
Del Mar Mesa	Greystone Torrey Highlands	EO 94	A: OHV damage; dumping E: Trampling			
		H 39		Private	Fenced, conserved mitigation site (CSD 2004, p. 14)	
	Penasquitos North	EO 38 (DFG pools H 1-23)		Caltrans, private, etc.		
		H 1-3	A: OHV damage; fire prevention measures E: Nonnative plants	City of San Diego, USFWS	Mitigation site conserved in 2002; NWR (CSD 2004, p. 17). In MHPA, conserved (GIS 2009)	Present (RP 1998 p. E10)
		H 4-10	A: OHV damage; fire prevention measures E: Nonnative plants	CDFG, USFWS	Mitigation site conserved in 2002; NWR (CSD 2004, p. 17). In MHPA, conserved (GIS)	Present (RP 1998 p. E10)
		H 13-15	A: OHV damage; fire prevention measures E: Nonnative plants	CDFG	Mitigation site conserved in 2002; NWR (CSD 2004, p. 17). In MHPA conserved (GIS 2009)	Present (RP 1998, E10)
	Rhodes vernal pool site	H 18-23; (CSD 2004, p. 15))	A: OHV damage; fire prevention measures E: Nonnative plants	CDFG, USFWS	Conservation easement in progress (CSD 2004, p. 15) Part in MHPA and conserved (GIS 2009)	Present (RP 1998 p. E11)
		H 24-26	A: Development	Private		Present (RP 1998, p. E11)

Regional Location	Location	CNDDB Occurrence # and/or pool complex	Threats	Owner	Status	Extant at Listing (Source)
Carmel Mountain	Upper end Deer Canyon	EO 95	A: development; OHVs; dumping E: Trampling		Possibly extant	
	Penasquitos Canyon	EO 34 (includes Beauchamp H33)	A: Nearby development		Not in MHPA, not conserved (GIS 2009)	
	Penasquitos North	EO 35 (includes DFG H 31&32; City/Recon HE, HXIV-XV)	A: Development		Partly in MHPA but not yet conserved (GIS 2009)	
Mira Mesa	Lopez Ridge VP Preserve	B 7-8		City of San Diego	Mitigation, part conserved (City of San Diego 2004 p.26) Part in MHPA not yet conserved, part not in MHPA (GIS 2009)	
	Camino Ruiz	EO 40 (includes DFG B 12 & B 13, City code BE)	A: Development; OHV damage; dumping		Not in MHPA, not conserved, extirpated by development (GIS 2009)	
	Mesa Norte	B 11	A: Habitat isolated within developed area		Conserved and fenced; 45 vp created or restored by 1998 (City of San Diego 2004 p. 24)	
	Fieldstone	C 17-18		Private	Fenced and conserved (CSD 2004, p. 28); Most in MHPA but not yet conserved (GIS 2009)	

Regional Location	Location	CNDDB Occurrence # and/or pool complex	Threats	Owner	Status	Extant at Listing (Source)
Mira Mesa	Mira Mesa central	EO 43 (includes DFG C 1-16 & 20-26)	A: Development; habitat fragmentation	Private	Nearly all of the occurrence site is developed (GIS 2009)	
		C 10-16 Winterwood		City of San Diego	12 of the 20 acres conserved (CSD 2004, p. 30); part in MHPA but not yet conserved (GIS 2009)	
	N rim Carroll Canyon	EO 50 (includes DFG D 1-25, City pool codes DA, B, C, 9-20)	A: Development	Private	Nearly all of the occurrence site is developed (GIS 2009)	
		D 5-8 Carroll Canyon Preserve	A: Trash	City of San Diego	Mitigation site, 119 pools (CSD 2004, 35). In MHPA but not yet conserved (GIS 2009)	Present (RP 1998, p. E10)
	S rim Carroll Canyon	EO 44 (includes DFG I 1, City/Recon PII)	A: Road construction; industrial development		Half is developed remainder not MHPA or conserved (GIS 2009)	
		I 1 Arjons, S. of Carroll Canyon	A: Graded since listing	Private	Fenced, conserved (CSD 2004, p. 37); Not in MHPA on map, not conserved (GIS 2009)	Present (RP 1998, p. E9)

Regional Location	Location	CNDDB Occurrence # and/or pool complex	Threats	Owner	Status	Extant at Listing (Source)
MCAS Miramar	Miramar Industrial	EO 36 (includes DFG I 7)	A: OHVs	MCAS Miramar		
		I 7 Eastgate Mall	E: Nonnative plants	MCAS Miramar	DOD MA 1, Restored. Appears extant (GIS 2009)	Present in 19 pools (RP 1998, E6)
	West MCAS Miramar	EO 33 (includes DFG pool codes I 6A, B, &C, X 1-4)	A: Grading; OHVs; altered hydrologyy	MCAS Miramar, private	I 6A and I 6B extirpated; I 6C extant (GIS 2009)	
		I 6C Bob Baker 2	A: Trash (CSD 2004, p. 41)	Private, City easement	Fenced not conserved (CSD 2004, p. 41-42); Not in MHPA, not conserved, appears extant (GIS 2009)	Present (RP 1998, p. E9)
		X 1-4 West Miramar	A: Military activities, fire protection measures E: Nonnative plants	MCAS Miramar	DOD MA 1/BRIG mitigation site. Appears extant (GIS 2009)	Present (RP 1998, p. E6)
	West Gate S of jct Miramar Rd & Way MCAS Miramar	EO 47 (DFG Z1-5; City ZII, Z5)	A: Altered hydrology; OHVs; brush clearance	MCAS Miramar	Eastern portions extirpated (GIS 2009)	
		Z 1-3	A: Military activities, fire protection measures E: Nonnative plants	MCAS Miramar	DOD MA 1. Appears extant (GIS 2009)	Present (RP 1998, p. E6)

Regional Location	Location	CNDDB Occurrence # and/or pool complex	Threats	Owner	Status	Extant at Listing (Source)
MCAS Miramar	West MCAS Miramar	EO 45 (DFG Z6-7; City & Recon Z1)	A: Construction; grading; OHVs	MCAS Miramar	Appears extant (GIS 2009)	
		Z 6-7	A: Military activities, fire protection measures E: Nonnative plants	MCAS Miramar	DOD MA 5 10% impacted, 90% restored. Appears extant (GIS 2009)	Present in 23 pools (RP 1998, p. E6)
	Kearny Villa Rd jct San Clemente Canyon MCAS Miramar	EO 17 (includes DFG AA 11, Recon AIV)	A: Isolated	MCAS Miramar	Appears extant (GIS 2009)	
		AA 11	A: Military activities, fire protection measures E: Nonnative plants	MCAS Miramar	DOD MA 1. Appears extant (GIS 2009)	Present (RP 1998, p. E7)
	S of SR 52 MCAS Miramar	EO 14 (DFG AA 3-7; City-Recon AA VII-Ix)	A: Highway development; OHV damage; brush clearance	MCAS Miramar	Appears extant (GIS 2009)	
		AA 3	A: Military activities, fire protection measures E: Nonnative plants	MCAS Miramar	DOD MA 1. Appears extant (GIS 2009)	Present (RP 1998, p. E8)
	W of I-15 just S Rose Canyon	EO 84 (includes DFG pools AA9, City-Recon AAII)	A: OHV damage; roads obstruct hydrology; brush clearance; isolation	MCAS Miramar	Appears extant (GIS 2009)	
		AA 9	A: Military activities, fire protection measures E: Nonnative plants	MCAS Miramar	DOD MA 1. Appears extant (GIS 2009)	Present (RP 1998, p. E7)

Regional Location	Location	CNDDB Occurrence # and/or pool complex	Threats	Owner	Status	Extant at Listing (Source)
MCAS Miramar	Between runways and San Clemente Canyon MCAS Miramar	EO 23 (DFG V 1-4, W 1-2, EE1&2, FF 1&2, GG)	A: OHV damage; mining; mowing; military activity	MCAS Miramar	Appears extant (GIS 2009)	
		V (V 1-4 Sim J. Harris in Appen F?)		MCAS Miramar	Appears extant (GIS 2009)	Present (RP 1998, p. E6)
		W 1-2		MCAS Miramar	DOD MA 1. Appears extant (GIS 2009)	Present (RP 1998, p. E6)
		GG 3+	A: Military activities, fire protection measures E: Nonnative plants	MCAS Miramar	DOD MA 3 Partially BRAC Impacted. Appears extant (GIS 2009)	
		GG 2+	A: Military activities, fire protection measures E: Nonnative plants	MCAS Miramar	DOD MA 1 Partially BRAC Impacted. Appears extant (GIS 2009)	Present in 1 pool (RP 1998, p. E5)
		GG 1	A: Military activities, fire protection measures E: Nonnative plants	MCAS Miramar	DOD MA 1 Partially BRAC Impacted. Appears extant (GIS 2009)	Present in 1 pool (RP 1998, p. E5)
		FF 1-2	A: Military activities, fire protection measures E: Nonnative plants	MCAS Miramar	DOD MA 4/Partially BRAC Impacted. Appears extant (GIS 2009)	Present in 8 pools (RP 1998, p. E5)
		EE 1	A: Military activities, fire protection measures E: Nonnative plants	MCAS Miramar	DOD MA 1. Appears extant (GIS 2009)	Present in 26 pools (RP 1998, p. E9)
		EE 2	A: Military activities, fire protection measures E: Nonnative plants	MCAS Miramar	MA 1/Partially BRAC Impacted/restored. Appears extant (GIS 2009)	Present in 41 pools (RP 1998, p. E9)

Regional Location	Location	CNDDB Occurrence # and/or pool complex	Threats	Owner	Status	Extant at Listing (Source)
MCAS Miramar	Between I-15 and SR 1163	EO 81 (includes DFG pools F 1-16, 20&26, City FII) (was part of EO 25)	A: Highway development; altered hydrology; brush clearance	MCAS Miramar	Appears to be extant (GIS 2009)	
		F north (F1-27 in Appen F)	A: Military activities, fire protection measures E: Nonnative plants	MCAS Miramar	MA 1 Partially impacted, BRAC mitigation. Appears to be extant (GIS 2009)	Present in "F north" (RP 1998, p. E8)
	Northwest of jct I-15 and SR 163 MCAS Miramar	GA	A: Military activities, fire protection measures E: Nonnative plants	MCAS Miramar	DOD MA 1. Appears to be extant (GIS 2009)	Present (RP 1998, p. E9)
	Southwest of W end runways MCAS Miramar	W 3		MCAS Miramar	DOD MA 1. Appears to be extant (GIS 2009)	Present (RP 1998, p. E6)
	Southwest MCAS Miramar	HH 4+		MCAS Miramar	Appears to be extant (GIS 2009)	
	W end runways MCAS Miramar	EO 21 (includes DFG pools HH, Recon MM)	A: Runway construction; OHVs; brush clearance	MCAS Miramar	Appears to be extant (GIS 2009)	
		HH 1+	A: Military activities, fire protection measures E: Nonnative plants	MCAS Miramar	DOD MA 1 restoration site. Appears to be extant (GIS 2009)	Present in 57 pools (RP 1998, p. E5)
		HH 2+ (mapped outside polygon)	A: Military activities, fire protection measures E: Nonnative plants	MCAS Miramar	DOD MA 1. Appears to be extant (GIS 2009)	

Regional Location	Location	CNDDB Occurrence # and/or pool complex	Threats	Owner	Status	Extant at Listing (Source)
MCAS Miramar	W of jct I-15 and SR 163 MCAS Miramar	EO 15 (includes DFG RR 1&2)		MCAS Miramar	Appears to be extant (GIS 2009)	
		RR 1	A: Military activities, fire protection measures E: Nonnative plants	MCAS Miramar	DOD MA 1. Appears to be extant (GIS 2009)	Present (RP 1998, p. E9)
	W of SR 163 between San Clemente Canyon and Clairmont Mesa Blvd.	EO 25 (includes DFG pools U 1-17)	A: Possible development; OHVs; brush clearance; altered hydrology; dumping; Highway construction	MCAS Miramar	Appears to be extant (GIS 2009)	
		U North (U 1-13 Landmark/U-North in Appen F)	A: Military activities, fire protection measures E: Nonnative plants	MCAS Miramar	DOD MA 1. Partial restoration site. Appears to be extant (GIS 2009)	Present (RP 1998, p. E8)
		U 15 [eastern half]		MCAS Miramar	Appears to be extant (GIS 2009)	
		U 15 [western half] Magnatron and Sander	A: Development	City of San Diego	Private, not in MHPA, not conserved (CSD 2004, p. 49); appears extant (GIS 2009)	Present in 3 pools (RP 1998, E9)
	Cubic	U 19	E: Nonnative plants	MCAS Miramar, small part private	Private, partially restored; Privately owned, not conserved (CSD 2004, p. 48). Appears to be extant (GIS 2009)	Present in 3 pools (RP 1998, p. E8)
	East MCAS Miramar	EO 30 (includes DFG pools AA 1&2; City, Recon AA 1)	A: Highway realignment; facilities development	MCAS Miramar	GIS map shows taxon present	

Regional Location	Location	CNDDB Occurrence # and/or pool complex	Threats	Owner	Status	Extant at Listing (Source)
	Kearny Villa South	EO 27 (includes DFG pools E 1-4)	A: Fragmented by development		Appears to be extirpated (Map 242-1725, CSD 2004); (GIS 2009)	
	NE of jct SR 163 and Clairmont Mesa Blvd.	J 27	A: Habitat fragmentation E: Nonnative plants	Private - Empire Center	Partially impacted, partially restored, conserved. Most not in MHPA or conserved, part in MHPS but not yet conserved	Present in 5 pools (RP 1998, p. E2)
	SE of jct SR 163 and Clairmont Mesa Blvd.	J 28E	A: Development	Private	In MHPA but not yet conserved (GIS 2009)	Present in 7 pools (RP 1998, p. E2)
	General Dynamics	N 8			Fenced, conserved mitigation site (CSD 2004, p. 52); In MHPA, conserved (GIS)	
	Montgomery Field	N 1-4, 6	A: Development; habitat disturbance due to emergency responses. E: Nonnative plants	City of San Diego	Taxon not present (CSD 2004, p. 54-55; GIS 2009)	Present in 3 pools (RP 1998, p. E4)
	Murphy Canyon	G 1	A: OHVs; fire protection measures. E: Nonnative plants	DOD Navy	Taxon not present but site in MHPA not yet conserved (GIS 2009). DOD partially restored mitigation.	Present in 1 pool (RP 1998, p. E4)
	Mission Valley	EO 20 (includes former EO 2)	A: heavily disturbed; development	Private	Presumed extant. Site virtually all graded (GIS 2009)	
		O 1 Mission Village		Private	Not in MHPA, not conserved. Site graded (GIS 2009)	Extirpated (RP 1998, p. E4)

Regional Location	Location	CNDDB Occurrence # and/or pool complex	Threats	Owner	Status	Extant at Listing (Source)
	Cholla Heights Naval Radio Station	EO 87	A: Disking, maintenance operations, OHVs E: Nonnative plants	U.S. Navy Radio Station	Partially impacted and restored mitigation; in MHPA but not yet preserved	Present in 6 pools (RP 1998, E4)
	Chollas Park	EO 68	A: Habitat degraded by *Eucalyptus* and park. C: Rabbits	City of San Diego	Not in MHPA, not conserved (GIS 2009)	
	Proctor Valley	EO 88	A: Development, illegal dumping	Private	In MHPA, conserved (GIS 2009)	
		R 3+			In MHPA conserved (GIS 2009)	Present (RP 1998, p. E4)
Otay Lakes	Otay Lakes	EO 11 (includes Beauchamp sites K 3, K 4, K 5)		City of San Diego	In MHPA but not yet conserved (GIS 2009)	
		K3-4	E: Grazing	City of San Diego	Not conserved (CSD 2004, p. 65); In MHPA but not yet conserved (GIS 2009)	Present in 10 pools (RP 1998, p. E2)
		K 5	E: Grazing	City of San Diego	Not conserved (CSD 2004, p. 65); In MHPA but not yet conserved (GIS 2009)	Present in 5 pools (RP 1998, p. E3)
		K 10+	E: Grazing	City of San Diego	Not conserved (CSD 2004, p. 65); In MHPA but not yet conserved (GIS 2009)	

Regional Location	Location	CNDDB Occurrence # and/or pool complex	Threats	Owner	Status	Extant at Listing (Source)
Otay Mesa	W of Brown Field	EO 56 (includes Beauchamp pool J 1)	A: Border crossing. C: Grazing	Pardee - CalTerraces	Presumed extant. Not in MHPA, not conserved (GIS 2009)	
		J 1 (GIS map includes M 4 sites) Pardee CalTerraces	A: Development C: Grazing	Private	Impacted; not in MHPA, not conserved (GIS 2009)	Extirpated (RP 1998, p. E2)
	E of Dennery Canyon	EO 57 and EO 72 (both EOs include Beauchamp J 2)	A: OHVs	Private	Most in MHPA and conserved (east part of J 2S is out of MHPA) (GIS 2009)	
		J 2 (including J2 N, J2 S, J 2 W)	A: Habitat fragmentation E: Nonnative plants	J2 N- Wall/Hudson; J2 S& W Calterraces Pardee & Otay Mesa Rd	J 2 N conserved; J 2 S conserved; J 2 W part in MHPA and conserved. J 2W not conserved (CSD 2004, p. 72). Conserved except for east part of J 2S (GIS 2009)	Present 22 pools (RP 1998, p. E1)
	Northwest of Brown Field	EO 58 (includes J 5)	A: Development	Private	Heavily degraded by OHVs. Not in MHPA, not conserved, developed (GIS 2009)	
		J 4-7 Robinhood Ridge	A: Habitat fragmentation E: Nonnative plants	Private	Partially impacted, partially restored, conserved. J 4-5 conserved, privately owned (CSD 2004, p. 68). J 4 conserved (GIS 2009).	Present 1 pool (RP 1998, p. E1)
	SE of East end Moody Canyon	EO 59 (includes Beauchamp pools J 13)	A: Industrial development; OHVs C: Grazing. E: Nonnative plants	Private	Not in MHPA, not conserved (GIS 2009)	

Regional Location	Location	CNDDB Occurrence # and/or pool complex	Threats	Owner	Status	Extant at Listing (Source)
Otay Mesa		J 13N	A: Development	Private	Not in MHPA, not conserved (GIS 2009)	Present in 3 pools (RP 1998, p. E1)
		J 13S	A: Development	Private	Not in MHPA, not conserved (GIS 2009)	Present in 1 pool (RP 1998, p. E1)
		J 13E	A: Development	Private	Not in MHPA, not conserved (GIS 2009)	Present in 1 pool (RP 1998, p. E1)
		EO 61 (includes Beauchamp pool J 15)	A: OHVs, Border Patrol activities; dumping	Private	In MHPA not yet conserved (GIS 2009)	
		J 15 Arnie's Point	A: Border Patrol activities E: Nonnative plants	Private; Federal	Partially impacted, partially restored. Part in MHPA but not yet conserved, part not in MHPA or conserved (GIS 2009)	Present in 13 pools (RP 1998, p. E2)
	S of Wruck Canyon	EO 89 (includes Beauchamp J 16-18)	A: OHVs. C: Grazing	City of San Diego	In MHPA, most is conserved (GIS 2009)	
		J 16-17 Goat Mesa Wruck Canyon	A: Border Patrol activities E: Nonnative plants	City of San Diego	Conserved (CSD 2004, p. 96-97); In MHPA and most is conserved (GIS 2009)	Present in 7 pools (RP 1998, p. E2)
	SE of Brown Field	EO 1 (Beauchamp pools J 19-21)	A: Border crossing; disking. C: Grazing	Private	Not in MHPA not conserved (GIS 2009)	

Regional Location	Location	CNDDB Occurrence # and/or pool complex	Threats	Owner	Status	Extant at Listing (Source)
Otay Mesa			A: Agriculture, development, Border Patrol activities	Private	Not in MHPA not conserved (GIS 2009)	Extirpated (RP 1998, p. E2)
		J 21	A: Agriculture, development, Border Patrol activities, altered hydrology	Private	Not in MHPA not conserved (GIS 2009)	Present (RP 1998, p. E2)
	S of Johnson Canyon	EO 12 (includes Beauchamp pool J 22)	A: Graded; habitat destroyed	Private	Not in MHPA, not conserved (GIS 2009)	
		J 22 Sunroad	A: Development	Private	Not in MHPA, not conserved (GIS 2009)	Present (RP 1998, p. E2)
	NE of Brown Field	EO 9 (includes Beauchamp pools J 23-25)	A: Border crossing. C: Grazing	USFWS, County of San Diego	Most in MHPA, most conserved (GIS 2009)	
		J 23-24	A: Development	County of San Diego	Most in MHPA, most conserved (GIS 2009)	Present in 28 pools (RP 1998, p. E2)
		J 25	A: Development	County of San Diego	In MHPA, conserved (GIS 2009)	Present in 11 pools (RP 1998, p. E2)
	S of Lower Otay Reservoir	EO 10 (includes Beauchamp pools J 26)	A: OHVs	Private	Nearly all not in MHPA or conserved (GIS 2009)	
		J 26 Upham	E: Nonnative plants	Private	Partially impacted, partially restored, conserved. S half in MHPA and conserved, N half not in MHPA or conserved (GIS 2009)	Present (RP 1998, p. E2)

Regional Location	Location	CNDDB Occurrence # and/or pool complex	Threats	Owner	Status	Extant at Listing (Source)
Otay Mesa	Recon South	J 14	A: OHV trails		Not in MHPA but is conserved (GIS 2009)	
	S rim of Spring Canyon	EO 60 (includes Beauchamp pools J 12, J 13E) [EO citation error uses 31 for 13]	A: OHVs; fire; border patrol activities; proposed sewer outfall C: grazing	Private	In MHPA but not yet conserved (GIS 2009)	
		J 12		Private	In MHPA but not yet conserved (GIS 2009)	
		J 13E	A: Development	Private	Not in MHPA, not conserved (GIS 2009)	Present (RP 1998, p. E1)
	N of Brown Field	EO 13 (includes J 30) (GIS includes J 29-31)	A: Border crossing. C: Grazing	Private	Nearly all J 29 and J 30 pools in MHPA but none conserved as yet (GIS 2009)	
		J 29-30	A: OHVs C: Grazing	Private	Privately owned, not conserved (CSD 2004, p. 102); nearly all J 29 and J 30 in MHPA but not conserved (GIS 2009)	Present in 106 pools (RP 1998, p. E2)
		J 31			Most in MHPA but not yet conserved (GIS 2009)	
	S of SR 905 E of I-805	No EO #; J33 Sweetwater High School, City of San Diego		City of San Diego	Pools created, not conserved (CSD 2004, p. 75); Not in MHPA, not conserved (GIS)	
	S rim Otay Mesa	EO 69 (J 11W)	A: OHVs; fire; border patrol activities; illegal aliens. C: Grazing		In MHPA but not yet conserved (GIS 2009)	

Regional Location	Location	CNDDB Occurrence # and/or pool complex	Threats	Owner	Status	Extant at Listing (Source)
Otay Mesa	W of Wruck Canyon	EO 71 (J 11E)	A: Industrial development; OHVs; border partol; fire; illegal aliens. C: Grazing.	Private	In MHPA but not yet conserved (GIS 2009)	Present (RP 1998, p. E1)
	S of Moody Canyon, E of San Ysidro	EO 80			Not in MHPA but is conserved (GIS 2009)	
	West Otay A+B	No EO#; J 32			Not in MHPA but is conserved (GIS 2009)	
Brown Field Station	Brown Field Station				Not in MHPA, not conserved (GIS 2009)	

CSD= City of San Diego 2004

GIS= Maps of ERARPA distribution produced in February 2010

RP= USFWS 1998 Recovery Plan

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

***Eryngium aristulatum* var. *parishii* (San Diego button celery)**

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 0 1 2010