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# A CONSERVATION ASSESSMENT FOR *ACMISPON DENDROIDEUS* VAR. *TRASKIAE* (SAN CLEMENTE ISLAND LOTUS, FABACEAE)

SULA VANDERPLANK, KIMBERLY O'CONNOR, BRYAN MUNSON AND DAWN LAWSON

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## 1.0 EXECUTIVE SUMMARY

This report summarizes the best available scientific information relevant to assessing the conservation status of *Acmispon dendroideus* (Greene) Brouillet var. *traskiae* (Eastw. ex Noddin) Brouillet (San Clemente Island lotus) that was listed as federally endangered in 1977 by the United States Fish and Wildlife Service (USFWS) under the Endangered Species Act (ESA) of 1973 (16 U.S.C. 1531 et seq.) and was downlisted to threatened in 2012. *Acmispon dendroideus* var. *traskiae* is an upright perennial shrub endemic to San Clemente Island, California. It is commonly found in canyons and on thin rocky soils throughout the island, and its numbers have risen dramatically from just six occurrences at the time of listing to more than 136 occurrences and 11,938 individuals based on surveys conducted from 2011 through 2012 (Map 1). At the time of listing, the major threat to this taxon was herbivory by non-native mammals. The eradication of the last feral mammalian herbivores in the early 1990s has resulted in a significant population increase in *A. dendroideus* var. *traskiae*. In the federal listing, downlisting and status reviews for *A. dendroideus* var. *traskiae*, land use, non-native species, fire and erosion were identified as threats under Factor A of the five-factor analysis, and climate change was identified under Factor E. These threats are evaluated in detail within this report and are determined to be minimal. *Acmispon dendroideus* var. *traskiae* is not likely to become endangered within the foreseeable future throughout all or a significant portion of its range. Based on the recovery of the taxon to date, ongoing conservation by the United States Department of the Navy (US Navy), which promotes the continued survival and expansion of *A. dendroideus* var. *traskiae* on San Clemente Island, and the existence of regulatory mechanisms other than the ESA, the protections afforded to the taxon as federally threatened under the Endangered Species Act are no longer warranted.

## 2.0 SCOPE AND PURPOSE

*Acmispon dendroideus* var. *traskiae* (San Clemente Island lotus) was selected as the focus of this conservation status review due to its range expansion and population size increases following significant efforts by the United States Department of the Navy (US Navy) to aid its recovery. The purpose of this conservation assessment is to compile and synthesize the best available scientific information about *A. dendroideus* var. *traskiae* to document its current conservation status. Discussion in this review highlights changes in this plant's demography over the past 47 years and focuses on modern distribution patterns (including evidence of natural recruitment) and the likelihood of its long-term survival.

## 3.0 METHODS

Taxonomic and life history data were compiled from multiple scientific publications. Current and historical data on the occurrences were retrieved from the US Navy, the US Fish and Wildlife Service (USFWS), the Consortium of California Herbaria (CCH), and the California Natural Diversity Database (CNDDB). Recent demographic data were furnished by the Soil Ecology and Restoration Group (SERG) of the San Diego State University Research Foundation and confirmed through the Commander U.S. Pacific Fleet Environmental Readiness Division and the Naval Base Coronado Natural Resources Office. Between December 2016 and March 2017, field visits to several populations of *A. dendroideus* var. *traskiae* were made to corroborate available data. Notes were taken on associated species and evidence of recruitment at the sites visited. Data on phenology, floral visitors, and potential threats came from published literature, personal observations, previous legal documentation and internal reports. Maps were generated by Tierra Data Inc., based on the most recent extensive survey data from SERG 2011–2012. Extensive surveys have not been conducted in the past five years because the high numbers of populations and individuals have greatly increased the level of effort required for monitoring and the significant recovery of this taxon has made it a lower priority for frequent monitoring.

## 4.0 BACKGROUND

### 4.1 *Taxonomic Description*

The description presented below is drawn from data adapted from Brouillet (2016), Allan (1999), Junak and Wilken (1998), Munz (1974) and Abrams (1917):

*Acmispon dendroideus* (Greene) var. *traskiae* (Eastw. ex Noddin) Brouillet—the San Clemente Island lotus—is a perennial herb or suffrutescent shrub in the Fabaceae (the legume family). It belongs to the subfamily Faboideae and the tribe Loteae and is part of the *Acmispon* group of perennial herbs with indehiscent fruits, which on the California Channel Islands includes two species (*A. dendroideus* and *A. argophyllus* (A. Gray) Brouillet) and six subspecific taxa, three in each species. The three varieties of *A. dendroideus* are restricted (endemic) to the islands. *Acmispon dendroideus* var. *veatchii* is endemic to San Miguel Island, *A. dendroideus* var. *traskiae* is endemic to San

Clemente Island, and *A. dendroideus* var. *dendroideus* is found on six of the islands, but not on San Miguel or San Clemente.

Individuals of *A. dendroideus* var. *traskiae* may reach up to 180 cm in height but are generally less than 1 meter tall, with slender, erect branches. The leaves are irregularly pinnate with 3–5 green leaflets (~64 mm long at maturity) that are finely or sparsely strigose (or uniformly glabrous) and have gland-like stipules. The inflorescences arise from the leaf axils of terminal shoots and are generally 3–5 flowered, with a peduncle that usually has a bract. The calyx (4–6 mm) is glabrous (not hairy). The corolla is yellow, 8–12 mm in length, with wings similar in length to the keel. The flowers are bisexual, with a pistil that matures from yellow to red, and a glabrous stigma. The indehiscent fruits are exserted early in development and 2.5–5 cm long, with up to six ovules and a narrow and abruptly curved beak at the tip, 2–3 mm long (Fig. 1–4). Chromosome number is $2n = 14$.

*Acmispon dendroideus* var. *traskiae* is distinguished from var. *dendroideus* by its greater fruit length (var. *dendroideus* has a fruit 1–1.5 cm long) and the presence of a peduncle bract, and from var. *veatchii* by its green foliage (var. *veatchii* has gray foliage) and the presence of more than three leaflets.

4.2 *Taxonomic History and Genetics*

Current name: *Acmispon dendroideus* (Greene) Brouillet var. *traskiae* (Noddin) Brouillet

Synonyms:

*Syrmatium traskiae* Eastw. ex Noddin
*Syrmatium traskiae* Eastw. ex Abrams
*Lotus scoparius* var. *traskiae* (Eastw. ex Abrams) Ottley
*Lotus scoparius* (Torr. & A. Gray) Ottley subsp. *traskiae* (Eastw. ex Abrams) P.H. Raven
*Lotus dendroideus* (Greene) Greene var. *traskiae* (Eastw. ex Abrams) Isely
*Acmispon dendroideus* var. *traskiae* (Eastw. ex Abrams) Brouillet

Invalid name previously used in the literature:

*Lotus dendroideus* subsp. *traskiae* (USFWS 2012)

Other common name:

San Clemente Island broom (USFWS 2013)

*Acmispon dendroideus* var. *traskiae* was first known as *Syrmatium traskiae*, the name under which it was first collected by Blanche Trask (# 287, June 1903). The type specimens are: US 469581 (type) and A 00066152 (isotype) (JSTOR Plants 2016). These specimens were collected on San Clemente Island at Mosquito Harbor. Alice Eastwood had first coined the name *S. traskiae* in honor of Trask, but the name was formally published by LeRoy Abrams (1917) who credits Ralph Noddin with the description. Abrams' publication has resulted in author citations for Eastwood ex Abrams and Eastwood ex Noddin. Perhaps the full citation should be "Eastwood ex Noddin in Abrams", but for the purposes of this document, in accordance with the Federal Register, we recognize the name *S. traskiae* Eastw. ex Noddin (JSTOR Plants 2016); consequently, we currently recognize the name *Acmispon dendroideus* (Greene) Brouillet var. *traskiae* (Eastw. ex Noddin) Brouillet (the names: *Syrmatium traskiae* Eastw. ex Abrams [Tropicos 2016] and *Acmispon dendroideus* var. *traskiae* (Eastw. ex Abrams) Brouillet [Brouillet 2016] are therefore considered synonyms.

In 1923, Ottley published a revision of the California species of lotus and recognized *Syrmatium* in the genus *Lotus* and placed *traskiae* as a variety of *Lotus scoparius*. In 1963, Raven upgraded *traskiae* to a subspecies in the Flora of San Clemente Island; and in 1977, *Lotus scoparius* subsp. *traskiae* was classified as endangered by the Federal Government (USFWS 1977). Duane Isley (1978) published new combinations for subspp. *traskiae* and *veatchii* in *Brittonia*, stating that "…these combinations, then, are a consequence of the taxonomic decision to recognize *Lotus dendroideus* at the species level" as he separated them from the mainland taxa of *L. scoparius*. In 2008, Luc Brouillet reclassified the genus *Lotus* and published the new combination *Acmispon dendroideus* var. *traskiae* (following supportive evidence of Allan and Porter 2000; Sokoloff 2000; and Degtjareva et al. 2008). In 2013, this taxon was reclassified as threatened by the federal government, and the name change to *A. dendroideus* var. *traskiae* was accepted and updated in the Federal Register (USFWS 2013). The genus *Acmispon* includes 23 currently recognized species distributed through southwestern Canada, the western United States and Mexico, with a single species in Chile (Brouillet 2016). The etymology of the name *Acmispon* comes from the Greek word acme, meaning point or apex, presumed to refer to the hooked tips of the fruits (Brouillet 2016). A key to all California taxa in the genus *Acmispon* can be found in Brouillet (2016). Today, *A. dendroideus* var. *traskiae* is one of eight taxa in the genus *Acmispon* that are found on San Clemente Island (US Navy 2002). The additional taxa include two perennials (*A. argophyllus* var. *adsurgens* (Dunkle) Brouillet, a San Clemente Island endemic taxon; *A. argophyllus* var. *argenteus* (Dunkle) Brouillet, a Channel Island endemic) and three annual species (*A. maritimus* (Nutt.) D.D. Sokoloff, *A. micranthus* (Torr. & A. Gray) Brouillet, and *A. strigosus* (Nutt.) Brouillet) and two waifs that were briefly documented on the


Fig. 1–4. *Acmispon dendroideus* var. *traskiae* flowers (Fig. 1), fruits (Fig. 2), leaves (Fig. 3) and general habit (Fig. 4).

island from a single individual (*A. prostratus* (Torr. & A. Gray) Brouillet (CNPS list 1B.1) and *A. glaber* (Vogel) Brouillet) (Soil Ecology and Restoration Group, unpubl. data; Raven 1963).

Wallace et al. (2017) recently conducted phylogeographic studies of island *Acmispon* taxa and found strong differentiation between the three varieties of *A. dendroideus*, with var. *traskiae* being the most distinct and basal to the clade. This variety is believed to have originated from a direct independent colonization event from mainland California ancestors (i.e., it did not evolve from *A. dendroideus* var. *dendroideus* on Santa Catalina Island). The genetic diversity of *A. dendroideus* var. *traskiae* is equal to or higher than that of *A. dendroideus* var. *dendroideus*, and *A. dendroideus* var. *traskiae* also contains unique and highly divergent genotypes (Wallace et al. 2017).

Hybridization between *A. dendroideus* var. *traskiae* and *A. argophyllus.* var. *argenteus* has been confirmed by genetic research (Liston et al. 1990). Hybridization has been known to occur between *A. argophyllus* and *A. dendroideus* var. *traskiae*, and despite its low levels of occurrence (5% of 219 plants sampled were documented to be hybrids by McGlaughlin and Helenurm [noted in USFWS 2013]), concerns of genetic assimilation and outbreeding depression have been raised (Liston et al. 1990). However, recent genetic studies and field data from McGlaughlin et al. (M. McGlaughlin, pers. comm.

2016) show very limited evidence of this hybridization, and hybridization is not considered a significant threat to *A. dendroideus* var. *traskiae* at this time (USFWS 2013). Despite the multiple changes in nomenclature, this plant has consistently been recognized as a unique entity. Recent genetic research shows that *A. dendroideus* var. *traskiae* is a good taxon, meaning that it is monophyletic and distinct from related taxa, and it is possibly deserving of elevation to species level (M. McGlaughlin, pers. comm. 2016).

### 4.3 *Regulatory History*

- *Acmispon dendroideus* var. *traskiae* was listed as federally endangered on 11 August 1977 (USFWS 1977).
- *Acmispon dendroideus* var. *traskiae* was listed as California endangered in April 1982.
- A Recovery Plan for Channel Island Species, including *A. dendroideus* var. *traskiae*, was finalized in 1984 (USFWS 1984).
- Five-year status reviews were completed in 2007 (USFWS 2007) and 2012 (USFWS 2012). These status reviews recommended reclassification of *A. dendroideus* var. *traskiae* from endangered to threatened status.
- On 18 May 2010, the USFWS received a petition, dated 13 May 2010, from the Pacific Legal Foundation requesting that the Service downlist *A. dendroideus* var. *traskiae* from endangered to threatened.
- On 19 January 2011, a 90-day finding announced the initiation of a status review (USFWS 2011).
- On 16 May 2012, a proposed rule to reclassify *A. dendroideus* var. *traskiae* from endangered to threatened was issued (USFWS 2012).
- On 26 July 2013, a final rule was issued, reclassifying *A. dendroideus* var. *traskiae* from endangered to threatened throughout its range (USFWS 2013).

## 5.0 BIOLOGY, ECOLOGY, HABITAT AND HUMAN USES

### 5.1 *Biology and Ecology*

*Acmispon dendroideus* var. *traskiae*) is an upright suffrutescent (semi-woody) shrub, with thin erect green branches (Fig. 3–5; Munz 1974). Like most legumes, the roots of *Acmispon* species have nodules that contain symbiotic nitrogen-fixing bacteria, which can make atmospheric nitrogen available to plants in the form of $NH_3$ (Sørensen and Sessitsch 2007). This nitrogen-fixing ability allows the plants to enrich the soil and makes them particularly important post-fire colonizers (Sørensen and Sessitsch 2007). Sister taxon *A. glaber* [syn. *Lotus scoparius*] has been documented to flower in response to available moisture from the marine layer (fog) and precipitation, primarily winter rainfall (Vanderplank 2013), thus the same is likely true for *A. dendroideus* var. *traskiae* on San Clemente Island. Peak flowering of *A. dendroideus* var. *traskiae* usually occurs from March to May (Junak and Wilken 1998; USFWS 2008), although the flowering times are documented from February to August (Brouillet 2016).

The flowers change color from yellow to orange to red with age (USFWS 2008). Studies on sister taxon *A. glaber*, which also displays this trait, suggest that there are various advantages to this morphological change. Though pollinators tend not to visit the orange/red flowers, their presence is thought to improve the overall pollinator display, attracting more pollinators to the plant (Jones and Cruzan 1999). Despite increased numbers of floral visitors, however, individual pollinators may visit fewer flowers per plant, which cumulatively works to reduce selfing and promote outcrossing (Jones and Cruzan 1999). Studies indicate that all insular *Acmispon* taxa are self-compatible (capable of setting fruit and producing viable seed in isolation) and inter-fertile, as indicated by the lack of full reproductive barriers and occasional hybridization events (Allan 1999). Little is known about the pollination specifics of *A. dendroideus* var. *traskiae*, but various floral visitors have been observed at multiple locations, including a wealth of halictid bees, bumblebees and small beetles (Junak and Wilken 1998; USFWS 2008). Narrowly endemic taxa that are self-incompatible may be highly dependent on their floral visitors for their genetic diversity and seed production (Jabis et al. 2011). However, all insular *Acmispon* taxa are visited by a wide range of potential pollinators, including generalist bees from the Adrenidae (*Anthidium maculosum*), Apidae (*Bombus edwardsii*), Anthrophoridae (*Habropoda depressa*) and Megachilidae (*Megachile* sp., *Osmia* sp.) (Allan 1999), and even the non-native bee *Apis mellifera* has been observed visiting *A. dendroideus* var. *dendroideus* on Santa Cruz Island (Thorp et al. 1994). *Acmispon argophyllus* on San Clemente Island was recently confirmed to be visited by the bees *Anthidium maculosum* and *Osmia* sp. (likely *O. gabrielis*) (SERG 2015*a*). In an hour-long observation period of foliar and floral visitors to *A. dendroideus* var. *traskiae* near the water tank in the vicinity of Wilson Cove at approx. 9 a.m. on 28 March 2017, 11 different invertebrates were observed (Vanderplank and Lawson, unpubl. data 2017).

The longevity of *A. dendroideus* var. *traskiae* generally has been reported to be five years or less

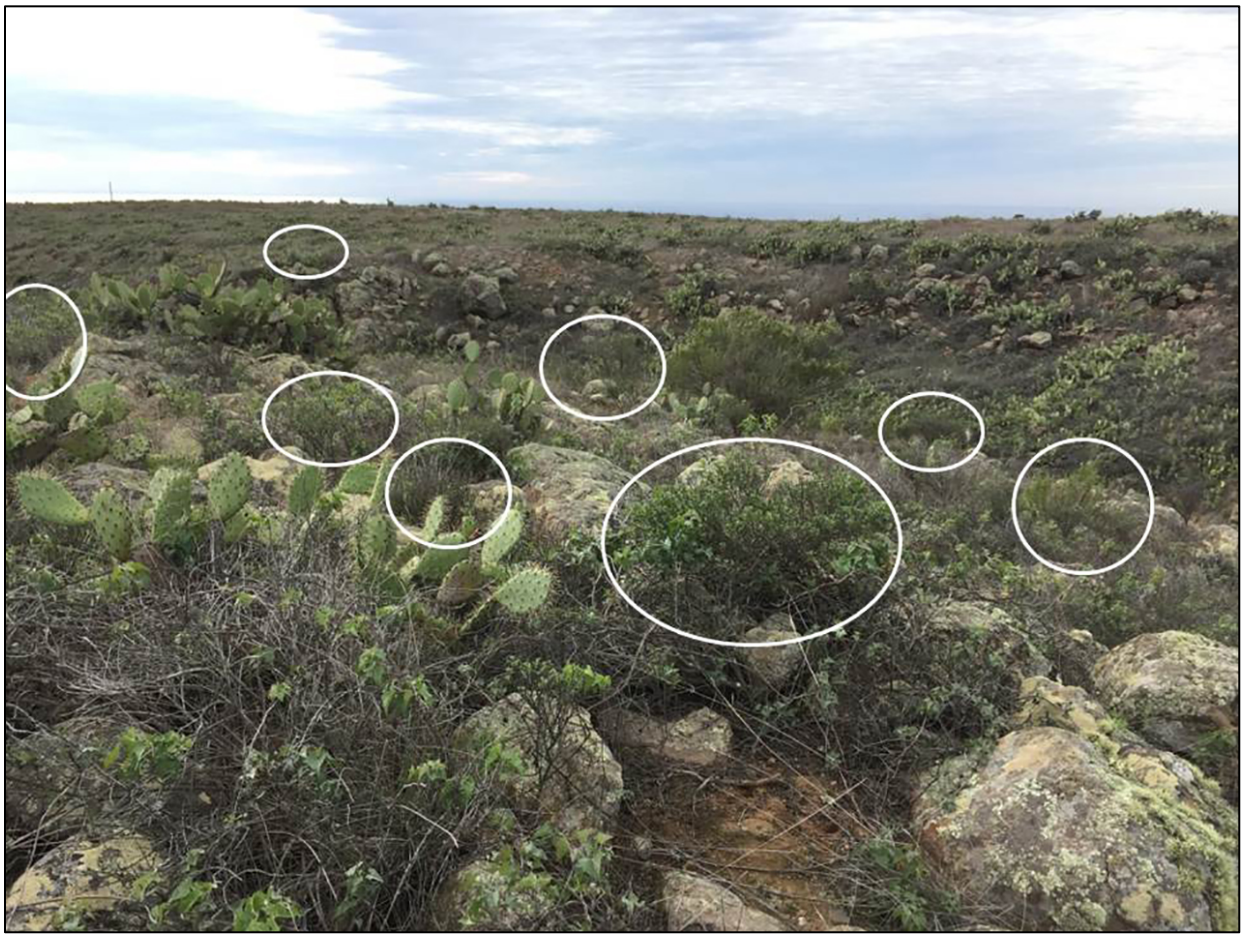

Fig. 5. High abundance of *Acmispon dendroideus* var. *traskiae* on the landscape at Middle Ranch.

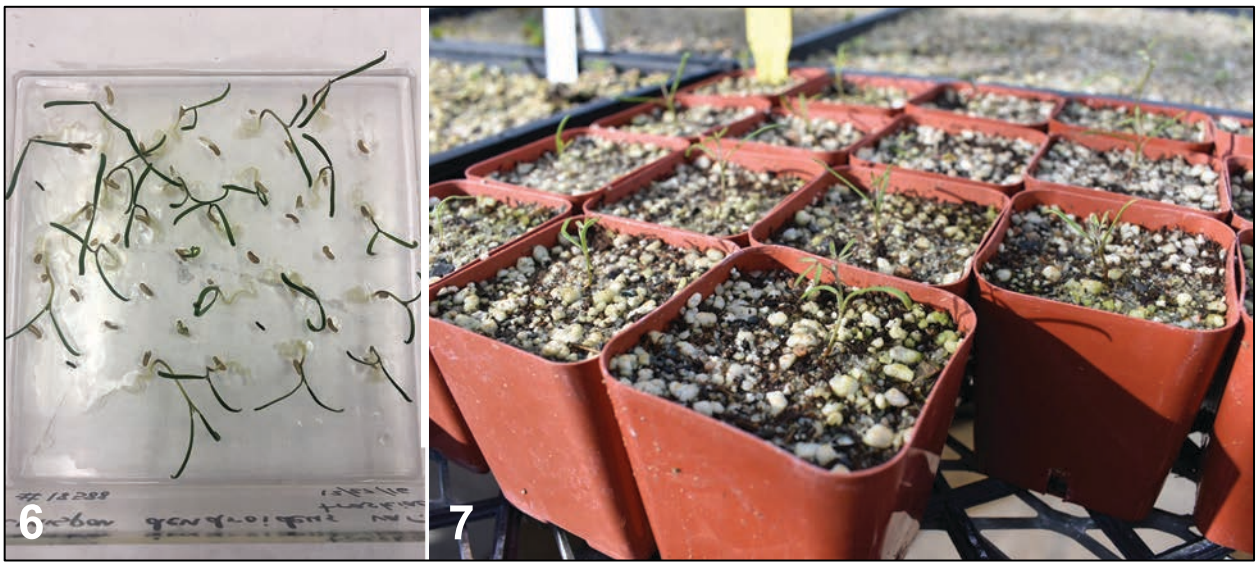


Fig. 6–7. Germination of seeds of *Acmispon dendroideus* var. *traskiae* after 20 years in the long-term conservation seed bank at Rancho Santa Ana Botanic Garden (courtesy of Cheryl Birker).

(USFWS 2008), although with the increase in demographic data and natural history studies, it is apparent that at least some individuals live much longer (USFWS 2013). Individuals at Lotus Hill south of the Natural Resources facility have been observed to live longer than six years (Emily Howe, pers. comm. 2017). The Sensitive Plant Status Survey (Junak and Wilken 1998) noted very high fecundity in *A. dendroideus* var. *traskiae*, with an individual plant producing 36–64 flowering shoots and 118–144 flowers per shoot. This gives a fruit-generating capacity of approx. 5000–9000 fruits per plant. Fruits have 4–6 seeds, and under ideal conditions a single plant could produce a total of 40,000 seeds or more (Junak and Wilken 1998).

Seed of *A. dendroideus* var. *traskiae* in long-term storage at the Conservation Seed Bank of Rancho Santa Ana Botanic Garden (RSABG) showed only a small reduction in germination after six years in storage (from 80% to 76%), suggesting that natural seed dormancy adaptations may allow these seeds to live a long time in the soil (Cheryl Birker, pers. comm. 2017). The seeds are noted to be among the most difficult to clean and process for long-term storage (Wall and Macdonald 2009). Recent longevity trials show significant germination after long-term storage, and one seed lot displayed 65% germination after more than 20 years in storage (Cheryl Birker, pers. comm. 2017; Fig. 6–7). Plants often produce dimorphic seed that differs in longevity (Dyer 2004). In 2002, a germination test assessed the viability of green or tan seeds versus dark brown seeds, and surprisingly the green to tan seeds (which might have been considered immature) actually displayed a higher germination rate (48%, 12/25 seeds) than the darker seeds (32%, 8/25 seeds). These results suggest that *A. dendroideus* var. *traskiae* is highly fecund given the propensity for long-term survival in the soil seed bank and the high viability of seeds that appear young or discolored.

The USFWS (2013) cites a personal communication with Michael Wall, former Conservation Seed Bank curator at RSABG, who noted that despite the germination-enhancing effects of hot water treatments, experiments conducted on other species suggest that heat above 200°F (93°C) can be detrimental to seed survival and germination, so dry heat (e.g., fire) may not have a similar enhancing effect. However, the low thermal conductivity of soil allows many seeds to survive fires at even shallow depths in the soil seed bank (Beadle 1940; Bradstock and Auld 1995; Neary et al. 1999). In addition, while seed at the soil surface can be killed by fire, fuel loading is often insufficient to produce reliably high enough temperatures to result in widespread mortality (Daubenmire 1968). Thus, it is unlikely that a fire would result in significant mortality in the soil seed bank of *A. dendroideus* var. *traskiae*, which is demonstrated by the persistence of populations throughout the island in areas that have previously burned [see Section 6.4.3 for more information].

### 5.2 *Habitat*

Data from the Integrated Natural Resources Management Plan (INRMP; US Navy 2013) give a sense of the local climate conditions (2008–2011) for *A. dendroideus* var. *traskiae.* Average monthly temperatures at Wilson Cove range from 58°F (14°C) to 66°F (19°C). The average monthly maximum temperature is 72°F (22°C) in August, and the monthly minimum temperature reaches 5°F (10°C) in December, although other areas of the island may be cooler in winter and warmer in summer (US Navy 2002). Although average monthly relative humidity has been documented to vary from 54% to 86% across the island, it is 70–80% much of the year at Wilson Cove. The average annual rainfall is 6.6 inches (16.8 cm), though annual fluctuations in rainfall can be high. Precipitation is received mainly from November through April, with little from May through October. In addition to precipitation, fog drip during the typical dry season is a vital source of moisture to the San Clemente Island ecosystem (INRMP, US Navy 2013).

Vegetation mapping of San Clemente Island (Sward and Cohen 1980) previously associated *A. dendroideus* var. *traskiae* with two major vegetation types: canyon woodland (which encompassed approx. 696 acres [282 ha]) and maritime desert scrub (which encompassed approx. 6228 acres [2520 ha] along the northeastern escarpment). Over time, the range of *A. dendroideus* var. *traskiae* has expanded and it now occupies new habitats within the same general vegetation types. Reported habitats for *A. dendroideus* var. *traskiae* are numerous and include grassy slopes and rocky outcrops, north- and northeast-facing slopes, maritime cactus scrub, canyon bottoms, coastal terraces, flats, and canyon walls (CNDDB, accessed 2017), rock outcrops in grassy areas and along the interface between grassland and maritime sage scrub (Allan 1999) and ridgelines (Junak 2006).

Currently, *A. dendroideus* var. *traskiae* occupies a broad range of habitats throughout San Clemente Island. Map 2 shows a vegetation map that was produced by RECON and modified by Tierra Data Inc. (INRMP, US Navy 2013). The vast majority of the 136 *A. dendroideus* var. *traskiae* occurrences are found in vegetation types dominated by *Artemisia californica* (38 occurrences), *Opuntia littoralis* (47 occurrences) and *Rhus integrifolia* (29 occurrences), although *A. dendroideus* var. *traskiae* also is found in seven additional vegetation communities (e.g., 382 individuals constituting nine occurrences have been documented in the *Lycium californicum* vegetation type).

Individuals of *A. dendroideus* var. *traskiae* have colonized areas in close proximity to buildings, roads, and pipelines, indicating that *A. dendroideus* var. *traskiae* is capable of colonizing disturbed areas (US Navy 2002) and has the potential to continue to expand its range on San Clemente Island. Populations on the eastern escarpment generally occur on slopes, canyon bottoms and ridge tops, and those on the western side occur in canyon bottoms (SERG 2012). Aspect varies widely, with most populations facing north to northeast, and most occurrences are on clay to rocky soils. Elevations range from 0 to approx. 1550 feet (475 m), and slopes range from 0 to 70 degrees, with the majority on moderately steep slopes of 10–30 degrees.

The considerable habitat diversity and wide range of suitable habitat of *A. dendroideus* var. *traskiae* is reflected in the large number of associated species with which it has been documented. The CNDDB (accessed 9/1/2017) lists the following associated species in the element occurrence records. Nomenclature has been updated to reflect the most current nomenclature, non-native plants are indicated with an asterisk*, and family names have been added in this report:

Associated species from CNDDB 2017: *Acmispon argophyllus* var. *argenteus* [as *Lotus argophyllus* subsp. *ornithopus*] (Fabaceae), *Amblyopappus pusillus* (Asteraceae), *Antirrhinum nuttallianum* (Plantaginaceae), *Artemisia californica* (Asteraceae), *Artemisia nesiotica* (Asteraceae), *Atriplex semibaccata** (Chenopodiaceae), *Avena barbata** (Poaceae), *Baccharis pilularis* (Asteraceae), *Bergerocactus emoryi* (Cactaceae), *Brodiaea kinkiensis* (Themidaceae), *Bromus diandrus** (Poaceae), *Bromus madritensis** (Poaceae), *Calystegia macrostegia* subsp. *amplissima* (Convolvulaceae), *Castilleja grisea* (Orobanchaceae), *Constancea nevinii* [as *Eriophyllum nevinii*] (Asteraceae), *Crassula connata* (Crassulaceae), *Crossosoma californicum* (Crossosomataceae), *Daucus pusillus* (Apiaceae), *Deinandra clementina* [as *Hemizonia clementina*] (Asteraceae), *Dichelostemma capitatum* (Themidaceae), *Dudleya virens* subsp. *virens* (Crassulaceae), *Encelia californica* (Asteraceae), *Eriogonum giganteum* var. *formosum* (Polygonaceae), *Eriogonum giganteum* var. *giganteum* [probably var. *formosum*] (Polygonaceae), *Eriophyllum confertiflorum* (Asteraceae), *Festuca myuros** (Poaceae), *Foeniculum vulgare** (Apiaceae), *Frankenia salina* (Frankeniaceae), *Galium catalinense* subsp. *acrispum* (Rubiaceae), *Gambelia speciosa* (Plantaginaceae), *Gastridium ventricosum** (Poaceae), *Gilia nevinii* (Polemoniaceae), *Heteromeles arbutifolia* (Rosaceae), *Lactuca serriola** (Asteraceae), *Lamarckia aurea** (Poaceae), *Lathyrus* [as *Lathrys*] *vestitus* (Fabaceae), *Lycium californicum* (Solanaceae), *Lyonothamnus floribundus* subsp. *asplenifolius* (Rosaceae), *Marah macrocarpa* (Curcurbitaceae), *Melica imperfecta* (Poaceae), *Mesembryanthemum crystallinum** (Aizoaceae), *Diplacus aurantiacus* [as *Mimulus aurantiacus*, *D. flemingii*] (Phrymaceae), *Mirabilis laevis* var. *crassifolia* [as *M. californica*] (Nyctaginaceae), *Munzothamnus blairii* (Asteraceae), *Nassella cernua* [as *Stipa cernua*] (Poaceae), *Nassella pulchra* [syn. *Stipa pulchra*] (Poaceae), *Opuntia littoralis* (Cactaceae), *Cylindropuntia prolifera* [as *Opuntia prolifera*] (Cactaceae), *Pellaea andromedifolia* (Pteridaceae), *Poa secunda* (Poaceae), *Prunus ilicifolia* subsp. *lyonii* [as *Prunus lyonii*] (Rosaceae), *Pseudognaphalium biolettii* [as *Gnaphalium bicolor*] (Asteraceae), *Pseudognaphalium californicum* [as *Gnaphalium californicum*] (Asteraceae), *Rhus integrifolia* (Anacardiaceae), *Ribes malvaceum* (Grossulariaceae), *Rumex salicifolius* [*? nativity unclear without subspecific identification] (Polygonaceae), *Salsola tragus** (Chenopodiaceae), *Selaginella bigelovii* (Selaginellaceae), *Senecio lyonii* (Asteraceae), *Toxicodendron diversilobum* (Anacardiaceae) and *Epilobium canum* subsp. *canum* [as *Zauschneria californica*] (Onagraceae).

Junak and Wilken (1998) also note *Quercus tomentella* (Fagaceae) as an associated species, and in December 2016 associated taxa were also noted to include *Pterostegia drymarioides* (Polygonaceae) at the northern end of the island (S. Vanderplank, pers. obs. 2017).

### 5.3 *Human Uses*

Although there are no documented human uses of this particular taxon, other species in *Acmispon* have been used in a variety of ways. In particular, the closely related species *Acmispon glaber* (formerly *Lotus scoparius*), commonly known as deer weed, is popular in the horticultural trade. Margaret Huffman of the North American Butterfly Association calls it “the best butterfly plant for Southern California” (Flutterblog 2017), and it is known to be a larval food plant for the Palos Verdes blue butterfly—*Glaucopsyche lygdamus palosverdesensis* Perkins & Emmel (Lipman et al. 1999). *Acmispon glaber* often is planted for habitat restoration and erosion control after a brush fire, in part for its role as a nitrogen-fixing plant, and it has been reported to encourage establishment of other species in restoration projects (San Elijo Lagoon Conservancy 2017). Although *A. dendroideus* var. *traskiae* was previously part of the diet of introduced grazers and browsers on San Clemente Island, it is not likely to have been an intentional forage species.

## 6.0 DISTRIBUTION, ABUNDANCE AND POPULATION TRENDS

### 6.1 *Distribution and Abundance*

*Acmispon dendroideus* var. *traskiae* is endemic to San Clemente Island, the southernmost of the California Channel Islands, which is located 64 miles (103 km) west of San Diego, California. The island is owned by the US Navy and encompasses 36,073 acres (14,598 ha) (US Navy 2002). *Acmispon dendroideus* var. *traskiae* was listed as federally endangered in 1977 (11 August) and state-endangered in 1982, but it was federally downlisted in 2012 (USFWS 2012) and is currently considered threatened at the federal level, though it remains endangered at the state level. In addition to federal and state processes that have resulted in legal protection of *A. dendroideus* var. *traskiae*, non-profit organizations have evaluated the conservation status of the taxon (Table 1).

*Acmispon dendroideus* var. *traskiae* is widely distributed throughout much of San Clemente Island (Map 1). Large populations occur on the eastern escarpment and the west-side canyons, mostly in the southern half of the island. Occurrences documented by the US Navy from 2011 to 2012 (US Navy 2017) consisted of contiguous biologically relevant clusters that were unbroken within a line of sight and did not include any obvious barriers to dispersal, pollination or recruitment. Notably (and positively), as these occurrences continue to expand and recruit over time, they are beginning to approach one another in some areas, making a more specific geographic definition challenging. Occurrences continue to expand toward one another and could be reclassified as larger populations in the future. Map 3 shows the distribution of *A. dendroideus* var. *traskiae* in different watersheds, which may be a useful way to track the geographic expansion of *A. dendroideus* var. *traskiae* on San Clemente Island in the future.

During surveys conducted in 2011 and 2012, *A. dendroideus* var. *traskiae* was mapped and documented to include 136 occurrences, and a total of 11,938 individuals were recorded (US Navy 2017). These findings did not include as many as 34 historic populations that were previously recorded within Restricted Access and Impact areas and were inaccessible during the 2011–2012 surveys, pushing the total number of expected occurrences on San Clemente Island to 170. It is important to note that all but one occurrence on San Clemente Island are thought to be natural; one was partially re-planted at a site on Lotus Hill south of the Natural Resources office in 2009 after a disturbance and is the only documented exception (SERG 2015). Thus, all other populations are thought to have recruited and expanded naturally following the removal of non-native mammalian herbivores.

The Consortium of California Herbaria (CCH) has a surprising paucity of data on *A. dendroideus* var. *traskiae* from the 34 participating herbaria, including only 18 unique specimen-collecting events between 1939 and 2017 (documented with 23 sheets when duplicates are included [Table 2]). There are undoubtedly more specimens in existence, including the type specimen at the National US Herbarium at the Smithsonian Institution, but the modern distribution is poorly reflected in the CCH herbarium record.

At the time of writing (January 2018), the CNDDB included 40 records of *A. dendroideus* var. *traskiae* (Appendix 1), none of which had been updated since 17 September 2012. All records are documented to be Native/Natural Occurrences, Presumed Extant, with population trends unknown (Appendix 1). Because CNDDB records for *A. dendroideus* var. *traskiae* have not been updated since 2012, these are the same occurrences documented in the petition to downlist (USFWS 2012; Appendix 2). Of all records in the CNDDB, only one potential threat (road construction) is indicated for only one Element Occurrence (EO11 on the east side of Wilson Cove).

Table 1. Current conservation status of *Acmispon dendroideus* var. *traskiae*.

| Status | Significance |
|---|---|
| Federally threatened | Taxon is likely to become endangered within the foreseeable future throughout all or a significant portion of its range. |
| State endangered (California Endangered - CE) | Taxon is in serious danger of becoming extinct throughout all, or a significant portion, of its range due to one or more causes, including loss of habitat, change in habitat, overexploitation, predation, competition, or disease. |
| Globally G4T2 (NatureServe) | *A. dendroideus* is apparently secure, var. *traskiae* is **imperiled** and at high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors. |
| Globally G4T3 (CNPS) | *A. dendroideus* is apparently secure, var. *traskiae* is at moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors |
| State rank S3 | Taxon is vulnerable in the state due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation. |
| CNPS 1B.3 | Rare throughout its range. This taxon is not very threatened in California (less than 20% of occurrences threatened / low degree and immediacy of threat or no current threats known). |

Table 2. Unique herbarium specimen collections of *Acmispon dendroideus* var. *traskiae* from San Clemente Island (from CCH, accessed January 2017).

| Accession | Collector & collection number | Date | Elevation | Locality | Latitude/longitude |
|---|---|---|---|---|---|
| SDSU4343 | *R. M. Beauchamp 120* | 27 Jan 1967 | | On slope south of Wilson Cove | 32.9990, -118.5586 |
| SD47445 | *I. L. Wiggins 11956* | 21 Feb 1949 | | Wilson Cove, on rocky side of ravine | 33.0096, -118.5639 |
| SD52896 | *P. H. Raven 17578* | 07 May 1962 | 299 ft (91 m) | Wilson Cove, in grassland on edges of gully | 33.0096, -118.5639 |
| SD52853 | *P. H. Raven 18044* | 12 July 1962 | 249 ft (76 m) | Wilson Cove, dry rocky grassland near barracks area | 33.0096, -118.5639 |
| SD92026 | *R. Moran, R. M. Beauchamp 22674* | 22 Aug 1975 | 82 ft (25 m) | Wilson Cove, on east slope | 33.00167, -118.55833 |
| UC1952554 | *Francis H. Elmore s.n.* | 26 Nov 1939 | | Wilson Cove | 33.00, -118.55 |
| CAS965971 | *F. C. Boutin 1704* | 24 Apr 1967 | | East side of island, Wilson Cove | 33.0096, -118.5639 |
| CATA2146 | *Howard L. Ferguson 124* | 17 Dec 1979 | 72 ft (22 m) | Growing on slope just west of gas pumps in Wilson Cove area | 33.0051, -118.5592 |
| SD48948 | *R. Moran 6841* | 15 Sep 1958 | 164 ft (50 m) | On slope above Wilson Cove | 33.00667, -118.55833 |
| SD66832 | *R. M. Beauchamp 292* | 18 Mar 1967 | 1099 ft (335 m) | Among rocks northeast of Bluff | 32.9318, -118.5126 |
| SBBG109011 | *S. A. Junak 489* | 18 May 1996 | 160 ft (49 m) | NE side of northwesternmost butte below Pyramid Light Station, 0.23 mi north of Triangulation Station | 32.8218, -118.3549 |
| SBBG109012 | *S. A. Junak 491* | 18 May 1996 | 120 ft (37 m) | Just south of main channel of Middle Ranch Canyon, just west of lower escarpment | 32.8702, -118.4965 |
| SBBG95677 | *A. Liston, O. Mistretta 805* | 20 Apr 1989 | | Waynuk Canyon | 32.8827, -118.4987 |
| SDSU19650 | *Michael G. Simpson et al. 2207* | 20 July 2000 | | South side of Eagle Canyon | 32.87194, -118.42639 |
| SBBG101159 | *T. Ross 6158* | 14 Apr 1992 | 325 ft (99 m) | Just below the mouth of Nanny Canyon on ridge that separates Nanny Canyon drainage from the escarpment | 32.9399, -118.5049 |
| SBBG101153 | *T. Ross 6174* | 14 Apr 1992 | 60 ft (18 m) | East escarpment, ca. 20 m south of where Nanny Canyon drainage meets the sea | 32.9421, -118.5056 |
| SD75519 | *M. B. Dunkle 7281* | 06 Apr 1939 | | Mosquito Ridge, grassy ridge | 32.8563, -118.4082 |
| SD75553 | *M. B. Dunkle 7285* | 06 Apr 1939 | | On beach bank at Mosquito Harbor | 32.8596, -118.4003 |

The current conservation status data (Table 1) has not been recently updated, and the current distribution suggests that many of these rankings should be adjusted, as there are now many more than 80 occurrences and the plant is not rare throughout its range.

### 6.2 *Population Trends*

Extensive data from recent years demonstrate clearly that the number of occurrences, range and abundance of *A. dendroideus* var. *traskiae* are increasing (US Navy 2002, 2008, 2017; Junak 2006; USFWS 2008). *Acmispon dendroideus* var. *traskiae* has been repeatedly documented to be expanding in range and readily occupying disturbed areas as a result of eliminating the primary threat, which was exotic herbivores (US Navy 2002, 2008). The number of documented occurrences since the time of listing has increased from two to 136 and the number of individuals has risen from 1340 in 1980 to 11,938 in 2012 (US Navy 2017).

San Clemente Island has a long history of human occupation, starting with Gabrielino people, whose presence on the island has been documented in shell middens dating back approx. 3000 years (Yatsko and Raab 2009). Some reports suggest that goats were first introduced on the island in 1827 (USFWS 2012), and the first documented grazing lease for sheep was awarded in 1848 (Schoenherr et al. 1999). Sheep, goats, pigs and cattle were ranched on the island until 1934, when the

island was transferred to the jurisdiction of the US Navy (US Navy 2008; USFWS 2012). These introduced herbivores decimated the vegetation of San Clemente Island, were cited in the final listing rule (USFWS 2012) as the main cause of decline for *A. dendroideus* var. *traskiae* and were acknowledged in the delisting document (USFWS 2013). Cattle and sheep were removed by 1935 (Bruce 1994). In 1991, the US Navy completed the eradication of feral goats and pigs in order to protect the endemic biota that were being pushed towards extinction (Keegan et al. 1994).

The earliest published information regarding population size for *A. dendroideus* var. *traskiae* can be found in the San Clemente INRMP, which states that nine occurrences and 1340 individuals were present on the island in 1980 (US Navy 2002), although little additional data are available. According to the Channel Islands Recovery Plan (1984), only six populations of *A. dendroideus* var. *traskiae* were known in 1984. This estimate of the population size of *A. dendroideus* var. *traskiae* at the time of listing is used as a baseline for recovery (USFWS 2012). Periodic surveys conducted between 1984 and 1996 indicated that approx. 30 separate populations of *A. dendroideus* var. *traskiae* existed (US Navy 2008). Comprehensive data are available beginning with surveys conducted in 1996 and 1997, which documented a total of 64 occurrences comprising over 3000 individual plants (Junak and Wilken 1998). These occurrences ranged from isolated individuals to populations of 750 plants. More surveys for *A. dendroideus* var. *traskiae* were conducted from 2003 through 2006, with 69 occurrences mapped, and estimates of 6570 individuals documented (Junak 2006; USFWS 2008; US Navy 2008). Occurrences ranged from isolated plants to a population with 2300 individuals. When combined, the 1996–1997 surveys and the 2003–2006 surveys suggest that *A. dendroideus* var. *traskiae* occurred in 147 locations and numbered approx. 9674 individuals (USFWS 2008; US Navy 2008). These totals are thought to be slightly inflated due to some overlap in the two sets of surveys.

The consolidated survey data 2011–2012 (US Navy 2017), which did not include overlapping data between years, documented 136 occurrences and 11,938 individuals. The data demonstrate an approx. 23-fold increase from the population low of six occurrences in 1984 and a significant increase in the nine occurrences and 1340 individuals documented in 1980 (approx. 15-fold and 9-fold increases, respectively). The precise abundance of this taxon is difficult to determine because time, budget, resources, and terrain limit the feasibility of an exhaustive survey of all 36,073 acres (14,598 ha) on the island, particularly due to the increasingly high abundance and widespread distribution of this taxon. The baseline data are challenging because it is impossible to assess the intensity of historical survey efforts and estimate the number of previously undetected individuals (USFWS 2012). New occurrences typically are documented only during focused surveys, but despite uncertainty in precise numbers, the data display a strong trend for increasing numbers (Table 3; Fig. 8).

Table 3. Increasing population trend in *Acmispon dendroideus* var. *traskiae.*

| Survey year | Occurrences | Individuals |
|---|---|---|
| 1980 | 9 | 1340 |
| 1984 | 6 | Unknown |
| 1996–1997 | 64 | 3000+ |
| 2003–2006 | 69 | 6570 |
| 2011–2012 | 136 | 11,938 |

It is unclear to what extent the increase in occurrences and individuals on San Clemente Island is a result of recruitment from the seed bank, recolonization associated with dispersal events or the US Navy's management efforts (USFWS 2012). However, even without a full and current census for all individuals on San Clemente Island, it is clear that *A. dendroideus* var. *traskiae* has steadily increased in total number of individuals and number of occurrences. As *A. dendroideus* var. *traskiae* continues to expand its range on the island, it may well go on to colonize new habitats or occupy larger areas within existing habitat. An estimate of the potential range of *A. dendroideus* var. *traskiae* on San Clemente Island can be obtained from assessing the full acreage of the habitats that it currently occupies (Table 4).

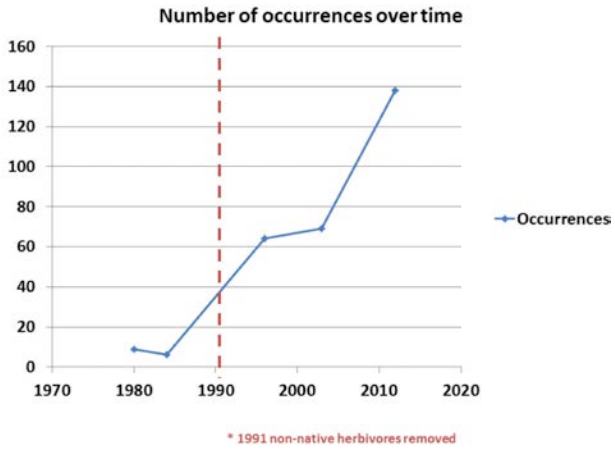


Fig. 8. Increasing population trend in *Acmispon dendroideus* var. *traskiae* after removal of non-native herbivores.

*Acmispon dendroideus* var. *traskiae* currently occurs within vegetation types that occupy more than 80% of the island (Table 4), which can be considered potential habitat. This estimate of potential habitat is inflated because *A. dendroideus* var. *traskiae* is not ubiquitous throughout these vegetation types; however, it also underestimates the potential range and habitats of *A. dendroideus* var. *traskiae*, which may expand into additional vegetation types and disturbed areas, as documented in the Environmental Impact Statement (US Navy 2008).

6.3 *Threats and Limiting Factors*

The major threat to *A. dendroideus* var. *traskiae* historically was direct impacts to individuals and populations as a result of grazing by non-native mammalian herbivores introduced to the island prior to its acquisition by the US Navy in 1934 (USFWS 1977, 2012). The eradication of the last feral herbivore in 1991 has removed the major limiting factor to the proliferation of *A. dendroideus* var. *traskiae*. Currently, the CNDDB notes all recorded element occurrences (EOs) of *A. dendroideus* var. *traskiae* as presumed extant, with just a single occurrence (EO 11) identified as having any threats (road construction). The US Navy implements an Integrated Natural Resources Management Plan (INRMP) on San Clemente Island and undertakes routine monitoring and extensive restoration efforts to conserve rare and threatened species on San Clemente Island (US Navy 2013). On all islands, biosecurity is a continuous potential concern, but the military control of San Clemente Island means that the island's biosecurity plan (US Navy 2016) can more effectively control the arrival of potentially invasive propagules than on non-military islands since access is strictly controlled. Threats to *A. dendroideus* var. *traskiae* are currently minimal and as noted in the 2012 downlisting proposal: "the threats to the habitat of *A. dendroideus* var. *traskiae* will not likely impact most of the known occurrences both now and into the future".

Table 4. Estimate of potential habitat for *Acmispon dendroideus* var. *traskiae* on San Clemente Island [using vegetation data from the Integrated Natural Resources Management Plan (US Navy 2013: pp. 3–59) and current distribution (US Navy 2017)].

| Vegetation type | Acres | % (of 36,073 acres) |
|---|---|---|
| *Artemisia californica* | 3920.7 | 10.9 |
| *Baccharis pilularis* | 1134.8 | 3.1 |
| *Cylindropuntia prolifera* | 5340.9 | 14.8 |
| *Lycium californicum* | 6458.8 | 17.9 |
| *Lyonothamnus floribundus* | 22.1 | <0.1 |
| *Opuntia littoralis* | 9441.8 | 26.2 |
| *Quercus tomentella* | 21.4 | <0.1 |
| *Rhus integrifolia* | 1232.4 | 3.4 |
| *Stipa* sp. | 2213.5 | 6.1 |
| Unvegetated—coastal | 318.1 | 0.9 |
| Total | 30,104.5 | 83.5 |

6.4 *Threats with Regard to Listing Requirements*—FIVE-FACTOR ANALYSIS (Threats, Conservation Measures and Regulatory Mechanisms)

The threats to *A. dendroideus* var. *traskiae* are classified and assessed here according to the five factors identified in Section 4(a)(1) of the Endangered Species Act for consideration in listing, delisting, and reclassification decisions.

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

***Previously cited:*** In the downlisting proposal of 2012 (USFWS 2012), threats to the populations under Factor A were noted to include (1) land use, (2) non-native species, (3) fire and (4) erosion.

*1. Land Use*

Potential indirect effects and associated issues (including soil erosion, non-native invasive plant species, fire and access to restricted areas) are addressed separately in this document to parallel the structure of the analysis of threats in the 5-Year Review (USFWS 2012).

San Clemente Island is part of the Southern California (SOCAL) Range Complex, which is the most capable and heavily used Navy range complex in the eastern Pacific region (Navy 2008: p. ES-3). Of the terrestrial training areas, the Shore Bombardment Area (SHOBA), which supports a diversity of military training (including Anti-Surface Warfare, Amphibious Warfare, Naval Special Warfare, Bombing Exercises, and Combat Search and Rescue) is the largest, occupying roughly the southern third of the island (US Navy 2008: Tables 2–7). Not all areas within SHOBA are intensively used for training, however. Some, particularly the escarpment along the eastern coast, have limited training value because precipitous terrain hinders ground access. Areas of intensive use within SHOBA include the two Impact Areas and three Training Area Ranges (TARs). Impact Areas support naval gun firing, artillery firing, and air-to-ground bombing (US Navy 2008: p. 2–7). TARs are littoral operating areas that support demolition, over-the-beach, and tactical ingress and egress training for Naval Special Warfare personnel (US Navy 2008: p. 2–7). Collectively, the Impact Areas and TARs encompass 3400 acres [1376 ha], which

amounts to 24.5% of the area within SHOBA. Outside SHOBA, San Clemente Island supports 18 additional terrestrial TARs, four Assault Vehicle Maneuver Areas (AVMA) that are designated for off-road vehicle use, including tracked vehicles, and the Infantry Operations Area (IOA), which is designated for dispersed foot traffic by military units in support of a battalion-sized landing (US Navy 2008: p. 2–37). All training areas described in this paragraph are collectively referred to in this document as "focal training areas" because their locations, extent, and uses warrant their evaluation for potential land use impacts on *A. dendroideus* var. *traskiae*.

Although land use was one of the primary threats to *A. dendroideus* var. *traskiae* at the time of listing (USFWS 1977), the 2012 proposal to downlist noted that land use appeared to pose a high-magnitude threat to the habitat of a small percentage of the occurrences of *A. dendroideus* var. *traskiae* on San Clemente Island. These threats exist primarily where *A. dendroideus* var. *traskiae* occurs within a focal training area or IOA. However, the final rule to downlist (78 FR 45405 2013) stated that although increased impacts associated with military training could threaten *A. dendroideus* var. *traskiae* in the future, 83% of *A. dendroideus* var. *traskiae* occurrences fell outside training areas where habitat disturbances are more likely to occur (Map 5). Based on 2011–2012 survey data, the percentage of occurrences outside focal training areas or the IOA has risen to 87% (US Navy 2017); thus the analysis of potential direct effects of land use on *A. dendroideus* var. *traskiae* within this assessment focuses on only 13% of the occurrences. During 2011–2012, no occurrences were documented in the TARs, the Impact Areas, or the AVMA (US Navy 2017), so the potential direct effects from land use within these areas are not considered in this assessment.

Surveys in 2011–2012 detected 26 *A. dendroideus* var. *traskiae* occurrences and 1580 individuals inside SHOBA, which constitutes 13% of the island-wide occurrences. Most of these occurrences are east-slope populations, located on the eastern drainages, away from the designated training areas and below the elevation of the IOA. During consultation with the USFWS on the San Clemente Island Military Operations and Fire Management Plan, the US Navy modified the boundary of TAR 11 to reduce the number of occurrences of *A. dendroideus* var. *traskiae* impacted within the TAR to just one (USFWS 2008). Just six individuals of *A. dendroideus* var. *traskiae* are documented inside the IOA (US Navy 2017). The likelihood of *A. dendroideus* var. *traskiae* being subjected to even minimal impacts from foot traffic within the IOA is very low because, as a suffrutescent shrub, it is fairly resilient to occasional physical disturbance. Trampling effects on individual plants would be temporary, as the affected plants would be expected to recover, even if individual stems were broken (US Navy 2008).

*2. Non-Native [Invasive] Plant Species*

Non-native plants were listed as a threat in the original 1977 listing of *A. dendroideus* var. *traskiae* and have been cited in both the 12-month finding (USFWS 2012) and the final rule (USFWS 2013) as impacts that are ongoing. Species of particular concern were noted to include: *Avena barbata* Pott ex Link (slender oat), *Bromus* spp. (bromes), *Foeniculum vulgare* Mill. (sweet fennel) and *Brassica tournefortii* Gouan (Sahara mustard). However, the 2013 downlisting rule (78 FR 45405 2013) acknowledged that the threat had been reduced and recognized the US Navy's reduction in the prevalence of particularly destructive species, citing *Foeniculum vulgare* (fennel) as a specific example (USFWS 2013).

Not all non-native plants present a threat to *A. dendroideus* var. *traskiae*, but invasive plants can directly impact native plant populations through competition for space and resources, potentially out-competing seedlings for light or moisture (Eliason and Allen 1997; see also DeSimone and Zedler 2001). Invasion is essentially a function of propagule pressure and dispersal ability, abiotic and habitat factors, and the biotic characteristics of the taxa, but also varies with a community's position in time and space (Catford et al. 2009). For invasion to occur, all three factors must be accommodating, if not favorable (Catford et al. 2009). As the native plant communities recover, the vegetation continues to change and no longer consists of the early seral communities that first recolonized the island following the removal of non-native mammalian herbivores (Stratton 2004).

As the flora of San Clemente Island recovers, the conditions also become less favorable to invasion, with more intact habitats and reduced erosion, a stronger suite of competitor native species, and a progressive reduction in propagule pressure when the invasive species are targeted and controlled. Many habitats underwent considerable invasion historically, and some, such as the central grasslands, continue to be heavily dominated by non-native species. *Acmispon dendroideus* var. *traskiae* frequently occurs in areas with rocky soils, which are less susceptible to invasion by annual grasses (Allan 1999; Navy 2002). In 1996 and 1997, non-native annual grasses were found to be present with *A. dendroideus* var. *traskiae* in 69% of its locations, yet these grasses were not dominant, having approx. 40% cover (US Navy 2008). Surveys conducted in 2011 and 2012 found no occurrences of *A. dendroideus* var. *traskiae* in communities dominated by invasive grasses (Map 2).

The 12-month finding on the petition to downlist (USFWS 2012) states that the restoration of the island's

vegetation communities carried out by the US Navy is expected to help improve habitat suitability by reducing the spread of invasive non-native plants and restoring ecological processes. For example, Allan (1999) listed the hottentot-fig (*Carpobrotus edulis* (L.) N.E. Br.) as a threat to *A. dendroideus* var. *traskiae* in a small fraction of its range on the active sand dunes on the northwest side of San Clemente Island, yet the Navy has routinely (annually) managed for the removal of *C. edulis* and has documented the remarkable recovery of native vegetation when it is hand-pulled, with *A. dendroideus* var. *traskiae* actively recruiting into the clearings (Emma Havstad, unpubl. data 2017). Navy management continues to reduce invasion pressure, and there is no evidence that invasive plants are leading to reductions in abundance of *A. dendroideus* var. *traskiae*. The recently completed Naval Auxiliary Landing Field San Clemente Island Biosecurity Plan (2016) focuses on prevention of—and response to—introductions of non-native species and bio-invasion vectors, including the arrival of any new propagules of invasive plants and animals (US Navy 2016). The current threat from invasive species comes from indirect effects on habitat. In a meta-analysis of the impacts, alien plants were found to decrease native plant abundance and diversity indirectly by reducing the fitness and growth of native plant species and promoting shifts in plant community structure (Vilá et al. 2011). The invasive species already present on San Clemente Island could be indirectly affecting the fitness of *A. dendroideus* var. *traskiae*, although this does not appear to be an impediment to recovery.

Invasive species present on San Clemente Island are managed following the Biological Opinion (USFWS 2008) and the INRMP (US Navy 2013; Table 5). Currently, all five strategic goals identified in the 2008–2012 National Invasive Species Management Plan are being implemented at San Clemente Island. The basic seven-step framework below is well established on a national level and is also reflected in California's existing Pest Prevention Program and Weed Plan.

1) Prevention (most cost-effective and environmentally beneficial)
2) Monitoring and early detection
3) Rapid response and eradication (see Table 3-49 in the INRMP (US Navy 2013) for species treated on San Clemente Island 2000–2009)
4) Long-term control and management
5) Education and outreach
6) Restoring high value ecosystems across scales
7) Organizational collaboration

The continual expansion of *A. dendroideus* var. *traskiae* on San Clemente Island, including disturbed areas (US Navy 2002), suggests that the indirect impacts of invasive plants are currently minimal, and though they may slow range expansion, they are not a barrier to recovery.

*3. Fire*

The final listing rule did not identify fire as a threat to *A. dendroideus* var. *traskiae* (USFWS 1977); however, the final downlisting rule mentioned that 50% of the island had burned at some point prior to listing (USFWS 2013). The final downlisting rule identified the potential depletion of the seed bank if frequent fires occurred before seed-drop as the primary concern associated with the potential effects of fire on *A. dendroideus* var. *traskiae*, but the rule also noted that the US Navy's annual reviews of fire management and fire occurrences allowed for adaptive management to minimize the threat of fire. The final downlisting rule concluded that the threat of fire was limited to just 14 occurrences of *A. dendroideus* var. *traskiae* within SHOBA, and the potential for frequent fires to affect these occurrences was reduced by their location on the eastern escarpment, away from Impact Areas I and II (USFWS 2013). Fire history has been recorded on San Clemente Island since 1979, and most documented fires with known ignition sources have been of anthropogenic origin. The US Navy's fire suppression efforts have been identified as key in the prevention of fire spread and ignition (USFWS 2008).

Fire is not always a threat to native plants. Many ecosystems, including those where *A. dendroideus* var. *traskiae* is found (Map 2), have some adaptation and resilience to fire. Studies on sister-species *Acmispon glaber* [syn. *Lotus scoparius*] (deer weed) show it to be fire tolerant and to experience increases in abundance following fire (USFWS 2012: who cite Nilsen and Schlesinger [1981] and Westman and O'Leary [1986]). However, studies on this same taxon (*A. glaber*) show that a high burn frequency (e.g., three times in six years) can lead to lower seedling establishment (USFWS 2012: Westman and O'Leary 1981; Haidinger and Keeley 1993). The San Clemente Island Wildland Fire Management Plan (US Navy 2009) follows an adaptive management strategy that sets average fire return interval thresholds within different plant communities to minimize potential adverse effects of fire.

A fire-return interval of three years or less has been documented to negatively impact woody shrubs such as *A. dendroideus* var. *traskiae* (Brennan and Keeley 2015), although it is unlikely that *A. dendroideus* var. *traskiae* would ever experience such a short return interval due to the US Navy's fire management practices (US Navy 2009). Since 1979, fire return intervals have been longer than the postulated ecological tolerance of *A. dendroideus* var. *traskiae* (US Navy 2009). Fires have occurred two times or less in the last 38 years in

areas where *A. dendroideus* var. *traskiae* is found (Map 6). Survey data from 2011–2012 showed that 5034 individuals occurred in areas that had not burned since fire records began in 1979; 6752 individuals of *A. dendroideus* var. *traskiae* occurred in areas that had burned once, and 152 individuals occurred in areas that had burned twice. No areas where *A. dendroideus* var. *traskiae* is found had burned more than twice in the last 38 years. The areas of highest fire frequency on San Clemente Island were restricted to the center of SHOBA, where there are no *A. dendroideus* var. *traskiae* occurrences. The vast majority of *A. dendroideus* var. *traskiae* individuals (6820 individuals, 98.8%) had not experienced a fire for 20 years or more (Map 7).

On San Clemente Island, past grazing and browsing by non-native mammalian herbivores has affected the abundance of vegetation and the balance between native

Table 5. Conservation measures for terrestrial plants on San Clemente Island (SCI; as relevant to *Acmispon dendroideus* var. *traskiae*) taken from the Biological Opinion (BO; USFWS 2008) and Table 3-48 of the Integrated Natural Resources Management Plan (US Navy 2013).

| Source | Measure or recommendation | Requirements |
|---|---|---|
| INRMP & BO | AVMC-M-7 | Require the following measures to reduce the potential for transport of invasive plants to the island. Prior to coming to SCI, military and non-military personnel will be asked to conduct a brief check for visible plant material, dirt, or mud on equipment and shoes. Any visible plant material, dirt or mud should be removed before leaving for SCI. Tactical ground vehicles will be washed of visible plant material, dirt and mud prior to embarkation for SCI. Additional washing is not required for amphibious vehicles after 15 minutes of self-propelled travel through salt water prior to coming ashore on SCI. |
| INRMP & BO | G-M-1. | Continue invasive species control on an island-wide scale, with emphasis on the AVMC, IOA, TARs, and other operations insertion areas such as West Cove, Wilson Cove and the airfield. A pretreatment survey to identify areas needing treatment, one treatment cycle, and a retreatment cycle (when necessary) will be planned each year to minimize the distribution of invasive species. Where feasible, the Navy will include future construction sites in a treatment and retreatment cycle prior to construction. |
| INRMP & BO | G-M-9. | Conduct monitoring and control activities for invasive non-native plant species outside the Impact Area boundaries. Navy installations will prevent the introduction of invasive species and provide for their control per EO 13112. The Navy will identify actions that affect the introduction of invasive species, prevent their introduction, respond rapidly to their control, monitor populations, restore affected native species and their habitat, conduct research and develop technologies to prevent further introductions, and promote public education of the issue. |
| BO 2008 | | A goal will be reducing the percent cover of invasive plants from the 1992–1993 baseline of 41 percent on terrace faces and 53 percent on terrace flats. |
| INRMP & BO | FMP-M-10. | Conduct prescribed fire experiments to evaluate their effectiveness in controlling non-native annual plants. |
| INRMP & BO | FMP-M-11. | Establish post-fire recovery plots to monitor recovery and identify new infestations of non-native invasive plants associated with both wildfire and prescribed fire. |
| INRMP & BO | FMP-M-12. | Evaluate burn areas and prioritize them, as appropriate, for inclusion in the weed eradication program. |
| INRMP | | To prevent the transfer of invasive species from the mainland to SCI, soil and fill brought to the island are treated with herbicide before importation (INRMP 2012). |
| INRMP | | Further prevention for the transfer of invasive species to the island is established through the *Do Not Plant* list maintained by the NAVFAC Southwest Botanist and Landscape Architect (INRMP 2012). |
| INRMP | | The NRO participates in a Channel Islands biosecurity working group, which meets quarterly to discuss and develop measures to prevent non-native species from invading Channel Islands ecosystems, and to share resources and knowledge of potential threats to the islands (INRMP 2012). |

and non-native vegetation. Intense grazing also significantly reduced fire frequency on San Clemente Island as a result of the reduced biomass available for ignition (Westman 1983). While fire is a natural part of these ecosystems, it has been infrequent within the range of *A. dendroideus* var. *traskiae*, and therefore a limited amount is known about the taxon's specific fire tolerance, survival and recovery. Observations made following the Canchalagua fire suggested that while adult individuals may be killed by the fire, there was high seedling recruitment after the fire, resulting in a similar number of individuals before and after the fire (US Navy 2002 INRMP; USFWS 2012). The growth characteristics and distribution of *A. dendroideus* var. *traskiae* suggest that it is resilient to at least occasional fire (USFWS 2012). As noted in Section 5, some heat-treatments are beneficial to the germination of *A. dendroideus* var. *traskiae* seeds, but little is known about high temperatures and dry heat, although temperatures over 93°C (200°F) are thought to be detrimental (USFWS 2013). The apparent ability of *A. dendroideus* var. *traskiae* to recover after fire and its distribution on the eastern side of the island suggest that it was not significantly impacted by the habitat conversion that occurred on the plateau. With an average fire return interval in *A. dendroideus* var. *traskiae* populations of more than 20 years, fire is not currently a threat to *A. dendroideus* var. *traskiae*.

Map 8 (*A. dendroideus* var. *traskiae* records on San Clemente Island and fire severity) shows fire severity values where they have been recorded. Fire severity is measured on a six-point scale in the US Navy's Fire Management Plan, which is based on that used by the National Park Service (see Table 6 below). Notably, the six occurrences of *A. dendroideus* var. *traskiae* to burn since fire severity has been monitored burned at Level 4 "Lightly burned, shrubs singed/stressed, many resprout/recover" (see Map 8). The Fire Management Plan (US Navy 2009) lists *A. dendroideus* var. *traskiae* as a suffrutescent, smaller, short-lived shrub that is killed by fire. Seedling establishment may be fire-stimulated, and germination is heat or charate stimulated, although a portion of the seed bank will germinate without exposure (Keeley et al. 1985).

The US Navy currently monitors live fuel moisture content of three shrub species on San Clemente Island in accordance with the Fire Management Plan (US Navy 2009; SERG 2014*a*). As fuel moisture decreases, fire danger increases, and the US Navy typically declares fire season and places associated restrictions on training when fuel moisture drops below 200% (SERG 2014*a*). The safeguards currently in place by the US Navy and the documented fire regime demonstrate low fire frequency, long fire return intervals, and limited severity in the range of *A. dendroideus* var. *traskiae* (see Map 6–8; US Navy 2009).

*4. Soil Erosion*

Though not noted as a threat to *A. dendroideus* var. *traskiae* in the final listing rule of 1977, soil erosion was identified as a threat in the 2007 status review (USFSW 2007). Extensive browsing by feral goats and overgrazing by other non-native herbivores greatly simplified the vegetation composition and significantly reduced the vegetation cover on San Clemente Island, increasing soil erosion (US Navy 2013*a*). Recovery of vegetation and soils on the island is a continuing process evident in residual erosion problems, including soil compaction, de-stabilization of slopes, and reduction of water infiltration (SERG 2015*b*). Following the removal of feral mammalian herbivores in 1991 and the subsequent recovery of vegetation, erosion on the island has decreased significantly. Heavy rainfall is better retained by soils with high vegetation cover and prolific root systems within the soil matrix (SERG 2015*b*). In areas with fine soils, many herbaceous natives have recovered, and on the slopes, subshrubs and herbs have spread, while some non-native herbs have declined (Wylie 2012).

On San Clemente Island, accelerated soil erosion resulting from historic and current land use mainly is limited to the heads of canyons, ephemeral drainages, and areas where groundwater seepage has created subsurface channels, referred to as "piping." Piping occurs in clay soils with high shrink-swell potential (US Navy 2013*a*). Areas of piping are unstable from above and prone to collapsing, creating gullies. The majority of individuals and occurrences of *A. dendroideus* var. *traskiae* (77% and 54%, respectively) are located on Ustalf cobbly silt soils (Map 9), which are not reportedly prone to piping (USDA 1983). Only 13% of individuals and 20% of occurrences are located on clay soils. Although piping has been documented on several areas on San Clemente Island, specifically within the AVMAs at the Old Rifle Range and VC-3 (Merkel and Associates, Inc., 2016) and just south of Stone Field Station (US Navy 2013*a*), no soil erosion channels or pipes have been observed in locations occupied by *A. dendroideus* var. *traskiae*.

The Navy monitors and evaluates erosion on San Clemente Island and uses multi-year data to assess priorities for remediation (SERG 2006; SERG2015*b*). Potential soil erosion impacts associated with military training were analyzed in the Southern California Range Complex Environmental Impact Statement/Overseas

Table 6. Fire severity classes and definitions, reproduced from the Fire Management Plan for San Clemente Island (US Navy 2009), with severity classes adapted from the National Park Service (1992).

| Fire severity class | Effects on litter/duff | Effects on herbs/grasses | Effects on shrubs | Effects on trees |
|---|---|---|---|---|
| 1 Completely Burned | Burned to ash | Burned to ash | Burned to ash, few resprouts | Burned to ash or killed by fire |
| 2 Heavily Burned | Burned to ash | Burned to ash | Burned to ash, some resprouts | Killed by fire or severely stressed |
| 3 Moderately Burned | Burned to ash | Burned to ash | Burned to singed, some resprouts | Crown damage only to smaller trees |
| 4 Lightly Burned | Blackened, but not evenly converted to ash | Burned to ash, some resprouting | Singed/stressed, many resprout/recover | No effect on mature trees, may kill seedlings/saplings |
| 5 Scorched | Blackened | Singed/stressed, many resprout/recover | Not affected, slight stress | No effect on trees |
| 6 Unburned* | – | – | – | – |

*Unburned inclusions within a fire should be marked as 6.

Environmental Impact Statement (EIS) (US Navy 2008). The analysis focused on areas with the potential for significant erosion due to their designated use for battalion-sized landings, which entail the operation of tracked vehicles and the movement of up to 1500 personnel within the Assault Vehicle Maneuver Areas (AVMAs), Artillery Firing Points (AFPs), Artillery Maneuver Points (AMPs) and Infantry Operations Area (IOA). Because the AVMAs allow for the most extensive off-road movement of tracked vehicles, these areas were anticipated to have the greatest potential impacts from soil erosion as a result of expected reductions in vegetation cover.

To address soil erosion associated with military training, the US Navy included a conservation measure in the EIS to develop an erosion control plan for the AVMAs, AFPs, AMPs and IOA that would accomplish the following: (1) minimize soil erosion within these training areas and minimize offsite impacts; (2) prevent soil erosion from adversely affecting federally listed or proposed species or their habitats; and (3) prevent soil erosion from significantly impacting other sensitive resources, including sensitive plant and wildlife species and their habitats, jurisdictional wetlands and non-wetland waters, the Area of Special Biological Significance surrounding the island and cultural resources. The Erosion Control Plan for San Clemente Island (US Navy 2013*a*) was developed in fulfillment of the US Navy's commitment to this conservation measure and received concurrence from the USFWS. The plan addresses all elements listed in the conservation measure and incorporates the following specifics: guidelines for the development and application of best management practices to minimize impacts to sensitive resources, including *A. dendroideus* var. *traskiae* and its habitat; site-specific erosion control recommendations for areas potentially affected by military operations; guidelines for restriction of vehicle maneuvering when soils are wet; operator education; vegetation management measures; methods to prevent gully development and restore existing gullies; and an adaptive management and monitoring plan to assess and modify BMPs, as needed. Incorporating recommendations from the erosion control plan and working with military operators to determine more precisely how areas would be used resulted in the delineation of unpaved roads to channel vehicle traffic through some portions of the AVMAs. This is expected to reduce the loss of vegetation cover and allow for better control of erosion.

Although implementation of the Erosion Control Plan (US Navy 2013*a*) is expected to prevent erosion from adversely affecting listed species, including *A. dendroideus* var. *traskiae*, an evaluation of *A. dendroideus* var. *traskiae* within AVMA watersheds demonstrates the unlikelihood of erosion impacts to this taxon from military activities. Based on current data, *A. dendroideus* var. *traskiae* is not documented in any of the watersheds containing the AVMA (Map 10); therefore, even if the Erosion Control Plan failed to meet its objectives and erosion impacted all AVMA watersheds, no *A. dendroideus* var. *traskiae* individuals or occurrences would be affected.

Although soil erosion monitoring is relatively recent on San Clemente Island, monitoring reveals that impacts from accelerated soil erosion currently are limited to a small number of specific point sources on San Clemente Island associated with roads, facilities, and training activities, none of which directly impact documented populations of *A. dendroideus* var. *traskiae*. The majority of *A. dendroideus* var. *traskiae* occurrences are located in rocky soils, which offer some stability and protection from erosion. In light of the lack of erosion

problems within existing occurrences and the Navy's implementation of the Erosion Control Plan to manage erosion associated with military activities, currently erosion does not pose a threat to *A. dendroideus* var. *traskiae*.

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

There are no documented cases of Overutilization for Commercial, Recreational, Scientific, or Educational Purposes, and this was not listed as a threat at the time of listing or in subsequent reviews (listing petition 1977; 2007 5-yr review; USFWS 2012, 2013). Only small numbers of specimens and seed have ever been collected, and given the current abundance of this taxon, scientific collecting of herbarium specimens and seed banking should be encouraged. Because *A. dendroideus* var. *traskiae* is restricted to a military training range with restricted access, future utilization will be limited and poses no apparent threat. As stated in the 2013 final downlisting rule (USFWS 2013), overutilization of *A. dendroideus* var. *traskiae* for any purpose is not currently considered a threat nor is expected to be in the future.

### FACTOR C: Disease or Predation

Direct predation by non-native mammalian herbivores (goats and pigs) was identified as the primary threat to this taxon at the time of listing. This threat has been eliminated with the removal of all non-native mammalian herbivores in 1991, and no other predators or diseases on San Clemente Island are known to pose a threat to *A. dendroideus* var. *traskiae* now or in the future (USFWS 2012). The predation of *A. dendroideus* var. *traskiae* by the native fauna has been little studied. Foliar or floral predation is not apparent, but seed predation is more cryptic, and although difficult to study, it is likely that granivores are eating some quantity of seeds. Some species likely to be consuming *A. dendroideus* var. *traskiae* seeds include the introduced Gambel's quail (*Callipepla gambelii*) and chukar (*Alectoris chukar*); however, seed consumption does not appear to be a threat, and given the high fecundity of this taxon, population-level impacts from granivory are unlikely. The absence of host-specific parasites on *A. dendroideus* var. *traskiae* is not surprising, as pathogens are less prevalent in species of restricted range (Gibson et al. 2010). Fungal pathogens such as *Phytophthora* spp. can enter wildlands through restoration efforts, and require increased vigilance; however, *Phytophthora* is not currently documented on San Clemente Island, and the Navy's Biosecurity Plan will help to prevent the arrival of pathogens.

### FACTOR D: Inadequacy of Existing Regulatory Mechanisms

The inadequacy of existing regulatory mechanisms was not indicated as a threat to *A. dendroideus* var. *traskiae* at the time of listing or in the recent status review (USFWS 2013). *Acmispon dendroideus* var. *traskiae* currently receives regulatory protection under the Endangered Species Act (ESA) as a threatened taxon; however, ESA is not the only regulatory mechanism that affords protection to this taxon. *Castilleja grisea* also benefits from regulations under the National Environmental Policy Act (NEPA) of 1969 (42 United States Code § 4321 et seq.), and the Sikes Act Improvement Act of 1997 (Sikes Act [as amended]; 16 United States Code § 670a et seq.). In the event that *A. dendroideus* var. *traskiae* were removed from the federal endangered species list, these other mechanisms would continue to provide protection and management benefits. Additionally, if delisted, *A. dendroideus* var. *traskiae* would receive strict regulatory protection associated with post-delisting monitoring requirements under the Endangered Species Act for a minimum of five years.

NEPA requires federal agencies to consider the environmental impacts of their proposed actions. Section 102 requires federal agencies to incorporate environmental considerations into their planning and decision-making through a systematic interdisciplinary approach. Specifically, federal agencies must evaluate proposed actions that may significantly impact the environment. For each major federal action determined to have significant impacts, federal agencies must prepare an Environmental Impact Statement (EIS) to evaluate the effects of and alternatives to the proposed action. As part of this process, federal agencies are required to solicit public involvement through scoping and public comment periods. Because *A. dendroideus* var. *traskiae* occurs exclusively on federal land, NEPA applies to all actions that could impact this taxon, and potential impacts must be evaluated as part of the environmental analysis. The Navy NEPA process is robust in addressing potentially significant impacts to species and their habitats regardless of their listing status under ESA.

The Sikes Act provides additional protection and benefits by requiring the Secretary of Defense to carry out a program for the conservation and rehabilitation of natural resources on military installations. Under the Sikes Act, natural resources management is to be guided by INRMPs, which are developed by each military installation in cooperation with the USFWS and state fish and wildlife agencies, who are joint signatories of the documents. Department of Defense policy requires officials with land management responsibilities "to help

ensure these natural resources are maintained in the best ecological condition possible to fully support current and future mission requirements" (US Navy 2013). INRMPs are required to take an ecosystem-based approach to natural resources management rather than focusing exclusively on federally listed species. The current San Clemente Island INRMP (US Navy 2013) includes the following objective for *A. dendroideus* var. *traskiae*: maintain existing populations and continue recovery efforts, where needed, while avoiding fragmentation of habitat throughout its current distribution (see Conservation Recommendations below for current recommendations).

In addition to management that specifically focuses on *A. dendroideus* var. *traskiae*, this taxon continues to benefit from many INRMP actions implemented island-wide or at the landscape-level, including invasive species management, habitat mapping, island-wide sensitive plant surveys, fire management (based on the San Clemente Island Wildland Fire Management Plan [US Navy 2009]), long-term vegetation trend analysis, and annual and perennial grassland management. Thus, the adequacy of regulatory mechanisms does not pose a threat to *A. dendroideus* var. *traskiae* at this time.

## FACTOR E: Other Natural or Human-Caused Factors Affecting Its Continued Existence

The final downlisting rule (USFWS 2013) lists other threats attributable to Factor E as including: (1) movement of vehicles and troops, (2) fire, (3) climate change and (4) hybridization. Threats were noted to be either of unknown magnitude (climate change), of low likelihood (hybridization) or reduced through conservation measures implemented by the US Navy (fire and military activities).

*1. Movement of Vehicles and Troops* – see Factor A for a detailed review of land use and associated threats.

*2. Fire* – see Factor A for a detailed summary of individual and habitat responses to fire.

*3. Climate Change*

In southern California, climate change generally is expected to result in drier and warmer conditions, with high inter-annual stochasticity and overall declines in mean seasonal precipitation (Cayan et al. 2012). Sea level may rise between 0.9 and 1.4 m (Cayan et al. 2012), which would not directly affect *A. dendroideus* var. *traskiae* populations, but coastal ecosystem dynamics would be altered, and indirect effects are hard to predict.

Along the California coast and Channel Islands, the Pacific Ocean moderates air temperatures at low altitudes and contributes to the formation of low-level temperature inversions, in which air temperature increases with altitude. Such inversions stimulate the formation of coastal low cloud cover, also known as the marine layer, which is manifested as fog if cloud elevations contact the ground. Many species are restricted to the fog belt where coastal low cloud cover has been documented to reduce drought stress on plants through shading and fog drip (Fischer et al. 2009). The marine layer has a strong influence on coastal ecosystems, and it is an important component of weather on San Clemente Island (US Navy 2013*a*). Fog is hypothesized to provide a climate refugium by buffering species from extinction brought on by climatic change, as evidenced by the elevated levels of endemism along the coast of Baja California and on the Channel Islands (Vanderplank 2013, 2015). Climate on the Channel Islands continues to support paleoendemic plants, such as *Lyonothamnus*, which once was widespread in the southwest of North America (Raven and Axelrod 1978) and is thought to have been extirpated on the mainland as conditions became warmer and drier (Bushakra et al. 1999).

Despite the importance of low coastal cloud cover and fog, these phenomena are poorly addressed in climate change models (Qu et al. 2014), and it is difficult to project their future conditions. Coastal fog has been decreasing in southern California, possibly due to urbanization (Williams 2015) and possibly due to climate change (Johnstone and Dawson 2010; LaDochy and Witiw 2012). Warming projections in California, particularly the possibility that the interior will experience greater warming than the coast (Cayan et al. 2008), suggest that the fate of coastal fog is uncertain (Lebassi-Habtezion et al. 2011). However, work by Iacobellis and Cayan (2010), which estimated the strength of low-level temperature inversions from climate change models, showed increasing trends in all seasons through the end of the century (confirmed using two different approaches to the estimation), suggesting that the marine layer is likely to persist and may even increase. Such a scenario would moderate the effects of climate change on the Channel Islands and would be expected to reduce its potential threat to island plants, including *A. dendroideus* var. *traskiae*.

*Acmispon dendroideus* var. *traskiae* is thought to have evolved from a mainland ancestor of *A. dendroideus*, and on the mainland this species inhabits a wide range of microclimates (Brouillet 2016). *Acmispon dendroideus* var. *traskiae* also occurs in a wide range of habitats on San Clemente Island. Because it does not have a particularly narrow niche and has ample genetic diversity (Wallace et al. 2017), *A. dendroideus* var. *traskiae* is expected to be somewhat resilient to climate

change, particularly given the buffering effect of a persistent marine layer.

*4. Hybridization*

Recent genetic work by Dr. M. McGlauglin et al. (pers. comm. 2017) has shown moderate levels of genetic diversity in *A. dendroideus* var. *traskiae*, with gene flow between neighbor populations and little threat from hybridization with other *Acmispon* species (see Section 5, Biology). Primary recommendations from their research focus on maintaining populations throughout the current range of *A. dendroideus* var. *traskiae* to avoid future potential genetic concerns that are not considered a threat at this time.

## 7.0 RECENT CONSERVATION ACTIONS

The US Navy has a long-term commitment to conservation of its natural resources, with particular focus on its state- and federally listed species (US Navy 2013). The US Navy has continued to adopt effective policies for the protection and restoration of endangered species on San Clemente Island and the integrated management of the island's natural resources. Their successes are clearly evidenced in the recovery and self-sustaining capacity of *A. dendroideus* var. *traskiae* populations. Significant conservation actions that have influenced the recovery and expansion of *A. dendroideus* var. *traskiae* on San Clemente Island are addressed in the INRMP (US Navy 2013) and are summarized below:

- Feral goat removal
- Annual rare plant surveys
- Genetic research
- Vegetation and habitat mapping
- Long-term vegetation trend analysis
- Annual invasive plant control
- Annual and perennial grassland management
- Native habitat restoration
- Soil erosion monitoring and control
- Wildland fire management
- Fire studies

### 7.1 *Conservation Status*

- Current individual and population numbers (136 occurrences and 11,938 individuals) suggest that the status warrants revision at many levels (see Table 1, Section 6).
- No criteria for delisting *A. dendroideus* var. *traskiae* and no quantifiable goals were established in the 1984 species recovery plan.
- At this time, *A. dendroideus* var. *traskiae* is not likely to become endangered within the foreseeable future throughout all or a significant portion of its range.
- *A. dendroideus* var. *traskiae* is increasing in abundance and not rare throughout its range; therefore, its current federal and state listing statuses are no longer warranted.
- *A. dendroideus* var. *traskiae* no longer meets the criteria of a S3 or G4T3 taxon since there are more than 80 populations (136 documented in 2012) (see Table 2).
- CNPS is currently in the process of reconsidering the 1B rank of *A. dendroideus* var. *traskiae*, along with several other island endemics that have made a significant recovery in recent years (Aaron Sims, pers. comm. 2017). California Rare Plant Rank 1B plants meet the definitions of the California Endangered Species Act of the California Department of Fish and Game Code and are eligible for state listing. Most of the plants that are ranked 1B have declined significantly over the last century (CNPS 2017), yet *A. dendroideus* var. *traskiae* has increased significantly in the last 20 years and is no longer rare throughout its range.

### 7.2 *Conservation Recommendations*

*Acmispon dendroideus* var. *traskiae* is currently in a strong conservation state, unlikely to become endangered within the foreseeable future throughout all or a significant portion of its range. In keeping with the INRMP, it is recommended that the US Navy continue the conservation actions listed in Section 7.0. Additional conservation actions could include:

- Individual longevity studies to quantify longevity and assess whether this is really a short-lived shrub.
- Banking seed of *A. dendroideus* var. *traskiae* collected throughout the range of the taxon would be beneficial as a future ex-situ conservation resource. The four seed bank accessions of *A. dendroideus* var. *traskiae* at RSABG are all over 20 years old, one is nursery propagated, and another has fewer than 500 seeds (Cheryl Birker, pers. comm. 2017).

## 8.0 CONCLUSION

The recovery of *A. dendroideus* var. *traskiae* is remarkable in number of individuals and occurrences. *Acmispon dendroideus.* var. *traskiae* is now broadly distributed throughout San Clemente Island and has increased from 6 occurrences in 1984 to 136 occurrences and approx. 12,000 individuals in 2017. Although specific quantifiable recovery goals for *A. dendroideus* var. *traskiae* were never identified in its recovery plan, the taxon's current abundance and distribution and the

increasing trend in both indicate continuing recovery and recolonization.

The numbers of individuals and occurrences of *A. dendroideus* var. *traskiae* now exceed those for which conservation concern is warranted. Because the US Navy has effectively addressed potential threats such that no apparent factors inhibit the taxon's range or recruitment, there is minimal risk to current populations of *A. dendroideus* var. *traskiae*. Although indirect effects from historical impacts to natural resources on the island from overgrazing by non-native mammals may challenge the speed of continued recovery of *A. dendroideus* var. *traskiae*, they have not proven to be a barrier to range expansion and population increases. Based on the taxon's abundance and distribution and the five-factor analysis of threats to its recovery, delisting under ESA appears appropriate for *Acmispon dendroideus* var. *traskiae.*

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## APPENDIX 1

Summary of Elemental Occurrences (EOs) of *Acmispon dendroideus* var. *traskiae*, taken from the CNDDB. All occurrences are cited as Presumed Extant and Natural/Native.

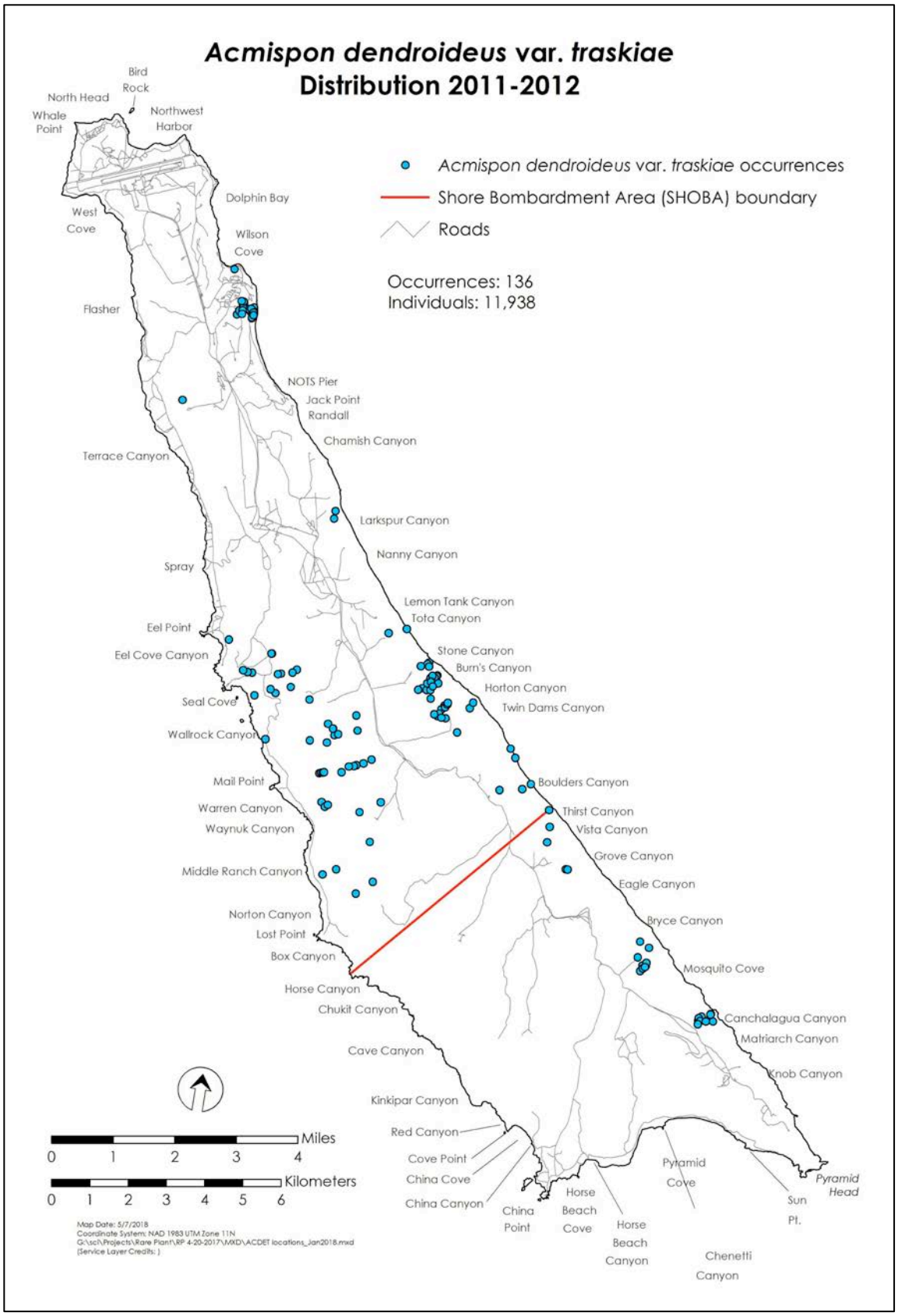
| EO # | Elevation (ft) | Latitude | Longitude | Threat list | Threat | Last update |
|---|---|---|---|---|---|---|
| 1 | 600 | 32.86795 | -118.417 | | | 9/13/2012 |
| 3 | 350 | 32.96837 | -118.529 | | | 9/13/2012 |
| 4 | 600 | 32.84807 | -118.389 | | | 9/13/2012 |
| 5 | 100 | 32.81919 | -118.357 | | | 9/13/2012 |
| 7 | 1100 | 32.92802 | -118.516 | | | 9/13/2012 |
| 9 | 500 | 33.00644 | -118.565 | | | 9/24/1996 |
| 10 | 1300 | 32.87924 | -118.489 | | | 9/13/2012 |
| 11 | 300 | 32.99764 | -118.552 | Development, road/trail construction/maintenance | Construction and road building are threats | 9/17/2012 |
| 12 | 1000 | 32.89296 | -118.5 | | | 9/14/2012 |
| 13 | 600 | 32.91865 | -118.483 | | | 9/14/2012 |
| 14 | 500 | 32.91307 | -118.526 | | | 9/14/2012 |
| 15 | 525 | 32.97251 | -118.561 | | | 9/14/2012 |
| 16 | 400 | 32.93982 | -118.506 | | | 9/14/2012 |
| 17 | 100 | 32.90271 | -118.456 | | | 9/17/2012 |
| 18 | 200 | 32.89653 | -118.449 | | | 9/17/2012 |
| 19 | 1550 | 32.89387 | -118.457 | | | 9/17/2012 |
| 20 | 400 | 32.88736 | -118.441 | | | 9/17/2012 |
| 21 | 1400 | 32.87796 | -118.435 | | | 9/17/2012 |
| 22 | 1630 | 32.86818 | -118.456 | | | 9/17/2012 |
| 23 | 700 | 32.85382 | -118.398 | | | 9/17/2012 |
| 24 | 750 | 32.94995 | -118.515 | | | 9/17/2012 |
| 25 | 800 | 32.93147 | -118.501 | | | 9/17/2012 |
| 26 | 150 | 32.91785 | -118.539 | | | 9/17/2012 |
| 27 | 1000 | 32.90721 | -118.514 | | | 9/17/2012 |
| 28 | 275 | 32.90178 | -118.526 | | | 9/17/2012 |
| 29 | 50 | 32.89624 | -118.524 | | | 9/17/2012 |
| 30 | 1150 | 32.90508 | -118.5 | | | 9/17/2012 |
| 31 | 900 | 32.89935 | -118.506 | | | 9/17/2012 |
| 32 | 1200 | 32.90693 | -118.469 | | | 9/17/2012 |
| 33 | 1350 | 32.90006 | -118.46 | | | 9/17/2012 |
| 34 | 1300 | 32.885 | -118.491 | | | 9/17/2012 |
| 35 | 700 | 32.88313 | -118.504 | | | 9/17/2012 |
| 36 | 1250 | 32.87481 | -118.482 | | | 9/17/2012 |
| 37 | 200 | 32.86803 | -118.501 | | | 9/17/2012 |
| 38 | 760 | 32.86735 | -118.488 | | | 9/17/2012 |
| 39 | 450 | 32.86393 | -118.492 | | | 9/17/2012 |
| 40 | 700 | 32.86105 | -118.485 | | | 9/17/2012 |
| 41 | 460 | 32.85489 | -118.476 | | | 9/17/2012 |
| 42 | 1050 | 32.8502 | -118.462 | | | 9/17/2012 |
| 43 | 550 | 32.84202 | -118.465 | | | 9/17/2012 |

## APPENDIX 2

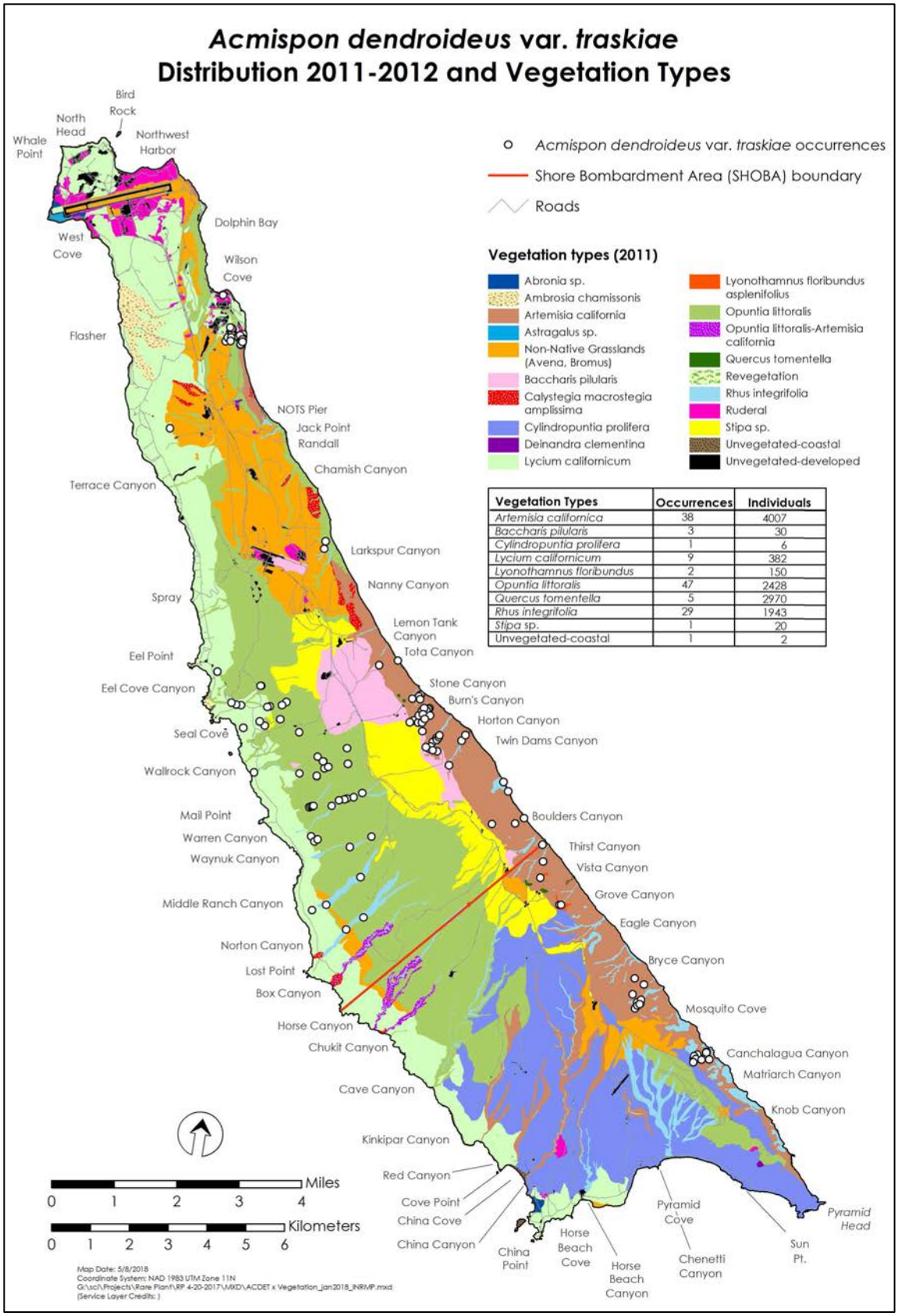
The 29 occurrences included in the 2012 proposal (77 FR 29078 2012) and) the final rule to downgrade *Acmispon dendroideus* var. *traskiae* from endangered to threatened (78 FR 45405 2013), including the value of the military areas where it occurred and the documented threats at that time.

| Location description | EO# and point location (PL) | Status at listing; year of first record; current status (reference) | Military value | Threats |
|---|---|---|---|---|
| Eagle Canyon | EO 1, 9 PLs | Extant; 1980 CNDDB; Extant (Junak 2006, SERG 2008) | Low; area recently closed | A: Land Use, Erosion, Non-native, Fire; E: Movement, Fire, Climate |
| Bryce Canyon | No EO, 14 PLs | Unknown; –; Extant (SERG 2009) | Low; area recently closed | A: Non-native, Fire; E: Fire, Climate |
| North Mosquito Cove | EO 8, 14 PLs | Extant; 1939 herbarium record; Extant (SERG 2010) | Low; area recently closed | A: Land Use, Erosion, Non-native, Fire; E: Movement, Fire, Climate |
| Canchalagua Canyon (including south Mosquito Cove) | EO 4, 21 PLs | Unknown; –; Extant (SERG 2011) | Low; area recently closed | A: Land Use, Erosion, Non-native, Fire; E: Movement, Fire, Climate |
| Thirst Canyon (including Vista Canyon) | No EO, 8 PLs | Unknown; –; Extant (SERG 2009) | Medium | A: Non-native, Fire; E: Fire, Climate |
| Cave Canyon | No EO, 3 PLs | Unknown; –; Presumed Extant (Junak 1997) | Medium | A: Non-native, Fire; E: Fire, Climate |
| Horse Canyon | No EO, 2 PLs | Unknown; –; Presumed Extant (Junak 1997) | Medium | A: Non-native, Fire; E: Fire, Climate |
| Pyramid Head | EO 5, 1 PL | Extant; 1979 CNDDB; Presumed Extant (Junak 1997) | High; area closed | A: Non-native, Fire; E: Fire, Climate |
| SHOBA Boundary (north to Twin Dams Canyon) | No EO, 8 PLs | Unknown; –; Presumed Extant (Junak 1996) | Medium | A: Non-native; E: Climate |
| Twin Dams Canyon | No EO, 2 PLs | Unknown; –; Extant (Junak 2006) | Medium | A: Non-native; E: Climate |
| Horton Canyon (including Stone, Burn's, and Horton Canyons) | EO 13, 27 PLs | Unknown; –; Extant (SERG 2010) | Medium | A: Erosion, Non-native; E: Climate |
| Tota Canyon | No EO, 7 PLs | Unknown; –; Presumed Extant (SERG 2010) | Low | A: Erosion, Non-native; E: Climate |
| Lemon Tank Canyon (including Nanny Canyon) | No EO, 19 PLs | Unknown; –; Extant (Junak 2004) | Low; area partially closed | A: Erosion, Non-native; E: Movement, Climate |
| Larkspur Canyon | EO 16, 2 PLs | Unknown; –; Extant (SERG 2011) | Low | A: Erosion, Non-native, Fire; E: Movement, Fire, Climate |
| Chamish Canyon | EO 3, 1 PL | Extant; 1980 CNDDB; Presumed Extant (Junak 1997) | Low | A: Erosion, Non-native, Fire; E: Movement, Fire, Climate |
| Box Canyon | No EO, 2 PLs | Unknown; –; Presumed Extant (Junak 1997) | Low | A: Non-native; E: Climate |

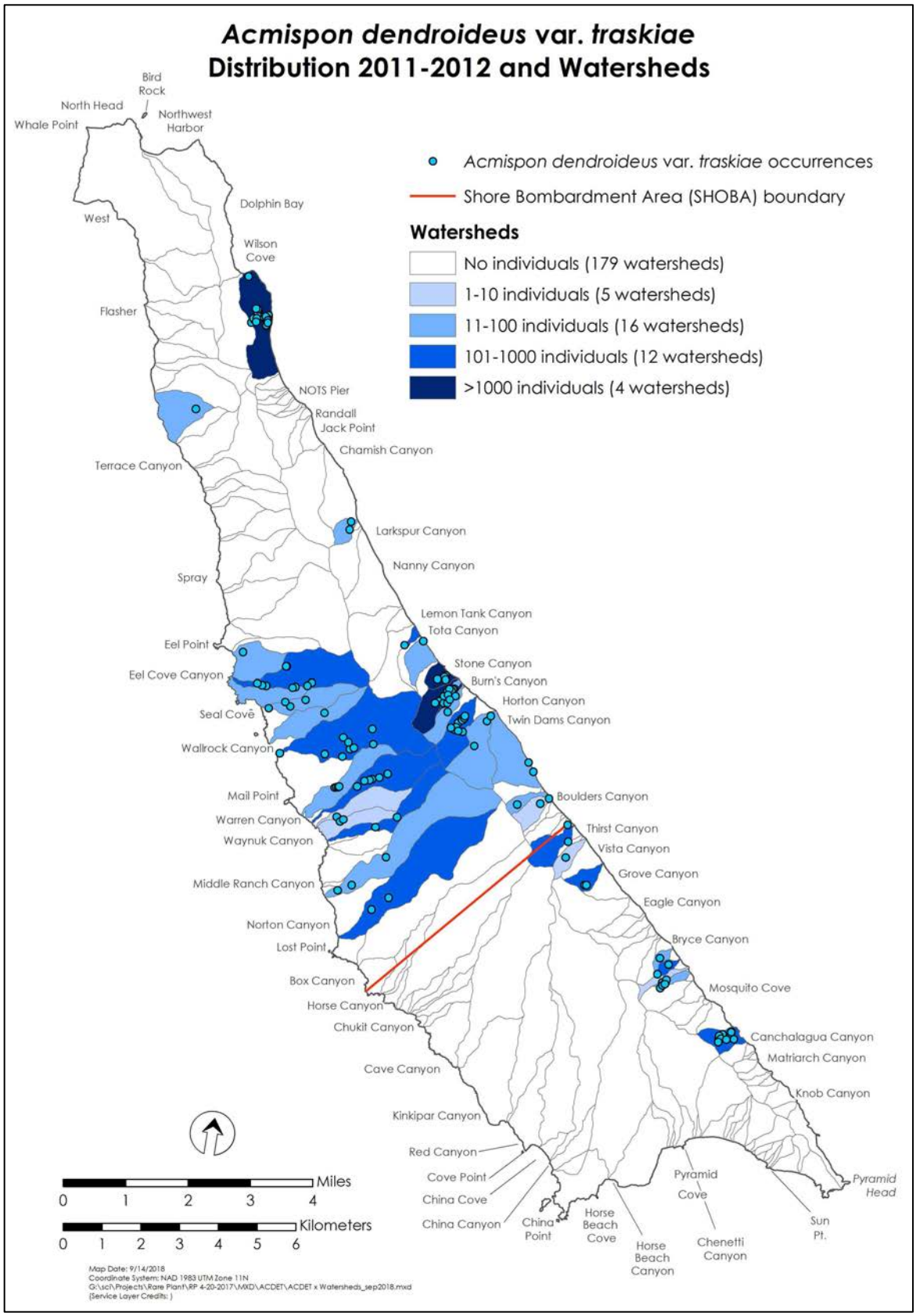
| | | | | |
|---|---|---|---|---|
| Norton Canyon | No EO, 1 PL | Unknown; –; Extant (Junak 2004) | Low | A: Non-native; E: Climate, Hybridization |
| Upper Middle Ranch Canyon | EO 10, 5 PLs | Unknown; –; Extant (Junak 2004) | Low | A: Erosion, Non-native; E: Climate |
| Lower Middle Ranch Canyon | No EO, 3 PLs | Unknown; –; Extant (SERG 2008) | Low | A: Non-native; E: Climate |
| Waymuck Canyon | No EO, 4 PLs | Unknown; –; Extant (SERG 2011) | High | A: Non-native; E: Climate |
| Warren Canyon | EO 12, 20 PLs | Unknown; –; Extant (SERG 2011) | High | A: Erosion, Non-native; E: Movement, Climate |
| Middle Wallrock Canyon | No EO, 10 PLs | Unknown; –; Extant (Junak 2004) | High | A: Non-native; E: Movement, Climate |
| Upper Wallrock Canyon | No EO, 3 PLs | Unknown; –; Extant (Junak 2006) | High | A: Erosion, Non-native; E: Climate |
| Seal Cove Terraces | No EO, 3 PLs | Unknown; –; Extant (Junak 2004) | High | A: Erosion, Non-native, Fire; E: Movement, Fire, Climate |
| Eel Cove Canyon (including terraces) | EO 14, 6 PLs | Unknown; –; Extant (SERG 2010) | High | A: Erosion, Non-native, Fire; E: Movement, Fire, Climate |
| Middle Island Plateau | EO 7, 6 PLs | Unknown; –; Extant (Tierra Data 2007) | High | A: Land Use, Erosion, Non-native, Fire; E: Movement, Fire, Climate |
| Wilson Cove | EO 11, 52 PLs | Extant; 1981 CNDDB; Extant (SERG 2010) | High | A: Land Use, Erosion, Non-native, Fire; E: Movement, Fire, Climate, Hybridization |
| North Wilson Cove | EO 9, no PLs | Extant; 1959 herbarium record; Unknown | High | A: Erosion, Non-native; E: Climate |
| North Island Terraces | EO 15, no PLs | Unknown; –; Presumed Extant (CNDDB 1996) | Medium | A: Erosion, Non-native; E: Movement, Climate |



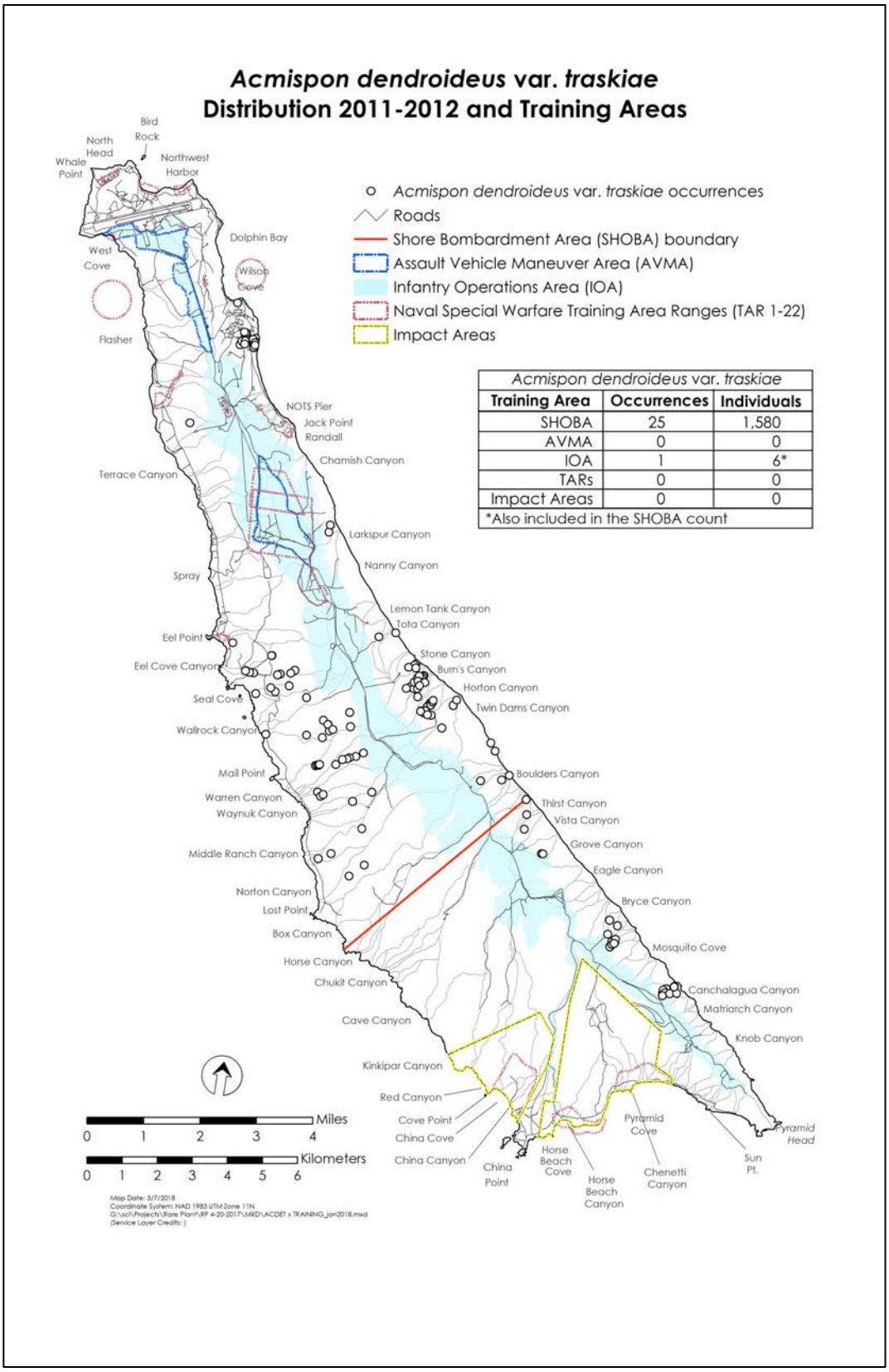

Map 1. Distribution of *Acmispon dendroideus* var. *traskiae* on San Clemente Island.



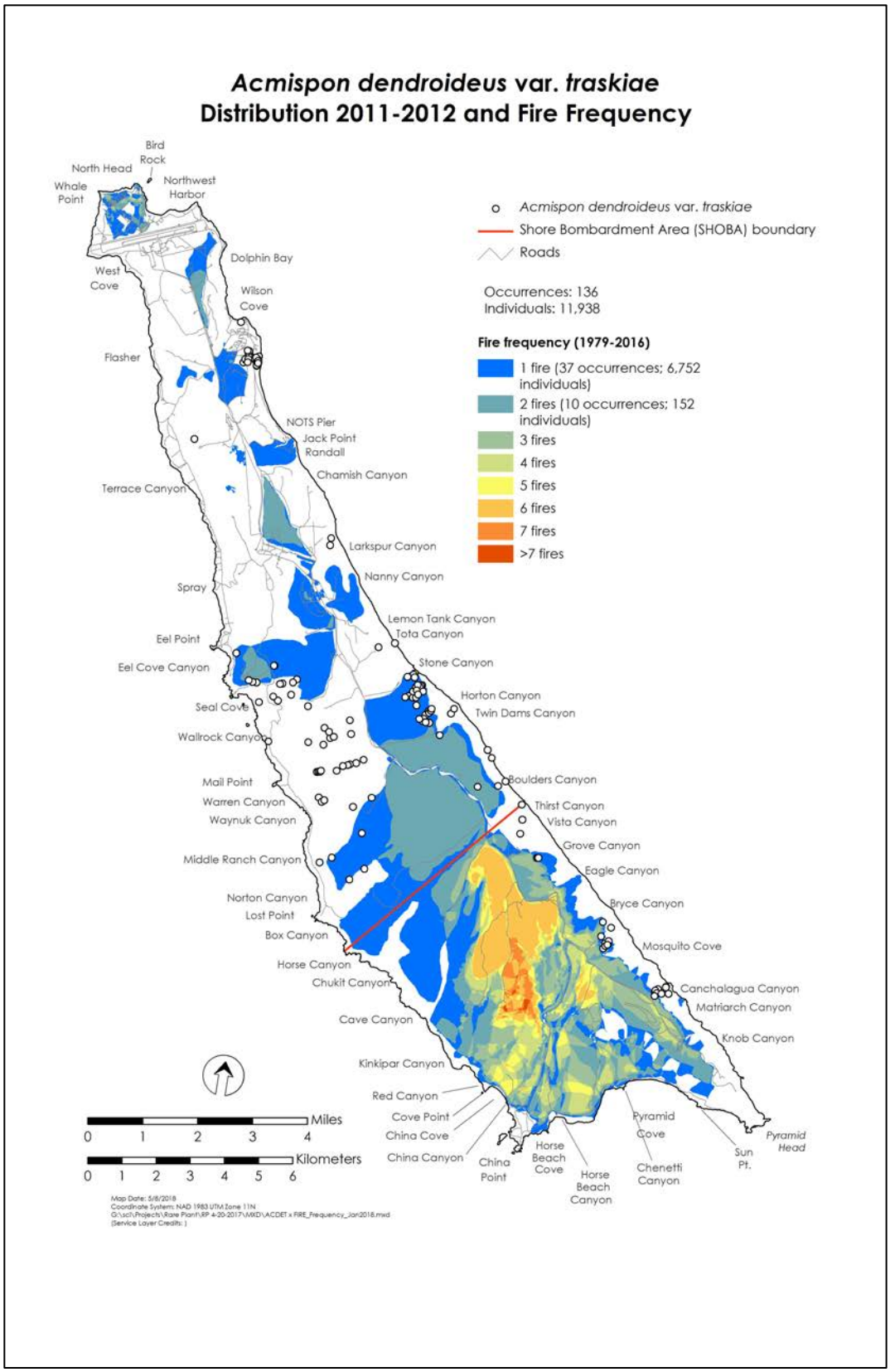

Map 2. Vegetation types and distribution of *Acmispon dendroideus* var. *traskiae*.



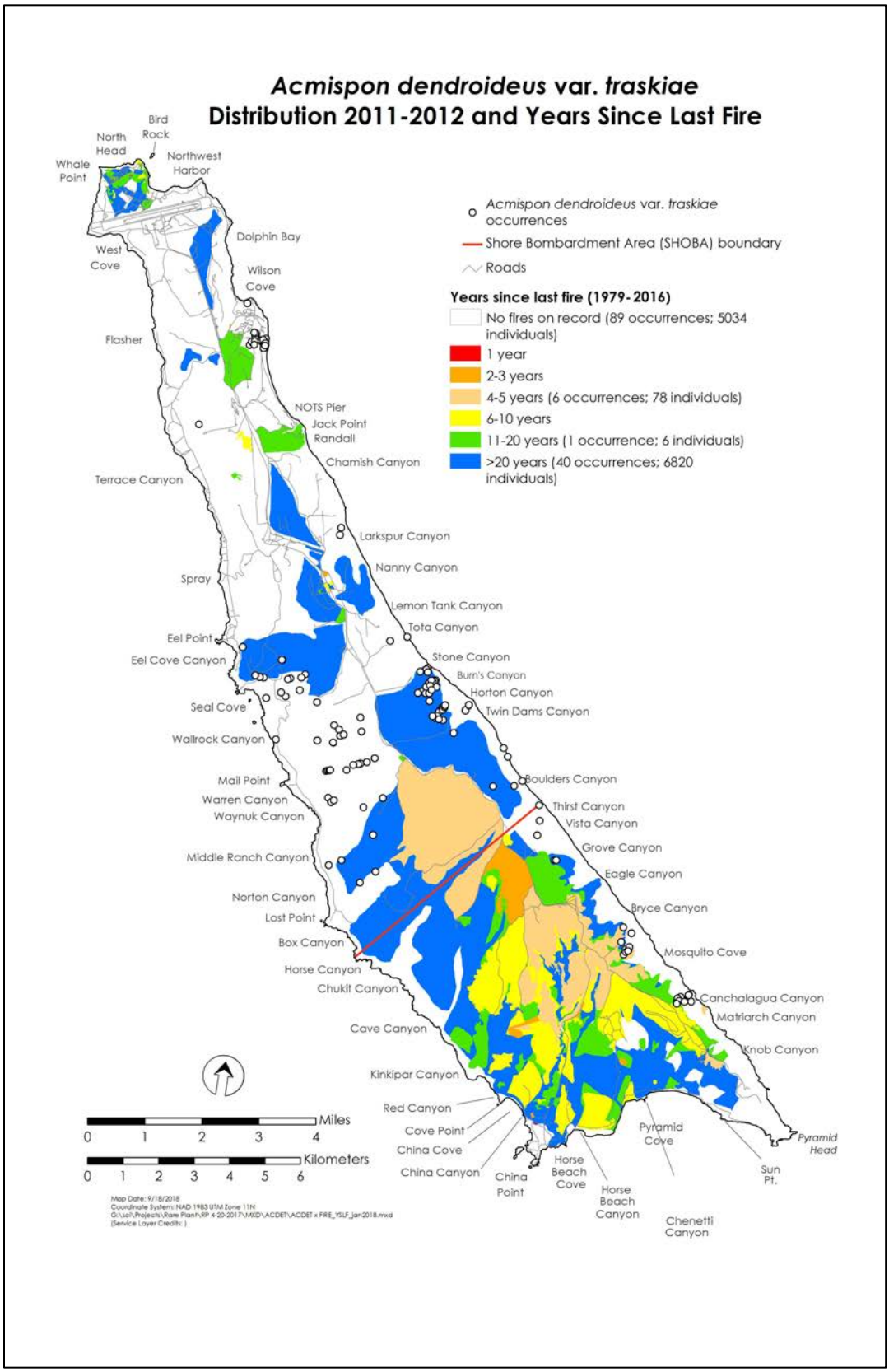

Map 3. Watersheds occupied by *Acmispon dendroideus* var. *traskiae*.



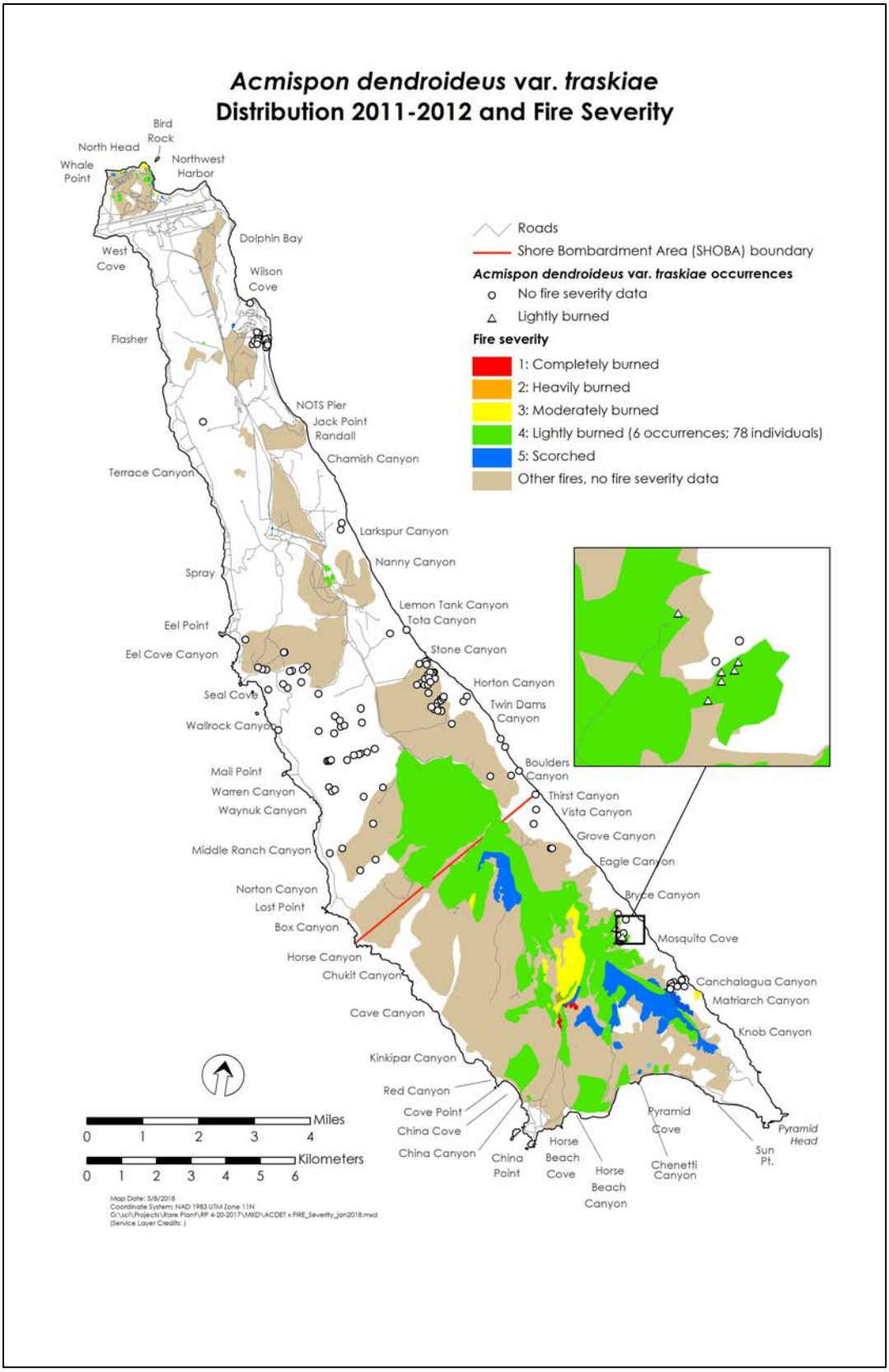

Map 4. Military training areas and distribution of *Acmispon dendroideus* var. *traskiae.*



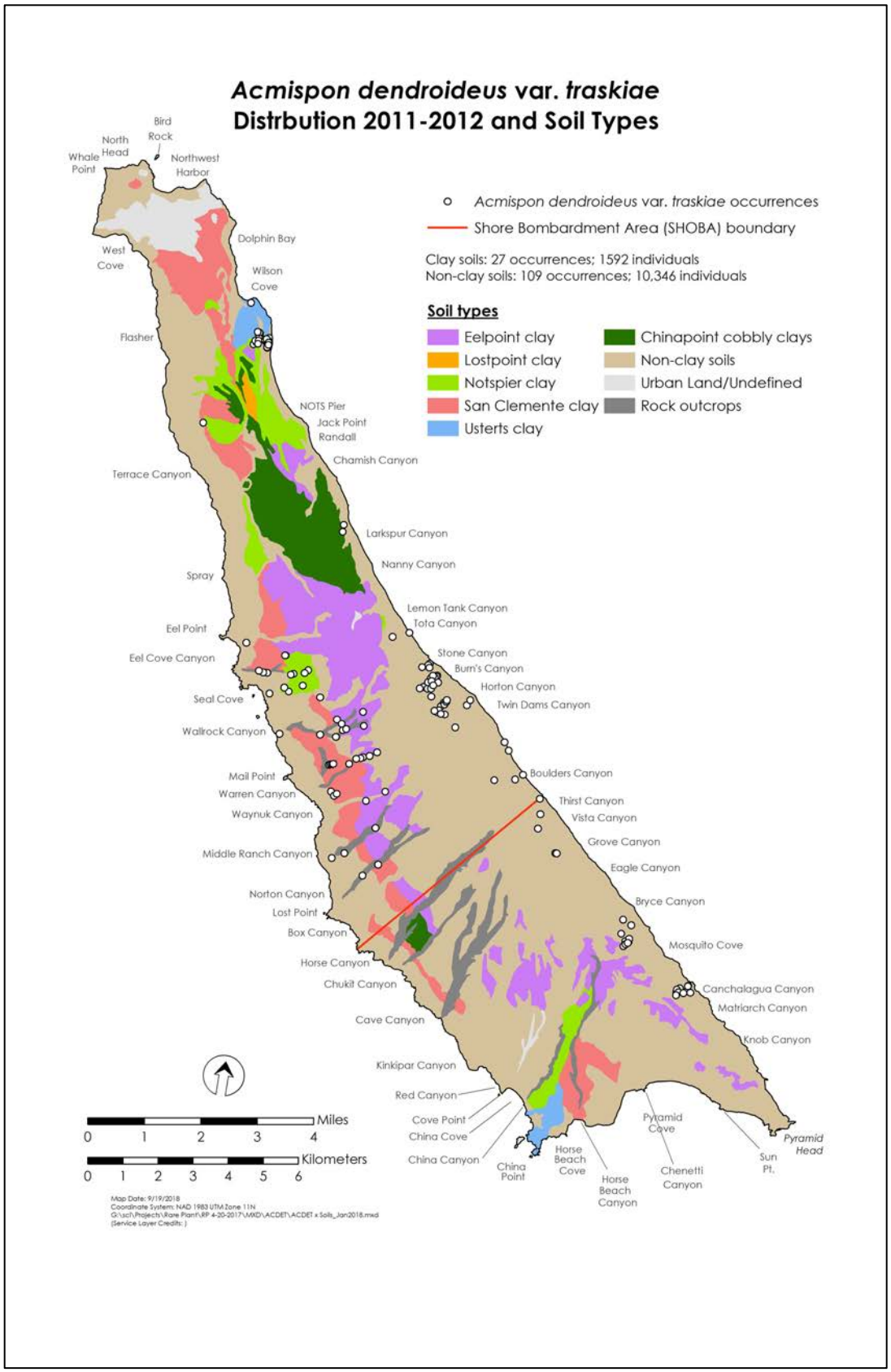

Map 5. Fire frequency and distribution of *Acmispon dendroideus* var. *traskiae*, based on the surveys of 2011–2012.



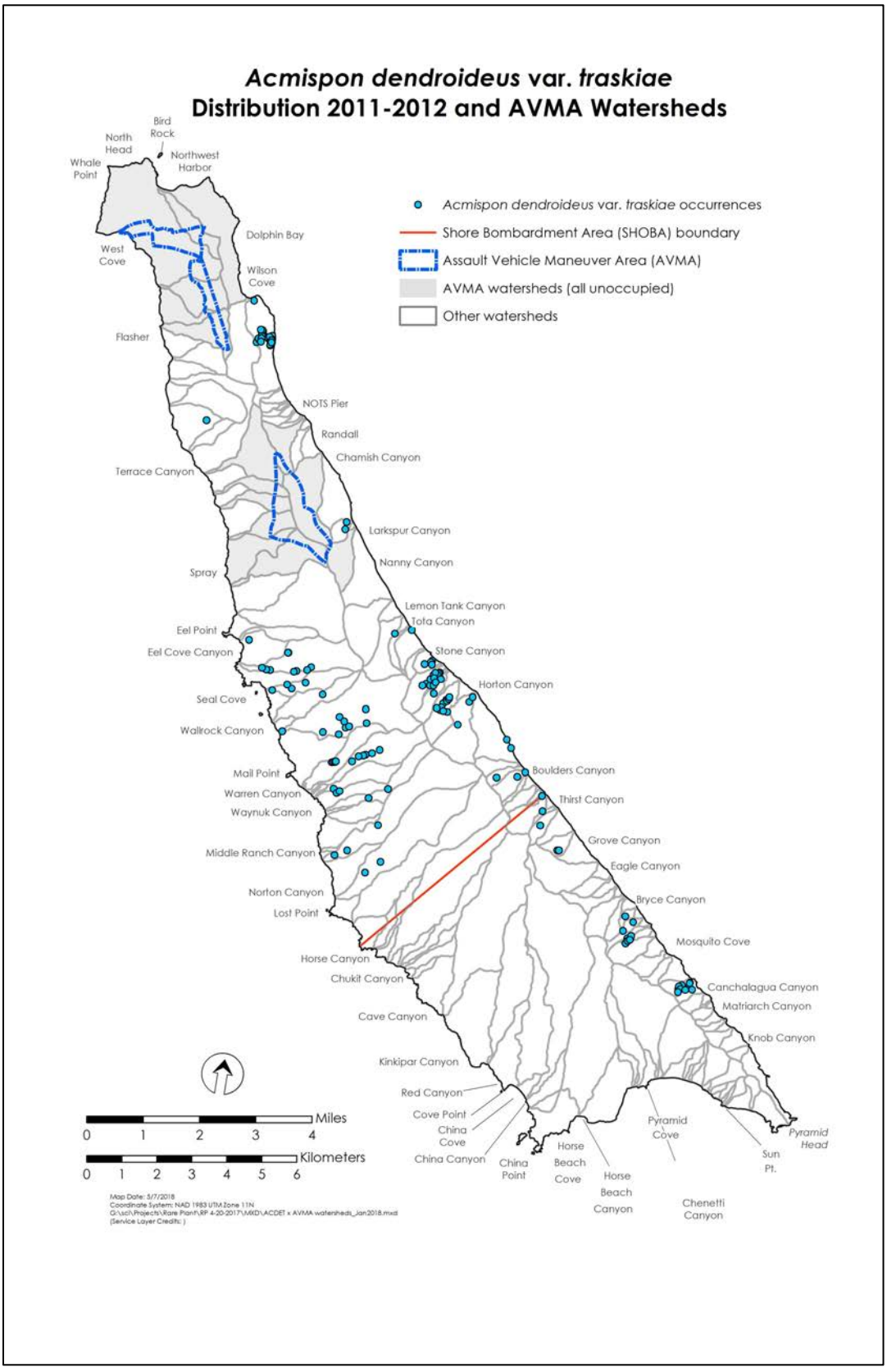

Map 6. Years since last fire recorded and distribution of *Acmispon dendroideus* var. *traskiae*, based on the surveys of 2011–2012.




Map 7. Fire severity and distribution of *Acmispon dendroideus* var. *traskiae*, based on the surveys of 2011–2012.




Map 8. Soil types and distribution of *Acmispon dendroideus* var. *traskiae*, based on the surveys of 2011–2012.




Map 9. AVMA watersheds and distribution of *Acmispon dendroideus* var. *traskiae*, based on the surveys of 2011–2012.