Species Status Assessment for Vandenberg Monkeyflower (*Diplacus vandenbergensis*)

Version 1.1

Vandenberg monkeyflower (*Diplacus vandenbergensis*) at Burton Mesa Ecological Reserve, Santa Barbara County, California, May 7, 2019

Photo credit: Kristie Scarazzo, Ventura Fish and Wildlife Office

U.S. Fish and Wildlife Service
Ventura Fish and Wildlife Office
Ventura, California

June 2026

Acknowledgements

Primary Authors

Kristie Scarazzo, U.S. Fish and Wildlife Service, Ventura Fish and Wildlife Office, Ventura, California

Cat Darst, U.S. Fish and Wildlife Service, Ventura Fish and Wildlife Office, Ventura, California

Peer and Partner Reviewers

Denise Knapp PhD, Santa Barbara Botanic Garden, Santa Barbara, California

Luanne Lum, Vandenberg Space Force Base, Vandenberg Air Force Base, California

Naomi Fraga, PhD, California Botanic Garden, Claremont, California

EXECUTIVE SUMMARY

Vandenberg monkeyflower is an herbaceous annual plant, endemic to the Burton Mesa landform in southwestern Santa Barbara County, California. It occurs on sandy soils, in openings within the canopy of Burton Mesa maritime chaparral habitat. The species is composed of 31 occurrences, delineated into three populations, and we estimate the current range to be 5,177 hectares (12,791 acres). The species needs contiguous stands of Burton Mesa maritime chaparral habitat, canopy openings within this habitat type, loose sandy soils derived from the Burton Mesa Dune Sheet, insect pollinators, adequate annual precipitation, appropriately timed first seasonal rains, and suitable temperature regimes.

Vandenberg monkeyflower was federally listed as endangered in 2014 (79 FR 50844-50854). Threats to the species identified at that time include development, utility and pipeline maintenance, invasive species, anthropogenic fire, recreation and other human activities, and climate change (79 FR 50844-50854). All these threats continue to act on the species and many of them do so in synergistic ways that create feedback loops, particularly non-native, invasive species and fire. We do not have data to determine the resiliency of Vandenberg monkeyflower populations. However, threats are acting on the populations, likely affecting their ability to withstand stochastic events. Redundancy will always be limited for local, endemic species with only three populations distributed over a small geographic range. Species representation is also naturally low because of its niche specificity and because it has been affected by reduced connectivity and habitat degradation.

Looking into the future, we developed two scenarios that capture the range of plausible effects to the species from predicted change over 50 years. We chose 50 years because this encompassed projections for each factor influencing viability, where available. Scenario 1 assumes a decrease in development from historical trends, small increase in recreation from population growth, and effects of Representative Concentration Pathway (RCP) 4.5 scenario for climate change in the California Central Coast region based on California's Fourth Climate Change Assessment (Langridge et al. 2018). Scenario 2 also assumes a decrease in development from historical trends, small increase in recreation from population growth, but assumes the RCP 8.5 scenario for climate change in the California Central Coast region (Langridge et al. 2018).

While we do not have data to determine the resiliency of Vandenberg monkeyflower populations, we can forecast that the resiliency of populations will likely change under each future scenario. Small-scale development, recreation, invasive, non-native vegetation, temperatures, drought, and fire are predicted to increase in Vandenberg monkeyflower's habitat, more so in Scenario 2 than Scenario 1. Vandenberg monkeyflower's ability to persist into the future will be negatively affected by increased habitat loss, degradation, and fragmentation from non-native, invasive vegetation, and increased fire and the resultant feedback loops that further increase non-native invasive vegetation. Increased temperatures and drought will decrease abundance, reproductive success, and survival of Vandenberg monkeyflower, potentially resulting in extirpations due to repeated low or no germination years and potential depletion of seed bank, again, more so under Scenario 2 than 1. If reduced resiliency possible under Scenario 2 leads to extirpations, then redundancy and representation for the species will also be reduced,

increasing extinction risk from reduced adaptive capacity in the face of environmental change and ability to withstand catastrophic events, such as wildfire or catastrophic drought.

CHANGES MADE BETWEEN VERSION 1.0 AND VERSION 1.1

As part of the 2026 5-year review, we incorporated updated information to the Species Status Assessment (SSA) for Vandenberg monkeyflower (*Diplacus vandenbergensis*). Notable changes occurred in the Seed Germination and Vegetative Growth and Flowering subsections of the Life History section; Invasive Species subsection of the Threats section; and the Species Abundance subsection of the Current Condition and Abundance section. We also added a new section to the SSA called Conservation Actions that has three subsections: Federal and State Regulatory Mechanisms, Invasive Species Management, and Seed Banking and Bulking.

We incorporated new information in multiple subsections of the Life History section. In the seed germination and vegetative growth subsection, results from ongoing studies continue to support a positive correlation between annual rainfall specifically during the months of March and April and Vandenberg monkeyflower abundance. The study results also corroborate a negative correlation between increased temperatures during the months of March through April and abundance, albeit these correlations may be weaker than previously assumed. Within the flowering subsection, new information validates the previously held notion that Vandenberg monkeyflowers located closer to the coast flower slightly later than plants in more inland locations.

In the Invasive Species subsection of the Threats section, new results show that habitat modifications from non-native, invasive species have potential to reduce habitat quality and extirpate occupied Vandenberg monkeyflower locations on Vandenberg Space Force Base (VSFB). The study found a negative relationship between veldt grass (*Ehrharta calycina*) cover and presence of Vandenberg monkeyflower, suggesting that complete removal of veldt grass provides measurable benefits to the species, both by reducing competition and supporting greater native plant species richness. Other preliminary results show that use of the grass specific herbicide clethodim as a treatment for veldt grass infestations has no lethal impacts to broadleaf plant species. Additional study results found that native plant species richness was highest with mechanical veldt grass removal and that this treatment may promote natural Vandenberg monkeyflower recruitment. Mechanical removal treatments benefit the species by reducing competition and promoting increased native species richness.

We included a new Conservation Actions section with three subsections. The Federal and State Regulatory Mechanisms subsection provides background information and context about the existing laws and other provisions that provide conservation benefits to Vandenberg monkeyflower and its habitat. The next subsection, Invasive Species Management, describes recent management activities designed for Vandenberg monkeyflower recovery completed at VSFB. The last subsection, Seed Banking and Bulking, discusses seed banking and bulking recovery actions completed for Vandenberg monkeyflower by partners.

We incorporated recent results from ongoing Vandenberg monkeyflower abundance monitoring efforts into the Species Abundance Subsection of the Current Condition and Abundance section. Partners reported new data for occurrences located within the Burton Mesa and La Purísima populations and we summarized this information in two new tables.

The 2026 new information does not substantively change our understanding of current resiliency, redundancy, or representation. Similarly, the new information did not warrant changes to the Future Scenarios, so overall our analysis of condition (current and future) remains unchanged.

Table of Contents

List of Figures

List of Tables

1.0 INTRODUCTION

This document presents the Species Status Assessment (SSA) for Vandenberg monkeyflower (*Diplacus vandenbergensis*). We, the U.S. Fish and Wildlife Service (USFWS; Service), developed this SSA for Vandenberg monkeyflower to compile and evaluate the best available scientific information on the species' biology and factors that influence its viability.

1.1 LISTING HISTORY

Original Listing
Federal Register Notice: 79 FR 50844-50854
Date of Final Listing Rule: August 26, 2014
Entity Listed: *Diplacus vandenbergensis*
Classification: Endangered

1.2 STATE LISTING

Vandenberg monkeyflower is not listed by the state of California under the California Endangered Species Act (CESA). It is recognized as a California Rare Plant Rank (CRPR) 1B.1 taxon by the California Native Plant Society (CNPS) in the Inventory of Rare and Endangered Plants of California (CNPS 2021, website). This rank indicates that it is considered rare or endangered in California and elsewhere (1B) and is seriously threatened in California (over 80 percent of occurrences threatened/high degree and immediacy of threat (0.1; CNPS 2021, website).

1.3 APPROACH TO THE SPECIES STATUS ASSESSMENT

The SSA Framework is an analytical approach designed to supply the foundational science needed to inform all Endangered Species Act of 1973 (Act), as amended (United States Code [USC] § 1531 et seq.) decisions. Following this framework, an SSA begins with a compilation of the best available information about the species (such as taxonomy, life history, and habitat requirements) and its ecological needs at the individual, population, and species levels. Next, the current condition of the species and its habitat, and the probable explanations for past and ongoing changes in abundance and distribution are described for the SSA. In the last section of the SSA, the species response to plausible future scenarios with differing environmental conditions and conservation efforts is forecast (Service 2016, entire).

The SSA is based on the conservation biology principles of resiliency, representation, and redundancy, which are used to evaluate the current and future condition of the species (Smith et al. 2018, entire). The goal of an SSA is to characterize a species' viability, which is its ability to sustain populations in the wild over time, using the best scientific understanding of the current and future condition of the species within its ecological settings (Service 2016, pg. 4).

Resiliency is the ability of a species to withstand environmental stochasticity (normal, year-to-year variations in environmental conditions such as temperature, rainfall), periodic disturbances within the normal range of variation (fire, floods, storms), and demographic stochasticity

(normal variation in demographic rates such as mortality and fecundity). Simply stated, resiliency is the ability to sustain populations through the natural range of favorable and unfavorable conditions.

We can best gauge resiliency by evaluating population level characteristics such as: demography (abundance and the components of population growth rate- survival, reproduction, and migration), genetic health (effective population size and heterozygosity), connectivity (gene flow and population rescue), and habitat quantity, quality, configuration, and heterogeneity. Also for species prone to spatial synchrony (regionally correlated fluctuations among populations), distance between populations and degree of spatial heterogeneity (diversity of habitat types or microclimates) are also important considerations.

Redundancy is the ability of a species to withstand catastrophes. Catastrophes are stochastic events that are expected to lead to population collapse regardless of population health and for which adaptation is unlikely.

We can best gauge redundancy by analyzing the number and distribution of populations relative to the scale of anticipated species-relevant catastrophic events. The analysis entails assessing the cumulative risk of catastrophes occurring over time. Redundancy can be analyzed at a population or regional scale, or for narrow-ranged species, at the species level.

Representation is the ability of a species to adapt to both near-term and long-term changes in its physical (climate conditions, habitat conditions, habitat structure, etc.) and biological (pathogens, competitors, predators, etc.) environments. This ability to adapt to new environments- referred to as adaptive capacity- is essential for viability, as species need to continually adapt to their continuously changing environments. Species adapt to novel changes in their environment by either moving to new, suitable environments or by altering their physical or behavioral traits (phenotypes) to match the new environmental conditions through either plasticity or genetic change. The latter (evolution) occurs via the evolutionary processes of natural selection, gene flow, mutations, and genetic drift.

We can best gauge representation by examining the breadth of genetic, phenotypic, and ecological diversity found within a species and its ability to disperse and colonize new areas. In assessing the breadth of variation, it is important to consider both larger-scale variation (such as morphological, behavioral, or life history differences which might exist across the range and environmental or ecological variation across the range), and smaller-scale variation (which might include measures of interpopulation genetic diversity). In assessing the dispersal ability, it is important to evaluate the ability and likelihood of the species to track suitable habitat and climate over time. Lastly, to evaluate the evolutionary processes that contribute to and maintain adaptive capacity, it is important to assess natural levels and patterns of gene flow, degree of ecological diversity occupied, and effective population size.

The scientific information used for this SSA is from a variety of resources such as primary peer-reviewed literature, reports submitted to the Service and other public agencies, species location information in Geographic Information Systems (GIS) databases, and expert experience and observations. We also used previous analyses presented in other Service documents including the

original listing rule (79 FR 50844-50854), proposed rule (78 FR 64840-64871), and critical habitat designation (80 FR 48142-48170).

2.0 SPECIES INFORMATION

2.1 CLASSIFICATION

Vandenberg monkeyflower was first described by David Thompson in 2005 and treated as *Mimulus fremontii* (Bentham) A. Gray var. *vandenbergensis* D.M. Thompson. He placed it in the Scrophulariaceae (or figwort) family (Thompson 2005, pg. 134). Other Mimulus spp. and relatives were already placed in the Phrymaceae (or lopseed) family (Beardsley and Olmstead 2002, pg. 1094 and 1098). This description was based on specimens collected by E.R. Blakley in Santa Barbara County in 1960, from open sandy banks, in sun, where Casmalia Road crosses Santa Lucia Canyon, north of Lompoc (Thompson 2005, pg. 134; Consortium of California Herbaria Data Portal [CCH2] 2021, website). It was elevated to species and reclassified as *Diplacus vandenbergensis* by G. L. Nesom in 2012 (pg. 2-3); the revised treatment of *Mimulus* included transferring 47 species assigned to the genus *Diplacus* (Barker et al. 2012, pg. 1, 28-29). In this treatment, Vandenberg monkeyflower was separated and distinguished from Fremont's monkeyflower (*D. fremontii* Bentham [G.L. Nesom], formerly *M. f.* var. *fremontii* [Thompson 2005, pg. 130-134]) by the color of the corolla lobes, tube, and throat, the spots and mottling on the palate ridges and adjacent lateral areas, and their geographic distributions (Nesom 2012, pg. 3). No subsequent revisions to its classification have occurred.

2.2 DESCRIPTION

This description of the diagnostic characters for Vandenberg monkeyflower is based on Nesom (2012, pg. 3), Thompson (2005, pg. 129-131 and 134), and the current treatments in the Jepson eFlora (Fraga 2018, website) and Flora of North America (Nesom and Tulig 2020, website).

Vandenberg monkeyflower is an herbaceous annual that grows to be between one and 20 centimeters (cm; 0.4 and 7.9 inches [in]) tall. The stems are generally erect and glandular. The leaves are narrowly elliptic to obovate (oval-shaped, with a narrower end at the base) and between two and 30 millimeters (mm; 0.08 and 1.12 in) long. The distal ends of the leaves are hairy, while the proximal ends are glabrous (smooth). Vandenberg monkeyflower inflorescences are racemes, with one flower per node. In this arrangement, each flower has a bract and occurs on a short (one to four mm long; 0.04 to 0.16 in) pedicel (or stalk), along a main, central axis. The lower flowers mature first. However, some plants may only produce a single flower during the growing season. The flowers are bilaterally symmetric, and the corolla is comprised of two upper lobes and three lower lobes that are fused into a tube (or throat). Vandenberg monkeyflower corollas are yellow with reddish-brown spots, beginning near the mouth of the tube and extending downward into it. The corolla tube is nine to 23 mm (0.35 to one in) long, glabrous, and has two longitudinal, yellow folds. The flowers are bisexual, with four stamens that occur in two pairs; all are attached towards the corolla tube base. The flowers have a single pistil with a two-chambered, superior ovary. The stigma has two lobes, and is included in the corolla, so it does not extend beyond the mouth of the floral tube when the flowers are blooming. Vandenberg monkeyflower typically blooms May through June. The species' flowers are

subtended by a calyx that ranges from five to 14 mm (0.2 to 0.56 in) in length. The calyx is widely ribbed, covered in white hairs, more or less equally lobed, and each lobe has acute (or short-pointed) tips. The fruit is a two-chambered (or bilocular), more or less cylindric, dehiscent capsule that reaches between 6.5 and 13 mm (0.3 to 0.5 in) in length. Each chamber contains many small (< one mm), ovoid (egg-shaped) seeds.

Vandenberg monkeyflower remains distinguished from the closely related Fremont's monkeyflower by corolla color. The corollas in Fremont's monkeyflower are magenta to dark red-purple, whereas the corollas in Vandenberg monkeyflower are yellow (Fraga 2018, website). The distributions of the two species do overlap. However, Fremont's monkeyflower has a broader geographic range and occupies a greater diversity of habitats than Vandenberg monkeyflower. Representative photographs of Vandenberg monkeyflower are provided in Figures 1, 2, and 3.

Figure 1. Vandenberg monkeyflower (*Diplacus vandenbergensis*) blooming on May 7, 2019 at the Burton Mesa Ecological Reserve, Santa Barbara County, California (Occurrence 3) with a single flower. Photo credit: Kristie Scarazzo, Ventura Fish and Wildlife Office

Figure 2. Vandenberg monkeyflower (*Diplacus vandenbergensis*) blooming on May 9, 2016 at the La Purísima Mission State Historic Park, Santa Barbara County, California (Occurrence 7) with multiple flowers. Photo credit: Denise Knapp, Santa Barbara Botanic Garden.

Figure 3. Vandenberg monkeyflower (*Diplacus vandenbergensis*) blooming on May 9, 2016 at the La Purísima Mission State Historic Park, Santa Barbara County, California (Occurrence 8). Photo credit: Denise Knapp, Santa Barbara Botanic Garden.

2.3 RANGE AND DISTRIBUTION

A species range is the geographic area where we know or suspect that a species occurs. It includes areas of suitable habitat and is not limited to locations with known species occurrences (Shultz and BalisLarson 2020, PowerPoint Presentation). Vandenberg monkeyflower is endemic to southwestern Santa Barbara County, California. The species range is restricted to the southeastern portion of the Burton Mesa landform, which is a physiographic region (meaning a geographic area with distinct physical properties), located south of San Antonio Creek and the associated river valley, west of the Purísima Hills, north of the Santa Ynez River and the associated river valley, and east of the Pacific Ocean. The Burton Mesa landform is a

consolidated dune sheet within the Santa Ynez Valley Dune Complex that formed by a series of depositional episodes, ranging in geologic time from approximately the mid-Pleistocene (25,000 to 80,000 years before present) to the present (Hunt 1993, pg. 13-14). Older deposits are located more towards the interior, generally where the species occurs, and the newest are located closer to the coast, where the species is absent. Both the geology of the Burton Mesa paleo-dunes and species distribution are generally wedge-shaped, and follow the northwest to southeast direction of the prevailing, off-shore winds (Hunt 1993, pg. 3-4, 6, 13).

In this section, we use the term "occurrence" to mean a specific location where Vandenberg monkeyflower is or has been known to occur. An occurrence typically represents a summary or compendium of all known observation data and other information for a documented location of the species, and most include several years of data from a variety of different sources, summarized into a single record. By convention, we separate occurrences when there is at least 0.4 kilometer (km)/0.25 mile (mi) distance between documented locations. Our definition is consistent with how the term occurrence is used by California Department of Fish and Wildlife (CDFW) in the California Natural Diversity Database ([CNDDB]; CNDDB 2020, pg. 9-10). Observation data and other location information for Vandenberg monkeyflower was used to complete a spatial analysis in geographic information system (GIS) to determine the species current range and distribution. Data used for this analysis were compiled from the following sources:

- Government version of the CNDDB through the Biogeographic Information and Observation System (CNDDB 2021, website);
- CCH2 records (CCH2 2021, website);
- Location information from the 2013 Proposed Rule for Endangered Status for Vandenberg Monkeyflower (78 FR 64840-64871);
- Vandenberg monkeyflower survey data from Vandenberg Space Force Base (VSFB) collected between 2010 and 2016 (ManTech SRS Technologies, Inc. 2020, pg. 24);
- 2019 Vandenberg monkeyflower survey data from VSFB (ManTech SRS Technologies, Inc. 2020, pg. 24);
- Other Vandenberg monkeyflower data from Santa Barbara Botanic Garden ([SBBG]; SBBG 2020, pers comm); and
- Other Vandenberg monkeyflower data from La Purísima Mission State Historic Park ([LPM-SHP]; LPM-SHP 2021, pers comm).

In most cases, data from these different sources overlap and consist of several points and polygons, all associated with a single, more general locality. We grouped and condensed the data for each occurrence into single, discrete points using GIS software to create the final, current distribution map for the species (Figure 4). For example, occurrence 1 (Figure 4) includes four CNDDB polygons, two CCH2 records, two point from the Service's 2013 Proposed Rule, 43 points/polygons from VSFB, and 10 points from SBBG (CNDDB 2021, website; CCH2 2021, website; 78 FR 64840-64871; ManTech SRS Technologies, Inc. 2020, pg. 24; SBBG 2020, pers comm). Detailed information about the data that compose each known Vandenberg monkeyflower occurrence is provided in Appendix A.

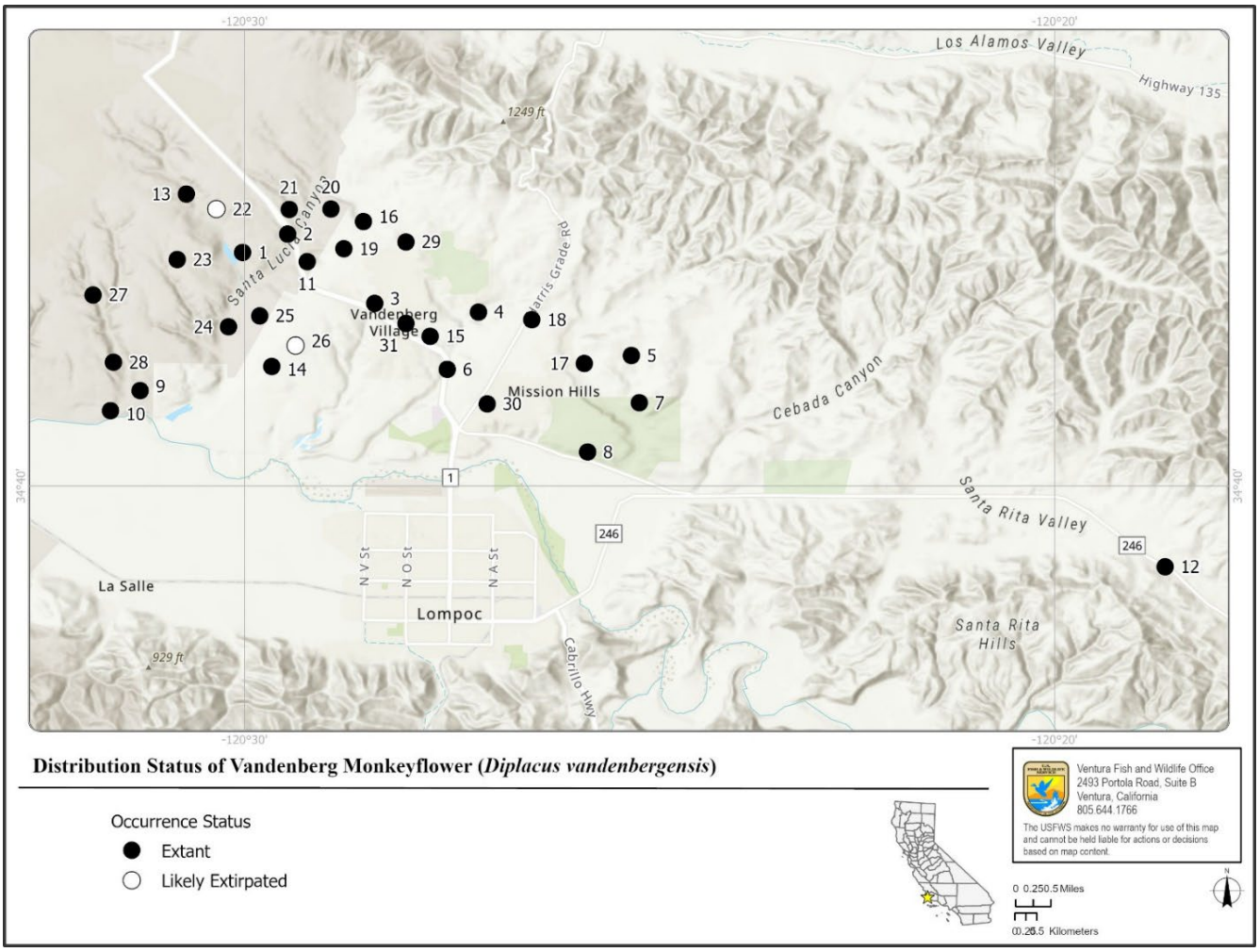

Figure 4. Distribution and status (extant/likely extirpated) of Vandenberg monkeyflower (*Diplacus vandenbergensis*) occurrences, Santa Barbara County, California.
The species current range and distribution is based on data from the California Natural Diversity Database (CNDDB), Consortium of California Herbaria Data Portal (CCH2), 2013 Proposed Rule for Endangered Status for Vandenberg Monkeyflower, Vandenberg Space Force Base (VSFB), Santa Barbara Botanic Garden (SBBG), and La Purísima Mission State Historic Park ([LPM-SHP]; CNDDB 2021, website; CCH2 2021, website; 78 FR 64840-64871; ManTech SRS Technologies, Inc. 2020, pg. 24; SBBG 2020, pers comm; LPM-SHP 2021, pers comm).

2.3.1 Historical Distribution of the Species

We reviewed all available location data (sources listed above) for Vandenberg monkeyflower to evaluate the species historical distribution. Historical data are any data collected prior to the time of listing; 2014 Listing Rule (79 FR 50844-50854). Historical species data are derived from multiple sources. For example, on Figure 4, occurrence 1 contains herbaria records of the species collected in 1998 and 2006 (CCH2 2021, website). Occurrence 1 is also mapped in the CNDDB with an element occurrence record dated 2006, which happens to correspond with one of the

herbarium collections. Occurrence 1 also appears in several other sources used for the distribution analysis.

There are a total of 15 historical occurrences of the species. Eight of these 15 historical occurrences are associated with historical herbaria records (CCH2 2021, website). And ten of them have a corresponding CNDDB record (CNDDB 2021, website). Two of the historical occurrences are likely extirpated. These are occurrence numbers 22 and 26 (Figure 4). The remaining 13 historical occurrences of the species are considered extant because they are associated with information from other data sources that has been updated, more recently surveyed, and/or review of modern aerial imagery shows that suitable habitat for the species is likely still present.

2.3.2 Range and Distribution at the Time of Listing, 2014

At the time of listing, the species range was estimated to be 4,070 hectares (10,057 acres). This estimate was based on the amount of remaining Burton Mesa maritime chaparral habitat. In 2014, Vandenberg monkeyflower was known from a total of 21 occurrences scattered throughout 11 different locations within the then known range (78 FR 64840-64871). Of these, 13 had corresponding element occurrence records in the CNDDB. We have considerably more data on historical occurrences (15 known historical occurrences) in the current analysis than in 2014, which included only three historical data points. This is because we received more accurate information on the historical distribution of the species on VSFB, our GIS capabilities have increased making the current analysis more robust, and more herbaria records of the species have been georeferenced and incorporated into the CCH2 database (ManTech SRS Technologies, Inc. 2020, pg. 24; CCH2 2021, website). The other 19 known Vandenberg monkeyflower occurrences at time of listing were considered extant.

2.3.3 Current Range and Distribution

We now estimate the species range to be 5,177 hectares (12,791 acres). This estimate is based on the sources of information listed in Section 2.1 and the results of the spatial analysis showing the complete, known distribution of the species. The range has increased since the time of listing by 1,107 hectares (2,734 acres). Vandenberg monkeyflower is now known from 31 occurrences (Figure 4). The range and number of occurrences increased since time of listing because several previously undocumented occupied sites have been found, and other new and existing data from the sources listed in Section 2.1 were incorporated into the spatial analysis. The previously undocumented Vandenberg monkeyflower occurrences include four additional CNDDB element occurrence records added to the database, since 2014 (CNDDB 2021, website). A detailed account of each occurrence can be found in Appendix A.

Two of the 31 occurrences currently known are likely extirpated (occurrence numbers 22 and 26 on Figure 4). Occurrence number 22 was not included in the listing rule, but two other occurrences of the species (occurrence numbers 1 and 13) were documented within the same general location at this time (78 FR 64840-64871). VSFB first mapped occurrence 22 in 2010 (ManTech SRS Technologies, Inc. 2010, pg. 4; ManTech SRS Technologies, Inc. 2020, pg. 26). It persisted at this site in 2012 (SAIC 2012, pg. 31). Botanists did not observe Vandenberg

monkeyflower at occurrence 22 in 2015 and noted that veldt grass (*Ehrharta calycina*) had invaded many areas throughout Lake Canyon (ManTech SRS Technologies, Inc. 2015, pg. 5-6). Botanists conducted Vandenberg monkeyflower surveys again in 2016, which was an above average rainfall year. They found the species in a slightly different location near the previously mapped area for occurrence 22, and noted that habitat quality continued to decline from veldt grass invasion. Also, it was noted that 98 percent of occupied stands within Lake Canyon had veldt grass encroachment (ManTech SRS Technologies, Inc. 2016, pg. 6, 8, and 10). Botanists did not observed any Vandenberg monkeyflower at this site during surveys conducted in 2019 (ManTech SRS Technologies, Inc. 2020, pg. 24). Based on these data, we consider this occurrence likely extirpated. Occurrence number 26 was included in the proposed listing rule. It was considered a historical occurrence at that time and identified as a potentially extirpated site (78 FR 64840-64871). For these reasons, we also consider occurrence 26 likely extirpated in the current analysis.

We now consider occurrence number 12 potentially extant. This occurrence was identified as a historical, extirpated occurrence in the proposed listing rule (78 FR 64840-64871). The occurrence is based off an herbarium record dated 1931, from an unknown locality described as "eight miles west of Buellton." By convention, the site was georeferenced and mapped as a single, discrete point located eight miles west of the intersection of U.S. Highway 101 and State Route 246, along the roadway (CCH2 2021, website). The vague locality of the record is accounted for in the CNDDB, and the occurrence is mapped as a circle with a 3.2 km (two mi) diameter that State Route 246 bisects (CNDDB 2021, website). Further review of recent aerial imagery of this area and the immediate surrounding vicinity shows that some potentially suitable Burton Mesa maritime chaparral habitat is likely present. Similarly, this region is underlain by geology mapped as Burton Mesa paleo-dunes (Hunt 1993, pg. 4). Consequently, we determined that occurrence 12 is possibly extant and warrants further surveys.

2.3.4 Current Land Ownership

All known Vandenberg monkeyflower occurrences are located on lands with three different types of ownership: privately owned land, publicly owned land that is not generally publicly accessible, and publicly owned land that is generally publicly accessible. The publicly owned lands with public access include BMER, which is owned by CDFW, and LPM-SHP, which is owned by California State Parks. Public ally owned lands that are generally inaccessible to the public include VSFB and U.S. Penitentiary, Lompoc. These two types of lands are federally owned. Figure 5 below illustrates land ownership within the Vandenberg monkeyflower range.

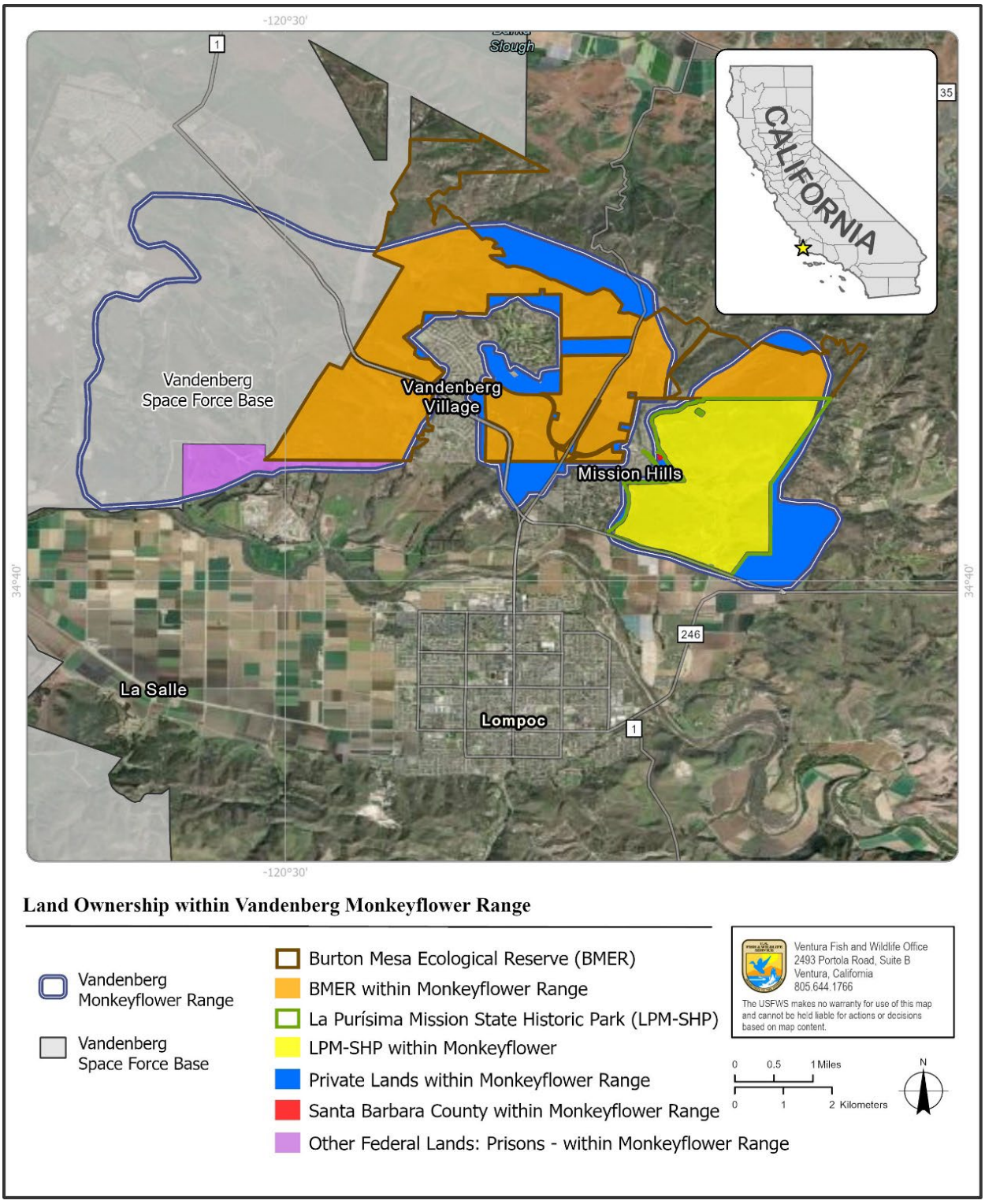

Figure 5. Ownership of lands within known Vandenberg monkeyflower (*Diplacus vandenbergensis*) range, Santa Barbara County, California.

There are 31 known Vandenberg monkeyflower occurrences (Section 2.3.3 and Figure 5). Of these, only 16 percent occur on private lands. The remaining 84 percent occur on publicly owned lands, with 39 percent on state owned lands (CDFW and California State Parks), and 45 percent on federally owned lands (VSFB and U.S. Penitentiary, Lompoc). Table 1 below provides a breakdown of the ownership for each Vandenberg monkeyflower occurrence.

Table 1. Land ownership of Vandenberg monkeyflower (*Diplacus vandenbergensis*) occurrences.

Occurrence Number	Ownership Type	Owner	Publicly Accessible
1	Federal	Department of Defense	No
2	Federal	Department of Defense	No
11	Federal	Department of Defense	No
13	Federal	Department of Defense	No
20	Federal	Department of Defense	No
21	Federal	Department of Defense	No
22	Federal	Department of Defense	No
23	Federal	Department of Defense	No
24	Federal	Department of Defense	No
25	Federal	Department of Defense	No
27	Federal	Department of Defense	No
28	Federal	Department of Defense	No
9	Federal	Department of Justice	No
10	Federal	Department of Justice	No
3	State	Department of Fish and Wildlife	Yes
14	State	Department of Fish and Wildlife	Yes
15	State	Department of Fish and Wildlife	Yes
16	State	Department of Fish and Wildlife	Yes
18	State	Department of Fish and Wildlife	Yes
19	State	Department of Fish and Wildlife	Yes
26	State	Department of Fish and Wildlife	Yes
29	State	Department of Fish and Wildlife	Yes
5	State	Department of Parks and Recreation	Yes
7	State	Department of Parks and Recreation	Yes
8	State	Department of Parks and Recreation	Yes
17	State	Department of Parks and Recreation	Yes
4	Private	Private	No
6	Private	Private	No
12	Private	Private	No
30	Private	Private	No
31	Private	Private	No

2.4 LIFE HISTORY

Vandenberg monkeyflower is an annual herb, meaning that above-ground presence of the species is relatively short-lived (less than one year), and low to none in years with unfavorable conditions (78 FR 64840-64871; ManTech SRS Technologies, Inc. 2020, pg. 5). Its life history and demography are not well studied. Certain attributes of the species life history are similar to other species within the genus and other annual forbs that occur in openings within chaparral habitats and other grassland communities. Therefore, such species serve as analogues to our understanding of this species' life history.

Vandenberg monkeyflower has four distinct stages in its life cycle that include: seed germination and vegetative growth, flowering, fruiting, and seed dormancy. As with other annual species, the length and timing of each stage is dependent on habitat suitability and abiotic factors, such as temperature and amount and timing of annual precipitation (ManTech SRS Technologies, Inc. 2020, pg. 5; SBBG 2020, pg. 3; Levine et al. 2008, pg. 805). Other biotic factors, like percent cover of non-native, invasive grasses, can affect the species during any of the life cycle stages (ManTech SRS Technologies, Inc. 2020, pg. 27). Many ephemeral annuals, including Vandenberg monkeyflower, are adapted to a Mediterranean climate regime characterized by mild, wet winters and hot, dry summers (Keeley and Davis 2007, pg. 340). Its life cycle begins at the onset of seed germination and is completed when viable seed has formed and is dispersed from the parent plant into the surrounding environment. Transitions from one stage of the life cycle to the next are contingent on the success of the preceding stages and other environmental variables.

2.4.1 SEED GERMINATION AND VEGETATIVE GROWTH

Seed dormancy is broken at germination, and this is the first stage in the Vandenberg monkeyflower life cycle. The specific mechanisms required for seed germination in the species are unknown, especially its response to fire, which has not been studied. We presume that Vandenberg monkeyflower seeds are non-refractory (fire-resistant) because they demonstrate site fidelity in unburned stands and appear in the same, open locations year after year, like other annuals that occur in chaparral habitats and germinate in the absence of fire-related cues. Non-refractory seeds typically germinate relatively soon after dispersal, rely on mesic conditions to break dormancy, and are opportunistic because population expansion often depends on wind or animal dispersal and suitability of other habitat and environmental parameters (Keeley 1991, pg. 81-82, and 105).

Water availability influences seed germination of Vandenberg monkeyflower (SBBG 2020, pg. 3; ManTech SRS Technologies, Inc. 2020, pg. 26). Like other California annuals, germination depends on adequate winter rainfall and typically occurs between the months of November and February, corresponding to the wet season (Thompson 2005, pg. 23). Seed wetting that cues germination typically occurs during the first major storm event of the wet season. On the Channel Islands, located approximately 70 kilometers (km)/44 miles (mi) south of Vandenberg Village, the timing of the first major storm event varied greatly over the last 20 years and ranged from mid-September to late February (Levine et al. 2011, pg. 2237). The timing of the first storms essentially determines the length of the growing season for many Californian annual

species. It also influences the timing of demographic transitions, which ultimately affects the species' overall viability (Levine et al. 2011, pg. 2236). In many California annuals, 2.5 cm (0.98 in) of rain is an amount that is required to trigger germination (Levine et al. 2008, pg. 798; Levine et al. 2011, pg. 2237).

Other environmental conditions associated with the first major rainfall event, like temperature and the timing of these and other precipitation events play an important role in the viability and variation in annual species. SBBG found a positive correlation between annual rainfall specifically during the months of March and April and Vandenberg monkeyflower abundance (SBBG 2020, pg. 6-7; SBBG 2025, pg. 2, 5, and 8–9). They also found a negative correlation between increased temperatures during the months of March through April and abundance (SBBG 2020, pg. 6-7). However, ongoing studies showed that these correlations may be weaker than previously assumed (SBBG 2025, pg. 3 and 10). Three native, rare, and endangered annual species on the Channel Islands had the greatest abundance in years with cold, average low temperatures at the first rainfall events (Levine et al. 2008, pg. 804). In a subsequent study on the same species, two of the three plants showed increased germination in colder temperatures at first rains. The timing of the first major storm event was the most important determinant for germination in the third species (Levine et al. 2011, pg. 2236). These same three annuals had low abundance during drought, which supports water limitation as a mechanism for germination. Overall, they were relatively insensitive to the amount of total annual rainfall, in the absence of drought (Levine et al. 2008, pg. 795-797, 803-804). This body of work suggests that cues for demographic transitions, such as germination, depend on multiple climatic factors and may be species-specific (Levine et al. 2011, pg. 2236).

The seedling structures (root, shoot, and first leaves) begin to develop from the embryo as germination continues. We do not know if Vandenberg monkeyflower seeds require stratification to germinate, just that rainfall and temperature regimes must generally be suitable for the species to complete this stage in the life cycle and achieve adequate vegetative growth, preceding the flowering stage.

Once the seedling is more developed and the above ground structures have matured enough to begin photosynthesis, the vegetative growth period begins. The specific amount of time between germination and vegetative growth is unknown. However, given Vandenberg monkeyflower's relatively small size (one to 20 cm; 0.4 and 7.9 in tall) and annual nature, this phase of the life cycle is likely brief because most of the annual plants in the genus undergo little vegetative growth before flowering (Thompson 2005, pg. 23; Fraga 2018, website).

For Vandenberg monkeyflower, total amount of annual precipitation, timing of first major rainfall event, timing and amount of subsequent precipitation events, and temperatures at that event and over the growing season, are all likely important factors that affect not only germination and vegetative growth, but all demographic transitions in the life cycle. We know that precipitation and temperature factors are important to the species. Moreover, there is a significant positive relationship between abundance and March and April precipitation and a negative relationship with March and April temperatures (SBBG 2020, pg. 3; SBBG 2025, 5 and 8–9).

2.4.2 FLOWERING

The species typically flowers May through June, after a period of vegetative growth (Fraga 2018, website). If more than one flower is produced, the lower flowers open first in the raceme. However, flowering is affected (like all stages in the life cycle) by the climatic factors previously discussed above. Plants may flower slightly sooner or later, depending on these factors and the microclimates of the different localized habitats where they are occurring. Anecdotal observations have shown that plants closer to the coast may flower slightly later, whereas plants located in the eastern portion of the range may flower somewhat sooner. Additional observations at two separate locations corroborate this phenological pattern where the more coastal site flowered earlier than the more inland location (SBBG 2025, pg. 5–6 and 10). Early first rain events and drought conditions may suppress or arrest flowering, preventing plants from completing the life cycle (Levine et al. 2011, pg. 2245). Alternatively, late rains and relatively cool temperatures can prolong flowering and the subsequent fruiting stage (Thompson 2005, pg. 23).

Species in the genus *Diplacus* (including Vandenberg monkeyflower) are considered to have chasmogamous flowers, which means showy, generally open before fertilization, and typically cross-pollinated (Tulig and Nesom 2021, website; Harris and Harris 2001, pg. 24). However, the reproductive biology in Vandenberg monkeyflower is unstudied. The large flower size, relative to the rest of the plant, suggests insect pollination and sexual reproduction in the species because a substantial amount of metabolic resources are allocated to attract pollinators with its large, showy flowers. Similarly, production of viable seed is assumed to be dependent on pollinators (78 FR 64840-64871). Annual *Diplacus* spp. are thought to be capable of both self-fertilization and cross-fertilization. This is primarily because the pollen matures at the same time as the stigma (Thompson 2005, pg. 12). However, reproduction by self-fertilization in the genus is likely rare (Thompson 2005, pg. 12; Beeks 1962, pg. 90). Sutherland and Vickery (1988) showed resource allocation to sexual reproduction across six species in the genus *Mimulus* (now *Erythranthe*). This supports the idea of a tradeoff favoring the cross-fertilization mechanism of reproduction in Phrymaceae (Sutherland and Vickery 1988, pg. 330 and 334). It is likely that reproduction in Vandenberg monkeyflower occurs predominantly through cross-fertilization using insect pollinators. However, self-pollination rates in Vandenberg monkeyflower may be influenced by resource availability, such as insect pollinators (Fraga 2021, pers comm). Therefore, we need more information about the species' reproductive biology to better understand its distinct mechanisms.

Diplacus is mainly composed of bee-pollinated species; but also includes several species that are pollinated by hummingbirds (such as Anna's hummingbird [*Calypte anna*], Allen's hummingbird [*Selasphorus sasin*], and Calliope hummingbird [*S. calliope*]), hawk/sphinx moths (Sphingidae), beeflies (Bombyliidae), and other flies (order Diptera; Wu et al. 2008, pg. 224). Several bees were observed visiting Vandenberg monkeyflower, including species of sweat bee (Halictidae), miner bee (Andrenidae), mason bee (Megachilidae), and leaf-cutter bee (also Megachilidae; 78 FR 64840-64871). Since listing, SBBG collected insect data from two sites occupied by Vandenberg monkeyflower (CNDDB Occurrences No. 4 and 6) to get a general sense of the insect diversity at these sites. Both sites had high insect diversity, including several species of bees and flies that are generally considered effective pollinators. Bee species observed

onsite included: miner bee (*Perdita* sp.), digger bee (*Anthophora* sp.), European honeybee (*Apis mellifera*), bumble bee (*Bombus vosnesenskii*), carpenter bee (*Ceratina acantha* and *C. arizonensis*), masked bee (*Hylaeus* sp.), green sweat bee (*Agapostemon texanus*), sweat bee (*Lasioglossum* spp.), cotton bee (*Anthidium* spp.), hairy belly bee (*Ashmeadiella* sp.), mason bee (*Hoplitis* sp. and *Osmia* spp.), leaf-cutting bee (*Megachile* spp.), and evening bee (*Hesperapis* sp.). Fly species in the Acroceridae, Bombyliidae, and Syrphidae were also observed at these sites and are considered effective pollinators in general. A single floral visitor (meaning not definitively confirmed as a pollinator), a carpenter bee, was the only insect observed using Vandenberg monkeyflower during these survey efforts (SBBG 2021, pers comm).

2.4.3 FRUITING

Vandenberg monkeyflower fruits likely begin to develop shortly after fertilization occurs. The total amount of time required for the fruits to mature is unknown. Fruits in other members of the genus with broader ranges typically form by late April (at the earliest) through July (Thompson 2005, pg. 130). Like other stages in the Vandenberg monkeyflower life cycle, fruiting is affected by local climatic conditions such as temperature, and the timing and amount of annual rainfall, and depends on the outcomes of the preceding life stages. Unfavorable or harsh conditions may arrest fruit development and affect seed viability.

Each fruit is a capsule that has two chambers (or locules) and each chamber contains many small, seeds. The fruits are wider at the base and gradually taper to a rounded tip (apex) towards the top. Vandenberg monkeyflower fruits open when the seeds are ripe along two vertical seams (known as loculicidal dehiscence) that end at the upper to mid-portion of the fruit (Thompson 2005, pg. 12, 18, and 130-131).

We assume that the most basic mechanism of dispersal is gravity, where the fruits open at the apex and the ripe seeds drop out, within close proximity to the parent plant. If wildlife (such as mammals or large insects) bump or brush up against the ripe fruits, this can also disperse the seeds over relatively short distances. However, Vandenberg monkeyflower seeds do not have any special adaptations to attach to fir or other parts of animals to increase dispersal distances in this manner. Gale-force winds are common throughout the species range that function to create and maintain suitable canopy openings for the species within the otherwise dense, chaparral habitat. Such winds also act to disperse Vandenberg monkeyflower seeds over greater distances. This mechanism of dispersal is crucial for establishing new populations in previously unoccupied canopy openings and for gene flow between populations (80 FR 48142-48170). Strong north/north-westerly winds that prevail in all seasons on the Burton Mesa, cannot only shake the seeds out of the fruits, but can also transport them after falling from the parent plant (with sand) into open areas like canopy breaks and blow-outs. Aeolian (wind-driven) processes are critical for both the maintenance of habitat heterogeneity within the chaparral and for longer-distance dispersal of the species. Water is another possible dispersal agent for Vandenberg monkeyflower seeds after they are released from the fruits. The seeds may be transported by surface flows from rain events into other areas and through ephemeral drainages and other shallow, erosional features (Thompson 2005, pg. 18; Ferren et al. 1984, pg. 4).

2.4.4 SEED DORMANCY

Vandenberg monkeyflower enters the final, dormant stage in the life cycle after seed dispersal. We do not know how long the seeds remain viable and dormancy will persist until environmental conditions signal seeds to germinate. Dormant seeds will eventually die if germination does not occur. Considerable differences in the numbers and locations of plants observed annually at several occupied sites suggest that seeds can persist for an extended time as a seed bank, even through multiple dry years (ManTech SRS Technologies, Inc. 2020, pg. 5). Experiments conducted on seed dormancy in other *Diplacus* spp. (species treated in Thompson 2005, subg. *Schizoplacus*) suggest that the seeds are long-lived. Seed collected more than 10 years prior to sowing had similar germination percentages to that of freshly collected seed (Thompson 2005, pg. 18). Other annual *Diplacus* spp. can be present in low numbers for several years, (while failing to produce substantial amounts of new seed because of drought) and will then appear in large numbers when environmental conditions become optimal (Thompson 2005, pg. 18).

Persistence of the seed bank is critical for long-term survival of annual species like Vandenberg monkeyflower because it maintains viable seed between recruitment episodes. Depletion of the seed bank may result from loss of dormant seed viability over time or germination during unsuitable conditions, which can adversely affect the stability of populations. If the seed bank is not replenished, populations may become extirpated. Changes in the environment, such as variability in temperature and rainfall, and other stochastic events (like fire) can also affect long-term persistence of the seed bank (Ooi 2012, pg. S53-S54).

3.0 BIOLOGICAL NEEDS

This section describes the biological needs of Vandenberg monkeyflower, which are the fundamental requirements for the species to maintain itself in the wild over time (Service 2016, pg. 10). Our understanding of the species biological needs is primarily based on the physical characteristics of occupied habitat and the different stages of its life cycle discussed above. We designated critical habitat for Vandenberg monkeyflower in 2015 and assessed the species' biological needs for the designation. Approximately 2,329 hectares (5,755 acres) of Vandenberg monkeyflower critical habitat were designated on public and privately owned lands in Santa Barbara County (80 FR 48142-48170). The designation is based on the physical or biological features (PBF) that are deemed essential to conservation of the species at the time of listing, which may require special management considerations or protections.

The PBFs identified for Vandenberg monkeyflower critical habitat include, but are not limited to:

1. Canopy openings (or gaps) within Burton Mesa maritime chaparral habitat that provide space needed for individual and population growth, including sites for seed germination, reproduction, seed dispersal, seed banks, and pollination;
2. Loose sandy soils derived from the Burton Mesa Dune Sheet that occur within the canopy openings found throughout Burton Mesa maritime chaparral vegetation; and

3. Contiguous maritime chaparral habitat on the Burton Mesa landform, which provides connectivity needed for seed dispersal and establishment and for intra and interpopulation pollinator movements (80 FR 48142-48170).

Two primary constituent elements (PCEs) for Vandenberg monkeyflower were also recognized (80 FR 48142-48170). PCEs are other, specific attributes of the physical or biological features that provide for a species' life-history processes and that are also considered essential to conservation of the species.

These PCEs identified for the species critical habitat include:

1. Native maritime chaparral communities of the Burton Mesa; and
2. Loose sandy soils on the Burton Mesa (80 FR 48142-48170).

The PBFs and the PCEs outlined for the species critical habitat have several similarities and do overlap. In combination, the PBFs and PCEs provide an effective description of the species habitat requirements.

3.1 ADDITIONAL BIOLOGICAL REQUIREMENTS

Recent observations, reports, and other data have increased our understanding of Vandenberg monkeyflower's biological needs. However, we do not currently have sufficient demographic data to accurately quantify them. Along with the Vandenberg monkeyflower critical habitat PBFs and PCEs described above, the species also needs the following:

1. Adequate annual precipitation;
2. Appropriately timed first seasonal rains;
3. Suitable temperature regimes; and
4. Insect pollinators.

3.2 INDIVIDUAL NEEDS

Biological needs at this scale equate to the basic habitat requirements and ideal ecological setting for individual Vandenberg monkeyflower plants to successfully complete all stages of the life cycle. We identified six primary individual needs for the species from Sections 3.1 and 3.2 above. Habitat quality and quantity are incorporated into the species individual needs and these parameters ultimately determine how well individuals can survive and whether they reproduce (Smith et al. 2018, p. 306). Additional information about each of Vandenberg monkeyflower's biological needs at the individual scale is provided below and how each need relates to the species life cycle is summarized in Table 2.

Table 2. Vandenberg monkeyflower (*Diplacus vandenbergensis*) individual needs by life cycle stage.

	Life Cycle Stage			
Individual Need	**Germination and Vegetative Growth**	**Flowering**	**Fruiting**	**Seed Dormancy**
Canopy openings in Burton Mesa maritime chaparral habitat	X	X	X	
Loose sandy soils derived from the Burton Mesa Dune Sheet	X	X	X	X
Adequate annual precipitation	X			
Appropriately timed first seasonal rains	X			
Suitable temperature regimes	X			
Insect pollinators			X	

3.2.1 Canopy Openings in Burton Mesa Maritime Chaparral Habitat

Vandenberg monkeyflower individuals require canopy openings (or gaps) within Burton Mesa maritime chaparral habitat for at least three of the four stages of the life cycle. Suitable gaps must also have low vegetative cover. Dormant seeds need sufficient open space for germination, and these openings are also necessary to support the subsequent life cycle stages including vegetative growth, flowering, and fruiting/seed production (Christensen and Muller 1975, pg. 50). Seeds of other annual species were found to concentrate in gap areas and openings within Burton Mesa maritime chaparral habitat, and this is likely true for Vandenberg monkeyflower (Davis et al. 1989, pg. 53 and 64). Canopy openings provide important microclimates, are known to have lower herbivory, and likely play an essential role in dispersal of the species (Davis and Mooney 1985, pg. 527 and Christensen and Muller 1975, pg. 46, 50, and 54). Seed banks of Vandenberg monkeyflower may be able to remain viable for extended periods of time outside of canopy openings, until the gaps reopen, and environmental conditions become suitable for germination. But this aspect of the species demography is unstudied.

3.2.2 Loose Sandy Soils Derived from the Burton Mesa Dune Sheet

Vandenberg monkeyflower individuals also require loose, sandy soils derived from the Burton Mesa Dune Sheet. These soil types resulted from layers of wind-blown sand that accumulated during several different depositional events that ranged over geologic time. Like Burton Mesa maritime chaparral habitat, Vandenberg monkeyflower is edaphically tied to this substrate. Loose, sandy soils are required for individual seeds to germinate, vegetative growth, flowering, and fruit production.

3.2.3 Adequate Annual Precipitation

Ultimately, seed germination and vegetative growth in Vandenberg monkeyflower individuals are dependent on adequate annual precipitation (see Section 2.5.1). Within Mediterranean climates, like Santa Barbara County, most of the total annual rainfall occurs during the winter months of approximately October to April. Adequate annual precipitation is required to break seed dormancy and for the vegetative growth stages of the life cycle. Disruption of seed dormancy is likely triggered by seed wetting and largely dependent on adequate moisture. Newly sprouted seedlings also need sufficient rainfall to grow. Again, the specific mechanisms required to break seed dormancy in the species have not been studied. Therefore, the amount of annual rainfall individuals require cannot yet be quantified.

3.2.4 Appropriately Timed First Seasonal Rains

In addition to adequate annual precipitation (and suitable temperature regimes, Section 3.2.5), Vandenberg monkeyflower individuals need appropriately timed first seasonal rains because the timing of these events basically determines the end of seed dormancy and length of the growing season. The timing of the first rainfall events inadvertently affects all subsequent stages of the annual life cycle (Section 2.5.1). Hypothetically, early first rainfall events extend the length of the growing season. But if total rainfall is early and inadequate, individuals may be at higher risk of drought and succumb to mortality before completing their annual life cycle. Alternatively, late onset first seasonal rains would shorten the length of the growing season, which provides less time for vegetative growth and reproduction and could make individuals more vulnerable to mortality associated with warmer temperatures and drier conditions. The specific environmental cues and other demographic factors that regulate life cycle transitions in Vandenberg monkeyflower have not been studied, so the requirements for them to complete their life cycle cannot yet be accurately quantified. In general, the timing of the first seasonal rains must be appropriate for Vandenberg monkeyflower individuals to germinate, achieve vegetative growth, and progress on to the succeeding stages of the life cycle.

3.2.5 Suitable Temperature Regimes

Like moisture conditions and timing of the first major rainfall events, temperature regimes must also be conducive for Vandenberg monkeyflower seed germination and vegetative growth (see Section 2.5.1). If temperatures are too extreme (either hot or cold), germination and vegetative growth may not occur or be disrupted, and other important demographic transitions may not occur. Early leaf and stem tissues are vulnerable to temperature extremes and likely cannot tolerate consistent hot or cold conditions. Above average temperatures increase evaporative loss and can lead to desiccation. Extensive withering from heat can result in necrosis and eventually kill individuals. Similarly, excessively cold temperature exposure can also cause wilting, chlorosis, necrosis, and mortality of individuals (Ruelland and Zackowski 2010, pg. 225). Temperature regimes must be suitable for Vandenberg monkeyflower seed germination and vegetative growth. Individuals cannot transition on to subsequent stages of the life cycle or complete it without suitable temperature regimes.

3.2.6 INSECT POLLINATORS

Although the reproductive biology of Vandenberg monkeyflower has not been well studied, we presume that insect pollinators are needed for individuals to successfully reproduce in the wild (refer to Section 2.5.2). This is primarily because of the large flower size, relative to the rest of the plant, suggests insect pollination and sexual reproduction in the species, along with other data in Phrymaceae supporting cross-fertilization. Other mechanisms of reproduction are unlikely because Vandenberg monkeyflower individuals are allocating substantial metabolic resources to attract pollinators via their large, showy flowers. Therefore, insect pollinators are considered a requirement for the fruiting stage of the life cycle, including viable seed development.

3.3 POPULATION SCALE

At this scale, a population is defined as a group, or groups, of individuals that have the capability to interbreed though exchange of pollen and are geographically similar; meaning that the physical and environmental effects that may influence the group, or groups, of individuals are similar within a population, but different between populations. Generally speaking, populations need abundant individuals within habitat patches of adequate area and quality to maintain survival and reproduction, regardless of stochastic disturbance and other environmental variation (Service 2016, p. 12).

Vandenberg monkeyflower populations must be able to maintain adequate abundance within a sufficient area to be self-sustaining in the wild. Resilient populations of the species include an adequate soil seed bank to not only survive dormancy during unfavorable conditions, but also to sustain the population in years where seed production is low. Annual species are notorious for boom-and-bust years, which is why an adequate soil seed bank is so important for maintaining populations over time. Soil seed bank longevity and/or persistence has not been studied in Vandenberg monkeyflower and little information on this subject is available for the genus.

Resilient populations of the species also need Burton Mesa maritime chaparral habitat distributed in contiguous stands that support sufficient survival, reproduction, and abundance. Contiguous stands of this specific suitable habitat type are necessary for seed dispersal and establishment, as well as pollinator movements between populations.

We identified one primary population need for the species from Sections 3.1 and 3.2 above.

3.3.1 CONTIGUOUS STANDS OF BURTON MESA MARITIME CHAPARRAL HABITAT

Vandenberg monkeyflower is edaphically restricted to the Burton Mesa maritime chaparral vegetation community type and populations are unlikely to persist within habitat types other than this specific vegetative stand. It is assigned to *Arctostaphylos* (*purissima*, *rudis*) Shrubland Special Stands/Burton Mesa Chaparral in the second edition of the Manual of California Vegetation. The vegetation community type is called a special stand, (as opposed to an alliance) in the treatment because the type itself is rare; meaning there are less than 10 stands across the landscape and that it supports many other rare and endemic species (Sawyer et al. 2009, pg. 45, 48, 376). The Burton Mesa landform supports a variety of vegetation community types including

Burton Mesa maritime chaparral, annual grassland, coastal scrub, oak woodland, and Bishop pine forest. These habitat types intergrade and overlap depending on where they occur and their distribution on the landform, when they last burned, the current land uses, and historical land use patterns. Stands of Burton Mesa maritime chaparral occur within a broader mosaic of these other successional habitat types, whereas woodlands and forests are considered the climax communities within the system. Therefore, populations require contiguous stands of Burton Mesa maritime chaparral habitat and by extension, these other associated plant communities. When these vegetation communities are combined, they collectively form a larger, dynamic, and integrated ecosystem that serves many successional and ecological functions, providing connectivity between populations needed for seed dispersal and intra and interpopulation pollinator movements.

3.4 SPECIES SCALE

The species needs (1) resilient populations, (2) sufficient redundancy to be able to withstand catastrophic events such that single or multiple catastrophic events are less likely to cause the species to go extinct and the populations can more easily re-establish if affected, and (3) representation within and among populations to be able to adapt to novel changes in its environment. Adequate representation includes the breadth of genetic and ecological diversity within the species so that it can adapt to both near-term and future changes in its environment.

4.0 THREATS

When the species was listed in 2014, the primary threats to Vandenberg monkeyflower identified were: habitat loss from development (including military, state, and residential); utility and pipeline maintenance, presence and expansion of invasive, non-native species; anthropogenic fire; recreation and other human activities; and climate change (79 FR 50844-50854). Each of the threats identified in 2014 are assessed below.

4.1 DEVELOPMENT

At time of listing, we found that most of the historical loss of Burton Mesa maritime chaparral habitat where Vandenberg monkeyflower occurs was due to military activities (at VSFB), building of residential communities (Vandenberg Village, Mission Hills, and Mesa Oaks), development of infrastructure at LPM-SHP, and other commercial growth that occurred in the past and resulted in many urbanized areas that have now existed for decades. Prior to 1938, there were approximately 9,350 hectares (23,550 acres) of Burton Mesa maritime chaparral (Hickson 1987, pg. 34). In 2012, approximately 4,070 hectares (10,057 acres) of Burton Mesa chaparral remained, which represents a loss of 53 percent (79 FR 50844-50854). Based on the habitat characteristics of Burton Mesa maritime chaparral, it is probable that an equivalent percent loss of sandy openings that occur in-between shrubs may have occurred over this timeframe. For the purposes of this analysis, we regard Burton Mesa maritime chaparral and the sandy openings that support the species as one in the same.

The majority of remaining Burton Mesa maritime chaparral habitat where Vandenberg monkeyflower occurs is within Federal or state-owned lands and is predominantly protected

from future development (Figure 5). Therefore, anticipated, large-scale development of remaining Burton Mesa maritime chaparral is not likely to occur and thus is not considered a significant threat to Vandenberg monkeyflower. However, smaller-scale development on private property, acquisition and access to easements, and development and maintenance of infrastructure such as roads, utility, oil, and gas pipelines may continue to take place throughout Burton Mesa. Some of these activities may occur within Burton Mesa maritime chaparral habitat or in other areas adjacent to occurrences of Vandenberg monkeyflower, resulting in the destruction and possible removal of the species habitat and creating pathways and open areas for non-native plants to invade. Therefore, the direct destruction and alteration of Burton Mesa maritime chaparral habitat due to development is likely to continue, but on a relatively small scale and is considered a threat to Vandenberg monkeyflower both currently and in the future.

At VSFB, the Service consulted on several projects determined likely to adversely affect Vandenberg monkeyflower and/or Burton Mesa maritime chaparral habitat. Impacts from most of these projects were relatively small. The consultations addressed activities for installation of fire breaks, vegetation management for fire prevention (such as controlled burns and manual removal), access roads and infrastructure for maintenance of existing facilities, and emergency fire responses. Newer consultations for development projects on VSFB that are underway and/or anticipated in the next several years include: facilities and infrastructure for new launch pads; road maintenance and improvements (such as parking lots); utilities installation, maintenance, and removal (water and gas pipelines, communications lines and access points, and stormwater lines); vegetation management and maintenance for fire prevention, fencing, and erosion control and bank stabilization. General mission operations at VSFB, associated with past developments, may also result in inadvertent adverse effects to the species in the future from activities such as security and antiterrorism and other unanticipated events, such as wildfire and other natural disaster responses.

We are not aware of any development projects that have occurred since the 2014 listing rule, at Burton Mesa Ecological Reserve (BMER) or LPM-SHP that resulted in adverse effects to Vandenberg monkeyflower or its habitat. Nor do we expect any major development projects at either location in the immediate future. The only activities anticipated at either site that may result in impacts to the species and/or its habitat include routine maintenance of existing infrastructure and facilities, vegetation management for fire prevention and erosion control, and other inadvertent impacts in the event of an emergency, such as a wildfire or other natural disaster. At BMER, constant maintenance of utilities including overhead and underground power and pipelines and roads persists as a significant threat to the species. CDFW strives to uphold the pursuant regulations and standards associated with these activities and requires that utility companies use best management practices to avoid and minimize adverse effects to Vandenberg monkeyflower and its habitat (Brody 2021, pers comm).

4.1.1 Utility and Pipeline Maintenance

Utility and pipeline maintenance was identified as a primary threat to Vandenberg monkeyflower in the 2014 listing rule because these structures and the related infrastructure (such as roads and access points), occur within and span the BMER. Most of these structures, infrastructure and pipelines, and the associated maintenance activities support ongoing operations of the Lompoc

Oil Field, which is located immediately north and northeast of the Reserve boundaries. Other facilities and infrastructure that occur within BMER are owned and maintained by local public works and utilities agencies. We include utility and pipeline maintenance here because it is an ancillary form of development; most of which has occurred in the past to support other, larger development projects like residential communities.

Again, many of the access routes, pipelines, and other facilities within BMER service the Lompoc Oil Field Oil and Gas Processing Facility that is currently owned by Freeport McMoRan Oil and Gas, LLC and is immediately adjacent to the northern and northeastern Reserve boundaries. Additionally, local land use agencies and public works agencies retain other utilities and pipelines, and easements to BMER for access to maintain their facilities. For example, the Vandenberg Village Community Services District has several structures and infrastructure (including water tanks, a water processing plant, wells, and water and sewer lines) located within BMER (Gevirtz et al. 2007, p. 63). These existing facilities or structures require routine maintenance to ensure proper operation. As a result, vehicles and foot traffic could occur at or adjacent to these structures and potentially result in trampling of habitat and other soil surface disturbance, which in turn could result in ground disturbance that removes Burton Mesa maritime chaparral habitat and creates open areas in the vegetation that act as pathways for non-native, invasive plants to expand or invade. There is no indication that ongoing maintenance activities of existing pipelines and utilities have directly impacted Vandenberg monkeyflower habitat. However, utility maintenance actions could result in ground disturbance that removes Burton Mesa maritime chaparral, creating open areas in the vegetation that act as pathways for non-native plants to invade.

4.2 INVASIVE SPECIES

At time of listing, we found that invasive, non-native plants occur and were expanding throughout Burton Mesa. At the time, at least one of the four most problematic invasive species including veldt grass, iceplant (*Carpobrotus* spp.), Saharan mustard (*Brassica tournefortii*), and pampas/jubata grass (*Cortaderia* spp.) occurred within or adjacent to suitable habitat at each of the nine extant occurrences of Vandenberg monkeyflower and at one potentially extirpated location. Invasive, non-native plants reduce the amount and quality of habitat for Vandenberg monkeyflower by outcompeting Burton Mesa maritime chaparral vegetation and decreasing the amount and availability of the sandy openings where Vandenberg monkeyflower grows. Native shrub recruitment and growth of native annuals (including Vandenberg monkeyflower) into open areas are substantially decreased where these invasive, non-native plants become established. Thus, it is likely that invasive, non-native plants will become more dominant where they already occur and will continue to expand to new areas due to the human activities on Burton Mesa, the competitive fitness of these invasive plants, the direction of the prevailing wind, and the potential for small- and large-scale disturbances, all of which could create open areas that promote invasive, non-native species invasion and expansion.

This expanding trend of invasives has continued; all the occurrences being monitored recently have widespread infestations of veldt grass (ManTech SRS Technologies, Inc. 2020, pg. 27; Matthews 2021, pers comm; SBBG 2020, pg. 9). Because veldt grass will outcompete native vegetation (including overcrowding the sandy openings where Vandenberg monkeyflower

grows) and it is difficult to eradicate once it is established, the presence and expansion of veldt grass within known occurrences of Vandenberg monkeyflower is a continuous threat because it reduces the amount and quality of this species' habitat. Three other invasive, non-native species (iceplant, Sahara mustard, and pampas grass) currently have substantial impacts to Vandenberg monkeyflower and its habitat. These species, along with numerous other non-native plant species, are present throughout Burton Mesa and at all extant occurrences of Vandenberg monkeyflower. Nevertheless, no invasive plant is as prevalent and represents as much of a threat to Vandenberg monkeyflower habitat as veldt grass.

At VSFB, habitat modification from both veldt grass and Saharan mustard has potential to reduce habitat quality and extirpate occupied Vandenberg monkeyflower locations on base (ManTech SRS Technologies, Inc. 2024, pg. 3). Study results found a negative relationship between veldt grass cover and presence of Vandenberg monkeyflower (ManTech SRS Technologies, Inc. 2024, pg. 21). Study results obtained from SBBG suggest that complete removal of veldt grass provides measurable benefits to the species, both by reducing competition and supporting greater native plant species richness (SBBG 2025, pg. 10). We provide information about conservation actions that combat nonnative, invasive plants in Section 5.2.

4.3 ANTHROPOGENIC FIRE

We do not know how fire affects Vandenberg monkeyflower; just that it evolved in a fire-adapted, chaparral habitat. Given that Vandenberg monkeyflower seeds are non-refractory, fire likely plays a role in structuring and maintaining its habitat. The average natural fire regime in chaparral and coastal sage scrub communities in California is 50 years (U.S. Department of Agriculture [USDA] 2021, website). Anything more than this is attributed to anthropogenic causes including human-mediated climate change, fire suppression, accidental ignitions (such as vehicles, downed power lines), and encroachment and expansion of the wildland/urban interface. These can be stand-replacing crown fires that kill all above-ground biomass with the number of fires peaking in the summer and most of the total area burned in the fall. Large fires, such as these in coastal Santa Barbara County are often coincident with Santa Ana and sundowner winds, which are northerly offshore winds that result from high atmospheric pressure off the southern Pacific slope of Santa Ynez Mountains accelerated by local and regional topography (Keeley and Fotheringham 2001, pg. 1537, 1540, and 1542). The effects of fire on Vandenberg monkeyflower, its habitat, and its ecological functions need more evaluation.

Because of the human presence, development, and other infrastructure on Burton Mesa, the frequency of anthropogenic (human-caused) wildfires is likely greater than the frequency of historical fires on the landform. An increased fire frequency in Burton Mesa maritime chaparral would tend to favor the establishment of non-native vegetation in open areas at the expense of native vegetation. Additionally, because the presence of invasive, non-native plants creates a positive feedback mechanism, the greater the percent cover of non-native vegetation, the more likely fires will occur on Burton Mesa (Brooks et al 2004, entire; Keeley 2001, entire). Therefore, the primary threat to Vandenberg monkeyflower and its habitat from fire is likely the post-fire expansion of invasive, non-native plants (especially grasses), regardless of the fire frequency.

As mentioned previously in Section 4.1.1, VSFB has consulted with the Service several times since the 2014 listing rule on fire-related activities including: installation of fire breaks, vegetation management for fire prevention (such as controlled burns and manual vegetation removal), and emergency fire responses. We expect these activities to continue and increase into the future because consultations are currently underway for new vegetation management and maintenance programs aimed at fire prevention. Extensive fuels modifications and installation of several breaks have occurred at BMER since the 2014 listing rule and these activities are also expected to continue and increase into the foreseeable future at this site (Brody 2021, pers comm). We do not know what fire-related activities have occurred since the listing rule, or if any are proposed at LPM-SHP. Regardless, we anticipate threats to Vandenberg monkeyflower from anthropogenic fire to increase because California experienced a fivefold increase in annual total burned area between 1972 and 2018, and these trends are consistent with anthropogenic trends simulated by climate models (Williams et al. 2019, pg. 892).

4.4 Recreation and Other Human Activities

At time of listing, authorized recreational activities throughout Burton Mesa included hunting, hiking, biking, wildlife observation, and leashed-dog walking. Off-highway vehicle (OHV) use was permitted in some areas on VSFB, but not within the species range. This activity was not allowed on BMER or LPM-SHP (78 FR 64840-64871). OHV use and other casual recreational activities may contribute to soil disturbance and increase the potential for invasive, non-native plants to be introduced and further spread across Burton Mesa, including into locations where Vandenberg monkeyflower and its habitat occur. At time of listing, the best available information did not indicate that recreational activities posed a substantial direct threat to Vandenberg monkeyflower or its habitat, although these activities could indirectly affect them by contributing to the spread of invasive, non-native plants within the habitat, reducing the quality.

We are not currently aware of any new or expanded recreational land uses on Burton Mesa since time of listing. Outdoor recreation activities, such as hunting and fishing are still allowed in all the areas occupied by the species at VSFB. OHV is not permitted in areas occupied by the species (United States Air Force 2015, pg. 4). Recreational use within portions of the species range on VSFB is light and limited to personnel with base access only (Lum 2021, pers comm). Burton Mesa maritime chaparral habitat areas that support the species are bisected by several roads and trails. However, we need more information to understand how intensively these trails, roads, and open habitat stands are used for recreation. Recreational land uses do occur at both BMER and LPM-SHP and the authorized uses have not changed since the time of listing. Hiking is allowed at BMER. Mountain biking and OHV are not permitted at this site. Hiking and horseback riding are allowed at LPM-SHP and OHV is not. Hikers and horses could trample plants and introduce and spread non-native, invasive weeds. Unauthorized mountain biking is reported at BMER, which is considered detrimental to the habitats onsite by the land use managers. Mountain bikers may crush Vandenberg monkeyflower, disturb its habitat, and increase the introduction and spread of non-native, invasive plants. Some enforcement efforts occur at BMER, but have had varied success (Brody 2021, pers comm). We do not have any additional information on the intensiveness of the authorized recreational activities at LPM-SHP. For these reasons, we still consider recreation a minor threat to the species and its habitat and this threat is expected to persist into the foreseeable future.

4.5 CLIMATE CHANGE

At time of listing, climate change was identified as a primary threat to Vandenberg monkeyflower and its habitat, with potential impacts from factors such as increased temperatures and decreased precipitation that would likely reduce suitable habitat. Since the time of listing, our understanding of the potential effects of future climate change has improved. Climate change effects are likely to influence the species phenology and timing of life history transitions. Temperatures along the Central Coast Region of California are expected to increase (Langridge 2018, pg. 13). Annual average and maximum temperatures for Santa Barbara County from 2014 through 2020 were the highest recorded since 1895 (National Oceanic and Atmospheric Administration [NOAA] National Centers for Environmental Information 2021, website). Rainfall for the County does not show such distinct trends. Except for 2017 and 2019 rainfall years, annual precipitation from 2014 through 2020 has been well below the 1901 to 2000 County mean of 47.85 cm (18.84 in), with 2013 and 2015 being two of the five driest years recorded since 1895. In 2013, only 10.0 cm (3.94 in) of rain fell throughout the County all year, which is the driest year ever recorded for Santa Barbara (NOAA 2021, website). In general, increased temperatures and decreased precipitation could negatively affect Vandenberg monkeyflower survival and reproduction and its habitat.

4.5.1 INCREASE IN TEMPERATURE

Overall, annual average maximum temperatures are expected to increase across the California Central Coast Region under different climate change scenarios. In Santa Barbara County this metric is predicted to change between 2.7 and 4.1 degrees Celsius (ºC) or 4.8 to 7.4 degrees Fahrenheit (ºF) from the historical monitoring period, over the next 50 years. (Langridge 2018, pg. 13). There are also expected to be changes in temperature extremes associated with future climate change. The number of extremely hot days during the months of April through October is also expected to increase compared to the historical monitoring period over the next 50 years. In Santa Barbara County between 17 and 33 extremely hot days are expected, compared to 4.3 historically recorded (Langridge 2018, pg. 15). Depending on the relationship with changing rainfall, higher temperatures and more extremely hot days could lead to decreased soil moisture, which is likely to negatively impact Vandenberg monkeyflower seed germination and survival during the other stages of the life cycle.

4.5.2 INCREASE IN PRECIPITATION WITH DROUGHT

Precipitation is expected to increase slightly throughout the California Central Coast Region with future climate change. However, inter-annual precipitation variability is predicted to increase substantially, with wetter days during periods of precipitation, but fewer total days of precipitation overall. Annual rainfall averages are expected to increase over the next 50 years in Santa Barbara County between 3.3 and 10 cm (1.3 and 3.9 in) under different climate change scenarios. While this increase might be expected to be beneficial for plant recruitment and growth, extreme rainfall events are expected to increase, along with increased local erosion, more frequent flooding events, and drier conditions overall (Langridge 2018, pg. 6 and 16-17). In

short, a 25 to 100 percent increase in extreme dry-to wet rainfall events is expected throughout California with only moderate changes in mean precipitation (Langridge 2018, pg. 21-22).

Germination in annual *Diplacus* spp. is stimulated by winter rains and likely largely depends on water availability. Inadequate annual rainfall, increased temperatures, or combinations of these factors may result in low germination or no germination at all. If seeds do germinate during drought (for example, from an early, isolated rain event), drought conditions can increase the rate of plant development so that little vegetative growth occurs before the flowering stage (Thompson 2005, pg. 23; ManTech SRS Technologies, Inc. 2020, pg. 5). Alternatively, drought conditions may kill seedlings before they are able to flower and complete their life cycle (Levine et al. 2011, pg. 2245). Drought associated with future climate change is expected to negatively affect Vandenberg monkeyflower and its habitat (SBBG 2020, pg. 3, 6-7, and 9).

4.5.3 Non-native Annual Grasses

Future climate change is expected to cause an increase in non-native grass cover throughout California. As temperature increases and water availability decreases, the effects of non-native annual grasses are expected to also increase (Sandel and Dangremond 2019, pg. 284-287). These environmental conditions favor traits in non-native grass species, such as relatively tall stature and large leaves, which could give them a competitive advantage over native herbs, and facilitate non-native grass invasion. Increased cover of non-native annual grasses can also increase the chance of fire (Fusco et al. 2019, pg.1-4).

One of the current primary threats to Vandenberg monkeyflower and its habitat is invasive species (Section 4.2). Any increase in cover of non-native grasses associated with climate change will adversely affect the species and its habitat. Non-native invasive grasses quickly fill in the sandy, canopy openings Vandenberg monkeyflower requires, which will adversely affect survival and reproduction. Accumulated thatch from non-native grasses greatly reduces native forb performance and results in suppression and nearly complete exclusion of numerous native herb species (Molinari and D'Antonio 2020, pg. 957 and 964).

4.6 Vandenberg Monkeyflower Influence Diagram

The influence diagram for Vandenberg monkeyflower shows the factors affecting viability (Figure 6). Interactions between the species threats and its biological needs are also shown. The influence diagram does not consider management actions, which may reverse the effects of threats or eliminate them all together.

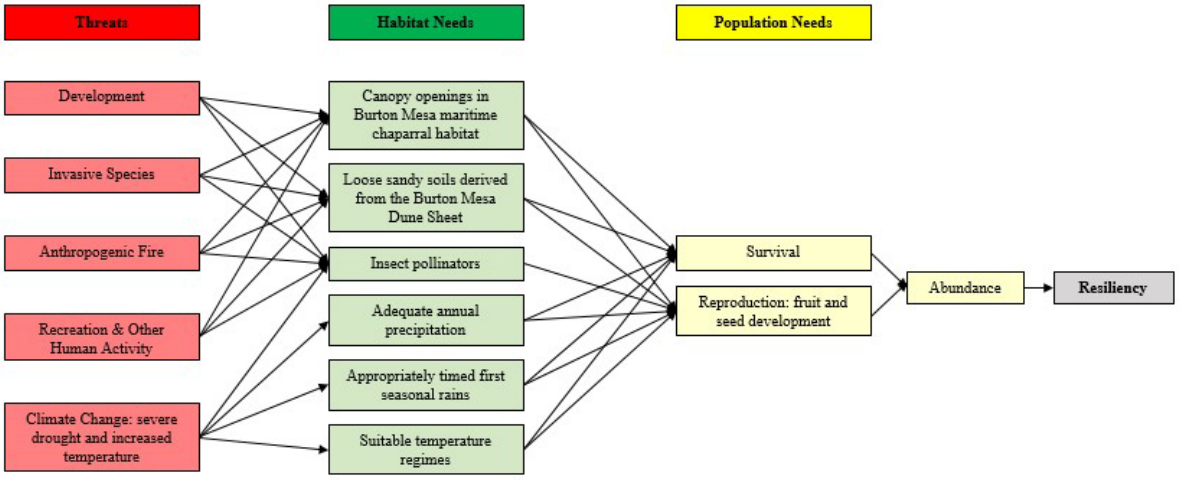

Figure 6. Influence diagram for Vandenberg monkeyflower (*Diplacus vandenbergensis*). Red boxes represent the species threats, green boxes are the habitat needs, and yellow boxes are the population needs. Black arrows represent interactions that show how the different factors influence resiliency.

5.0 CONSERVATION ACTIONS

5.1 FEDERAL AND STATE REGULATORY MECHANISMS

Section 7 of the Act ESA is titled Interagency Cooperation. It identifies the responsibilities of the Service and other federal agencies to use their authorities in furtherance of the purposes of the Act. Section 7(a)(1) requires all federal agencies to carry out programs for the conservation of listed species, and section 7(a)(2) of the Act requires federal agencies to consult with the Service to ensure that any project we fund, authorize, or carry out does not jeopardize the continued existence of federally listed species or destroy or adversely modify designated critical habitat. Section 9 of the Act prohibits the removal and reduction to possession (meaning collection) of endangered plants from federal lands and the removal, cutting, digging, damage, or destruction of endangered plants on any other area in knowing violation of state laws or regulations, or in the course of any violation of state criminal trespass laws. Federally listed plants may be incidentally protected if they co-occur with federally listed wildlife species.

The Sikes Act, 16 USC 670 et seq., as amended, requires military installations to conduct programs that provide for conservation, management, and rehabilitation of their natural resources. It also requires them to prepare an associated, primary guidance document called an Integrated Natural Resources Management Plan (INRMP), in coordination with the Service, which outlines their resource management goals, timelines, and other projects and priorities to achieve compliance with the Sikes Act and fulfill these obligations. Installations base their INRMPs on ecosystem management principles and comprehensively describe all their natural resource management endeavors. INRMPs usually account for multipurpose uses of their natural

resources, define public access, and ensure that there is no net loss in their capabilities to achieve the installations' overall military and training missions.

VSFB has an INRMP that includes provisions for Vandenberg monkeyflower, since it supports 14 of the 21 total known occurrences within the Vandenberg Population of the species (see Figure 7). VSFB strives to avoid and protect Vandenberg monkeyflower and its habitat onsite, meaning that no new development will occur in these areas unless determined to be mission critical. If projects or other activities are required in areas occupied by Vandenberg monkeyflower populations, VSFB coordinates with the Service to ensure that adverse effects to the species and its habitat are minimized and to develop suitable compensatory mitigation and restoration programs, and specific projects. Some existing infrastructure, such as roads, utilities, buildings, and fencing requires periodic maintenance. If maintenance must occur in areas occupied by Vandenberg monkeyflower, VSFB strives to employ measures and coordinates with personnel to avoid and minimize adverse effects to the species and its habitat to the extent feasible. If adverse effects from required maintenance can't be avoided, VSFB coordinates with the Service to devise a suitable compensatory mitigation plan (VSFB 2024, Tab D pp. 8–10).

Any projects that would affect Vandenberg monkeyflower are subject to the California Environmental Quality Act (CEQA) requirements because federally listed plant species automatically qualify as rare or endangered under these guidelines (California Code of Regulation, Title 14, §15380). Under CEQA, project proponents must evaluate and publicly disclose anticipated environmental impacts, including those to federally listed plants, and are required to adopt feasible alternatives and suitable compensatory mitigation measures designed to reduce all significant impacts to listed plants to less than significant levels (CDFW 2025, website).

5.2 Invasive Species Management

Since listing, several of the Vandenberg monkeyflower land managers have begun to develop and implement invasive weed management programs designed to eradicate veldt grass and assist in the species recovery. VSFB is conducting research on the use of the grass specific herbicide clethodim as a treatment for veldt grass infestations, using Fremont's monkeyflower as an analogue for Vandenberg monkeyflower. Preliminary results suggest that there are no lethal impacts to broadleaf plant species from clethodim exposure (ManTech SRS Technologies, Inc. 2024, pg. 7). VSFB has also developed a management plan for Burton Mesa maritime chaparral habitat onsite that lists several habitat restoration activities to benefit the species that they have begun implementing (ManTech SRS Technologies, Inc. 2020, pg. 28; ManTech SRS Technologies, Inc. 2024, pg. 3).

SBBG and Wildlands Conservation Science (WCS) prepared an invasive species management plan for BMER (Brody 2021, pers. comm; SBBG and WCS 2019). Botanists conducted comprehensive helicopter surveys to identify and prioritize invasive plant management areas throughout the entire 5,368-acre BMER. They confirmed that veldt grass, iceplant, Sahara mustard, and pampas grass still pose the greatest threat to Vandenberg monkeyflower. They identified 29 invasive plant species within BMER, of which 19 are targeted for eradication, and two (iceplant and pampas grass) are targeted for containment. SBBG and WCS identified 10

specific areas for veldt grass control to conserve Vandenberg monkeyflower in the plan (SBBG and WCS 2019 pg. 9, 13-14, 21). Several glyphosate herbicide treatments in areas with heavy veldt grass infestations have taken place (SBBG 2020, pg. 2). Otherwise, we do not know the status of plan implementation. We also know that larger scale veldt grass removal activities are planned at LPM-SHP, but we do not know who is conducting them, when they will take place, or where they are going to occur (SBBG 2020, pg. 3).

Preliminary results from veldt grass treatment experiments showed that native plant species richness was highest in mechanical removal plots, where veldt grass individuals were physically removed, and that complete mechanical removal may promote natural Vandenberg monkeyflower recruitment. Further, the results suggest that mechanical removal provides important benefits to the species both by reducing competition and by promoting increased native species richness (SBBG 2025, pg. 4 and 9–10).

VSFB implements a non-native, invasive plant species management plan and conducts other habitat enhancement activities to control and ameliorate threats from non-native, invasives to Vandenberg monkeyflower and its habitat, and to actively manage its federally listed species and other natural resources. They utilize a variety of eradication methods within the species habitat and other adjacent areas, including chemical and mechanical controls. VSFB also conducts periodic monitoring efforts to track and map the distribution and spread of non-native, invasive species and use these data to prioritize treatment projects. VSFB provides special training to personnel that perform this work and employs other protective measures to reduce potential adverse effects on the species and its habitat. They, to the extent possible, try to time control efforts so that they occur outside of the Vandenberg monkeyflower growing season. The VSFB non-native, invasive plant species management plan includes provisions to monitor and target controls within post-fire areas because these sites often cause new introductions and spread of non-native, weedy plant species, and they try to implement controls as quickly as possible to prevent emergence and rapid proliferations. These efforts help protect and conserve Vandenberg monkeyflower and its habitat (VSFB 2024, Tab D p. 9; ManTech SRS Technologies, Inc. 2024, pg. 1).

VSFB documented and summarized the non-native, invasive plant species management activities they completed from 2022 through 2024 including rapid response efforts targeting multiple invasive plant species and their progress towards eradication of the highly invasive jubata grass (*Cortaderia jubata*). Treated areas occurred in habitats associated with Vandenberg monkeyflower including Burton Mesa maritime chaparral and coastal scrub (VSFB 2025, pg. 1, 3, 6, 11, 37–38, 43, 49, and 53). VSFB also reported Vandenberg monkeyflower habitat enhancement activities completed in 2019 through 2021 to support the species, including experimental veldt grass management trials and monitoring to explore a variety of techniques including clethodim and glyphosate applications and manual removal treatment options. Their results showed significantly less live veldt grass cover after the hand pulling treatments and no significant differences in live veldt grass cover for the other treatments. They also found significant effects of treatments on percent cover of basal vegetation, live non-native vegetation, dead non-native vegetation, and Vandenberg monkeyflower abundance that were primarily driven by the hand pulling treatments. Lastly, they found significant differences due to treatment

effects over time within the perennial grass/non-native plant diversity guild, which is composed entirely of veldt grass (ManTech SRS Technologies, Inc. 2024, pg. 1–2, 8, 15–16, and 19).

SBBG also assessed mechanical removal and glyphosate herbicide treatments for veldt grass management within portions of occurrence four at BMER. They positioned their treatment plots in areas where the species has become extirpated, but that were in close proximity to other occupied locations. They found both treatments to be significantly effective at reducing veldt grass cover. In this study, mechanical removal including disposal of biomass offsite, was less effective than the herbicide treatment, where the biomass was left in place. However, they noted natural recruitment of a single Vandenberg monkeyflower individual into one of the mechanical treatment plots and did not have any recruitment in any of the other treatment plots. SBBG recommends further study to determine whether these treatments promote recruitment and recolonization (SBBG 2025, pg. 4–5 and 9–10).

LPM-SHP conducted manual removal activities for veldt grass abatement within areas that encompass occurrence number eight from 2022 through 2026 to support persistence and recovery of the species at this location. They collect and remove the weedy biomass and dispose of it securely offsite. LPM-SHP plans to continue these efforts into the future and may expand efforts at other occurrences if able (LPM-SHP 2026, pers comm).

5.3 Seed Banking and Bulking

Seed banking practices have become increasingly important and prioritized as an essential and prudent plant conservation action. Seed banks are effective at conserving species genetic diversity and provide insurance if stochastic loss or extirpation occurs. Similarly, seed bulking activities ensure that there is an ample supply of seed available for strategic restoration and recovery efforts. SBBG has made several Vandenberg monkeyflower seed bank accessions for conservation (Table 3).

Table 3. Vandenberg monkeyflower (*Diplacus vandenbergensis*) conservation seed banking accessions. Vandenberg monkeyflower (Diplacus vandenbergensis) conservation seed banking accessions (California Plant Rescue 2026, website; SBBG 2026a, pers comm; CNDDB 2026, website).

Accession Year	Number of Seeds	Status	Institution	Occurrence Number
2009	100	Frozen	SBBG	CNDDB EO 8
2010	100	Frozen	SBBG	CNDDB EO 4
2010	100	Frozen	SBBG	CNDDB EO 8
2014	386	Frozen	SBBG	CNDDB EO 4
2014	287	Frozen	SBBG	CNDDB EO 4
2014	2,840	Frozen	SBBG	CNDDB EO 6
2017	2,209	Frozen	SBBG	CNDDB EO 4
2017	4,700	Frozen	SBBG	CNDDB EO 8
2017	1,039	Frozen	SBBG	CNDDB EO 4
2017	2,214	Frozen	SBBG	CNDDB EO 16
2024	7,034	Frozen	SBBG	CNDDB EO 4

SBBG completed Vandenberg monkeyflower a seed bulking effort in 2024 through 2025 using three accessions from occurrence number four. The did two treatments to test viability; mass bulking and an ex situ/focused test. The mass bulking treatment resulted in 43 percent germination, and the ex situ treatment had 92 percent germination. SBBG Vandenberg monkeyflower seed bulking activities generated more than 30,000 seeds for restoration and recovery purposes (SBBG 2026a, pers comm; SBBG 2026b, pers comm; SBBG 2026c, pers comm).

6.0 CURRENT CONDITION

6.1 CURRENT CONDITION AND ABUNDANCE

The species known range increased slightly since the time of listing because of new information and improvements in analytical techniques (see Section 2.1.3). Vandenberg monkeyflower remains a geographically restricted species, endemic to a small portion of southwestern Santa Barbara County, associated with the Burton Mesa landform. There were 21 known occurrences at the time of listing (79 FR 50844-50854). The species is presently known from 31 occurrences. Two of these are likely extirpated (refer to Figure 4). The number of known occurrences increased because several new occupied sites have been found, and other new and existing data were incorporated into the spatial analysis. All known Vandenberg monkeyflower occurrences are located on lands with three different types of ownership: privately owned land, publicly owned and publicly accessible land (including BMER, owned by CDFW and LPM-SHP, owned by California State Parks), and one military installation, VSFB. VSFB is federally owned, but not generally publicly accessible. We do not currently have adequate data on the species distribution and annual abundance to estimate the total amount of area occupied because many of the known sites are recorded simply as points. Estimates of total occupied area are inherently challenging for Vandenberg monkeyflower because the number of individuals and the area they occupy in any given year is highly variable. Abundance and distribution in species with annual life cycles can fluctuate drastically from year to year, making such estimates difficult to generate (ManTech SRS Technologies, Inc. 2020, pg. 5; Nunney 2002, pg. 195).

6.1.1 VANDENBERG MONKEYFLOWER POPULATIONS

Excluding the eastern-most, isolated Vandenberg monkeyflower occurrence (number 12 on Figure 4), there are three main populations of the species throughout the range (Figure 7). These delineations are based on geography, topography, land use, and other barriers. The first (from west to east) is the Vandenberg population. It is the largest in size and includes 21 occurrences, while seven are located on BMER and the other 14 are within VSFB. Therefore, the entire known population occurs on publicly owned lands. The Vandenberg population contains the two known occurrences that are likely extirpated (occurrence numbers 22 and 26 on Figure 7) and both are located on VSFB.

The second population is the Burton Mesa population. It is centrally located, smaller in size than the Vandenberg population, and includes five known species occurrences. All five of the occurrences are located on BMER, which is publicly owned land. This population is almost surrounded by residential development and is bisected by several roads, including State Route 1. A few of the known colonies that comprise a few of the occurrences located within this population appear to have become extirpated because of development on privately owned lands immediately adjacent to BMER (CNDDB 2021, website).

The third population is the La Purísima population and it is the smallest of the three. This population is located the furthest east, into the interior of the landform. It includes four species occurrences and all of them are located on publicly owned lands within LPM-SHP.

6.1.2 SPECIES ABUNDANCE

We have limited survey data for several of the occurrences within the three populations that provide some insights into species abundance. However, these data were not collected uniformly or consecutively, so they are not suitable for analyzing trends across the populations or for individual occurrences. Available abundance data from each of the populations is discussed below.

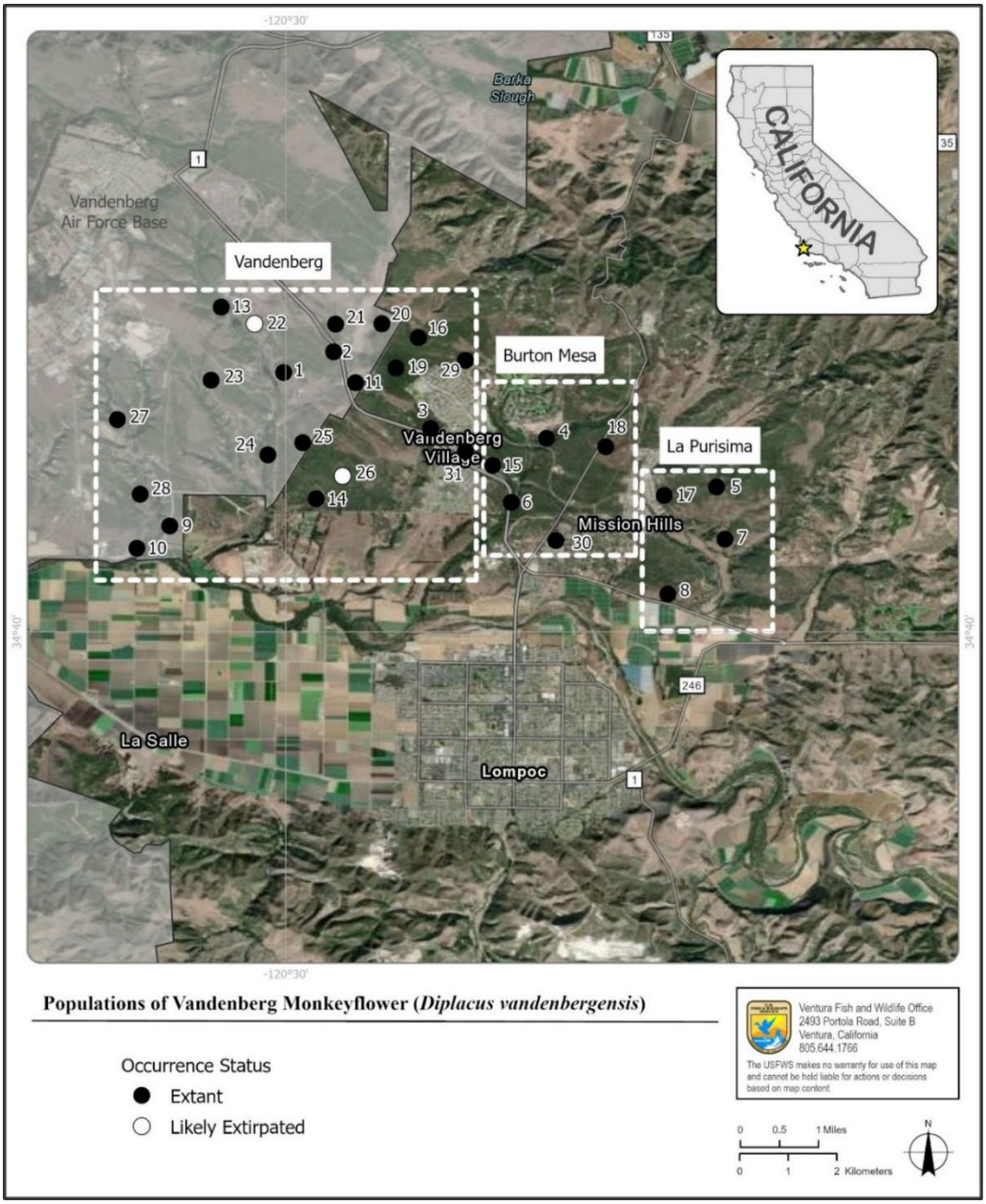

Figure 7. Main populations of Vandenberg monkeyflower (*Diplacus vandenbergensis*) throughout the known range, Santa Barbara County, California.

1. Vandenberg Population:

The Vandenberg Population is composed of 21 occurrences of the species. Seven of the occurrences are located on BMER lands and the rest occur on VSFB. All the known occurrences within VSFB were aerially surveyed via helicopter during the blooming period (May through June) in 2019, except for occurrence numbers nine and 10 (refer to Figure 7). Several of the surveyed occurrences were grouped together when counted, because they are associated with particular geographic locations and features. A total of 2,574 Vandenberg monkeyflower individuals were located within various occupied sites on VSFB in 2019 (ManTech SRS Technologies, Inc. 2020, pg. 25). Abundance data from the 2019 VSFB surveys is further summarized and broken down by occurrence number in Table 4 below. Occurrence number 22 on VSFB is likely extirpated (Figure 7).

The other Vandenberg monkeyflower occurrences within the Vandenberg population are located on the western portion of BMER, west of the Vandenberg Village Residential Development (see Figure 7). These other occurrences include numbers: three, 14, 16, 19, 26, 26, 29, and 31. Note that occurrence number 26 on BMER, within this population is likely extirpated. BMER is owned and managed by CDFW. During survey efforts in April and May of 2021, CDFW counted 129 Vandenberg monkeyflower individuals at occurrence number 29 and 43 at occurrence number 31 (LPM-SHP 2021, pers comm). We do not have any recent abundance data for the other five occurrences.

Table 4. Vandenberg monkeyflower (*Diplacus vandenbergensis*) 2019 abundance survey data by occurrence number on Vandenberg Space Force Base (ManTech SRS Technologies, Inc. 2020, pg. 25).

Geographic Location	**Occurrence Number(s)**	**Total Number of Individuals**
Lower Oak Canyon	28	5
Upper Oak Canyon	27	52
Pine Canyon	23 and 24	100
Lake Canyon	1, 13, and 22*	2,311
Santa Lucia West	2	11
Santa Lucia Central	21	34
Santa Lucia East	11, 20, and 25	61
Total: 2,574		

*occurrence is likely extirpated (Figure 4).

2. Burton Mesa Population:

The Burton Mesa Population consists of five occurrences of the species including numbers: four, six, 15, 18, and 30 (Figure 7). This population is located east of the Vandenberg Village Residential Development, on the eastern side of BMER. All the occurrences are located within BMER. Occurrence numbers four and six were recently surveyed by SBBG. In May of 2020, SBBG observed 571 Vandenberg monkeyflower individuals within occurrence number four and a total of 304 individuals within occurrence number six (SBBG 2020, pg. 5). In April and May of

2021, CDFW recently surveyed occurrence number 30 and a total of 432 Vandenberg monkeyflower individuals were observed (LPM-SHP 2021, pers comm). We do not have any recent abundance data for occurrence numbers 15 and 18 within this population.

SBBG continued annual monitoring within occurrence number four through 2025. We provide these data in Table 5 below.

Table 5. Vandenberg monkeyflower (*Diplacus vandenbergensis*) abundance survey data within one polygon of occurrence number four (SBBG 2025, pg. 6).

Monitoring Year	Monitoring Date	Total Number of Individuals
2020	May 13	571
2021	May 7	55
2022	May 8	19
2023	May 10	129
2024	April 19	23
2024	May 10	433
2025	April 18	161
2025	May 9	117

3. La Purísima Population:

The La Purísima Population contains four occurrences of the species, including numbers: five, seven, eight, and 17 (Figure 7). All four of the Vandenberg monkeyflower occurrences within the population occur within LPM-SHP, which is owned and managed by California State Parks. In May 2019, occurrence number eight was surveyed by SBBG, and a total of 5,763 Vandenberg monkeyflower individuals were counted. In May 2020, occurrence number seven was surveyed by SBBG, and a total of 841 Vandenberg monkeyflower individuals were observed (SBBG 2020, pg. 5). We do not have any recent survey data for occurrence numbers five and 17.

SBBG continued annual monitoring within occurrence number eight from 2020 through 2025 (Table 6).

Table 6. Vandenberg monkeyflower (*Diplacus vandenbergensis*) abundance survey data within one polygon of occurrence number eight (SBBG 2025, pg. 6).

Monitoring Year	Monitoring Date	Total Number of Individuals
2020	May 23	9,603
2021	April 9	458
2021	May 7	104
2022	May 5	698
2023	May 10	2,279
2024	April 19	6,495
2024	May 10	4,282
2025	April 18	2,582
2025	May 9	1,804

6.2 CURRENT RESILIENCY, REDUNDANCY, AND REPRESENTATION

6.2.1 RESILIENCY

Resiliency is positively related to population size, growth rate, and may be influenced by connectivity among populations. We need more information on abundance and growth rates of the populations over a series of consecutive years, or an acceptable proxy to determine resiliency. Demographic data, such as counts of flowering and fruiting individuals and estimates of seed set, and other metrics to assess habitat quality and quantity, would be useful to help better assess population resiliency.

Using the abundance data we have, we know that the most individuals have been counted in the La Purisima population, followed by the Vandenberg population. The fewest individuals have been counted at the Burton Mesa population. Overall, the numbers of individuals are small ranging in the hundreds to few thousand. Given these small numbers, these occurrences also likely have sparse soil seed banks. Small occurrences such as these have a high risk of extirpation because they are more vulnerable to stochastic events. Any loss of occurrences results in reduced abundance at the population scale.

We also know that all three populations have widespread infestations of veldt grass based on the data from the occurrences being monitored (Section 4.2). Invasive species are one of the biggest threats to Vandenberg monkeyflower because these species adversely affect habitat quality (Burton Mesa maritime chaparral and loose sandy soils required), and insect pollinators. Similarly, climate change effects associated with increased temperatures and severe drought are likely affecting all populations to some degree, affecting life stage needs for sufficient survival and reproduction. Therefore, we can speculate that resiliency of all populations is being impacted by current threats.

6.2.2 REDUNDANCY

Species redundancy will always be limited for local, endemic species like Vandenberg monkeyflower with a naturally limited range. However, redundancy is likely lower for the species now, than what it was historically. Vandenberg monkeyflower is comprised of three populations that we've delineated based on geography, topography, land use, and other barriers, like residential developments (Section 5.1.1). All populations are edaphically tied to the Burton Mesa landform, and all occur within the same Burton Mesa maritime chaparral habitat type. The populations are distributed over a relatively small area and the amount of Burton Mesa maritime chaparral habitat has also been reduced over time from development and other infrastructure. Overall redundancy in the species is low because there are only three populations that are distributed over a small geographic range and connectivity between them is reduced. Low redundancy in the species means potentially low ability to withstand catastrophic events.

6.2.3 REPRESENTATION

The three populations of Vandenberg monkeyflower encompass the inherently narrow north-south and east-west gradients within the species limited distribution and the totality of ecological settings it currently occupies. Its relatively small geographic range likely encompasses the breadth of genetic and ecological diversity within and among the populations. Vandenberg monkeyflower is edaphically restricted to the sandy substrates of the Burton Mesa landform and requires canopy openings within Burton Mesa maritime chaparral habitat, which is a highly specialized niche. Therefore, representation in the species is naturally limited.

Each of the three populations are largely bound by residential developments; including from east to west, Mission Hills, which separates the La Purísima and Burton Mesa populations, Vandenberg Village, which separates the Burton Mesa and Vandenberg populations, and VSFB Family Housing, and main base developed area that occur west of the Vandenberg population and restricting its' expansion further to the west. Undoubtedly, these developments have reduced connectivity between the metapopulations over time.

The canopy openings Vandenberg monkeyflower requires are facing intensive threats from non-native invasive species, especially grasses, and other threats to the species act synergistically to increase invasions and spread of noxious weeds throughout the range. Vandenberg monkeyflower appears to have a low adaptive capacity because of its niche specificity and habitat loss and fragmentation. Threats currently acting on the species, including invasive species, are further reducing its already limited, overall representation.

7.0 FUTURE SCENARIOS

Based on the best available information, we developed two plausible future scenarios to evaluate Vandenberg monkeyflower's response to the range of anticipated futures (Table 7). Each scenario captures the breadth of plausible variation in the factors that affect Vandenberg monkeyflower viability over a 50-year period. We chose 50 years as the evaluation timeframe because this encompasses the full spectrum of projections for each factor influencing the species viability, where available (Langridge 2018, pg. 12-23). The 50-year period also incorporates a

wide and practical amount of inter-annual variability in temperature and rainfall, and captures several typical drought cycles (NOAA 2021, website). Then we analyzed how the species is likely to respond to the range of conditions under each future scenario.

Table 7. Fifty-year projection for Vandenberg monkeyflower *(Diplacus vandenbergensis*) future scenarios including the effects of RCP 4.5 projections with less change for Scenario 1 and RCP 8.5 projections with more change for Scenario 2. Fifty-year projection for Vandenberg monkeyflower (Diplacus vandenbergensis) future scenarios including the effects of RCP 4.5 projections with less change for Scenario 1 and RCP 8.5 projections with more change for Scenario 2. Anticipated changes in temperature and precipitation are based on Langridge (2018, pg. 12-22 and 29-31) and invasive species, non-native annual grasses are based on Sandel and Dangremond (2012).

Factor Influencing Viability	**Scenario 1 - Less Change**	**Scenario 2 - More Change**
Development	Decrease from historical trends	Decrease from historical trends
Invasive Species (non-native, annual grasses)	Increase in non-native annual grasses compared to current conditions, due to increase in temperatures	Greater magnitude increase in non-native annual grasses compared to current conditions, due to greater increase in temperatures
Anthropogenic Fire	Increase from current conditions, due to increased temperatures, increased precipitation variability, and hotter, more intense Santa Ana and sundowner winds	Greater increase from current conditions, due to increased temperatures, increased precipitation variability, and hotter, more intense Santa Ana and sundowner winds
Recreation and Other Human Activities	Increase compared to current conditions, due to population growth	Increase compared to current conditions, due to population growth
Temperature	RCP 4.5: Annual average maximum temperatures are expected to increase 2.7 ºC (4.8 ºF)	RCP 8.5: Annual average maximum temperatures are expected to increase 4.1 ºC (7.4 ºF)
Precipitation	RCP 4.5: Annual average rainfall is expected to increase 3.3 cm (1.3 in), increase in annual variability compared to current conditions	RCP 8.5: Annual average rainfall is expected to increase 10 cm (3.9 in), greater increase in annual variability compared to current conditions

7.1 FUTURE SCENARIO 1

The plausible future with less change is summarized in Scenario 1, including the effects of Representative Concentration Pathway (RCP) 4.5 projections for climate change in the California Central Coast Region. In Future Scenario 1 emissions peak near 2040 and then decline, generally resulting in less severe, overall change.

Development on the Burton Mesa landform is expected to decrease from historical trends under Future Scenario 1. This is primarily because it has been predominantly built out to the maximum extent practicable in terms of large developments. The majority of remaining Burton Mesa maritime chaparral habitat where Vandenberg monkeyflower occurs is within Federal or state-owned lands and is predominantly protected from future large-scale development. However, smaller-scale development, acquisition and access to easements, and development and maintenance of infrastructure such as roads, utility, oil, and gas pipelines will continue to take place throughout Burton Mesa. Some of these activities may occur within Burton Mesa maritime chaparral habitat or in other areas adjacent to occurrences of Vandenberg monkeyflower, resulting in the destruction and possible removal of the species habitat and creating pathways and open areas for non-native plants to invade. Therefore, the direct destruction and alteration of Burton Mesa maritime chaparral habitat due to development is likely to continue, but on a relatively small scale, which may affect survival and reproduction of the species.

Introductions and spread of non-native, invasive species are expected to increase under Future Scenario 1 conditions. This is primarily due to increased temperatures, and increased annual variability and drought associated with climate change. As temperature increases and water availability decreases, the effects of non-native annual grasses are expected to also increase (Sandel and Dangremond 2019, pg. 284-287). Invasive, non-native plants reduce the amount and quality of habitat for Vandenberg monkeyflower by outcompeting Burton Mesa maritime chaparral vegetation and decreasing the amount and availability of the sandy openings where Vandenberg monkeyflower grows. Invasion of non-native, invasive species also reduces pollinator diversity. Increased cover of non-native annual grasses can also increase the chance of fire (Fusco et al. 2019, pg.1-4). The more fires that occur, the more intense the invasion and spread of non-native grasses. For these reasons, an increase in non-native, invasive species under Future Scenario 1 is expected to decrease Vandenberg monkeyflower survival, reproduction, and abundance.

Anthropogenic fire is also expected to increase under Future Scenario 1. Increased temperatures with drought, along with stronger winds during the later months of the season (specifically December through January) results in relative low humidity that quickly dries fuels and rapidly spreads large, intense wildfires (Williams et al. 2019, pg. 893; Guzman-Morales and Gershunov, pg. 2779). Increased anthropogenic fire is expected to increase invasions and spread of non-native, invasive species, previously described above. While the direct effects of fire on Vandenberg monkeyflower are unknown, increased anthropogenic fire under Future Scenario 1 is likely to adversely affect the species and its habitat primarily because of feedback loops that increase invasive species. Increased frequency of anthropogenic fire can also prevent recovery of vegetation post-fire and exacerbate erosion. The combined effects from more anthropogenic fire under Future Scenario 1 are anticipated to decrease the species survival, abundance, and reproduction of the species.

Recreation and other human activities on the Burton Mesa landform are expected to increase slightly under Future Scenario 1 because of increased human population growth. More people in the area will increase the use of existing parks and open spaces for recreational purposes including hunting, fishing, hiking, horseback riding, and OHV. Expanded recreation will contribute to the spread of invasive, non-native plants within the species habitat, reducing the

quality and causing more edge effects and further fragmentation. Unauthorized and off-trail recreation can also result in direct mortality and disturbance of individuals through trampling and other disruptions. Effects from increased recreation and other human activities will lower abundance, reproductive success, and survival of Vandenberg monkeyflower.

Climate change is expected to have multiple effects throughout the California Central Coast Region (Section 4.5). Projected increases in temperature and precipitation with drought are especially notable. Annual average maximum temperatures are expected to increase 2.7 ºC (4.8 ºF) under Future Scenario 1. Annual average precipitation is expected to increase 3.3 cm (1.3 in), with greater variability and increased drought in this future scenario. Changes in temperature and precipitation will fuel increasing extent and spread of non-native, invasive grasses, and anthropogenic fire. Climatic changes in temperature and precipitation will also assert direct negative influences on Vandenberg monkeyflower during its different life stages. For example, lowered precipitation and timing of first rainfall, along with increased temperatures will impact seed germination and vegetative growth, and will adversely affect Vandenberg monkeyflowers' pollinators. Combined, the effects of projected increases in temperature and drought under Scenario 1 will decrease abundance, reproductive success, and survival of Vandenberg monkeyflower.

In summary, large-scale development is expected to decrease from historical trends under Future Scenario 1, while small-scale development is expected to continue resulting in possible removal of the species and habitat, and creating pathways for non-native, invasive species to invade. Introductions and spread of non-native, invasive species, especially grasses, is anticipated to increase under this scenario, decreasing the amount and availability of the sandy openings where Vandenberg monkeyflower grows, impacting pollinator diversity, and fueling the fire cycle. Temperature is expected to increase 2.7 ºC (4.8 ºF) and annual precipitation is also expected to increase 3.3 cm (1.3 in), with greater variability and increased drought, directly impacting germination, vegetative growth, and reproductive success. Collectively, all trajectories of threats under Future Scenario 1 are expected to adversely affect survival, reproduction, and abundance of the species. Therefore, under Future Scenario 1 we presume an overall decline in Vandenberg monkeyflower population resiliency. Redundancy and representation within the species will also likely be reduced, particularly if smaller, more vulnerable Vandenberg monkeyflower sites become extirpated.

7.2 FUTURE SCENARIO 2

The plausible future environment with more change is summarized in Future Scenario 2, including the effects of RCP 8.5 projections for climate change within the California Central Coast Region. In Future Scenario 2 emissions continue to rise strongly through 2050 and plateau near 2100, generally resulting in more pronounced, overall change.

Development on the Burton Mesa landform is expected to decrease from historical trends under Future Scenario 2, to the same extent as under Future Scenario 1. Thus, under Future Scenario 2, the direct destruction and alteration of Burton Mesa maritime chaparral habitat due to development is likely to continue, but on a relatively small scale, which may affect survival and reproduction of the species.

Introductions and spread of non-native, invasive species are expected to increase under Future Scenario 2 to a greater extent than under Scenario 1. This is primarily because of greater increases in temperatures, and greater increases in annual variability and drought associated with climate change. Invasive, non-native plants reduce the amount and quality of habitat for Vandenberg monkeyflower by outcompeting Burton Mesa maritime chaparral vegetation and decreasing the amount and availability of the sandy openings where Vandenberg monkeyflower grows. Invasion of non-native, invasive species also reduces pollinator diversity. Increased cover of non-natives is also likely to result in an increase in anthropogenic fires because these fuels are dry and highly flammable. The more fires that occur, the more intense the invasion and spread of non-native grasses. For these reasons, the greater increase in non-native, invasive species under Future Scenario 2 is expected to decrease Vandenberg monkeyflower survival, reproduction, and abundance more than under Future Scenario 2, and could result in extirpations of small, vulnerable sites that become outcompeted.

Anthropogenic fire is also expected to increase under Future Scenario 2, again to a greater extent than under Future Scenario 1, due to greater increase in temperatures, drought, and late-season Santa Ana and sundowner winds associated with climate change. While the direct effects of fire on Vandenberg monkeyflower are unknown, greater increased anthropogenic fire under Future Scenario 2 is likely to adversely affect the species and its habitat primarily because of feedback loops that increase invasive species, decreasing survival, abundance, and reproduction.

Recreation and other human activities on the Burton Mesa landform are expected to increase slightly under Future Scenario 2 as in Scenario 1. Effects from increased recreation and other human activities will also lower abundance, reproductive success, and survival of Vandenberg monkeyflower.

Future Scenario 2 assumes RCP 8.5 for climate change. Average annual maximum temperatures are expected to increase 4.1 ºC (7.4 ºF) under Future Scenario 2. Average annual precipitation is also expected to increase 10 cm (3.9 in), with greater variability and increased drought under this future scenario. Changes in temperature and precipitation will further fuel increasing extent and spread of non-native, invasive grasses, and anthropogenic fire. And to a greater degree than under Future Scenario 2, climatic changes in temperature and precipitation will assert direct negative influences on Vandenberg monkeyflower during its different life stages. Inadequate annual rainfall, increased temperatures, or combinations of these factors may result in low germination or no germination at all. If seeds do germinate during drought, drought conditions may kill seedlings before they are able to flower and complete their life cycle. Combined, the effects of projected increases in temperature and drought under Scenario 2 will decrease abundance, reproductive success, and survival of Vandenberg monkeyflower, potentially resulting in extirpations due to repeated low or no germination and depletion of the soil seed bank due to a series of years with inadequate annual precipitations, inappropriately timed first rains, and unsuitable temperature regimes.

In summary, large-scale development is expected to decrease from historical trends under Future Scenario 2; while small-scale development is expected to continue resulting in possible removal of the species and habitat, and creating pathways and open areas for non-native plants to invade.

Introductions and spread of non-native, invasive species, especially grasses, is anticipated to increase under Future Scenario 2 more than Scenario 1, decreasing the amount and availability of the sandy openings where Vandenberg monkeyflower grows, impacting pollinator diversity, and fueling the fire cycle. Temperature is expected to increase 4.1 ºC (7.4 ºF) and annual precipitation is also expected to increase 10 cm (3.9 in), with even greater variability and future increased drought under Future Scenario 2, directly impacting germination, vegetative growth, and reproductive success. Combined, the effects of projected increases in temperature and drought under Scenario 2 will decrease abundance, reproductive success, and survival of Vandenberg monkeyflower, potentially resulting in extirpations due to repeated low or no germination and depletion of seed bank. Therefore, under Future Scenario 2 we presume an overall decline in Vandenberg monkeyflower population resiliency with some predicted extirpations. Redundancy and representation within the species will also likely be reduced, particularly if multiple Vandenberg monkeyflower sites become extirpated.

8.0 SUMMARY AND CONCLUSIONS

Vandenberg monkeyflower is an herbaceous annual, endemic to the Burton Mesa landform in southwestern Santa Barbara County, California. It occurs on sandy soils, in openings within the canopy of Burton Mesa maritime chaparral habitat. The species is composed of three populations and we estimate the current range to be 5,177 hectares (12,791 acres). We have a limited amount of survey data for several of the occurrences within each of the three populations. It is not currently possible to assess population abundance or to detect population trends over time.

Vandenberg monkeyflower was federally listed as endangered in 2014. Threats to the species identified at that time include development, utility and pipeline maintenance, invasive species, anthropogenic fire, recreation and other human activities, and climate change (79 FR 50844-50854). All these threats continue to act on the species and many of them do so in synergistic ways that create feedback loops, particularly non-native, invasive species, and fire. We do not have data to determine the resiliency of Vandenberg monkeyflower populations. However, threats are acting on the populations, likely affecting their ability to withstand stochastic events. Redundancy will always be very limited for local, endemic species with only three populations distributed over a small geographic range. Species representation is also naturally low because of its niche specificity and has been affected by reduced connectivity and habitat degradation.

Looking into the future, we developed two scenarios that capture the range of plausible effects to the species from predicted change over 50 years. We chose 50 years because this encompassed projections for each factor influencing viability, where available. Scenario 1 assumes a decrease in development from historical trends, small increase in recreation from population growth, and effects of Representative Concentration Pathway (RCP) 4.5 scenario for climate change in the California Central Coast region based on California's Fourth Climate Change Assessment (Langridge et al. 2018). Scenario 2 also assumes a decrease in development from historical trends, small increase in recreation from population growth, but assumes the RCP 8.5 scenario for climate change in the California Central Coast region (Langridge et al. 2018).

While we do not have data to determine the resiliency of Vandenberg monkeyflower populations, we can forecast that the resiliency for populations will likely change under each

future scenario. Small-scale development, recreation, invasive, non-native vegetation, temperatures, drought, and fire are predicted to increase in Vandenberg monkeyflower's habitat, more so in Scenario 2 than Scenario 1. Vandenberg monkeyflower's ability to persist into the future will be negatively affected by increased habitat loss, degradation, and fragmentation from non-native, invasive vegetation, and increased fire and the resultant feedback loop which further increases non-native invasive vegetation. Increased temperatures and drought will decrease abundance, reproductive success, and survival of Vandenberg monkeyflower, potentially resulting in extirpations due to repeated low or no germination years and depletion of seed bank, again, more so under Scenario 2 than 1. If reduced resiliency possible under Scenario 2 leads to extirpations, then redundancy and representation for the species will also be reduced, increasing extinction risk from reduced adaptive capacity in the face of environmental change and ability to withstand catastrophic events, such as wildfire or catastrophic drought.

9.0 REFERENCES

Barker, W.R., G.L. Nesom, P.M. Beardsley, and N.S. Fraga. 2021. A taxonomic conspectus of Phrymaceae: A narrowed circumscriptions for *Mimulus*, new and resurrected genera, and new names and combinations. Phytoneuron 2012-39: 1-60.

Beardsley, P.M and R.G. Olmstead. 2002. Redefining Phrymaceae: the placement of *Mimulus*, tribe *Mimuleae*, and *Phyrma*. American Journal of Botany 89(7): 1093-1102.

Beeks, R.M. 1962. Variation and Hybridization in Southern California Populations of *Diplacus* (Scrophulariaceae). Aliso: A Journal of Systematic and Evolutionary Botany 5(2): 83-122.

Brooks, M.L., C.M. D'Antonio, D.M. Richardson, J.B. Grace, J.E. Keeley, J.M. DiTomaso, R.J. Hobbs, M. Pellant, and D. Pyke. 2004. Effects of invasive alien plants on fire regimes. BioScience 54(7): 677-688.

California Department of Fish and Wildlife [CDFW]. 2025. California Laws Protecting Native Plants. Available online at: https://wildlife.ca.gov/Conservation/Plants/Laws.

California Natural Diversity Database [CNDDB] 2020. CNDDB Management Framework. California Department of Fish and Wildlife. Biogeographic Data Branch. Sacramento, California.

California Natural Diversity Database [CNDDB] 2021. RareFind 5. California Department of Fish and Wildlife, Government Version 5.96.99. Biogeographic Information and Observation System Viewer. Available online at: https://apps.wildlife.ca.gov/bios/.

California Natural Diversity Database [CNDDB] 2026. RareFind 5. California Department of Fish and Wildlife, Government Version 6.26.0226. Biogeographic Information and Observation System Viewer. Available online at: https://apps.wildlife.ca.gov/bios/.

California Native Plant Society [CNPS], Rare Plant Program. 2021. Inventory of Rare and Endangered Plants of California (online edition, v9-01 0.0). Available online at: http://www.rareplants.cnps.org/.

California Plant Rescue. 2026. Search for California Plants in CAPR Conservation Collections. Available online at: https://www.caplantrescue.org/old---collections-database.html#memberssearch.

Christenson, N. L. and C.H. Muller. 1975. Effects of fire on factors controlling plant growth in *Adenostoma* chaparral. Ecological Monographs. 45:29-55.

Consortium of California Herbaria Portal [CCH2]. 2021. Data for *Diplacus vandenbergensis*. Available online at: http://cch2.org/portal/index.php.

Davis, F.W., M.I. Borchert, and D.C. Odion. 1989. Establishment of microscale vegetation pattern in maritime chaparral after fire. Vegetatio. 84(1):53-97.

Ferren, W.R., H.C. Forbes, D.A. Roberts, D.M. Smith. 1984. The Botanical Resources of La Purísima Mission State Historic Park, Santa Barbara County, California. The Herbarium, Department of Biological Sciences, University of California, Santa Barbara. Publication No. 3. Santa Barbara, California.

Fraga, N.S. 2018. *Diplacus vandenbergensis*, in Jepson Flora Project (eds.) Jepson eFlora, Revision 6. Available online at: https://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=99080.

Fusco, E.J., J.T. Finn, J.K. Balch, R.C. Nagy, and B.A. Bradley. 2019. Invasive grasses increase fire occurrence and frequency across US ecoregions. Proceedings of the National Academy of Sciences of the United States of America (PNAS). 116(47):23594-23599. Available online at: https://www.pnas.org/content/116/47/23594.

Gevirtz, E., M. Carroll, K. Burton, P. Collins, M. Holmgren, L. Spanne, and A. Nelson. 2007. Final Land Management Plan, Burton Mesa Ecological Reserve. Unpublished technical report prepared for the California Department of Fish and Game. Condor Environmental Planning Services, Inc. Santa Barbara, California.

Guzman-Morales, J. and A. Gershunov. 2019. Climate change suppresses Santa Ana winds of Southern California and sharpens their seasonality. Geophysical Research Letters. 46:2772-2780. Available online at: https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2018GL080261.

Harris, J.G. and M.W. Harris. 2001. Plant Identification Terminology, An Illustrated Glossary. Second Edition. Spring Lake Publishing. Payson, Utah.

Hickson, D.E. 1987. The Role of Fire and Soil in the Dynamics of Burton Mesa Chaparral, Santa Barbara County, California. Master's thesis submitted to University of California, Santa Barbara. Santa Barbara, California.

Hunt, L.E. 1993. Origin, Maintenance and Land Use of Aeolian Sand Dunes of the Santa Maria Basin, California. Unpublished technical report prepared for the Nature Conservancy. Department of Biological Sciences, University of California, Santa Barbara. Santa Barbara, California.

Keeley, J.E. 2001. Fire and invasive species in Mediterranean-climate ecosystems of California. Pgs. 81-94 in K.E.M. Galley and T.P. Wilson (eds.). Proceedings of the Invasive Species Workshop: the Role of Fire in the Control and Spread of Invasive Species. Fire Conference 2000: the First National Congress on Fire Ecology, Prevention, and Management. Miscellaneous Publication No. 11, Tall Timbers Research Station, Tallahassee, Florida.

Keeley, J.E. 1991. Seed germination and life history syndromes in the California chaparral. The Botanical Review 57(2):81-116.

Keeley, J.E. and F.W. Davis. 2007. Chaparral. In Barbour, M.G., T. Keeler-Wolf, and A.A. Schoenherr (eds.). Terrestrial Vegetation of California. University of California Press. Berkeley, California.

Keeley, J. E. and C.J. Fotheringham. 2001. Historic fire regime in Southern California shrublands. Conservation Biology. 15(6):1536-1548.

Langridge, R. 2018. Central Coast summary report. California's Fourth Climate Change Assessment. Publication number: SUM-CCCA4-2018-006. 115 pgs.

Levine, J.M., A.K. McEachern, and C. Cowan. 2008. Rainfall effects on rare annual plants. Journal of Ecology. 96:795-806.

Levine, J.M., A.K. McEachern, and C. Cowan. 2011. Seasonal timing of first rain storms affects rare plant population dynamics. Ecology. 92(12):2236-2247.

ManTech SRS Technologies, Inc. 2010. 2010 Special Status Plants Monitoring on Vandenberg Air Force Base, California. Unpublished technical report prepared for 30th Space Wing, Installation Management Flight, Environmental Conservation. ManTech SRS Technologies, Inc. Lompoc, California.

ManTech SRS Technologies, Inc. 2015. 2014-2015 Special Status Plant Surveys on Vandenberg Air Force Base, California. Unpublished technical report prepared for 30th Space Wing, Installation Management Flight, Environmental Conservation. ManTech SRS Technologies, Inc. Lompoc, California.

ManTech SRS Technologies, Inc. 2016. 2015-2016 Threatened and Endangered Plant Surveys on Vandenberg Air Force Base, California. Unpublished technical report prepared for 30th Space Wing, Installation Management Flight, Environmental Conservation. ManTech SRS Technologies, Inc. Lompoc, California.

ManTech SRS Technologies, Inc. 2020. Threatened and Endangered Plant Surveys on Vandenberg Space Force Base, California. 2019 Final Report. Unpublished technical report prepared for 30th Space Wing, Installation Management Flight, Environmental Conservation. ManTech SRS Technologies, Inc. Lompoc, California.

ManTech SRS Technologies, Inc. 2024. Threatened and Endangered Plant Restoration: Vandenberg Monkeyflower, Vandenberg Space Force Base, California. 2020–2021 Final Report. Unpublished technical report prepared for 30th Space Wing, Installation Management Flight, Environmental Conservation. ManTech SRS Technologies, Inc. Lompoc, California.

ManTech SRS Technologies, Inc. 2025. Invasive Plant Species Rapid Response and Jubata Grass Eradication Programs Vandenberg Space Force Base, California. 2022–2024 Invasive Species Project Activities Final Report. Unpublished technical report prepared for 30th Space Wing, Installation Management Flight, Environmental Conservation. ManTech SRS Technologies, Inc. Lompoc, California.

Molinari, N. and C. M. D'Antonio. 2020. Where have all the wildflowers gone? The role of exotic thatch. Biological Invasions. 22: 957-968.

National Oceanic and Atmospheric Administration [NOAA]. 2021. National Centers for Environmental Information. Climate at a glance: U.S. time series, county, average temperature, maximum temperature, and precipitation datasets. Available online at: https://www.ncdc.noaa.gov/cag/county/time-series.

Nesom, G.L. 2012. Three varieties raised to specific rank in *Diplacus* (Phrymaceae). Phytoneuron. 47:1-6.

Nesom, G.L. and M.C. Tulig. 2020. *Diplacus vandenbergensis*. In: Flora of North America Editorial Committee, eds. Available online at: http://beta.floranorthamerica.org/Diplacus_vandenbergensis.

Nunney, L. The effective size of annual plant populations: the interaction of a seed bank with fluctuating population size in maintaining genetic variation. The American Naturalist. 160(2):195-204.

Ooi, M.K.J. 2012. Seed bank persistence and climate change. University of Wollongong. Research Online. Faculty of Science - Papers. Available online at: http://ro.uow.edu.au/scipapers/4390.

Ruelland, E. and A. Zachowski. 2010. How plants sense temperature. Environmental and Experimental Botany 69(2010): 225-232.

SAIC. 2012. Results of Surveys for Federally-Listed Plant Species on Vandenberg Air Force Base, California. Final Report. Unpublished technical report prepared for 30th Space Wing, Installation Management Flight, Environmental Conservation. SAIC, Science Applications International Corporation, Carpinteria, California.

Sandel, B. and E.M. Dangremond. 2012. Climate change and the invasion of California by Grasses. Global Change Biology 18:277-289.

Santa Barbara Botanic Garden (SBBG). 2020. 2020 Annual Report to U.S. Fish and Wildlife Service: *Diplacus vandenbergensis*. Unpublished technical report prepared for Ventura Fish and Wildlife Service. Santa Barbara Botanic Garden. Santa Barbara, California.

Santa Barbara Botanic Garden (SBBG). 2025. Annual Progress Report to U.S. Fish and Wildlife Service: Elucidating Threats and Recovery Actions for Vandenberg Monkeyflower (*Diplacus vandenbergensis*). Unpublished technical report prepared for Ventura Fish and Wildlife Service. Santa Barbara Botanic Garden. Santa Barbara, California.

Santa Barbara Botanic Garden (SBBG) and Wildlands Conservation Science (WCS). 2019. Burton Mesa Ecological Reserve Invasive Plant Management Plan. Unpublished technical report prepared for Santa Barbara County Planning and Development Department. Santa Barbara Botanic Garden. Santa Barbara, California. Wildlands Conservation Science. Lompoc, California.

Sawyer, J.O., T. Keeler-Wolf, and J.M. Evens. 2009. A Manual of California Vegetation, Second Edition. California Native Plant Society. Sacramento, California.

Shultz, M. and M. BalisLarsen. 2020. ECOS Species Range Project (PowerPoint Slides). U.S. Fish and Wildlife Service, Department of the Interior. Available online at: https://doimspp.sharepoint.com/:p:/r/sites/ESSpeciesRangeProject/_layouts/15/Doc.aspx?sourcedoc=%7B159D7AC6-5BBF-4597-86EF-86AC987F70D3%7D&file=SpeciesRangeMappingProject%2020%20April%202020%20R8%20updatefinalpptx.pptx&action=edit&mobileredirect=true.

Smith D.R., N.L. Allan, C.P. McGowan, J.A. Szymanski, S.R. Oetker, and H.M. Bell. 2018. Development of a species status assessment process for decisions under the U.S. Endangered Species Act. *Journal of Fish and Wildlife Management* 9:302–320.

Sutherland, S. and R.K. Vickery. 1988. Trade-offs between sexual and asexual reproduction in the genus *Mimulus*. Oecologia 76: 330-335.

Thompson, D.M. 2005. Systematics of *Mimulus* subgenus Schizoplacus (Scrophulariaceae). Systematic Botany Monographs. 75:1-213.

Thorne, J. H., R. M. Boynton, A. J. Holguin, J. A. E. Stewart, and J. Bjorkman. 2016. A climate change vulnerability assessment of California's terrestrial vegetation. California Department of Fish and Wildlife. Sacramento, California.

Tulig, M.C. and Nesom, G.L. 2021. *Diplacus vandenbergensis*. In: Flora of North America Editorial Committee, eds. 1993+. Flora of North America. Volume 17. Available online at: http://beta.floranorthamerica.org/Diplacus_vandenbergensis.

U.S. Air Force. 2015. Integrated Natural Resources Management Plan, Vandenberg Air Force Base (now Vandenberg Space Force Base). Tab H, Outdoor Recreation Management Plan. Prepared for 30 CES/CEIE. Vandenberg Space Force Base, California.

U.S. Department of Agriculture [USDA]. 2021. Fire Effects Information System. Fire regimes of the conterminous United States. Available online at: https://www.fs.fed.us/database/feis/fire_regime_table/PNVG_fire_regime_table.html#California.

U.S. Fish and Wildlife Service [Service]. 2016. Service species status assessment framework: an integrated analytical framework for conservation. Version 3.4. August 2016. Washington, D.C.

Vandenberg Space Force Base [VSFB]. 2024. Integrated Natural Resources Management Plan, Vandenberg Space Force Base, California. Tab D, Threatened and Endangered Species Management Plan. June 2024.

Vandenberg Space Force Base [VSFB]. 2025. Invasive Plant Species Rapid Response and Jubata Grass Eradication Programs on Vandenberg Space Force Base, California. 2022–2024 Invasive Species Project Activities Final Report. Prepared for SLD 30 CEIEA.

Williams, A.P., J.T. Abatzoglou, Gershunov, A., J. Guzman-Morales, D.A. Bishop, J.K. Balch, and D.P. Lettenmaier. 2019. Observed impacts of anthropogenic climate change on wildfire in California. Earth's Future. 7: 892-910. Available online at: https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2019EF001210.

Wu, C.A., D.B. Lowry, A.M. Cooley, K.M. Wright, Y.M. Lee, and J.H. Willis. 2008. Mimulus is an emerging model system for integration of ecological and genomic studies. Heredity 100: 220-230.

Personal Communications

Brody, R. 2021. Personal communication. Re: Threats - Vandenberg monkeyflower. Email from Richard Brody, South Coast Region Land Manager, California Department of Fish and Wildlife, Topanga, California to Kristie Scarazzo, Botanist, Ventura Fish and Wildlife Office, Ventura, California. August 27, 2021.

Fraga, N.S. 2021. Personal communication. Re: Peer Reviews - Vandenberg monkeyflower draft Species Status Assessment. Comments provided via email from Naomi Fraga, PhD. Director of Conservation Programs, California Botanic Garden, Claremont, California to Kristie Scarazzo, Botanist, Ventura Fish and Wildlife Office, Ventura, California. November 9, 2021.

La Purísima Mission State Historic Park (LPM-SHP). 2021. Personal communication. Re: Updated VMF survey report. Email from Timothy Matthews, South Coast Region Scientific Aid, California Department of Fish and Wildlife, Topanga, California to Kristie Scarazzo, Botanist, at Ventura Fish and Wildlife Office, Ventura, California. August 27, 2021.

La Purísima Mission State Historic Park (LPM-SHP). 2026. Personal communication. Re: DIVA items. Email from Brittney Sheets, Environmental Scientist, California State Parks – Channel Coast District to Kristie Scarazzo, Senior Biologist/Botanist, at Ventura Fish and Wildlife Office, Ventura, California. March 4, 2026.

Lum, R. 2021. Personal communication. Re: Peer Reviews - Vandenberg monkeyflower draft Species Status Assessment. Comments provided via email from Luanne Lum, Botanist and Biological Scientist, Vandenberg Space Force Base, Vandenberg Air Force Base, California to Kristie Scarazzo, Botanist, Ventura Fish and Wildlife Office, Ventura, California. November 4, 2021.

Matthews, Timothy. 2021. Personal communication. Re: Threats - Vandenberg monkeyflower. Email from Timothy Matthews, South Coast Region Scientific Aid, California Department of Fish and Wildlife, Topanga, California to Kristie Scarazzo, Botanist, at Ventura Fish and Wildlife Office, Ventura, California. August 30, 2021.

Santa Barbara Botanic Garden (SBBG). 2020. Personal communication. Re: Vandenberg monkeyflower. Email from Dr. Denise Knapp, Director of Conservation and Research, at SBBG, Santa Barbara, California to Kristie Scarazzo, Botanist, at Ventura Fish and Wildlife Office, Ventura, California. December 31, 2020.

Santa Barbara Botanic Garden (SBBG). 2021. Personal communication. Re: Vandenberg monkeyflower. Email from Dr. Denise Knapp, Director of Conservation and Research, at SBBG, Santa Barbara, California to Kristie Scarazzo, Botanist, at Ventura Fish and Wildlife Office, Ventura, California. April 1, 2021.

Santa Barbara Botanic Garden (SBBG). 2026a. Personal communication. Re: VMF – are you working today? Email from Manual Hernandez, Rare Plant Nursery Technician, at SBBG, Santa Barbara, California to Kristie Scarazzo Senior Botanist, at Ventura Fish and Wildlife Office, Ventura, California. March 25, 2026.

Santa Barbara Botanic Garden (SBBG). 2026b. Personal communication. Re: Checking in on DIVA seed bulking + next steps. Email from Manual Hernandez, Rare Plant Nursery Technician, at SBBG, Santa Barbara, California to Kristie Scarazzo Senior Botanist, at Ventura Fish and Wildlife Office, Ventura, California. January 2, 2026.

Santa Barbara Botanic Garden (SBBG). 2026c. Personal communication. Re: Connecting about DIVA. Email from Manual Hernandez, Rare Plant Nursery Technician, at SBBG, Santa Barbara, California to Kristie Scarazzo Senior Botanist, at Ventura Fish and Wildlife Office, Ventura, California. January 16, 2026.

APPENDIX A

Detailed information about each known Vandenberg monkeyflower occurrence throughout its range in southwestern Santa Barbara County, California (CNDDB 2021, website; CCH2 2021, website; 78 FR 64840-64871; ManTech SRS Technologies, Inc. 2020, pg. 24; SBBG 2020, pers comm; LPM-SHP 2021, pers comm).

APPENDIX A. Data for all known occurrences of Vandenberg monkeyflower (*Diplacus vandenbergensis*)

Service Occurrence Number	CNDDB Occurrence Number	Number of CNDDB Data within Occurrence	Number of CCH2 Records within Occurrence	Data From 2013 Proposed Rule, Extant	Data From 2013 Proposed Rule, Extirpated	Vandenberg 2019 Data, Potentially Extirpated (2010-2016)	Vandenberg 2019 Data, Extant	Vandenberg 2019 Data, New	Other, SBBG Data	Other, CDFW Data	Extant vs. Extirpated	Historical
1	1	4	2	2	0	13	21	9	10	0	Extant	yes
2	2	2	0	1	0	7	2	0	3	0	Extant	yes
3	3	1	0	1	0	0	0	0	1	0	Extant	yes
4	4	7	2	4	0	0	0	0	14	0	Extant	yes
5	5	1	0	1	0	0	0	0	2	0	Extant	yes
6	6	6	0	2	0	0	0	0	4	0	Extant	no
7	7	8	0	2	0	0	0	0	20	0	Extant	no
8	8	4	0	1	0	0	0	0	5	0	Extant	no
9	9	1	3	1	0	0	0	0	2	0	Extant	yes
10	10	1	0	1	0	2	0	0	2	0	Extant	yes
11	11	1	1	1	0	1	0	0	3	0	Extant	yes
12	12	1	1	0	0	0	0	0	0	0	Extant	yes
13	13	1	1	0	0	2	6	2	1	0	Extant	yes
14	14	1	0	0	0	0	0	0	0	0	Extant	no
15	15	1	2	0	0	0	0	0	0	0	Extant	no
16	16	2	0	0	0	0	0	0	1	0	Extant	no
17	17	1	0	0	0	0	0	0	1	0	Extant	no
18	none	0	3	0	0	0	0	0	1	0	Extant	yes
19	none	0	1	0	0	0	0	0	2	0	Extant	yes
20	none	0	0	0	0	1	1	1	0	0	Extant	no
21	none	0	0	0	0	1	0	3	0	0	Extant	no
22	none	0	0	0	0	2	0	0	0	0	Extirpated	yes
23	none	0	0	1	0	2	3	3	0	0	Extant	yes
24	none	0	0	1	0	1	1	4	0	0	Extant	no
25	none	0	0	0	0	0	0	2	0	0	Extant	no
26	none	0	0	0	1	0	0	0	0	0	Extirpated	yes
27	none	0	0	0	0	1	2	2	0	0	Extant	no
28	none	0	0	0	0	1	1	0	0	0	Extant	no
29	none	0	0	0	0	0	0	0	0	2	Extant	no
30	none	0	0	0	0	0	0	0	0	6	Extant	no
31	none	0	0	0	0	0	0	0	0	1	Extant	no