# BEFORE THE CALIFORNIA FISH AND GAME COMMISSION

## A Petition to List the Inyo Rock Daisy (*Perityle inyoensis*, synonym *Laphamia inyoensis*) as Threatened or Endangered under the California Endangered Species Act (CESA)

Maria Jesus, the Center for Biological Diversity, and California Native Plant Society

February 2, 2022

CENTER for BIOLOGICAL DIVERSITY

CALIFORNIA NATIVE PLANT SOCIETY

**Notice of Petition**

For action pursuant to Section 670.1, Title 14, California Code of Regulations (CCR) and Division 3, Chapter 1.5, Article 2 of the California Fish and Game Code (Sections 2070 *et seq*.) relating to listing and delisting endangered and threatened species of plants and animals.

I. SPECIES BEING PETITIONED:

Species Name: Inyo rock daisy (*Perityle inyoensis,* synonym *Laphamia inyoensis*) as a full species.

II. RECOMMENDED ACTION: Listing as Threatened or Endangered

Maria Jesus, the Center for Biological Diversity, and California Native Plant Society submit this petition to list the Inyo rock daisy (*Perityle inyoensis*) as a threatened or endangered species pursuant to the California Endangered Species Act (California Fish and Game Code §§ 2050 et seq., "CESA").

This petition demonstrates that the Inyo rock daisy is eligible for and warrants listing under CESA based on the factors specified in the statute and implementing regulations. A plant is an "endangered species" when it is "in serious danger of becoming extinct throughout all, or a significant portion, of its range due to one or more causes, including loss of habitat, change in habitat, overexploitation, predation, competition, or disease." Cal. Fish & Game Code § 2062. A "threatened species" of plant is one "that, although not presently threatened with extinction, is likely to become an endangered species in the foreseeable future in the absence of the special protection and management efforts . . . ." Cal. Fish & Game Code § 2067.

As detailed in this petition, given the Inyo rock daisy's restricted range and known threats, including a proposed large-scale mining project in the core of its range, listing as a threatened or endangered species clearly "may be warranted." We respectfully request the Department of Fish and Wildlife and Fish and Game Commission should make such recommendations and findings pursuant to their respective authorities. Cal. Fish & Game Code §§ 2073.5 & 2074.2.

Cover photo of Inyo rock daisy growing within a crevice of calcareous bedrock located at Conglomerate Mesa, near the site of ongoing gold exploration projects. Photo by Dylan Cohen, used with permission.

III. AUTHORS OF PETITION:

Maria Jesus
PO Box 364
Bishop, CA 93515
(760) 914-4932
inyorockdaisy@gmail.com

Ileene Anderson, Senior Scientist/Public Lands Desert Director
Center for Biological Diversity
PO Box 549
Joshua Tree, CA 92252
(323) 490-0023
ianderson@biologicaldiversity.org

Nicholas Jensen, PhD, Conservation Program Director
California Native Plant Society
2707 K Street, Suite 1
Sacramento, CA 95816
njensen@cnps.org

I hereby certify that, to the best of my knowledge, all statements made in this petition are true and complete.

Signature: Date: February 2, 2022

**The Center for Biological Diversity** ("Center") is a nonprofit, public interest environmental organization dedicated to the protection of imperiled species and the habitat and climate they need to survive through science, policy, law, and creative media. The Center is supported by more than 1.7 million members and online activists worldwide.

**California Native Plant Society** ("CNPS") is a non-profit environmental organization with over 11,000 members in 35 Chapters across California and Baja California, Mexico. CNPS's mission is to protect California's native plant heritage and preserve it for future generations through the application of science, research, education, and conservation.

## Table of Contents

**Executive Summary**

Maria Jesus, the Center for Biological Diversity, the California Native Plant Society submit this petition to list the Inyo rock daisy (*Perityle inyoensis,* synonym *Laphamia inyoensis*) as a threatened or endangered species pursuant to the California Endangered Species Act (CESA). This petition demonstrates that the Inyo rock daisy is eligible for and warrants listing under CESA based on the factors specified in the statute and implementing regulations.

The Inyo rock daisy belongs to a group of perennial, self-incompatible subshrubs in the sunflower family (Asteraceae). The species is endemic to the southern Inyo Mountains in Inyo County, CA where it persists on sparsely distributed calcareous rock outcrops at the highest elevations of the mountain range. The global range of the species is spread across approximately 51.4 $km^2$ (19.8$mi^2$), but the cumulative mapped area of occupancy is less than 1 $km^2$ (0.62 $mi^2$). There are only 26 known extant occurrences and the total number of individuals is in the low thousands (estimated to range from 2921 to 5395).

The 26 extant occurrences are concentrated in two core areas - on Conglomerate Mesa (14 occurrences) and Cerro Gordo-Pleasant Point (11 occurrences) - with an additional isolated occurrence on a small calcareous outcrop at the former Santa Rosa Mine site. Twenty-two occurrences are on federal lands administered by the Bureau of Land Management (BLM) and the remaining four occurrences are partially on BLM and partially on private lands at Cerro Gordo and Bonham Canyon.

While inherently vulnerable to climate change, invasive species, and other threats due to its restricted range, the Inyo rock daisy faces significant and imminent threats to its continued existence from habitat loss and disturbance due to mining. Extensive historic mining activity, which began in 1865, has already modified and/or destroyed occupied habitat through the construction of adits, mineshafts, pits, roads, surface workings, and other structures. The current population distribution and abundance is likely already significantly reduced from its pre-disturbance state. Mining, however, is not just an historic threat; 25 out of 26 occurrences are subject to existing mining claims, the 26$^{th}$ occurrence is within 0.25 mi of mining claims, and a pending proposal for a large-scale open-pit gold mine would destroy the bulk of the species' habitat on Conglomerate Mesa.

Mining would interfere with the continued existence of the Inyo rock daisy by habitat removal and/or fragmentation, destruction of individual plants and/or populations, introduction and/or expansion of non-native plant populations, and disruption of critical pollinator services. In addition to the threat of mining, plans to develop the Cerro Gordo area into a tourist attraction may impact Inyo rock daisy occurrences on private lands.

There are no existing regulatory mechanisms that are sufficient to protect this plant from extinction. Although Inyo rock daisy is a BLM California sensitive species and has a California Rare Plant Rank of 1B.2, these designations do not provide adequate substantive protections from new and existing threats to the species. Listing of the Inyo rock daisy as a threatened or endangered species under CESA is necessary to provide critical legal protections to ensure the survival of this highly imperiled plant species.

Under CESA, a "threatened species" is "a native species or subspecies of a … plant that, although not presently threatened with extinction, is likely to become an endangered species in the foreseeable future in the absence of the special protection and management efforts…" Cal. Fish & Game Code § 2067. A plant is an "endangered species" when it is "in serious danger of becoming extinct throughout all, or a significant portion, of its range due to one or more causes, including loss of habitat, change in habitat, overexploitation, predation, competition, or disease." Cal. Fish & Game Code § 2062.

Given the Inyo rock daisy's restricted range and known threats, that listing as a threatened or endangered species *may be* warranted cannot be subject to reasonable dispute; in light of the significant impacts posed by a proposed large-scale mining project in the heart of its limited range, classification as - at a minimum - a threatened species clearly *is* warranted. The appropriate classification can be determined following the competition of the Department of Fish and Wildlife's status review and recommendation carried out pursuant to Cal. Fish & Game Code § 2074.6.

**The Inyo Rock Daisy Warrants Listing as a Threatened or Endangered Species under the California Endangered Species Act (CESA)**

## 1 Introduction

This petition summarizes the available scientific information regarding the taxonomy and natural history of the Inyo rock daisy (*Perityle inyoensis*, synonym *Laphamia inyoensis*), its distribution and abundance in California, population trends and threats, and discusses the limitations of existing management measures in protecting the species. As demonstrated below, the Inyo rock daisy meets the criteria for protection as a "threatened" or "endangered species" under the California Endangered Species Act (CESA) and would benefit greatly from such protection.

The Inyo rock daisy has long been understood to be a narrow endemic, limited to the Inyo Mountain range in Inyo County, CA (Ferris 1958; Baldwin and Moe 2002), but little else was known about this species until relatively recently. The species has also been recognized as potentially warranting legal protection for almost five decades but has never received formal federal Endangered Species Act (ESA) protection.[1] Currently, the species has a California Rare Plant Rank of 1B.2 (CNDDB and CNPS 2020), while the Bureau of Land Management (BLM) considers it a sensitive species (CNDDB 2021). Neither status confers substantive protection.

Since 2018, our understanding of the taxonomy, biology, distribution, and threats of the Inyo rock daisy has increased significantly. Scientific interest in the genus *Perityle,* and close relatives (tribe Perityleae), led to extensive field surveys documenting the full range of the Inyo rock daisy. The associated phylogenetic analyses reinforce our understanding of the species as a distinct taxon and bring to light certain biological vulnerabilities that face this rock-dwelling plant species (Lichter-Marck et al. 2020). In addition, a comprehensive study of the flora of the southern Inyo Mountains (Jesus 2021) as well as seed collection efforts initiated by the California Botanic Garden (CBG), located and characterized new occurrences of the Inyo rock daisy concentrated in the Conglomerate Mesa area of the Inyo Mountains (CBG 2019; CDFW 2022;).

In parallel to this scientific research, the threat of mining development in the southern Inyo Mountains has continued to grow. Since 2019, mining exploration company K2 Gold has acquired control of several hundred mining claims, which total 58.3 $km^2$ (22.5 $mi^2$) and overlap with a significant portion of the Inyo rock daisy's global distribution (K2 Gold 2021c). K2 Gold is currently conducting extensive mineral exploration in the area and claims it contains "one of

---

[1] The federal ESA directed the Smithsonian Institution to prepare a list of threatened and endangered plants in the United States. 16 U.S.C. § 1541. The Inyo rock daisy was recommended for protection as a threatened species in the Smithsonian's 1975 report to Congress and the U.S. Fish and Wildlife Service (USFWS) subsequently designated the species a candidate for such listing under the ESA. 40 Fed. Reg. 27824 (July 1, 1975) (USFWS 1975). In subsequent notices, USFWS reaffirmed the species' candidate status but grouped it, along with numerous other plants, as a "C2" species, one for which "proposing to list as threatened or endangered is possibly appropriate, but for which sufficient data on biological vulnerability and threat are not currently available to support proposed rules" (USFWS 1993). The USFWS subsequently eliminated the C2 category entirely without ever addressing whether the species in fact warranted listing. 61 Fed. Reg. 64481 (February 28, 1996) (USFWS 1996).

the best oxide gold intersections in the SW US in the past decade" (K2 Gold 2021a). In particular, the area is thought to contain extensive sediment-hosted gold deposits (K2 Gold 2021a), which typically require open-pit mining methods (Berger et al. 2014; Manning and Kappes 2016).

Mining-related development represents the single largest threat to the Inyo rock daisy and existing regulatory mechanisms do not provide adequate protection. Habitat fragmentation and/or loss associated with mining is likely to intensify the effects of additional threats such as invasive plants, climate change, and vulnerabilities associated with small population size already facing the Inyo rock daisy.[2] In light of these threats, the Inyo rock daisy qualifies for, and desperately needs, the protections afforded by CESA.

## 2 Life History

### *2.1 Taxonomy*

While the nomenclature and our understanding of the evolutionary history of the Inyo rock daisy has changed since its original description, its status a valid and distinct taxon is firmly established. *Perityle* is currently recognized as one of five genera in the Perityleae tribe in the sunflower family (Asteraceae). *Perityle inyoensis* was first described by Roxana Ferris in 1958 who originally placed it in the genus *Laphamia*. In 1941, the discovery of a taxon which appeared to be intermediate between *Perityle* and *Laphamia* prompted a re-examination of the groups (Johnston 1941). In 1959, Shinners proposed a transfer of the entire genus *Laphamia* into *Perityle* owing to "overrated" morphological differences that had previously separated the two genera. Shinners' inclusive generic concept was upheld by Powell (1968) who formally transferred *Laphamia* to *Perityle*, though he chose to retain *Laphamia* as an infrageneric section.

The Inyo rock daisy was collected at least four times in the Inyo Mountains before being described as a distinct taxon (*Alexander & Kellogg 3056A*, GH!; *Jaeger s.n.*, *Kerr s.n.*, *DeDecker 746*, RSA). As evidenced by the herbarium labels on specimens held at the California Botanic Garden herbarium (*Kerr s.n.*, *Alexander and Kellogg 3056A*), these collections were originally determined to *Laphamia megalocephala* (synonymous with *Perityle megalocephala*), which occurs in the northern Inyo Mountains. Ferris noted in her species description (1958) that, "An intensive field survey with especial attention to variation in growth forms as shown by their response to ecological conditions may necessitate changes in the taxonomic status of our species." Indeed, a thorough phylogenetic study of the tribe Perityleae was recently completed and fully supports recognition of Inyo rock daisy as a distinct taxon (Lichter-Marck et al. 2020). However, this study resolves the genus *Perityle* as non-monophyletic and supports

[2] For instance, ground disturbance associated with mining could facilitate the spread of invasive species. Additionally, mining development could destroy microrefugia that could be essential for the continuation of the species as the warming and drying effects of climate change render current habitat unsuitable. Finally, habitat destruction, modification, and/or curtailment could further fragment populations leaving them more susceptible to stochastic events.

reclassification at the generic level.[3] Put simply, the genus will be split into smaller groups that better reflect evolutionary relationships. A revised taxonomic classification of the rock daisy tribe (Perityleae) is forthcoming and is expected to reinstate the genus *Laphamia* (Lichter-Marck and Baldwin in press). The scientific name for the Inyo rock daisy is expected to revert back to *Laphamia inyoensis* Ferris, which is fully synonymous with *Perityle inyoensis* (Ferris) A.M. Powell. This name update will not change the distribution or rarity of this taxonomic entity.

### *2.2 Species Description*

The Inyo rock daisy is a perennial subshrub that ranges from 10 to 30 cm tall (Yarborough and Powell 2006). Multiple branches arise from a woody caudex and are densely covered in soft, spreading hairs and short glandular hairs (Fig. 1). Leaves are arranged opposite or alternate with petioles from 5 to 20 mm long. Leaf blades range from 1 to 2 cm long, and are orbiculate, ovate, or triangular with serrate to serrate-lobed margins. Both leaf surfaces are covered in soft, spreading hairs intermixed with short glandular hairs.

The discoid inflorescences consist of one to three bell-shaped involucres that arise individually or in a corymbiform array on peduncles that are 8 to 40 mm long (Yarborough and Powell 2006; Fig. 2). Flowers are subtended by 14 to 21 persistent involucral bracts that are linear-lanceolate and arranged in two similar series. They range from 5.5 to 6.5 mm long and 1.1 to 1.5 mm wide. Inflorescences contain 35 to 60 yellow, bisexual disc flowers with 4 lobes and no ray flowers. Total corolla length is between 4 and 5 mm long; the tubes are 1.4 to 1.6 mm long, throats are 2 to 2.4 mm long, and lobes are 0.6 to 0.7 mm long (Fig. 3). The four yellow stamens have deltate (triangular) anther tips. The style branches narrow into tapered tips. Fruits are linear to oblanceolate with short-hairy margins; the faces are dark brown to black, puberulent, flattened, and obscurely rounded or angled on one or both surfaces. Mature fruits typically lack pappus, but if pappus is present then it consists of an inconspicuous crown of minute scales.

[3] Modern taxonomists generally delineate genera to reflect monophyletic groups (i.e. groups that include the last common ancestor and all its descendants). Phylogenetic trees produced by Lichter-Marck et al. (2020) resolved four separate clades of *Perityle* with some taxa more closely related to other genera.

Fig. 1–3. Distinguishing morphological characters of the Inyo rock daisy.—1. Long hairs. Photo credit: Steve Matson, CC BY-NC 3.0.—2. Discoid inflorescence. Photo credit: Maria Jesus.—3. Linear-lanceolate involucral bracts, cypselae, inconspicuous pappus, and disc flowers. Photo credit: Steve Matson, CC BY-NC 3.0.

*Perityle inyoensis* is morphologically similar to *P. villosa* (Hanaupah rock daisy) which occurs over 30 miles to the east in Death Valley National Park. *Perityle villosa* is best distinguished from *P. inyoensis* by leaf characteristics (Ferris 1958). The margins of *P. villosa* are entire or have one- to three-pointed lobes, and the leaves are alternately arranged, whereas the leaves in *P. inyoensis* are serrate to serrate-lobed and sometimes oppositely arranged (Fig. 4). *Perityle inyoensis* was thought to be allied with *P. megalocephala* var. *megalocephala* (large headed rock daisy) and var. *oligophylla* (straight leaf rock daisy; Yarborough and Powell 2006), which surround the range of *P. inyoensis* on three sides (CCH2 2021). These taxa can be differentiated by the presence of short-rough-hairy leaves and stems as compared to the long-hairy herbage found on *P. inyoensis* (Figs. 1, 5).

Fig. 4–5. Species allied with *P. inyoensis*.—4. Entire leaves of *P. villosa*. Photo credit: Dana York CC BY-ND 3.0.—5. Short-hairy herbage of *P. megalocephala* var. *megalocephala*. Photo credit: Steve Matson, CC BY-NC 3.0.

### *2.3 Reproduction and Growth*

While little is known about the reproductive mechanisms of the Inyo rock daisy, all available evidence suggests the species is self-incompatible and dependent upon sexual reproduction as described in further detail below.

<u>Flowering & Pollination</u>

As described above, bisexual flowers are aggregated into discoid heads which arise individually or in a corymbiform array. Flowering occurs between June and September (Keil 2012) with plants at lower elevations blooming sooner than plants at higher elevations (Lichter-Marck pers. comm. 2018; Jesus pers. obs. 2018–2021). Based on field observations and notes from historical collections, peak flowering occurs between July and August (Bell pers. comm. 2018; Marck pers. comm. 2018; Jesus pers. obs.; *Alexander and Kellogg 3056*, UTC; *DeDecker 6331*, RSA). Adequate precipitation is needed for plants to flower. Although the exact precipitation amount for flowering is unknown, observations from 2021, an exceptional drought year, indicate flowering was markedly decreased from previous years (SBBG 2021; Schneider pers. comm. 2021; Jesus pers. obs. 2021).

Both population size and pollinator services play a crucial role in the reproductive success of the Inyo rock daisy, which is expected to require pollen from relatively distant individuals due to its breeding system. In a study of closely related species from section *Pappothrix* and section *Laphamia*, individuals were grown from seed and/or woody caudexes and all individuals were determined to be self-incompatible (Powell 1972). Successful reproduction for self-incompatible species requires that they differ by at least one allele at the *S* locus (a linked cluster of genes responsible for self-sterility) (De Nettancourt 1977). While this strategy undoubtedly promotes outcrossing, small populations are at a disadvantage due to the reduced number of genetically compatible mates (Byers and Meagher 1992; Young and Pickup 2010). Therefore, having a suitable number of genetically compatible mates within the range of pollinators is expected to be vital to the continuation of *P. inyoensis*.

Based on extensive field observations in the southern Inyo Mountains, the Inyo rock daisy appeared to be one of the only species in flower during July and hosted an abundance of pollinators (Lichter-Marck pers. comm. 2018). Flower visitors included leaf cutting bees, bumblebees, and sweatbees (families Megachilidae, Apidae, and Halictidae respectively), flies (families Bombyliidae, Tachinidae, and Culicidae), and wasps (several subfamilies of Vespidae, including Ichneumonidae and Pepsidae) (Lichter-Marck pers. comm. 2018).

<u>Seed production & dispersal</u>

Fruiting for the Inyo rock daisy has been observed to begin as early as July and continues through September at higher elevations (Lichter-Marck pers. comm. 2018; Jesus pers. obs. 2018–2021). Fruits are typically 3–3.5 mm long and lack a well-developed pappus (Yarborough and Powell 2006).

Little is known about seed dispersal mechanisms for this species, but anatomical features and ancestral state reconstructions provide some insight. Many species within Asteraceae possess complex pappus structures which are thought to increase dispersal distance by wind (Sheldon and Burrows 1973). The pappus structure for the Inyo rock daisy ranges from rudimentary to wholly absent which limits opportunities for long-distance wind-dispersal. However, long-distance wind-dispersal may offer few benefits to the Inyo rock daisy, which is generally limited to crevices on steep, sometimes vertical, rocky outcrops (Figs. 6–7). An analysis of ancestral state reconstructions for the genus *Perityle s.l.* suggests that pappus elements are under extreme selection and rock specialists such as *P. inyoensis* have lost pappus traits that would be more conducive to wind dispersal (Lichter-Marck et al. 2020). It is reasonable to assume that gravity is an important component for dispersing these fruits into suitable crevices near the maternal plants as opposed to distant dispersal by wind or other means into unsuitable habitat. Across all the rock-dwelling *Perityle s.l.* species, individuals that disperse beyond suitable cliff faces into non-rocky habitats seem to rarely survive to maturity (Lichter-Marck et al. 2020). Seeds may be moved by animals in the area, such as rodents or ants, but additional research is needed to identify potential dispersers as well as corresponding dispersal distance and frequency.

Fig. 6–7. Inyo rock daisy growing in crevices of calcareous rock.—6. Photo credit: Steve Matson, CC BY-NC. —7. Photo credit: Amy Patten, CC BY-ND.

<u>Asexual reproduction</u>

Plants grow from a single woody caudex and there is no evidence of propagules borne on rhizomes or branch sprouts. Most plants occur in narrow rock crevices where growth is restricted. Without rhizomes or branch sprouts, it is unlikely the species would reproduce asexually in this habitat (Figs. 6–7).

<u>Germination and growth</u>

Seeds were collected for conservation purposes by CBG in 2018. Germination trials in a controlled setting (i.e. sown in agar and placed in growth chambers) resulted in 52.6% and 73.8% germination for the two conservation seed collections (CBG 2019). While these results indicate seeds are viable and capable of effective germination, few established seedlings have been observed in the field. For instance, fewer than 5 seedlings were observed during 2018 (Marck pers. comm. 2018) and 2019 surveys (Jesus pers. obs.) and fewer than 20 seedlings were observed during 2020 surveys (Jesus pers. obs.). All established seedlings that were observed occurred in the crevices of calcareous rock outcrops.

Little is known about the age of flowering or the typical life span of the Inyo rock daisy. In general, shrub species that occur in desert environments are understood to be long-lived and slow growing (Goldberg and Turner 1986; Bowers et al. 1995). In a long-term study of Mojave Desert species, small shrubs were found to grow 0.02–0.05$m^2$/year and were replaced approximately once every century (Cody 2000). In addition, plants that occur on the nutrient-poor soils of rocky cliffs have been found to grow more slowly and reach an older maximum age compared to plants growing on surrounding high quality soils (Larson et al. 2000).

### *2.4 Kind of Habitat Necessary for Species Survival*

The Inyo rock daisy occurs at the intersection of the Southern Great Basin and Mojave Desert subregions as defined by the US Forest Service's National Ecological Region System for California (McNab and Avers 1994; Miles and Goudey 1997). Plants generally are found on sparsely vegetated calcareous rock outcrops above 2019 m (6623 ft) (Bell pers. comm. 2018; Jesus pers. obs. 2018–2020; CDFW 2022). These outcrops and canyons are most commonly situated in pinyon woodlands, and more rarely in Joshua tree woodlands or sagebrush shrublands, which are typically located near the pinyon belt (Bell pers. comm. 2018; Jesus pers. obs. 2018–2021; CDFW 2022). Associated species include *Astragalus lentiginosus* var. *fremontii* (Fremont's milkvetch), *Astragalus newberryi* var. *newberryi* (Newberry's milkvetch), *Artemisia nova* (black sagebrush), *Artemisia tridentata* (big sagebrush), *Atriplex confertifolia* (shadscale), *Bromus rubens* (red brome), *Bromus tectorum* (cheatgrass), *Calochortus brunueanis* (pinyon mariposa), *Castilleja chromosa* (desert paintbrush), *Caulanthus crassicaulis* (thickstem wild cabbage), *Chaenactis douglasii* var. *douglasii* (Douglas' dustymaiden), *Chamaebatiaria millefolium* (fernbush), *Chrysothamnus viscidiflorus* subsp. *puberulus* (yellow rabbitbrush), *Cycladenia humilis* var. *jonesii* (Sacramento waxy dogbane), *Elymus elymoides* (squirreltail), *Ephedra nevadensis* (Nevada ephedra), *Ephedra viridis* (Mormon tea), *Ericameria cuneata* (cliff goldenbush), *Ericameria nauseosa* (rubber rabbitbrush), *Ericameria teretifolia* (green rabbitbrush), *Erigeron aphanactis* var. *aphanactis* (rayless daisy), *Eriogonum heermannii* var. *argense* (Heermann's buckwheat), *Eriogonum nidularium* (birdnest buckwheat), *Glossopetalon spinescens* (spiny greasebush), *Gutierrezia sarothrae* (broom snakeweed), *Halimolobos jaegeri* (Jaeger's halimolobos), *Heuchera rubescens* (pink alumroot), *Hilaria jamesii* (galleta), *Holodiscus discolor* var. *microphyllus* (oceanspray), *Juniperus osteosperma* (Utah juniper), *Krascheninnikovia lanata* (winterfat), *Lepidium fremontii* (desert pepperweed), *Linanthus pungens* (granite prickly phlox), *Lomatium nevadense* (Nevada biscuitroot), *Lupinus argenteus* (silvery lupine), *Opuntia basilaris* (beavertail cactus), *Opuntia polyacantha* (plains pricklypear), *Oreocarya flavoculata* (roughseed cryptantha), *Petrophytum caespitosum* (rock spirea), *Pinus flexilis* (limber pine), *Pinus monophylla* (singleleaf pinyon pine), *Poa secunda* (Sandberg bluegrass), *Purshia stansburyana* (Stansbury's cliffrose), *Purshia tridentata* (Antelope bitterbrush), *Ribes velutinum* (desert gooseberry), *Salsola tragus* (Russian thistle), *Stanleya pinnata* var. *pinnata* (desert prince's plume), *Stipa hymenoides* (Indian ricegrass), *Stipa speciosa* (desert needlegrass), *Symphoricarpos longiflorus* (desert snowberry), *Vulpia octoflora* (sixweeks fescue) and *Yucca brevifolia* (western Joshua tree; Jesus pers. obs. 2018–2021; CDFW 2022). Plant species with a California Rare Plant Rank (CNDDB 2021) that are known to co-occur with Inyo rock daisy include *Allium atrorubens* var. *cristatum* (crested onion), *Boechera shockleyi*

(Shockley's rockcress), *Diplacus parryi* (Parry's monkeyflower), *Ericameria nana* (Dwarf goldenbush), *Erigeron uncialis* var. *uncialis* (Lone fleabane), *Eriogonum mensicola* (Pinyon Mesa buckwheat), *Hesperidanthus jaegeri* (Jaeger's hesperidanthus), *Jamesia americana* var. *rosea* (Fivepetal cliffbush), *Oenothera cespitosa* subsp. *crinita* (cespitose evening primrose), *Pinus longaeva* (Bristlecone pine) and *Sclerocactus polyancistrus* (Mojave fishhook cactus; Jesus pers. obs. 2018–2021; CDFW 2022).

The Inyo rock daisy is endemic to the southern extent of the Inyo Mountains where the surface rock is a heterogeneous mix of sedimentary, volcanic, and alluvial deposits (Stone et al. 2004, 2009). However, nearly all documented occurrences of the Inyo rock daisy occur in the presence of carbonate rock (e.g., dolomite, limestone). No occurrences have been located on volcanic or alluvial substrates. Geologic formations that correspond to Inyo rock daisy occurrences include the Lost Burro Formation, Tin Mountain Limestone, Mexican Spring Formation, and Rest Spring Shale (Stone et al. 2004). In the Conglomerate Mesa area, the Inyo rock daisy occurs on outcrops that belong to a complex series of sedimentary formations (e.g., Conglomerate Mesa Formation) with abundant limestone components (Stone et al. 2009). There is a single occurrence of Inyo rock daisy on an isolated calcareous rock exposure in the Malpais Mesa Wilderness, an area that is otherwise comprised of volcanic rock (Hall and MacKevitt 1962; Jayco 2009).

Climate patterns within the Inyo rock daisy's range are typical of cold desert environments in western North America. There are no weather stations in the immediate vicinity, but modeled data provide a reasonable indication of average weather conditions. The PRISM Climate Group Explorer Tool (2021) was used to estimate standard 30-year normals (1981–2010) at a 4 km resolution for Cerro Gordo (36.5386, -117.7903) and Conglomerate Mesa (36.5118, -117.7436), the two main areas where Inyo rock daisy occurs. In general, summers are hot and dry while winters are cold, moist, and often reach freezing temperatures. On average, Cerro Gordo and Conglomerate Mesa are modeled to receive 34.7 cm (13.7 in) and 29.4 cm (11.6 in) of precipitation a year, respectively, with most falling from November through March. However, interannual variability in the region is considerable with annual precipitation values ranging from 3.8 cm (1.5 in) to 43.9 cm (17.3 in), based on data from the nearest weather station in Haiwee, CA (WRCC 2021). While the exact amount of precipitation needed for leaves and flowers to emerge is unknown, the extreme drought conditions of 2021 appear to have prevented many plants from flowering (Schneider pers. comm. 2021; Jesus pers. obs. 2021).

## 3 Range and Distribution

The Inyo rock daisy only occurs in California, at the southern end of the Inyo Mountains in Inyo County. There are 26 known Element Occurrences (EO) recorded in the California Natural Diversity Database (CNDDB) as of January 2022 (Fig. 8; Table 1). These represent all known occurrences of the Inyo rock daisy at this time. A single CNDDB EO may consist of one or more locations that are close enough in proximity to be considered part of the same occurrence.

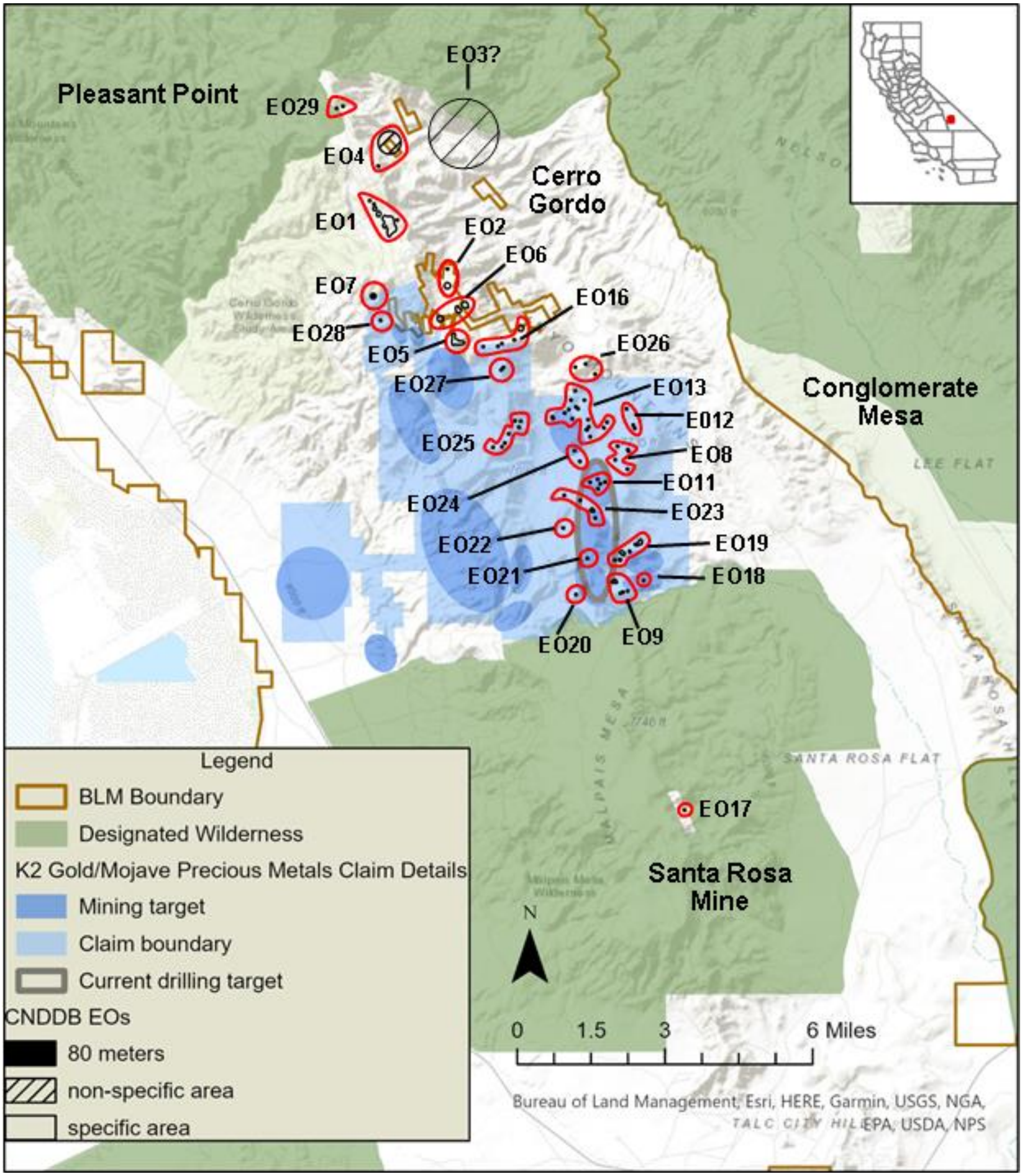


Fig. 8. Map of Inyo rock daisy range, all known occurrences (CNDDB EOs), and K2 Gold/Mojave Precious Metals' project area (K2 Gold 2021c; CDFW 2022). EOs often consist of multiple polygons (black) which are outlined here (red) for clarity.

.

Table 1. Summary of all known Inyo rock daisy occurrences based on CNDDB element occurrences except where noted otherwise (CDFW 2022). Population minimum and maximum values are derived from estimates shown in Appendix I.

| EO | # of Parts | Elevation (ft) | Area (acres) | Ownership | Pop. Min | Pop. Max | Threats[1] |
|---|---|---|---|---|---|---|---|
| 1 | 6 | 8600 | 38 | BLM | 241 | 463 | Mining, trampling |
| 2 | 2 | 8360 | 6 | BLM, PVT | 83 | 157 | Mining |
| 3 | 1 | 5900 | (non-specific area) | BLM | 3 | 77 | Mining[2] |
| 4 | 2 | 8000 | (non-specific area) | BLM, PVT? | 6 | 154 | Mining[2] |
| 5 | 1 | 8900 | 13 | BLM | 100 | 100 | Mining |
| 6 | 3 | 8800 | 15 | BLM, PVT | 106 | 254 | Mining |
| 7 | 1 | 7400 | 5 | BLM | 35 | 35 | Mining[2] |
| 8 | 4 | 7600 | 3 | BLM | 69 | 291 | Mining |
| 9 | 4 | 7000 | 5 | BLM | 164 | 164 | Mining, overland travel/road construction |
| 11 | 5 | 7200 | 4 | BLM | 15 | 311 | Mining, invasive species, overland travel/road construction |
| 12 | 3 | 7530 | 2 | BLM | 27 | 101 | Mining |
| 13 | 15 | 7400 | 11 | BLM | 499 | 1049 | Mining, invasive species |
| 16 | 5 | 8400 | 8 | BLM, PVT | 616 | 616 | Mining, invasive species |
| 17 | 1 | 6725 | 1 | BLM | 50 | 50 | Mining, invasive species |
| 18 | 1 | 6623 | 1 | BLM | 3 | 77 | Mining |
| 19 | 5 | 6800 | 10 | BLM | 101 | 101 | Mining, invasive species, overland travel/road construction, trampling |
| 20 | 1 | 7234 | 1 | BLM | 60 | 60 | Mining, invasive species |
| 21 | 1 | 7167 | 1 | BLM | 3 | 3 | Mining, trampling |
| 22 | 1 | 6715 | 1 | BLM | 3 | 77 | Spider mites |
| 23 | 4 | 7000 | 4 | BLM | 46 | 194 | Mining, overland travel/road construction |
| 24 | 2 | 7000 | 1 | BLM | 6 | 154 | Mining, invasive species |
| 25 | 7 | 8130 | 5 | BLM | 501 | 575 | Mining |
| 26 | 3 | 7400 | 2 | BLM | 70 | 70 | Mining, invasive species |
| 27 | 2 | 8656 | 1 | BLM | 58 | 58 | Mining |
| 28 | 1 | 7119 | 1 | BLM | 3 | 77 | Mining[2] |
| 29 | 2 | 9000 | 1 | BLM | 53 | 127 | Mining |
| | | **TOTALS** | **140**[3] | | **2921** | **5395** | |

[1]Invasive species, climate change, and small population size threaten all occurrences to some degree.
[2]No threats listed in EO. Inferred based on presence of mining claims.
[3]Does not include acreage for EO 3 and EO 4 which are based on incomplete data.

The global range of the Inyo rock daisy is approximately 51.4 $km^2$ (19.8 $mi^2$) and was calculated using the GeoCAT tool (Bachman et al. 2011) with all known Inyo rock daisy occurrences as inputs. The minimum mapped area of actual occupancy is less than 1 $km^2$ (0.62

mi$^2$) as most of the range consists of unsuitable habitat (e.g., lower elevations, volcanic substrates, alluvial deposits). Occurrences are primarily found on calcareous rock outcrops at elevations between 2019 and 2743 m (6623 and 9000 ft). Occurrences are concentrated along the Inyo Mountains crest, extending south from Pleasant Point to Cerro Gordo, and then broadening to the east in the Conglomerate Mesa area (Fig. 8). A single, isolated occurrence is located at the Santa Rosa Mine on the eastern side of the Malpais Mesa Wilderness, just south of Conglomerate Mesa.

From 2018 to 2021, numerous attempts were made to document the Inyo rock daisy's range extent and to locate new occurrences. In 2018, researchers surveyed and sampled putative individual Inyo rock daisy plants throughout the species' range to inform phylogenetic analyses of the genus *Perityle s.l.* Suitable habitat was surveyed along the Inyo crest, between the base of Pleasant Point and New York Butte, but no additional occurrences were located (Lichter-Marck pers. comm. 2018). Similar surveys were conducted to the east at Tin Mountain where one set of historical collections (*DeDecker 4748, 4761*, CAS) had been previously determined to *P. inyoensis* (though duplicate specimens at RSA and UC were determined to *P. villosa*). Recent morphological, ecological, and genetic analysis of this population confirms these plants are not *P. inyoensis*, and instead form a cryptic and undescribed evolutionary lineage previously unknown to western science (Lichter-Marck et al. 2020; Lichter-Marck pers. comm. 2021). Finally, in-depth study of populations previously believed to be *P. inyoensis* in the Talc City Hills to the southeast of the Inyo Mountains have revealed these to constitute a distinctive evolutionary lineage, more closely related to *Perityle megalocephala* var. *oligophylla* and possibly of hybrid origins pending further study (Lichter-Marck in prep., pers. comm. 2021).

Several new occurrences have been documented within the known extent of *P. inyoensis* as a result of recent floristic research (Jesus 2021) as well as seed collection efforts initiated by CBG (Bell pers. comm. 2018) and Santa Barbara Botanic Garden (SBBG; Schneider pers. comm. 2021). Extensive surveys of the northern portion of Malpais Mesa Wilderness did not reveal any additional suitable habitat or occurrences (Jesus pers. obs. 2018–2020), but a small, isolated limestone outcrop to the south at relatively low elevation (5000–6000 ft), remains to be surveyed. Additional surveys of calcareous substrates at lower elevations (e.g., San Lucas Canyon, White Mtn. Talc Road, lower Bonham Canyon, west slope of Inyo crest) failed to locate new occurrences (Jesus 2021, pers. obs. 2018–2021).

Most EOs have been verified by field surveys except for EO 3, which is based on vague data from a 1939 E.C. Jaeger herbarium collection and is mapped by CNDDB as a non-specific feature in lower Bonham Canyon (CDFW 2022; Fig. 8). Jaeger is known for reporting imprecise and sometimes outright false locations. Indeed, habitat at this elevation (5900 ft) appears unsuitable and it is possible the collection was made further up the canyon, possibly at or near EO4 (Jesus pers. obs. 2021; CDFW 2022).

## 4 Abundance and Population Trends

Ten CNDDB EOs include complete population numbers and provide a basis for estimating abundance across all documented occurrences. Known population numbers, extrapolated to density per acre, range from 3 plants per acre at EO 21 to 77 plants per acre at EO 16 (CDFW

2022; Appendix I). This range in density was used to estimate minimum and maximum values for all polygons (i.e. EO "parts") where population numbers were not counted in the field. The global population is estimated to range from 2921 to 5395 individuals (Appendix I).

The Inyo rock daisy was likely more abundant before the onset of widespread mining development in the area (McKee et al. 1985; Unrau 1997), including the Cerro Gordo mine, which became one of the largest silver mines in California's history (Merriam 1963). Cerro Gordo and other historic mines modified and/or destroyed occupied habitat of the Inyo rock daisy through the construction of adits, pits, roads, surface workings, trenches, and other structures. Historic mines within the range of the Inyo rock daisy include the following (listed from north to south): Bonham Talc Mine, Holiday Mine, Silver Spear Mine, Ella Mine, San Lucas Mine, Newtown Mine, Sunset Mine, Cerro Gordo Mine, Ignacio Mine, Belmont Mine, Morning Star Mine, and Santa Rosa Mine (Fig. 9).

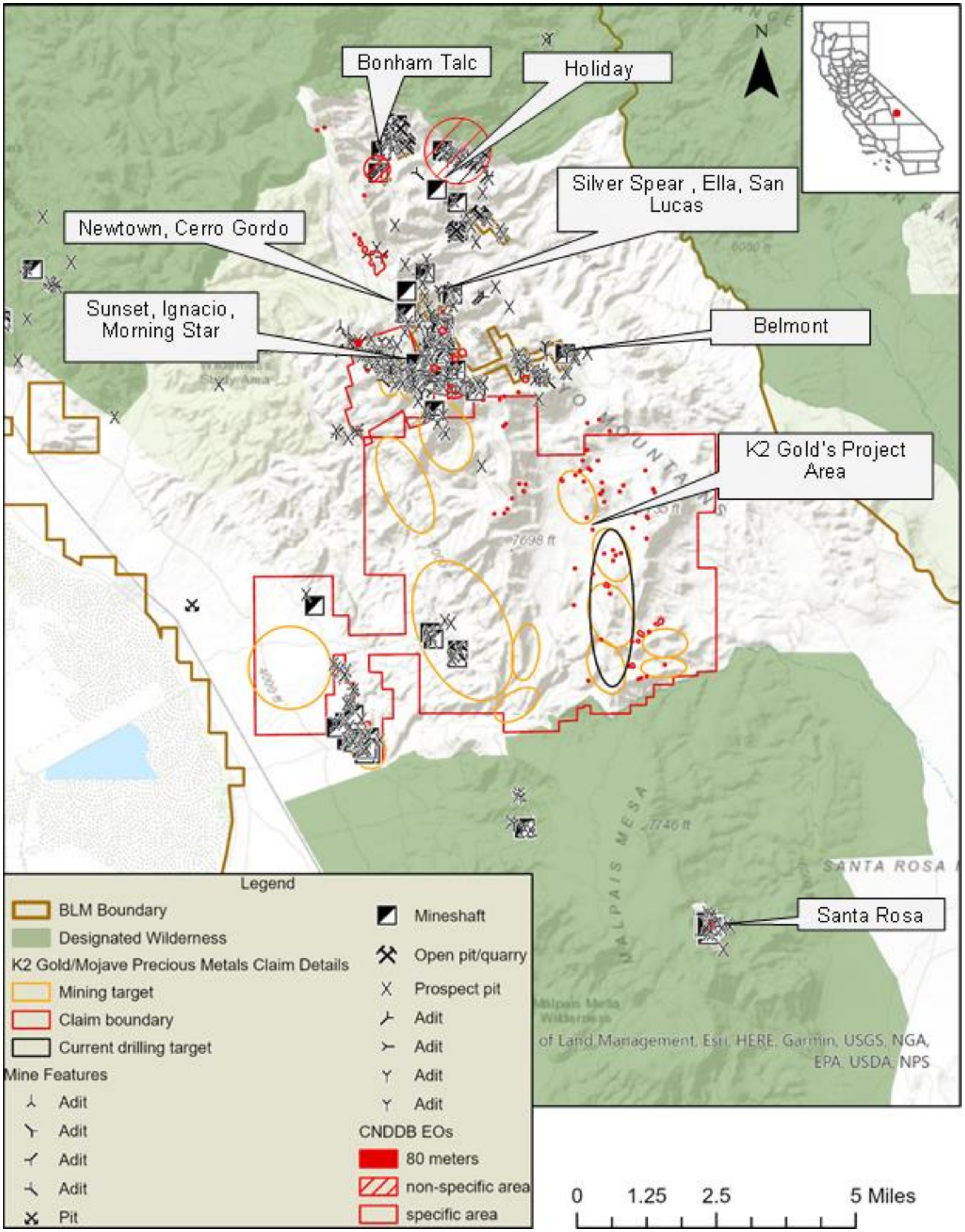


Figure 9. Map of historical mining features and K2 Gold/Mojave Precious Metals' mineral claim area and mining targets. CNDDB EOs represent all known locations of the Inyo rock daisy.

While baseline population numbers are lacking for many occurrences, it is clear that mining activities have reduced available habitat for Inyo rock daisy, and by extension have almost certainly reduced population numbers of the species. All known habitat impacts and historical population data are summarized below.

<u>Pleasant Point (EOs 1, 3–4, 29)</u>

The only definitive historical occurrence in the Pleasant Point area is from a 1979 observation corresponding to EO 4. As described above, an herbarium specimen from 1939, corresponding to EO 3, was likely collected from this area as well. The only documented population numbers in the area are for EO 1 which consists of several areas, including one which was visited in 1996 and estimated to contain more than 100 individuals (CDFW 2022). A more recent survey of an area partially overlapping with EO 1 estimated 221 individuals (SBBG 2021).

Mining activity appears to be limited at EO 1 except for a few adits and a single exploration pit (Fig. 9). Adits, mineshafts, pits, and roads are much more extensive at the site of the Bonham Talc Mine, near EO 4 and possibly near EO 3.

<u>Cerro Gordo (EOs 2, 5–7, 16, 27–28)</u>

Population estimates were not recorded in the Cerro Gordo area until the mid-1990s when BLM botanist, Anne Halford, visited several occurrences (CDFW 2022). Prior to her surveys, the only historical information regarding abundance comes from a DeDecker herbarium label, corresponding to EO 6, which states, "plants plentiful" (*DeDecker 6331*, RSA). Halford observed 100+ plants between EO 5 and EO 6 in 1994 (CDFW 2022). During a subsequent survey in 1996, only 50 plants were observed at EO 5 and 18 at EO 6. In 2013, EO 6 was revisited by B. Keelan who noted the presence of the Inyo rock daisy but did not provide a numerical estimate (CDFW 2022).

These population estimates may represent a shifted baseline following the loss of individual plants and/or populations due to development from the historic mining era. Areas of mining interest in the Cerro Gordo area generally co-occur with the calcareous substrates preferred by the Inyo rock daisy. The construction of adits, pits, roads, surface workings, trenches, and other structures occurred within areas of occupied habitat and are particularly abundant within the Cerro Gordo Mining District, an area of about 1.6 $km^2$ (1 $mi^2$) adjacent to Cerro Gordo Peak (USGS 2005) (Fig.9).

<u>Conglomerate Mesa (EOs 8–9, 11–13, 18–26)</u>

All occurrences in the Conglomerate Mesa area were documented after 2010 and there is little information regarding population trend in this area. Exploratory drilling has occurred in the area since the 1980s (K2 Gold 2021c) and a mining access road was constructed in 1997 that has since been reclaimed (Timberline 2007; MPM 2021). In 2018, BLM issued a decision regarding a proposed mining exploration project that allowed for impacts to EOs 9, 11, 19, 21, and 23

(BLM 2018). The permit was modified in 2020, which allowed a new mining company, K2 Gold, to conduct exploratory drilling at a reduced number of drill pads, but with an increased number of drill holes (BLM 2020a). Based on the modified plan of operations, it appears EO 11, EO 23, and EO 19 may have been impacted due to proximity to drill sites and a water tank site. There have been no follow-up surveys to date to measure impacts to the affected EOs and the degree to which earlier exploration activities impacted occurrences is presently unknown.

Santa Rosa Mine (EO 17)

The only occurrence of the Inyo rock daisy that has been confidently documented south of Conglomerate Mesa is at the Santa Rosa Mine within the boundary of the Malpais Mesa Wilderness. Importantly, the mine site and the Inyo rock daisy occurrence are located in a small area that is excluded from actual wilderness designation. And while the patented claim block was donated back to BLM in 1999, the land has yet to be added to the wilderness and active mining claims are present in the area (BLM 2015, 2021). This Inyo rock daisy occurrence is estimated to contain a maximum of 50 individuals. As is the case with occurrences in the Cerro Gordo area, this occurrence was likely impacted by historic mining. The Santa Rosa Mine was the eighth largest lead producer in California (BLM 2015) and was in operation from 1910–1938 (Hall and McKevitt 1962). Suitable habitat in the area was impacted by adits, road construction, surface workings, and other structures along the limestone cliff face (Jesus pers. obs. 2019; Fig. 9).

While more research is needed to characterize Inyo rock daisy's population trends, it is clear that without additional protections in place, its abundance will decline in the future given the overlapping threats of habitat modification and/or loss, climate change, and other sources of mortality as discussed below.

# 5 Factors Affecting Ability to Survive and Reproduce

Factors that interfere with the continued survival and reproductive success of the Inyo rock daisy include habitat modification and/or loss, invasive plant species, climate change, and vulnerabilities associated with small population size.

## *5.1 Modification and/or Destruction of Habitat*

The greatest and most immediate threat to the Inyo rock daisy is habitat modification and/or destruction due to activities associated with mineral exploration and mining. There are hundreds of mining claims within the range of Inyo rock daisy occurring on lands administered by the BLM, while lands under private ownership also face equal or greater mining threats (USGS 2005; BLM 2021; Fig. 10).

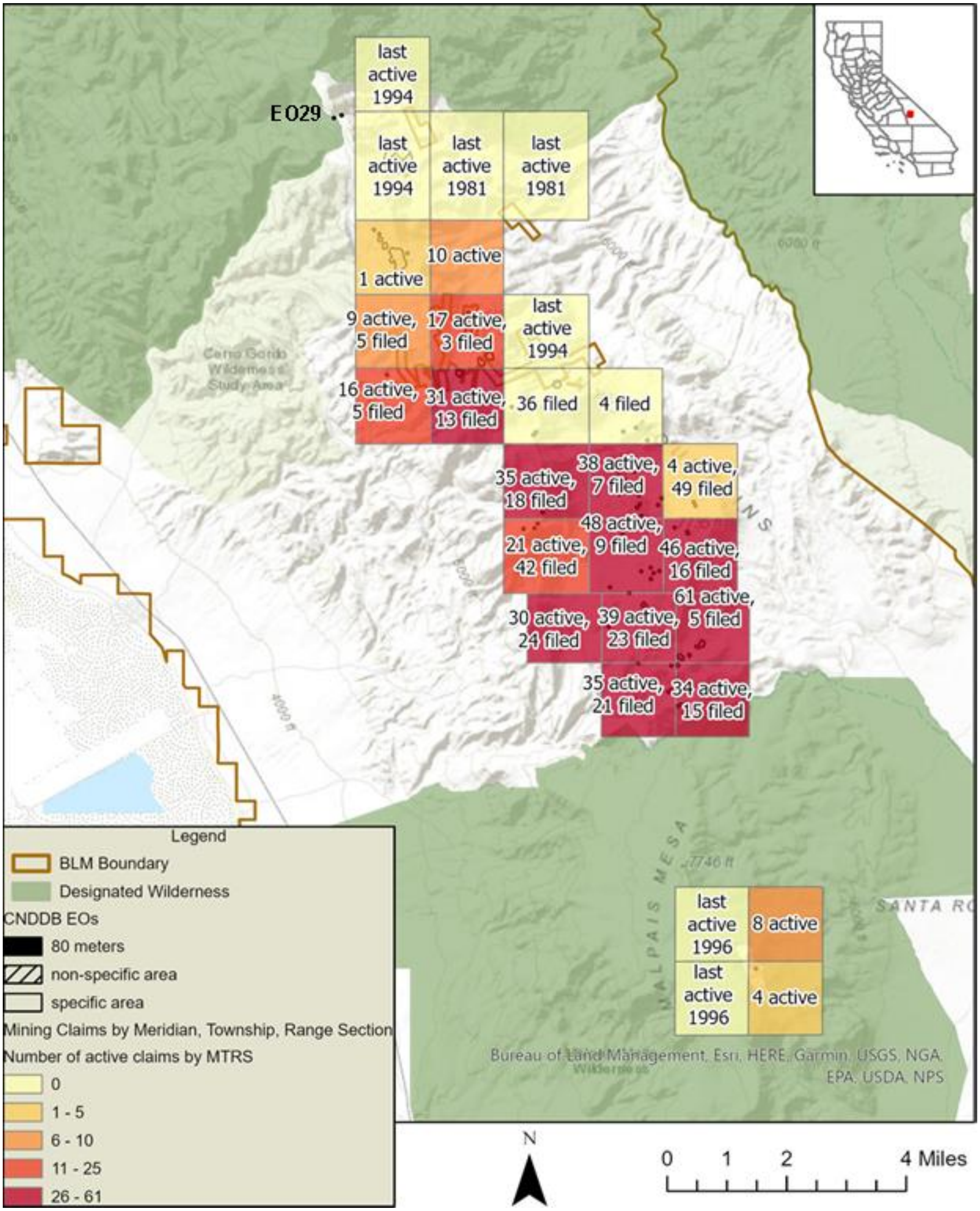


Fig. 10. Number of active mining claims grouped by Meridian, Township, Range, and Section (BLM 2021). "Filed" claims are expected to become "active" after adjudication is complete. CNDDB EOs represent all known locations of the Inyo rock daisy.

Of particular concern are ongoing mineral exploration activities by K2 Gold (subsidiary Mojave Precious Metals) intended to lay the groundwork for an industrial-scale mine which would cause significantly more disturbance than the historic mines described above. Since 2019, K2 Gold has acquired mining claims at Cerro Gordo and Conglomerate Mesa, which total 58 $km^2$ (22.5 $mi^2$) and overlap with the core of the Inyo rock daisy's distribution (K2 Gold 2021c; Fig. 8–9; Table 1). The company hopes to repeat past successful exploration projects, initiated by its board members and executive team (K2 Gold 2021d), by delineating valuable mineral resources in the southern Inyo Mountains. As described in a video to investors (Business Television 2020), K2 Gold stands for "Kaminak Two," a reference to the company chairman's most recent success which involved demarcating and selling a multi-million-ounce gold deposit in the Yukon that is in the process of being developed into an industrial scale, cyanide heap leach mine (Del Real 2017; Morin 2018; Gignac 2020).

Based on extensive sampling conducted in 2021, K2 Gold characterizes its claims in the southern Inyo Mountains as a "large multi-commodity mineral zone that hosts gold, silver, copper, and other base metals" (K2 Gold 2021b). Furthermore, the area has been shown to contain valuable sediment-hosted disseminated gold deposits (K2 Gold 2021a), including "Carlin-type" deposits (Timberline 2008; Crux Investor 2020), which generally require open-pit mining methods to recover a profitable amount of mineral (Berger et al. 2014; Manning and Kappes 2016). Vast amounts of ore must be excavated to process the submicroscopic gold particles, producing waste rock and tailings measured in tons, to recover quantities of gold measured in ounces (Earthworks 2004).

Open-pit gold mines generally involve one or more large open pits, overburden stockpiles, heap leach pads, and road construction (Manning and Kappes 2016; BLM 2020b). Populations of the Inyo rock daisy would be destroyed and/or fragmented by the construction of open pit(s), overburden stockpiles, heap leach pads or pools, roads, and other structures. A mine of this scale would alter ecologic processes on the landscape through extensive ground disturbance, fugitive dust, toxic chemicals, large volumes of water, and ongoing noise that may disrupt pollinators and/or seed dispersers. Regardless of whether or not K2 Gold's exploration directly leads to the development of a large scale mine, the threat of mining is expected to remain as claims have already changed ownership multiple times and have often resulted in subsequent development (Budlong 2017; K2 Gold 2020).

Currently, K2 Gold intends to expand its exploration activities and conduct extensive drilling and road construction in a 9.8 $km^2$ (3.8 $mi^2$) area that overlaps with EOs 9, 11, 19, 21, and 23 (MPM 2021; Fig. 8). In addition, K2 Gold expects to identify additional drilling targets following the analysis of an electromagnetic survey conducted across the entire claim area and additional Inyo rock daisy occurrences are likely to be impacted (K2 2021b).

Threats posed by exploratory drilling include habitat loss and fragmentation, destruction of individual plants via ground-disturbance and trampling, and interference with pollinator activities. Botanical surveys conducted in 2016 and 2017 documented at least 43 individual plants within 50 m (0.03 mi) of the proposed road footprint (BLM 2018). However, it is likely that additional plants are located beyond the 50 m (0.03 mi) road buffer and could experience negative impacts. Habitat fragmentation has been associated with the disruption of pollinators and associated declines in reproductive success, particularly for plant species that are self-incompatible (Rathcke and Jules 1993). Fugitive dust particles have been shown to drift onto plant stigmas and negatively impact pollination and seed set (Waser et al. 2017). Finally, individual plants could be crushed by activities described in the proposal such as the laying of water hoses, and the use of mule pack strings (MPM 2021).

Development of private lands in the Cerro Gordo area may also pose a threat to Inyo rock daisy. Portions of the Cerro Gordo Mining District were recently sold to investors with plans to develop the area into a tourist attraction (Gomez 2018). A fire which burned much of the ghost town in 2020 will likely also spur increased construction activities as buildings are rebuilt or added (Sahagun 2020). In the absence of conservation measures, increased recreational use or construction projects in the area could result in the destruction and/or trampling of individual plants.

### *5.2 Invasive plant species*

Invasive plant species including cheatgrass (*Bromus tectorum)* and red brome (*Bromus rubens*), have been documented throughout Inyo rock daisy's range (BLM 2018; Jesus 2021, pers. obs. 2018–2021; CDFW 2022). Cheatgrass is known for its ability to outcompete native plants, especially in nutrient-poor and/or disturbed habitats (Mack 1981). A cheatgrass invasion could pose a significant threat to the Inyo rock daisy by outcompeting seedlings or interrupting the nitrogen cycle and making the environment more favorable for non-native plant species (Rimer & Evans 2006). Furthermore, these grasses have been strongly associated with significant ecosystem changes including altered fire regimes that pave the way for additional annual grass invasions (D'Antonio & Vitousek 1992; Brooks 1999).

### *5.3 Climate Change*

A strong, international scientific consensus has established that human-caused climate change is causing widespread harms to natural systems and climate change threats are becoming increasingly dangerous. In a 2018 *Special Report on Global Warming of 1.5°C* from the Intergovernmental Panel on Climate Change (IPCC), the leading international scientific body for the assessment of climate change, describes the devastating harms that would occur at 2°C warming above pre-industrial levels, highlighting the necessity of limiting warming to 1.5°C to avoid catastrophic impacts to people and life on Earth, including significant levels of habitat loss and species extinction (IPCC 2018). Since 2012, global warming has been especially pronounced, with the past five years (2016–2020) being the hottest five-year period since 1850 (IPCC 2021a). Global temperatures of the last decade are likely the hottest it has been on Earth in 125,000 years (IPCC 2021b).

Deserts in North America are expected to undergo increased aridification during the 21st century (Seager et al. 2007), and southern California has been identified as a climate change hotspot where the magnitude of physical climate response is expected to be greater relative to other regions in the US (Diffenbaugh et al. 2008). Precipitation is expected to increase in temporal variability (Swain et al. 2018) and regional modeling for the Owens Valley predicts a 6% increase in precipitation, but an overall loss of water due to increased evapotranspiration rate of 19% (OVGA 2021).

Although desert plants are assumed to be adapted to hot and dry conditions, the changing climate is likely to challenge the physiological thresholds of many desert species. Significant declines of vegetation cover in the Sonoran Desert of California suggest arid-adapted perennial taxa are much more susceptible to aridification than anticipated (Hantson et al. 2021). Long-term data demonstrate that vegetation in the Mojave Desert is undergoing increased water stress due to prolonged higher temperatures and reduced precipitation levels (Khatri-Chhetri et al. 2021) and many species are shifting to higher elevations (Kelly and Gouden 2008; Guida 2011). In particular, plant taxa with restricted ranges, poor dispersal capacity, and/or long generation times are especially vulnerable to climate change impacts (Hawkins et al. 2008).

*Perityle inyoensis* is restricted to calcareous substrates in the southern Inyo Mountains where it occupies the highest elevations within this mountain range (Jesus pers. obs. 2018–2021; CDFW 2022). Nearly all plants are found above 2019 m (6623 ft) though there is a single herbarium specimen purported to be collected from 1798 m (5900 ft) (CDFW 2022). As described in the Range and Distribution section above, no individual plants have been found at lower elevations despite the presence of calcareous parent material. In the event climatic conditions surpass the physiological thresholds of *P. inyoensis*, the species is unlikely to be able to migrate to more suitable habitat given its limited dispersal capacity, long generation time, and episodic recruitment patterns. In addition, suitable habitat at higher latitudes and elevations are currently occupied by the more common *P. megalocephala* which has the potential to outcompete *P. inyoensis* (CCH2 2021). Furthermore, several occurrences observed in 2021 had very few flowering stems and many inviable seeds, presumably due to the exceptional drought conditions (SBBG 2021; Schneider pers. comm. 2021; Jesus pers. obs. 2021).

### *5.4 Vulnerability of Small Populations*

The vulnerabilities associated with small population size are well-documented and include susceptibility to demographic, environmental, and genetic stochasticity (Goodman 1987; Menges 1991; Caswell and Kaye 2001; Matthies 2004). Species that are self-incompatible, such as the Inyo rock daisy, face additional risks associated with small population size. Studies have shown that small populations of self-incompatible species have fewer compatible mates leading to reductions in seed set (Byers and Meagher 1992; Allphin et al. 2002; Young and Pickup 2010) and offspring with reduced fitness (Fischer et al. 2002). Overall, such populations have been characterized as having a high risk of extinction (Byers and Meagher 1992). Few studies have examined the effects of small population size of self-incompatible species in arid environments where recruitment is typically episodic.

The Inyo rock daisy occurrence at Santa Rosa Mine (EO 17) is estimated to consist of ca. 50 individuals and is isolated from other occurrences by nearly 8 km (5 mi) making it especially susceptible to the effects described above. This occurrence is likely under threat of genetic swamping (Ellstrand and Elam 1993) given the presence of putative hybrid populations nearby at Talc City Hills (Lichter-Marck pers. comm. 2021) and elsewhere in the Malpais Mesa Wilderness (*Jesus 786*, RSA). While the metapopulations at Conglomerate Mesa and Cerro Gordo are relatively less isolated, an increase in mining-related development resulting in additional fragmentation would have severe impacts on the continued existence of this species through the mechanisms described above.

## 6 Degree and Immediacy of Threat

All 26 Inyo rock daisy occurrences are threatened to some degree by modification and/or destruction of habitat, invasive plants, climate change, and vulnerabilities associated with small population size.

As demonstrated in the previous sections, mining-related development poses an immediate and ongoing threat to all or a significant portion of the Inyo rock daisy's range. The entire global population is located in an area with high potential for the extraction of valuable minerals (USGS 2005; Causey 2011). The entire area of occupancy is subject to valid and existing mining claims (Causey 2011; BLM 2021) with the exception of a small single occurrence (EO 29) located within 0.4 km (0.25 mi) of mining claims (Fig. 10). While much of the area occupied by the Inyo rock daisy was considered for wilderness designation, nearly all lands were released, in large part because of the high mineral value as well as the extent of past mining activity that scarred the landscape (BLM 2015). While a mineral withdrawal could reduce the threat in some areas by prohibiting new mining claims, any valuable mineral deposits already discovered may be considered valid existing rights and not subject to mineral withdrawal.

K2 Gold completed their first phase of exploratory drilling in 2020 which was anticipated to impact EOs 11, 19, and 23, which were within 0.25 mi of drill sites and the water tank site (BLM 2018, 2020a). The second phase of mining exploration is expected to begin soon and as described below, existing regulatory mechanisms are inadequate to address this threat. In the absence of protective measures for the Inyo rock daisy, continued mining exploration and the development of an industrial-scale mine is likely to cause extirpation through all or a significant portion of its range. As mentioned above, the threat of mining is expected to remain as claims have already changed ownership multiple times and have often involved development (Budlong 2017; K2 Gold 2020). In sum, mining is an immediate extinction-level threat to the Inyo rock daisy that alone is sufficient to justify CESA protection.[4]

Invasive plant species also represent an immediate threat to the Inyo rock daisy. Such plants are present throughout the species' range though they tend to be most abundant in areas with historic and/or ongoing disturbance such as Cerro Gordo, Conglomerate Mesa, and Santa Rosa Mine (Jesus pers. obs. 2018–2021). Climate change may also already be impacting the Inyo rock daisy recruitment throughout its range and additional impacts are likely to increase through the end of this century. The Inyo rock daisy shows no signs of expanding its range and the

---

[4] The plight of the Inyo rock daisy is similar to other endemic plants threatened by mining. Recently, Bartram's stonecrop (*Graptopetalum bartramii*), an endemic plant in Arizona, was listed as federally threatened by USFWS with the greatest threat listed as habitat loss, in large part due to mining-related development (USFWS 2021). The final rule considered threats of future mineral exploration and mining development even though the full extent of these threats was unknown.

inherent vulnerability of small populations is an ongoing threat to all occurrences, particularly EO 17 which is isolated from other occurrences. The threat of small population size is likely to become more pronounced over time as other threats become realized and lead to further fragmentation.

## 7 Impact of Existing Management Efforts

No existing regulatory mechanisms are currently in place at the federal or state level that adequately protect the Inyo rock daisy from immediate and ongoing threats.

### *7.1 Federal Mechanisms*

Nearly all known occupied habitat of the Inyo rock daisy occurs on federal lands administered by BLM. Although the Inyo rock daisy is not protected under the authority of the federal Endangered Species Act (ESA), BLM has listed it as a sensitive species. According to BLM Planning Manual 6480.06, the agency is directed to "implement measures to conserve these species and their habitats" in order to reduce the likelihood of their listing under the federal ESA (BLM 2008). However, the only known proactive conservation measure implemented by the agency to date has been to permit seed collecting for conservation purposes.

Nearly all occurrences on BLM lands fall within the boundaries of the California Desert Conservation Area (CDCA) and are managed under the CDCA Plan including the Desert Renewable Energy Conservation Plan, Land Use Plan Amendment to the CDCA Plan (DRECP) (BLM 2016). The DRECP defines allowable uses and management actions related to the conservation of BLM sensitive plant species. In particular, section II.4.2 establishes conservation management actions (CMAs) that provide specific requirements for plant surveys (LUPA-BIO-PLANT-1), sets disturbance impacts to suitable habitat at 1% (LUPA-BIO-PLANT-3), and establishes 0.25 mi avoidance setbacks from sensitive plant occurrences (LUPA-BIO-PLANT-2) (BLM 2016).

However, unfortunately, BLM sensitive status and the Plan's CMAs are insufficient to protect the Inyo rock daisy from threats associated with mineral development. For example, a recent BLM Environmental Analysis (EA) allowed mining exploration activities regardless of the CMAs set forth in the DRECP stating, "Denial of access to these claims would otherwise be in violation of the access requirements established by the mining laws" (BLM 2018). On that basis, BLM permitted ground disturbance within 0.25 mi of individual plants belonging to EOs 9, 11, 23, 21 and the siting of a water tank near EO 19. Furthermore, the plant surveys conducted in advance of the EA did not adhere to the protocols set forth in DRECP. Most egregiously, surveys were limited to a 50 m (0.03 mi) buffer along the proposed road construction route, resulting in many undetected individual plants within the 0.25 mi buffer requirement (BLM 2018). Finally, the model used by BLM to justify the allowable disturbance to suitable habitat was likely based on insufficient data, though the model was not made available for public review (BLM 2018). In a recent study of 43 BLM sensitive species that occur within the DRECP boundary, the suitable habitat model for *P. inyoensis* was found to have too few occurrences to build a reasonably accurate model (Reese et al. 2019).

### *7.2 State Mechanisms*

The Inyo rock daisy has a California Rare Plant Rank of 1B.2 (CNDDB and CNPS 2020; CDFW 2022), which means that this taxon is rare or endangered throughout its range and moderately threatened (CNPS 2021). While this ranking does not directly offer environmental protection, the 1B CNPS ranking means the species meets the definition of "rare" under 14 C.C.R. § 15380(b) of the California Environmental Quality Act (CEQA) regulations. Therefore, impacts to this taxon must be considered in CEQA reviews of agency actions. However, only a small portion of the Inyo rock daisy's habitat is on private lands where development proposals would be subject to California CEQA review (Fig. 8). On federal lands, absent a state or local permit requirement, or other non-federal process requiring state or local action, CEQA's requirements would not be applicable. For mining or mineral exploration projects, the Surface Mining and Reclamation Act (SMARA; California Public Resources Code, Sections 2710-2796) provides for regulation of surface mining operations to ensure that mined lands are reclaimed. SMARA requires that a reclamation plan be approved by the local agency (usually the County) and CEQA compliance is required before adoption of those plans. However, SMARA exempts projects that do not include removal of a total of more than 1000 cubic yards of minerals, ores, and overburden, or do not disturb more than one acre in any one location. 14 C.C.R. § 3505(a)(1). As a result, many mineral exploration projects are designed to disturb less than one acre total, even if the project covers a large area, and thereby are not subject to SMARA or CEQA review.

## 8 USFWS's Review for Possible Listing as Endangered or Threatened Species

The strongest federal regulatory mechanism that could protect the Inyo rock daisy is the federal Endangered Species Act. In 1993, the USFWS determined that "proposing to list as threatened or endangered is possibly appropriate, but for which sufficient data on biological vulnerability and threat are not currently available to support proposed rules" (USFWS 1993; *see* footnote 1 *supra*). Considerable research on the biology and threats to the Inyo rock daisy has been carried out over the last decade and a federal listing petition has been submitted concurrently.

## 9 The Inyo Rock Daisy Warrants Listing under CESA

As detailed above, in conformance with the requirements of Cal. Code Regs., tit. 14, § 670.1, this petition presents scientific information regarding the Inyo rock daisy's life history, population trend, range, distribution, abundance, kind of habitat necessary for survival, factors affecting the ability to survive and reproduce, degree and immediacy of threat, impact of existing management efforts, suggestions for future management, availability of sources and information, and detailed distribution maps.[5]

That information clearly demonstrates that the Inyo rock daisy (*Perityle inyoensis*, synonym *Laphamia inyoensis*) is eligible for and warrants listing under CESA based on the

---

[5] Information on suggestions for future management and availability of sources and information are contained in the Management Recommendations and References sections *infra*.

factors specified in the statute and implementing regulations. Under CESA, a "threatened species" is "a native species or subspecies of a … plant that, although not presently threatened with extinction, is likely to become an endangered species in the foreseeable future in the absence of the special protection and management efforts . . . ." Cal. Fish & Game Code § 2067. A plant is an "endangered species" when it is "in serious danger of becoming extinct throughout all, or a significant portion, of its range due to one or more causes, including loss of habitat, change in habitat, overexploitation, predation, competition, or disease." Cal. Fish & Game § 2062.

Given the Inyo rock daisy's restricted range and known threats, that listing as a threatened or endangered species *may be* warranted cannot be subject to reasonable dispute; in light of the significant impacts posed by a proposed large-scale mining project in the heart of its limited range, classification as - at a minimum - a threatened species clearly *is* warranted. The appropriate classification can be determined following the competition of the Department of Fish and Wildlife's status review and recommendation carried out pursuant to Cal. Fish & Game Code § 2074.6.

## 10 Recommended Management and Recovery Actions

To ensure adequate management and recovery of the Inyo rock daisy, the species must be listed pursuant to CESA by the State of California and the following objectives should be implemented:

1. Preserve habitat and prevent loss of habitat;
2. Restrict destruction and/or removal of individual plants;
3. Establish quantitative baseline population data;
4. Implement a monitoring program to detect population trends;
5. Manage invasive plant populations;
6. Determine additional biological factors related to long-term survival;
7. Assess gene flow and genetic diversity;
8. Expand ex-situ plant material in conservation seed collections;
9. Study consequences of hybridization; and,
10. Ensure traditional tribal uses are maintained.

*Actions to preserve habitat and prevent loss.*—Given the extremely limited distribution of *P. inyoensis*, existing habitat should be protected in order to maintain occurrences across the species range. CDFW should expand its cooperative work with BLM, California Department of Conservation, and Inyo County to better protect *P. inyoensis* on federal lands. Furthermore, CDFW should work with private landowners to restrict impacts to Cerro Gordo occurrences and consider offering landowner incentives for habitat protection.

As mentioned in previous sections, *P. inyoensis* is largely restricted to limestone rock outcrops and faces limitations in seed dispersal and seedling establishment. In addition to protecting known habitat from disturbance, it is important to protect potential habitat near known occurrences due to the limited distribution and habitat for this taxon. Population dynamics are likely such that groups of plants on outcrops periodically die out, but over time, are replenished by groups on neighboring rocks (Harrison 2000). Therefore, suitable rock outcrops that do not currently support *P. inyoensis* should still be preserved to support future populations and ensure that gene flow is maintained.

*Actions to restrict destruction and/or removal of individual plants.*—Human-caused impacts including ground disturbance, burial, trampling, and the introduction of non-native plant species should be restricted.

*Actions to establish quantitative baseline data for occurrences.*— Comparable baseline data are needed to monitor for changes in population size and/or extent. Therefore, reference populations should be sampled in order to establish quantitative baseline data to inform future monitoring and management efforts.

*Actions to implement a monitoring program to detect trends*.— Populations should be monitored using a statistically valid sampling scheme, such as a stratified random sample (e.g., Vitt et al. 2016). Counts should include the number of seedlings, juveniles, reproductive adults, and senesced plants in order to inform a population viability analysis (PVA). If a decline in the population is observed or additional threats are noted, then a PVA should be conducted in order to estimate the extinction risk for these populations. The outcome should inform management actions. If such a monitoring plan is cost-prohibitive, then occurrences should be resurveyed and analyzed on a regular basis to determine general population trends. At least one permanent photo-point should be established at each occurrence. In all cases, monitoring the variation in seed set as a function of population size can provide strong indication of genetic mate limitation (Byers and Meagher 1992)

*Actions to manage invasive plant populations.*— Methods for managing harmful invasive plant populations should be researched and implemented using the best available science.

*Actions to determine additional biological factors related to the long-term survival of P. inyoensis*.—More research is needed in order to understand this taxon's germination requirements, dispersal methods, life-span, and dynamics relating to resource competition. Given the importance of outcrossing for this species, studies should be conducted to identify key pollinator(s). *In situ* seedlings should be identified, marked, counted, and measured on a regular basis in order to estimate time to reproductive maturity, and the life-span of individual plants. Studies should be carried out to better understand fitness measures such as seed production and seed viability, as well as to quantify this taxon's performance in a resource-competitive environment. Such studies will improve our understanding of the edaphic preferences of *P. inyoensis* and better predict the population dynamics in response to the introduction of non-native species.

*Actions to assess genetic diversity*.—The dynamics of gene flow, genetic drift, and *S* allele diversity can dramatically impact the fitness of narrow endemics such as *P. inyoensis* (Ellstrand 1993; Silva et al. 2016). Genetic diversity should be measured within and between populations in order to better understand the role of gene flow in maintaining the health of this taxon.

*Actions to expand* ex situ *plant material*.—Two conservation seed collections – one from EO 16 near Belmont Mine and one from EO 13– are currently being stored at CBG. A third collection, from EO 1, is currently stored at SBBG. The seeds are maintained separately by maternal lines and are an important source of genetic material that can be utilized for research and may be required for restoration in the event of a catastrophic decline of *in situ* populations. Seeds should be gathered from the Santa Rosa Mine (EO 17) and private inholdings at Cerro Gordo to enhance the genetic diversity of these conservation collections.

*Actions to understand hybridization consequences*.—Research should be conducted on the Inyo rock daisy and/or close relatives to understand the long-term consequences of hybridization.

*Actions to ensure traditional tribal uses are maintained.*— The Inyo rock daisy is a plant of cultural significance to the Lone Pine Paiute Shoshone Tribe (Bancroft pers. comm. 2022). Input should be solicited from the tribe regarding management and to ensure non-impairment of traditional uses.

## 11 Conclusion

The Inyo rock daisy is a rare plant species that is restricted to calcareous rock outcrops at a distinctive transition zone between the Great Basin and Mojave Desert ecoregions in the Inyo Mountains. The global range is limited to a 51.4 $km^2$ (19.8 $mi^2$) area and the mapped area of actual occupancy is less than 1 $km^2$ (0.62 $mi^2$). This habitat is unique and is at risk of destruction and/or fragmentation due to mining activities, development, and climate change. Invasions of non-native plants and vulnerabilities associated with small population size further threaten Inyo rock daisy. These threats are likely to result in the destruction of individual plants and/or entire populations. There are no existing regulatory mechanisms that would otherwise protect this plant from extinction. Inyo rock daisy needs CESA protection to ensure its continued existence in the face of ongoing mining-related development.

## 12 References Cited

Copies of references cited in the petition are either linked to websites below or included as files on a disk accompanying a hard copy of the petition sent to the Commission. Electronic copies are available upon request.

### *12.1 Literature Cited*

Allphin L., D. Wiens, and K.T. Harper. 2002. The Relative Effects of Resources and Genetics on Reproductive Success in the Rare Kachina Daisy, *Erigeron kachinensis* (Asteraceae). *International Journal of Plant Sciences* 163: 599–612.

Bachman, S., J. Moat, A.W. Hill, J. de la Torre, and B. Scott. 2011. Supporting Red List threat assessments with GeoCAT: geospatial conservation assessment tool. *Zookeys* 150: 117–126.

Baldwin, B.G. and R.L. Moe. 2002. Floristic diversity in the California deserts, pp. 40-46. *In* B.G. Baldwin, S. Boyd, B.J. Ertter, et al. [eds.], The Jepson desert manual: vascular plants of southeastern California. University of California Press, Berkeley.

Baldwin, B.G., B.L. Wessa, and J.L. Panero. 2002. Nuclear rDNA evidence for major lineages of Helenioid, Heliantheae (Compositae). *Systematic Botany* 27: 161-198.

Berger, V.I., D.L. Mosier, J.D. Bliss, and B.C. Moring. 2014. Sediment-hosted gold deposits of the world—Database and grade and tonnage models (ver. 1.1, June 2014): U.S. Geological Survey Open-File Report 2014–1074. Available at: http://dx.doi.org/10.3133/ofr20141074.

Bowers, J.E., R.H. Webb, and R.J. Rondeau. 1995. Longevity, recruitment and mortality of desert plants in Grand Canyon, Arizona, USA. *Journal of Vegetation Science* 6: 551–564.

Brooks, M.L. 1999. Alien Annual Grasses and Fire in the Mojave Desert. *Madrono* 46: 13–19.

Budlong, T. 2017. Once again threatened by gold miners: Conglomerate Mesa on the western rim of Owens Lake. Desert Report, Dec. 5, 2017. California/Nevada Desert Committee of the Sierra Club. Available at: https://desertreport.org/once-again-threatened-by-gold-miners-conglomerate-mesa-on-the-western-rim-of-owens-lake/.

[BLM] Bureau of Land Management. 2008. Manual 6840, the Special Status Species Management for the Bureau of Land Management. Available at: https://www.blm.gov/sites/blm.gov/files/uploads/mediacenter_blmpolicymanual6840.pdf

[BLM] Bureau of Land Management. 2015. Documentation of BLM Wilderness Findings on Record, WIU #CDCA 124.

[BLM] Bureau of Land Management. 2016. Desert Renewable Energy Conservation Plan, Land Use Plan Amendment to the California Desert Conservation Plan, Bishop Resource Management Plan, and Bakersfield Resource Management Plan. Available at: https://drecp.org/finaldrecp/lupa/DRECP_BLM_LUPA.pdf.

[BLM] Bureau of Land Management. 2018. Perdito Exploration Project Environmental Assessment. DOI-BLM-CA-D050-2017-0037-EA. Available at: https://eplanning.blm.gov/eplanning-ui/project/91166/510.

[BLM] Bureau of Land Management. 2020a. Mojave Precious Metals Perdito-Helicopter Drilling Plan Mod. Determination of NEPA Adequacy. https://eplanning.blm.gov/eplanning-ui/project/2000355/510.

[BLM] Bureau of Land Management. 2020b. Update of Castle Mountain Mine Plan of Operations Environmental Assessment. Available at https://eplanning.blm.gov/eplanning-ui/project/1502332/510.

[BLM] Bureau of Land Management. 2021. Mineral and Lands Records System Reports. Available at https://reports.blm.gov/reports/mlrs [Accessed Oct. 2021].

Business Television. 2020. CEO Clips: K2 Gold Corp. (TSX.V: KTO), Exploring for California Gold, Mar. 10, 2020. Available at: https://www.youtube.com/watch?v=-gkA_Xw4mPY&t=49s

[Accessed Sept. 2021].

Byers, D.L. and T.R. Meagher 1992. Mate availability in small populations of plant species with homomorphic sporophytic self-incompatibility. *Heredity* 68: 353–359.

[CBG] California Botanic Garden. 2019. Germination trials for *Perityle inyoensis* conducted in 2019. Unpublished raw data.

[CCH] Consortium of California Herbaria. 2021. Consortium of California Herbaria portal 2. https://cch2.org/portal/ [Accessed Oct 2021].

[CDFW] California Department of Fish and Wildlife. 2021. California Natural Diversity Database (CNDDB) – Government version dated September 3, 2021. Available at: https://apps.wildlife.ca.gov/rarefind/view/RareFind.aspx.

[CDFW] California Department of Fish and Wildlife. 2022. California Natural Diversity Database (CNDDB) – Government version dated February 1, 2022. Available at: https://apps.wildlife.ca.gov/rarefind/view/RareFind.aspx.

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

[CNDDB] California Natural Diversity Database. 2011. CNDDB Data Use Guidelines v.4.2. Available at: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=27285&inline

[CNDDB] California Natural Diversity Database. 2021. Special Vascular Plants, Bryophytes, and Lichens List. California Department of Fish and Wildlife (October 2021). Sacramento, CA.

[CNDDB] California Natural Diversity Database and [CNPS] California Native Plant Society. 2020. The CNDDB and CNPS Cooperative Relationship and Rare Plant Status Review Process. Sacramento, CA.

Caswell, H. and T.N. Kaye. 2001. Stochastic demography and conservation of an endangered perennial plant (*Lomatium bradshawii*) in a dynamic fire regime. *Advances in Ecological Research* 32: 1–51.

Causey, J.D., 2011, Mining claim activity on Federal Land in the United States: Data Series 290, U.S. Geological Survey, Menlo Park, California. Available at: https://pubs.usgs.gov/ds/2007/290/

Cody, M.L. 2000. Slow-motion population dynamics in Mojave Desert perennial plants. *Journal of Vegetation Science* 11: 351–358.

Crux Investor. 2020. K2 Gold (KTO) – Gold Explorer Hits 87m of Gold @ 4g/t, Dec. 4, 2020.

Available at: https://www.youtube.com/watch?v=DeDNKhfhqm0. [Accessed Sept. 2021].

D'Antonio, C.M. and P.M. Vitousek. Biological invasions by exotic grasses, the grass/fire cycle, and global change. *Annual Review of Ecology and Systematics* 23: 63-87.

De Nettancourt, D. 1977. The genetic basis of self-incompatibility. *In* R. Frankel, G.A.E Gall, M. Grossman, H.F. Linskens, and D. de Zeeuw [eds.], Monographs on theoretical and applied genetics, Incompatibility in angiosperms. Springer-Verlag, Berlin.

Del Real, Gerardo. 2017. Is K2 Gold the Next Kaminak? Resource Stock Digest, May 30, 2017. Available at: https://resourcestockdigest.com/archives/market-commentary/is-k2-gold-the-next-kaminak-by-gerardo-del-real/ [Accessed Sept. 2021].

Diffenbaugh, N.S., F. Giorgi, J.S. Pal. 2008. Climate change hotspots in the United States. *Geophys. Res. Lett*. 35(16): L16709.

Earthworks. 2004. How the 20 tons of mine waste per gold ring figure was calculated, May 21, 2004. Available at: https://earthworks.org/publications/how_the_20_tons_of_mine_waste_per_gold_ring_figure_was_calculated/ [Accessed Nov. 2011].

Earthworks. 2009. Hardrock Mining and Reclamation Reform Act of 2009 Fact Sheet. Available at: https://sierrafund.org/hmra09/ [Accessed Nov. 2021].

Ellstrand N.C. and D.R. Elam. Population Genetic Consequences of Small Population Size: Implications for Plant Conservation. *Annu. Rev. Ecol. Syst.* 24: 217–242.

Ferris, R.S. 1958. *Laphamia inyoensis. Contr. Dudley Herb*. 5: 104–106.

Fischer M., M. Hock, and M. Paschke. Low genetic variation reduces cross-compatibility and offspring fitness in populations of a narrow endemic plant with a self-incompatibility system. *Conservation Genetics* 4: 325–336.

Gignac, Julien. 2020. 9 things you need to know about the Coffee Gold mine proposed for a remote corner of Yukon. The Narwhal, May 8, 2020. Available at: https://thenarwhal.ca/9-things-need-know-about-coffee-gold-mine-remote-corner-yukon/ [Accessed Sept. 2021].

Goldberg, D.E. and R.M Turner. 1986. Vegetation Change and Plant Demography in Permanent Plots in the Sonoran Desert. *Ecology* 67: 695–712.

Gomez, M. 2018. They bought a ghost town for $1.4 million. Now they want to revive it. New York Times, July 7, 2018. Available at: https://www.nytimes.com/2018/07/18/us/cerro-gordo-ghost-town-california.html [Accessed Nov. 2018].

Goodman, D. 1987. The demography of chance extinction. *In*: Soule´, M. E. (ed.), Viable populations for conservation. Cambridge Univ. Press, pp. 11–34.

Guida, R.J. 2011. Climate and vegetation change in the Newberry mountains, Southern Clark County, Nevada [dissertation]. University of Nevada, Las Vegas.

Hall, W.E. and E.M. McKevitt, Jr. 1962. Geology and Ore Deposits of the Darwin Quadrangle, Inyo County, CA. Geological Survey Professional Paper 368.

Hantson S., T.E. Huxman, S. Kimball, J.T. Randerson, and M.L. Goulden. 2021. Warming as a driver of vegetation loss in the Sonoran Desert of California. *Journal of Geophysical Research: Biogeosciences* 126: e2020JG005942.

Harrison, S., J. Maron, and G. Huxel. 2000. Regional Turnover and Fluctuation in Populations of Five Plants Confined to Serpentine Seeps. *Conservation Biology* 14: 769-779.

Hawkins, B., S. Sharrock, and K. Havens. 2008. Plants and climate change: which future? Botanic Gardens Conservation International, Richmond, UK.

[IPCC] Intergovernmental Panel on Climate Change. 2018. Global Warming of 1.5° C: An IPCC Special Report on the Impacts of Global Warming of 1.5° C Above Pre-Industrial Levels and Related Global Greenhouse Gas Emission Pathways, in the Context of Strengthening the Global Response to the Threat of Climate Change, Sustainable Development, and Efforts to Eradicate Poverty. Intergovernmental Panel on Climate Change. Available at: http://www.ipcc.ch/report/sr15/.

[IPCC] Intergovernmental Panel on Climate Change. 2021a. Technical Summary. *In* Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Available at: https://www.ipcc.ch/report/sixth-assessment-report-working-group-i/ at TS-8.

[IPCC] Intergovernmental Panel on Climate Change. 2021b. Summary for Policymakers. *In* Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Available at: https://www.ipcc.ch/report/sixth-assessment-report-working-group-i/ at SPM-9.

Jayko, A.S. 2009. Surficial geologic map of the Darwin Hills 30' x 60' quadrangle, Inyo County, California: U.S. Geological Survey Scientific Investigations Map 3040, 20 p. pamphlet, 2 plates, scale 1:100,000.

Jesus, M.J. 2021. A vascular flora of the southern Inyo Mountains, Inyo County, California [thesis]. Claremont: Claremont Graduate University. 106 p.

Johnston, I.M. 1941. New phaenerogams from Mexico, IV. Journal of the Arnold Arboretum 22:110–124.

K2 Gold. 2020. Investor Presentation. Gold Exploration in Southern California, June 2020.

K2 Gold. 2021a. Investor Presentation: Gold Exploration in Southern California, May 2021. Available at: https://k2gold.com/investors/presentation-fact-sheet/ [Accessed Sept. 2021].

K2 Gold. 2021b. K2 Reports Significant Gold Mineralization on Western Side of Mojave Property, June 2021. Available at: https://k2gold.com/news-media/news/ [Accessed Sept. 2021].

K2 Gold. 2021c. K2 Gold, Projects, Mojave Project, Aug. 2021. Available at: https://web.archive.org/web/20210815233223/https://k2gold.com/projects/mojave-project/ [Accessed Sept. 2021]

K2 Gold. 2021d. About Us. https://k2gold.com/corporate/about-us/. [Accessed Sept. 2021]

Keil, D.J. 2012. *Perityle inyoensis. In* Jepson Flora Project (eds.), Jepson eflora (October 2021). Available at https://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=4309 [Accessed October 19, 2021].

Kelly A.E. and M.L. Goulden. 2008. Rapid shifts in plant distribution with recent climate change. *Proceedings of the National Academy of Sciences* 105: 11823–11826.

Khatri-Chhetri, P., S.M. Hendryx, K.A. Hartfield, M.A. Crimmins, W.J.D. van Leeuwen, and V.R. Kane. 2021. Assessing vegetation response to multi-scalar drought across the Mojave, Sonoran, Chihuahuan Deserts and Apache Highlands in the Southwest United States. *Remote Sensing* 13: 1103.

Larson, D.W., U. Matthes, and P.E. Kell [eds.]. 2000. Summary. *In* Cliff Ecology: Pattern and Process in Cliff Ecosystems, 1st ed. Cambridge University Press.

Lichter-Marck, I.H. and B.G. Baldwin. In press. A phylogenetically informed reclassification of the rock daisies (Perityleae; Compositae). *Systematic Botany.*

Lichter-Marck, I.H., W.A. Freyman, C.M. Siniscalchi, J.R. Mandel, A. Castro-Castro, G. Johnson, and B.G. Baldwin. 2020. Phylogenomics of Perityleae (Compositae) provides new insights into morphological and chromosomal evolution of the rock daisies. *Journal of Systematics and Evolution* 58: 853–880.

Mack, R. 1981. Invasion of *B. tectorum* L. into western North America: an ecological chronicle. *Agro- Ecosystems* 7: 145-165

Manning, T.J. and D.W. Kappes. 2016. Heap leaching of gold and silver ores, pp. 413–428. *In* M.D. Adams [ed.], Gold ore processing: project development and operations, 2nd ed. Elsevier, Amsterdam, Netherlands.

Matthies D, I. Bräuer, W. Maibom, and T. Tscharntke. 2004. Population Size and the Risk of Local Extinction: Empirical Evidence from Rare Plants. *Oikos* 105: 481–488.

McKee, E. H., J.E. Kilburn, J.H. McCarthy, Jr., J.E. Conrad, and R.J. Blakely. 1985. Mineral Resources of the Inyo Mountains Wilderness Study Area, Inyo County, California. U.S. Geological Survey Bulletin, 1708-A. Available at: https://permanent.fdlp.gov/gpo63459/Report/report.pdf

McNab, W.H. and P.E. Avers. 1994. Ecological subregions of the United States. General Technical Report WSA-5. USDA, Forest Service, Washington, DC. Available at: http://www.fs.fed.us/land/pubs/ecoregions/.

Menges, E. S. 1991. The application of minimum viable population theory to plants. *In* D.A. Falk and K.E. Holsinger (eds), Genetics and conservation of rare plants. Oxford Univ. Press, pp. 47–61.

Merriam, C.W. 1963. Geology of the Cerro Gordo mining district, Inyo County, California. U.S. Geological Survey Professional Paper 408, 83 p.

Miles, S. R. and C. B. Goudey. 1997. Ecological subregions of California. Technical Report R5-EM-TP-005. USDA Forest Service, Pacific Southwest Region, San Francisco, CA. Available at: http://web.archive.org/web/20080304224853/http://www.fs.fed.us/r5/projects/ecoregions/.

[MPM] Mojave Precious Metals, Inc. 2021. Mojave Project Exploration Drilling, Plan of Operations Modification, Plan of Operations CACA-056492.

Morin, Philippe. 2018. Coffee Gold project prepares for 2021, with support of Tr'ondek Hwech'in. CBC News, Sept. 13, 2018. Available at: https://www.cbc.ca/news/canada/north/coffee-gold-mine-trondek-hwechin-1.4822191 [Accessed Sept. 2021].

[OVGA] Owens Valley Groundwater Authority. 2021. Owens Valley Groundwater Sustainability Plan, Oct. 2021. Available at: https://ovga.us/gsa-plan/.

Powell, A.M. 1968. Taxonomy of *Perityle* section *Laphamia* (Compositae-Helenieae-Peritylinae). *SIDA, Contributions to Botany* 3:270-278.

Powell, A. M. 1972. Artificial hybridizations in the subtribe Peritylanae (Compositae-Helenieae). *American Journal of Botany* 59: 760–768.

PRISM Climate Group. Explorer. Oregon State University. Available at: https://prism.oregonstate.edu/explorer/ [Accessed Sept. 2021].

Rathke, B.J. and E.S. Jules. 1993. Habitat fragmentation and plant-pollinator interactions. *Current Science* 65: 273–277.

Reese G.C., S.K. Carter, C. Lund, and S. Walterscheid. 2019. Evaluating and using existing models to map probable suitable habitat for rare plants to inform management of multiple-use public lands in the California desert. Zang R, editor. *PLoS ONE* 14(4):e0214099.

Rimer, R.L. and R.D. Evans. 2006. Invasion of downy brome (*Bromus tectorum* L.) causes rapid changes in the nitrogen cycle. *The American Midland Naturalist* 156: 252-258.

[SBBG] Santa Barbara Botanic Garden. 2021. Rare plant survey data for *Perityle inyoensis* conservation seed collections. Unpublished raw data submitted to CNDDB on Dec 13, 2021.

Sahagun, Louis. 2020. California ghost town with a bloody past suffers a new calamity. The LA Times, June 6, 2020. Available at https://www.latimes.com/california/story/2020-06-21/a-california-ghost-town-with-a-murderous-past-suffers-new-tragedy-as-famed-hotel-goes-up-in-flames

Seager, R., M. Ting, I. Held, Y. Kushnir, J. Lu, G. Vecchi, H.P. Huang, N. Harnik, A. Leetmaa, N.C. Lau, et al. 2007. Model Projections of an Imminent Transition to a More Arid Climate in Southwestern North America. *Science* 316: 1181–1184.

Sheldon, J.C. and F.M. Burrows. 1973. The dispersal effectiveness of the achene-pappus units of selected compositae in steady winds with convection. *New Phytol.* 72: 665–675.

Shinneman, D.J., C.L. Aldridge, P.S. Coates, M.J. Germino, D.S. Pilliod, and N.M. Vaillant. 2018. A conservation paradox in the Great Basin—Altering sagebrush landscapes with fuel breaks to reduce habitat loss from wildfire: U.S. Geological Survey Open-File Report 2018–1034.

Silva, J.L., A.C. Brennan, and J.A. Mejías. 2016. Population genetics of self-incompatibility in a clade of relict cliff-dwelling plant species. *AoB Plants* 8:plw029.

Smith S.D., R.K. Monson, J.E. Anderson. 1997. J.L. Cloudsley-Thompson [ed.], Physiological Ecology of North American Desert Plants. Springer-Verlag, Berlin, Germany.

Stone, P., G.C. Dunne, J.E. Conrad, B.J. Swanson, C.H. Stevens, and Z.C. Valin. 2004. Geologic map of the Cerro Gordo Peak 7.5' quadrangle, Inyo County, California: U.S. Geological Survey Scientific Investigations Map 2851, scale 1:24,000, 1 sheet, includes 16 p. pamphlet. Available at: https://pubs.er.usgs.gov/publication/sim2851.

Stone, P., B.J. Swanson, C.H. Stevens, G.C. Dunne and S.S. Priest. 2009, Geologic map of the southern Inyo Mountains and vicinity, Inyo County, California (ver. 1.1, September, 2014): U.S. Geological Survey Scientific Investigations Map 3094, scale 1:24,000, 1 sheet, includes 22 p. pamphlet. Available at: http://pubs.usgs.gov/sim/3094/.

Swain, D.L., B. Langenbrunner, J.D. Neelin, and A. Hall. 2018. Increasing precipitation volatility in twenty-first-century California. *Nature Clim. Change* 8: 427–433.

Timberline Resources Corporation. 2007. Timberline completes acquisition of Conglomerate Mesa Project, July 9, 2007. Available at:

https://www.sec.gov/Archives/edgar/data/1288750/000105291807000212/ex99.htm [Accessed Nov. 2018]

Timberline Resources Corporation. 2008. Timberline receives permits to drill Conglomerate Mesa Jan. 31, 2008. Available at: https://timberlineresources.co/timberline-receives-permits-to-drill-conglomerate-mesa/ [Accessed May 2021].

[USFWS] U.S. Fish and Wildlife Service. 1975. Threatened or Endangered Fauna or Flora; Review of Status of Over 3000 Vascular Plants and Determination of "Critical Habitat." 40 Fed. Reg. 27824 (June 20, 1975).

[USFWS] U.S. Fish and Wildlife Service. 1993. Endangered and Threatened Wildlife and Plants; Review of Plant Taxa for Listing as Endangered or Threatened Species. 58 Fed. Reg. 51144 (September 30, 1993).

[USFWS] U.S. Fish and Wildlife Service. 1996. Endangered and Threatened Wildlife and Plants; Notice of Final Decision on Identification of Candidates for Listing as Endangered or Threatened. 61 Fed. Reg. 64481 (December 5, 1996).

[USFWS] U.S. Fish and Wildlife Service. 2021. Endangered and Threatened Wildlife and Plants; Threatened Species Status for Bartram's Stonecrop with a Section 4(d) Rule. 86 Fed. Reg. 48545 (August 31, 2021).

[USGS] U.S. Geological Survey. 2005. Mineral Resources Data System: U.S. Geological Survey, Reston, Virginia. Available at: https://mrdata.usgs.gov/mrds/show-mrds.php?dep_id=10310600

Unrau, H.D. 1997. A history of the lands added to Death Valley National Monument by the California Desert Protection Act of 1994: special history study. National Park Service, Denver Service Center, CO. Available at: https://www.nps.gov/parkhistory/online_books/deva1/unrau.pdf.

Vitt, P., M. Tienes, K. Skogen, and K. Havens. 2016. Optimal monitoring of rare plant populations II: Data collection and analysis. Report for the USDA Forest Service.

Waser, N.M., M.V. Price, G. Casco, M. Diaz, A.L. Morales, and J. Solverson. 2017. Effects of Road Dust on the Pollination and Reproduction of Wildflowers. *International Journal of Plant Sciences* 178: 85–93.

[WRCC] Western Regional Climate Center. 2021. Monthly Precipitation Listings, Monthly Totals for Haiwee, CA. Available at: https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca3710 [Accessed Sept. 2021].

Yarborough, S.C. and M. Powell. 2006. *Perityle*. *In* Flora of North America Editorial Committee, eds. 1993+. Flora of North America North of Mexico. 20+ vols. New York and Oxford. Vol. 3, pp. 317-323. Available at:

http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=250067325. [Accessed Sept. 2021].

Young, A.G. and M. Pickup. 2010. Low S-allele numbers limit mate availability, reduce seed set and skew fitness in small populations of a self-incompatible plant. *Journal of Applied Ecology*. 47: 541–548.

### *12.2 Herbarium Specimens Cited*

| **Collector** | **Collection No.** | **Taxon** | **Location** | **Herbaria[1]** |
|---|---|---|---|---|
| Alexander & Kellogg | 3056A | *Perityle inyoensis* | Cerro Gordo Peak | GH, RSA |
| Jaeger | s.n. | *Perityle inyoensis* | "Talc Canon" | RSA |
| Kerr | s.n. | *Perityle inyoensis* | Cerro Gordo Mine | RSA |
| DeDecker | 746 | *Perityle inyoensis* | 2 mi S Cerro Gordo Spring | RSA |
| Alexander & Kellogg | 3056 | *Perityle inyoensis* | Cerro Gordo Peak | UTC |
| DeDecker | 6331 | *Perityle inyoensis* | SW of Cerro Gordo Peak | RSA |
| DeDecker | 4748 | *Perityle* cf. *villosa* | Tin Mountain | CAS, RSA, UC |
| DeDecker | 4761 | *Perityle* cf. *villosa* | Tin Mountain | CAS, RSA, UC |
| Jesus | 786 | *Perityle* sp. | Malpais Mesa | RSA |

[1]Abbreviations from Index Herbariorum, http://sweetgum.nybg.org/science/ih/.

### *12.3 Personal Communications Cited*

Bancroft, Kathy. 2022. Phone conversation between Maria Jesus and Kathy Bancroft, Tribal Historic Preservation Officer for the Lone Pine Paiute Shoshone Tribal Nation, regarding cultural significance of the Inyo rock daisy.

Bell, Duncan. 2018. In-person and email conversations between Maria Jesus and Duncan Bell, senior field botanist at California Botanic Garden, regarding seed collecting efforts and field observations of *Perityle inyoensis* populations at Belmont Mine, Cerro Gordo, and Conglomerate Mesa.

Bell, Duncan. 2021. Email conversations between Maria Jesus and Duncan Bell, senior field botanist at California Botanic Garden, regarding field observations of *Perityle inyoensis* at EO15 and EO16.

Lichter-Marck, Isaac. 2018. Email and phone conversations between Maria Jesus, Isaac Lichter-Marck, current post-doctoral researcher at UCLA, and Greg Suba, former CNPS Conservation Program Director, regarding field observations of *Perityle inyoensis* and insect visitors.

Lichter-Marck, Isaac. 2020. Phone conservations between Maria Jesus and Isaac Lichter-Marck, current post-doctoral researcher at UCLA, regarding identify of Tin Mountain *Perityle* specimens.

Lichter-Marck, Isaac. 2021. Phone conversations between Maria Jesus and Isaac Lichter-Marck, current post-doctoral researcher at UCLA, regarding identity of Talc City Hills *Perityle* specimens.

Schneider, Heather. 2021. Email conversations between Maria Jesus, and Heather Schneider, rare plant biologist for Santa Barbara Botanic Garden, regarding field observations of *Perityle inyoensis* populations at Pleasant Point.

**Appendix I. Population Estimates by CNDDB EO**

Information used to populate table was derived from CDFW (2022).

| EO | Parts[1] | Pop. Number | Min | Max | Year | Source | Acres | Known Density |
|---|---|---|---|---|---|---|---|---|
| **1** | POPULATION NUMBERS FOR PORTIONS OF SITE: 100+ PLANTS SEEN IN 1996, SEEN IN 2018, 5 PLANTS IN 2019, 6 IN 2020, 221 IN 2021. 1957 DEDECKER COLLECTION FROM "2 MI S OF CERRO GORDO SPRING, 8500 FT" IS ALSO ATTRIBUTED TO THIS SITE. | | | | | | | |
| | 1 | 221 | 221 | 221 | 1996, 2021 | Halford, SBBG | | |
| | 2 | unknown | 3 | 77 | 2018 | MB | | |
| | 3 | unknown | 3 | 77 | 2018 | MJJ | | |
| | 4 | unknown | 3 | 77 | 2018 | ILM | | |
| | 5 | 5 | 5 | 5 | 2019 | MJJ | | |
| | 6 | 6 | 6 | 6 | 2020 | MJJ | | |
| **subtotal** | | | 241 | 463 | | | 38 | |
| **2** | TYPE LOCALITY. 80 PLANTS SEEN IN S POLY IN 1996. UNKNOWN NUMBER SEEN IN N POLY IN 2018. 1940 KERR COLLECTION, 1942 ALEXANDER & KELLOGG COLLECTIONS, 1964 NILES COLLECTION, 1988 CLIFTON COLLECTION, AND A 2018 BIRKER PHOTO ATTRIBUTED HERE. | | | | | | | |
| | 1 | 80 | 80 | 80 | 1996 | Halford | | |
| | 2 | unknown | 3 | 77 | 2018 | ILM | | |
| **subtotal** | | | 83 | 157 | | | 6 | |
| **3** | ONLY SOURCE OF INFORMATION FOR THIS SITE IS A 1939 JAEGER COLLECTION. JAEGER WAS KNOWN TO USE FALSE LOCALITY NAMES, SO COLLECTION LABEL DATA IS QUESTIONABLE. | | | | | | | |
| **subtotal** | 1 | unknown | 3 | 77 | | Jaeger | non-specific area[1] | |
| **4** | NORTHERN POLYGON IS BASED ON A 1979 MAP, UNKNOWN WHEN SEEN. UNKNOWN NUMBER OF PLANTS SEEN IN SOUTHERN POLYGON IN 2018. | | | | | | | |
| | 1 | unknown | 3 | 77 | 1979 | DeDecker | | |
| | 2 | unknown | 3 | 77 | 2018 | ILM | | |
| **subtotal** | | | 6 | 154 | | | non-specific area[1] | |
| **5** | 100 PLANTS OBSERVED BETWEEN THIS SITE AND OCCURRENCE #6 ABOUT 0.5 MILE TO THE NORTH IN 1994. 18 PLANTS OBSERVED IN 1996. | | | | | | | |
| **subtotal** | 1 | 100[2] | 100 | 100 | 1994, 1996 | Halford | 13 | 7.7/acre |
| **6** | MIDDLE POLYGON: 100+ PLANTS OBSERVED IN 1994 BETWEEN THIS SITE AND EO #5 (ABOUT 0.5 MILE TO SOUTH), 50 PLANTS OBSERVED IN 1996. SW POLYGON: UNKNOWN NUMBER OF PLANTS SEEN IN 2011. NE POLYGON: UNKNOWN NUMBER OF PLANTS SEEN IN 2013 & 2018. | | | | | | | |
| | 1 | 100[2] | 100 | 100 | 1994, 1996 | Halford | | |
| | 2 | unknown | 3 | 77 | 2011 | Matson | | |
| | 3 | unknown | 3 | 77 | 2013, | Keelan, Lichter-Marck | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 2018 | | | |
| **subtotal** | | | 106 | 254 | | | 15 | |
| **7** | 35 PLANTS OBSERVED IN 1996. | | | | | | | |
| **subtotal** | 1 | 35 | 35 | 35 | 1996 | Halford | 5 | 7/acre |
| **8** | NE POLYGON OBSERVED IN 2011; 0.1% COVER WITHIN THE PLOT. 60+ PLANTS OBSERVED THROUGHOUT OCCURRENCE IN 2018. INCLUDES FORMER OCCURRENCE #10. | | | | | | | |
| | 1 | 0.1% cover in plot | 3 | 77 | 2011, 2018 | Slaton, Bell | | |
| | 2 | 60 | 60 | 60 | 2018 | Bell | | |
| | 3 | unknown | 3 | 77 | 2018 | Jesus | | |
| | 4 | unknown | 3 | 77 | 2018 | Jesus | | |
| **subtotal** | | | 69 | 291 | | | 3 | |
| **9** | NORTHERN POLYGON: 73+ PLANTS OBSERVED IN 2017. 3 SOUTHERN POLYGONS: 91 PLANTS OBSERVED IN 2020. | | | | | | | |
| | 1 | 73 | 73 | 73 | 2017 | Cedar Creek | | |
| | 2 | 91 | 91 | 91 | 2020 | Jesus | | |
| | 3 | NA | NA | NA | 2020 | Jesus | | |
| | 4 | NA | NA | NA | 2020 | Jesus | | |
| **subtotal** | | | 164 | 164 | | | 5 | 32.8/acre |
| **11** | UNKNOWN NUMBER OF PLANTS SEEN IN 2014. POSSIBLY SEEN IN 2016. 3+ PLANTS SEEN IN PORTION OF SITE IN 2018. UNKNOWN NUMBER OF PLANTS SEEN IN 2019. | | | | | | | |
| | 1 | unknown | 3 | 77 | 2016 | Cedar Creek | | |
| | 2 | unknown | 3 | 77 | 2016 | Cedar Creek | | |
| | 3 | 3 | 3 | 3 | 2018 | Bell | | |
| | 4 | unknown | 3 | 77 | 2018 | Jesus | | |
| | 5 | unknown | 3 | 77 | 2019 | Jesus | | |
| **subtotal** | | | 15 | 311 | | | 4 | |
| **12** | IN 2018, UNKNOWN # OF PLANTS IN NORTHERN POLYGON, 4 PLANTS IN MIDDLE POLYGON, AND 20 PLANTS IN SOUTHERN POLYGON. | | | | | | | |
| | 1 | 4 | 4 | 4 | 2018 | Bell | | |
| | 2 | 20 | 20 | 20 | 2018 | Bell | | |
| | 3 | unknown | 3 | 77 | 2018 | Lichter-Marck | | |
| **subtotal** | | | 27 | 101 | | | 2 | |
| **13** | POPULATION NUMBERS FOR PORTIONS OF SITE: 442+ PLANTS SEEN IN 2018, 56+ PLANTS SEEN IN 2019, 12 PLANTS SEEN IN 2020. INCLUDES FORMER OCCURRENCE #S 14 & 15. | | | | | | | |
| | 1 | 42 | 42 | 42 | 2018 | Bell | | |
| | 2 | 100 | 100 | 100 | 2018 | Bell | | |
| | 3 | 300 | 300 | 300 | 2018 | Bell | | |
| | 4 | unknown | 3 | 77 | 2018 | Lichter-Marck | | |
| | 5 | unknown | 3 | 77 | 2018 | Lichter-Marck | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 6 | unknown | 3 | 77 | 2018 | Fraga | | |
| | 7 | unknown | 3 | 77 | 2018 | Jesus | | |
| | 8 | unknown | 3 | 77 | 2018 | Jesus | | |
| | 9 | 8 | 8 | 8 | 2019 | Jesus | | |
| | 10 | 10 | 10 | 10 | 2019 | Jesus | | |
| | 11 | 3 | 3 | 3 | 2019 | Jesus | | |
| | 12 | unknown | 3 | 77 | 2019 | Jesus | | |
| | 13 | 12 | 12 | 12 | 2020 | Jesus | | |
| | 14 | 3 to 35 | 3 | 35 | 2020 | Jesus | | |
| | 15 | unknown | 3 | 77 | 2019 | Patten | | |
| **subtotal** | | | 499 | 1049 | | | 11 | |
| **16** | NE POLYGON: 500+ PLANTS OBSERVED IN 2018. 4 SW POLYGONS: ~116 PLANTS OBSERVED IN 2019. | | | | | | | |
| | 1 | 500 | 500 | 500 | 2018 | Bell | | |
| | 2 | 100 | 100 | 100 | 2019 | Jesus | | |
| | 3 | NA | NA | NA | 2019 | Jesus | | |
| | 4 | 8 | 8 | 8 | 2019 | Jesus | | |
| | 5 | 8 | 8 | 8 | 2019 | Jesus | | |
| **subtotal** | | | 616 | 616 | | | 8 | 77/acre |
| **17** | UNKNOWN NUMBER OF PLANTS SEEN IN 2018. 50 PLANTS ESTIMATED IN 2019. THIS POPULATION IS SURROUNDED BY UNSUITABLE HABITAT (VOLCANIC ROCK) AND IS VERY ISOLATED. | | | | | | | |
| **subtotal** | 1 | 50 | 50 | 50 | 2018, 2019 | Lichter-Marck, Jesus | 1 | 50/acre |
| **18** | FEW PLANTS OBSERVED IN 2018. | | | | | | | |
| **subtotal** | 1 | unknown | 3 | 77 | 2018 | Jesus | 1 | |
| **19** | POPULATION NUMBERS FOR PORTIONS OF SITE: UNKNOWN NUMBER OF PLANTS SEEN IN 2014, POSSIBLY SEEN IN 2016, 37 PLANTS SEEN IN 2017, 64 PLANTS SEEN IN 2020 | | | | | | | |
| | 1 | 37 | 37 | 37 | 2016, 2017 | Cedar Creek | | |
| | 2 | NA | NA | NA | 2016, 2017 | Cedar Creek | | |
| | 3 | NA | NA | NA | 2016, 2017 | Cedar Creek | | |
| | 4 | 48 | 48 | 48 | 2020 | Jesus | | |
| | 5 | 16 | 16 | 16 | 2021[3] | Jesus | | |
| **subtotal** | | | 101 | 101 | | | 10 | 10.1/acre |
| **20** | 60 PLANTS OBSERVED IN 2020. | | | | | | | |
| **subtotal** | 1 | 60 | 60 | 60 | 2020 | Jesus | 1 | 60/acre |
| **21** | 3 PLANTS OBSERVED IN 2021. | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **subtotal** | 1 | 3 | 3 | 3 | 2021[2] | Jesus | 1 | 3/acre |
| **22** | PLANTS NOT COUNTED IN 2018, BUT SITE QUALITY REPORTED AS EXCELLENT. | | | | | | | |
| **subtotal** | 1 | unknown | 3 | 77 | 2018 | Jesus | 1 | |
| **23** | 2 EASTERN POLYGONS: SEEN IN 2014, POSSIBLY ALSO SEEN IN 2016. 2ND W-MOST POLYGON: 30 PLANTS SEEN IN 2019. W-MOST POLYGON: 10 PLANTS SEEN IN 2019. | | | | | | | |
| | 1 | unknown | 3 | 77 | 2016 | Cedar Creek | | |
| | 2 | unknown | 3 | 77 | 2016 | Cedar Creek | | |
| | 3 | 30 | 30 | 30 | 2016 | Jesus | | |
| | 4 | 10 | 10 | 10 | 2019 | Jesus | | |
| **subtotal** | | | 46 | 194 | | | 4 | |
| **24** | PLANTS SEEN BUT NOT COUNTED IN 2018 AND 2019, THOUGH SITE QUALITY NOTED AS GOOD. | | | | | | | |
| | 1 | unknown | 3 | 77 | 2018 | Jesus | | |
| | 2 | unknown | 3 | 77 | 2019 | Jesus | | |
| **subtotal** | | | 6 | 154 | | | 1 | |
| **25** | POPULATION NUMBERS FOR PORTIONS OF OCCURRENCE: 13 PLANTS SEEN IN 2019, 185+ PLANTS SEEN IN 2020, 300 PLANTS SEEN IN 2021. | | | | | | | |
| | 1 | 8 | 8 | 8 | 2019 | Jesus | | |
| | 2 | 5 | 5 | 5 | 2019 | Jesus | | |
| | 3 | 5 | 5 | 5 | 2020 | Jesus | | |
| | 4 | unknown | 3 | 77 | 2020 | Jesus | | |
| | 5 | 30 | 30 | 30 | 2020 | Jesus | | |
| | 6 | 150 | 150 | 150 | 2020 | Jesus | | |
| | 7 | 300 | 300 | 300 | 2021[3] | Jesus | | |
| **subtotal** | | | 501 | 575 | | | 5 | |
| **26** | 3 POLYGONS MAPPED ACCORDING TO 2018 JESUS COORDINATES. ~70 PLANTS OBSERVED IN 2018. | | | | | | | |
| | 1 | 10 | 10 | 10 | 2018 | Jesus | | |
| | 2 | 30 | 30 | 30 | 2018 | Jesus | | |
| | 3 | 30 | 30 | 30 | 2018 | Jesus | | |
| **subtotal** | | | 70 | 70 | | | 2 | 35/acre |
| **27** | 8 PLANTS SEEN IN NORTHERN POLYGON AND 50 PLANTS SEEN IN SOUTHERN POLYGON IN 2019; NOT THOROUGHLY SURVEYED, LIKELY MANY MORE INDIVIDUALS IN THIS LOCATION. | | | | | | | |
| | 1 | 8 | 8 | 8 | 2019 | Jesus | | |
| | 2 | 50 | 50 | 50 | 2019 | Jesus | | |
| **subtotal** | | | 58 | 58 | | | 1 | |
| **28** | UNKNOWN NUMBER OF PLANTS SEEN IN 2020. A 1964 NILES COLLECTION FROM "ROCK OUTCROPS W OF AND NEAR TO RD TO CERRO GORDO MINE, 6900 FT ELEV" IS ALSO ATTRIBUTED TO THIS SITE. | | | | | | | |
| **subtotal** | 1 | unknown | 3 | 77 | 1964, 2020 | Miles, Batuik | 1 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **29** | UNKNOWN NUMBER OF PLANTS SEEN IN WESTERN POLYGON IN 2018. FEWER THAN 50 PLANTS SEEN IN EASTERN POLYGON IN 2019. | | | | | | | |
| | 1 | unknown | 3 | 77 | 2018 | Lichter-Marck | | |
| | 2 | 50 | 50 | 50 | 2019 | Jesus | | |
| subtotal | | | 53 | 127 | | | 1 | |
| **TOTAL** | | | **2921** | **5395** | | | **140** | |

[1]When a particular source provides population numbers for an EO or part of an EO, this information is specified in CDFW (2022). However, CDFW (2022) does not always explicitly assign constituent parts to a particular source within each EO. Therefore, in this table, the assignment of a part to a source within an EO is somewhat arbitrary, but this has no bearing on the overall estimate. For example, EO 29 says, "UNKNOWN NUMBER OF PLANTS SEEN IN WESTERN POLYGON IN 2018. FEWER THAN 50 PLANTS SEEN IN EASTERN POLYGON IN 2019" (CDFW 2022). In this table, EO 29 part 1 is arbitrarily assigned to the western polygon submitted by Lichter-Marck in 2018 and part 2 is arbitrarily assigned to the eastern polygon submitted by Jesus in 2019.

[2]Unclear if area surveyed in 1994 and 1996 were the same. The greater value (i.e. 100) was used as a more conservative estimate.

[3]Year should be 2020, but was incorrectly entered into CNDDB as 2021. A request to correct these dates was submitted to CNDDB.