

CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE

# California Endangered Species Act



## Petition Evaluation for *Morro manzanita (Arctostaphylos morroensis)*

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Report to the Fish and Game Commission  
November 2024



Cover page photo of Morro manzanita by Kristi Lazar (2024)

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## List of Abbreviations, Acronyms, and Terms

- CESA – California Endangered Species Act
- CNDDDB – California Natural Diversity Database
- CRPR – California Rare Plant Rank
- Commission – California Fish and Game Commission
- Department – California Department of Fish and Wildlife
- ESA – Federal Endangered Species Act
- et al. – “and others”
- HCP – Habitat Conservation Plan
- PRISM – Parameter-elevation Regressions on Independent Slopes Model
- USFWS – United States Fish and Wildlife Service

## Executive Summary

On July 20, 2024, Dr. Christopher Kofron and Dr. Claudia Tyler submitted a petition to the California Fish and Game Commission (Commission) to list Morro manzanita (*Arctostaphylos morroensis*) as endangered pursuant to the California Endangered Species Act (CESA).

On July 30, 2024, the Commission referred the petition to the California Department of Fish and Wildlife (Department) in accordance with Fish and Game Code section 2073 (Cal. Reg. Notice Register 2024, No. 32-Z, p. 1016). Pursuant to Fish and Game Code section 2073.5 and California Code of Regulations, title 14, section 670.1, the Department prepared this petition evaluation within 120 days of receiving the petition. The purpose of the petition evaluation is to evaluate the sufficiency of the scientific information contained in the petition in relation to other relevant information possessed or received by the Department during the evaluation period, and to recommend to the Commission whether the petition should be accepted and considered.

Morro manzanita is an erect, evergreen shrub in the heath family (Ericaceae). The petition indicates that Morro manzanita is restricted to seven occurrences in and around the town of Los Osos in San Luis Obispo County and occurs primarily on stabilized sand dunes associated with Baywood fine sand. The petition provides information on abundance estimates and declining population trends. The petition highlights five threats to Morro manzanita: (1) clearing of habitat for residential development, (2) non-native, invasive plant species, (3) stochastic events, (4) climate change, and (5) sudden oak death pathogen *Phytophthora ramorum*. Existing management efforts were reviewed and suggestions for future management actions discussed. The petition also includes information sources and provides a detailed distribution map.

After reviewing the petition and other relevant information, the Department has determined that the petition meets the requirements in Fish and Game Code section 2072.3 and California Code of Regulations, title 14, section 670.1, subdivision (d)(1). In completing its petition evaluation, the Department has determined that there is sufficient scientific information to indicate that the petitioned action to list Morro manzanita as endangered under CESA may be warranted. Therefore, the Department recommends that the Commission accept the petition for further consideration pursuant to CESA.

# 1 Introduction

## 1.1 Petition Evaluation Overview

This petition evaluation serves as the basis for the California Department of Fish and Wildlife's (Department) recommendation to the California Fish and Game Commission (Commission) on whether the petition to list Morro manzanita (*Arctostaphylos morroensis*) as endangered under the California Endangered Species Act (CESA) should be accepted and considered. The recommendation is based on the sufficiency of scientific information in the petition, as well as other relevant information possessed or received by the Department during the evaluation period.

A petition to list a species under CESA must include "information regarding the population trend, range, distribution, abundance, and life history of a species, the factors affecting the ability of the population to survive and reproduce, the degree and immediacy of the threat, the impact of existing management efforts, suggestions for future management, and the availability and sources of information. The petition shall also include information regarding the kind of habitat necessary for species survival, a detailed distribution map, and any other factors that the petitioner deems relevant" (Fish & G. Code, § 2072.3; see also Cal. Code Regs., tit. 14, § 670.1, subd. (d)(1)).

Once a petition is submitted to the Commission, the Department prepares a petition evaluation that evaluates each of the petition components and makes a recommendation to the Commission as to whether there is sufficient scientific information to indicate that the petitioned action to list the species under CESA may be warranted (Fish & G. Code, § 2073.5, subds. (a)-(b)). The petition evaluation is placed on the agenda for receipt at the next available meeting of the Commission after delivery. At that time, the petition evaluation will be made available to the public for a 30-day public comment period prior to the Commission taking any action on the petition. The Commission then considers the petition, the Department's petition evaluation, written comments received, and oral testimony to make a finding as to whether the petition provides "sufficient information to indicate that the petitioned action may be warranted" (Fish & G. Code, § 2074.2, subd. (e)(2)). The standard for accepting a petition for consideration and assessing sufficiency of information is addressed in *Center for Biological Diversity v. California Fish and Game Commission* (2008) 166 Cal.App.4th 597.

If the Commission determines that the petitioned action may be warranted, it accepts the petition, and the species becomes a candidate for CESA listing and proceeds to the status review stage of the CESA process. Within 12 months of the Commission's acceptance of the petition, the Department is required to produce a peer-reviewed report that advises the Commission on whether the petitioned action is warranted, based upon the best scientific information available (Fish & G. Code, § 2074.6). Finally,

the Commission determines whether the petitioned action to list the species as threatened or endangered is warranted, based on the Department's status review and other information in the administrative record (Fish & G. Code, § 2075.5).

## **1.2 CESA Petition History**

On February 19, 1991, Dr. Malcolm McLeod of the California Native Plant Society submitted a petition to the Commission to list Morro manzanita as threatened under CESA (McLeod 1991; McGuire and Morey 1992). On December 5, 1991, the Commission designated Morro manzanita as a candidate for CESA listing (Cochrane 1996). On January 5, 1993, the Department recommended to the Commission that Morro manzanita be listed as threatened under CESA (McGuire and Morey 1992; Cochrane 1996). The Commission then voted on whether Morro manzanita should be listed under CESA and the vote was a tie (Cochrane 1996). The Commission directed the Department to work with local government, environmental groups, and landowners to initiate a management plan while Morro manzanita remained a candidate species (Cochrane 1996). On August 5, 1993, the Commission voted again and determined that, based on regional planning efforts that were underway, CESA listing was not warranted at that time (Cochrane 1996).

On July 20, 2024, Dr. Christopher Kofron and Dr. Claudia Tyler submitted a petition to the Commission to list Morro manzanita as endangered under CESA (Kofron and Tyler 2024). On July 30, 2024, the Commission referred the petition to the Department for evaluation. At its meeting on August 14-15, 2024, the Commission officially acknowledged receipt of the petition. At its meeting on October 10, 2024, the Commission granted the Department's request for a 30-day extension of the period to review the petition and prepare this petition evaluation.

## **1.3 Federal Status**

On December 15, 1994, Morro manzanita was listed as a threatened species under the Federal Endangered Species Act (ESA) (USFWS 1994). In 2008, 2013, and 2022, the United States Fish and Wildlife Service (USFWS) conducted 5-year reviews for Morro manzanita to ensure that its classification as a threatened species under the ESA provided the appropriate level of protection (USFWS 2008, 2013, 2022). All three USFWS 5-year reviews concluded that Morro manzanita still met the definition of a threatened species under the ESA.

In 1998, the USFWS published a recovery plan for the Morro shoulderband snail and four plant species, including Morro manzanita (USFWS 1998). The recovery plan provided delisting criteria for Morro manzanita that required: (1) 90 percent of existing high and medium cover stands and 85 to 90 percent of low cover stands be preserved,

(2) evidence that the acreage and cover classes of Morro manzanita in preserves can be maintained over time, and (3) site-specific management plans to have been successfully implemented for the preserves (USFWS 1998). As of 2022, the first recovery criterion was close to being met with 70% of existing high and medium cover Morro manzanita stands and 89% of low cover stands protected in preserves (USFWS 2022). The second and third criteria have not been met as there are no monitoring programs in place to track the maintenance of Morro manzanita stands over time and site-specific management plans have only been developed for two of the five relevant preserves (USFWS 2022).

## **1.4 Additional Species Status Designations**

### *1.4.1 NatureServe Conservation Status Ranks*

NatureServe’s conservation status ranks consist of a global conservation status rank (global rank or G rank), describing the status of a given taxon over its entire global distribution, and a subnational conservation status rank (subnational rank or S rank), describing the status of a given taxon over its state distribution (Master et al. 2012). Morro manzanita has been assigned a NatureServe conservation status rank of G1 S1, indicating that the species is critically imperiled both globally and within California, with a very high risk of extirpation due to one or more of the following: very restricted range, very few populations or occurrences, very steep declines, severe threats, or other factors (CNDDDB 2020, 2024).

### *1.4.2 California Rare Plant Rank*

The California Native Plant Society works in collaboration with botanical experts throughout the state, including Department biologists, to assign rare plants a California Rare Plant Rank (CRPR) reflective of their rarity status (CNDDDB and CNPS 2020). Morro manzanita has been assigned a CRPR of 1B.1 (CNPS 2024). Plants with a CRPR of “1B” are considered rare, threatened, or endangered throughout their range with the majority endemic to California (CNDDDB and CNPS 2020). The threat code extension of “.1” indicates that the species is seriously threatened in California, with over 80 percent of occurrences threatened and a high degree and immediacy of threat (CNDDDB and CNPS 2020).

## **2 Species Description and Taxonomy**

The Commission has the authority to list certain species or subspecies as endangered or threatened under CESA (Fish & G. Code, §§ 2062, 2067, 2070). The listing process is the same for species and subspecies (Fish & G. Code, §§ 2070-2079.1).



## 2.1 Species Taxonomy

Morro manzanita (*Arctostaphylos morroensis* Wiesl. & B. Schreib.) was first described by Wieslander and Schreiber in 1939 (Wieslander and Schreiber 1939). The original description was based on collections from 1936 and 1938 from the vicinity of Hazard Canyon in what is now Montaña de Oro State Park in San Luis Obispo County (Wieslander and Schreiber 1939). Morro manzanita has been recognized in all relevant floras since it was originally described, including The Jepson Manual and the Flora of North America (Parker et al. 2009, 2023).

## 2.2 Species Description

Morro manzanita is an erect, evergreen shrub in the heath family (Ericaceae) (Parker et al. 2023). Morro manzanita typically grows from 0.5 m to over 4 m (1.6 to 13.1 ft) tall, with leaves that are covered with matted hairs on the lower leaf surface (especially when leaves are young) and generally without hairs on the upper leaf surface (Wieslander and Schreiber 1939; Mullany 1990; Parker et al. 2023). Leaf blades are oblong-ovate to elliptic, 1.5 to 3.5 cm (0.6 to 1.4 in) long, and 1 to 2.6 cm (0.4 to 1 in) wide (Mullany 1990; Parker et al. 2023). Stomata (pores) are present on the lower leaf surface but generally absent or sparse on the upper leaf surface (Mullany 1990).

Like all manzanita species, Morro manzanita flowers have petals fused into an urn-shape and are white to pink in color. There are five sepals (outermost whorl of flower parts) below the fused petals (Parker et al. 2023). Flowers are arranged in clusters called inflorescences and inflorescences hang down when they are young (Parker et al. 2023). Beneath the inflorescences are bracts that are leaf-like, lanceolate to linear in shape, and minutely hairy (Wieslander and Schreiber 1939; Parker et al. 2023). Fruits are 7 to 10 mm (0.3 to 0.4 in) wide, berry-like, and shaped as spheres that have been flattened on the top and bottom (Parker et al. 2023).

Morro manzanita stems have gray, shredding bark on older stems and both short and long, white, non-glandular hairs on twigs and young inflorescences (Parker et al. 2023). One characteristic of many manzanita species is the presence of a basal burl (woody growth) which allows the species to resprout after fire. Morro manzanita does not have a basal burl, meaning that when a fire burns a Morro manzanita population, Morro manzanita shrubs are unable to resprout and rely solely on their seed bank in the soil to germinate and replenish the population (Wells 1969; Parker et al. 2023).

### **3 Summary of Petition Components**

Pursuant to Fish and Game Code section 2072.3 and California Code of Regulations, title 14, section 670.1, subdivision (d)(1), the Department evaluated whether the petition contained information on each of the following petition components:

- Life history;
- Range;
- Distribution;
- Detailed distribution map
- Kind of habitat necessary for survival;
- Abundance;
- Population trend;
- Factors affecting the ability to survive and reproduce;
- Degree and immediacy of threat;
- Impact of existing management efforts;
- Suggestions for future management; and
- Availability and sources of information.

The Commission did not receive new information from the public during the petition evaluation period (Fish & G. Code, § 2073.4). Pursuant to Fish and Game Code section 2073.5, the Department evaluated the information contained in the petition to determine whether there is, or is not, sufficient information to indicate that the petitioned action may be warranted. A summary of the relevant information from the petition for each of the petition components is presented below. In some instances, the Department has grouped similar components together and renamed components to create a more cohesive and readable document.

#### **3.1 Life History**

This section summarizes the information in the petition regarding the species' life history (Fish & G. Code, § 2072.3; Cal. Code Regs., tit. 14, § 670.1, subd. (d)(1)).

##### *3.1.1 Scientific Information in the Petition*

The petition discusses the life history of Morro manzanita in the “Life History” section on pages 8 through 13. The petition describes Morro manzanita as an erect, spreading shrub, generally 1 to 4 m (3.3 to 13.1 ft) in height. The petition indicates that Morro manzanita produces abundant flowers in January through March and is dependent on pollinators to reproduce. After flowering, the petition notes that Morro manzanita produces fruits that mature in spring and summer, with each fruit containing five to

eight seeds. The petition discusses studies that found a low percent (10 to 18%) of Morro manzanita flowers produced fruit, but that the fruits contained a high percentage (73%) of viable seeds (Kelly and Parker 1991; Tyler et al. 2023). The petition notes that fruits fall from Morro manzanita shrubs in late spring to late fall, with the majority of the fruits removed by animals (such as small mammals and birds).

The petition discusses how the lack of a basal burl means Morro manzanita does not resprout when burned by fire and the species relies on a dormant seed bank in the soil to persist in the landscape. The petition cites a study that examined Morro manzanita seed germination in response to fire-related cues and found that these cues, specifically heat and charred wood, enhanced seed germination but seed germination was very low overall, with only 1 to 4% of all seeds germinating on average (Tyler and Odion 2020). The petition also mentions that, based on a study of three Morro manzanita stands, the older the stand, the fewer seeds being added to the soil seed bank each year (Tyler and Odion 2020; Tyler et al. 2023).

### **3.2 Range, Distribution, and Detailed Distribution Map**

This section summarizes the information in the petition regarding the species' range and distribution and provides a detailed distribution map (Fish & G. Code, § 2072.3; Cal. Code Regs., tit. 14, § 670.1, subd. (d)(1)). A species' range for the purposes of CESA and this status review is the species' California range (Cal. Forestry Assn. v. Cal. Fish and Game Com. (2007) 156 Cal.App.4<sup>th</sup> 1535, 1551). Range describes the general geographical area in which a species occurs. Distribution describes the actual sites where individuals and populations of the species occur within the species' range.

#### *3.2.1 Scientific Information in the Petition*

The petition discusses the range and distribution of Morro manzanita in the "Range, Distribution, and Abundance" section on pages 5 through 8. The petition also provides two detailed distribution maps for Morro manzanita as Figures 2 and 4 on pages 23 and 25, respectively. Figure 4 of the petition is included as Figure 1 on page 8 of this petition evaluation.

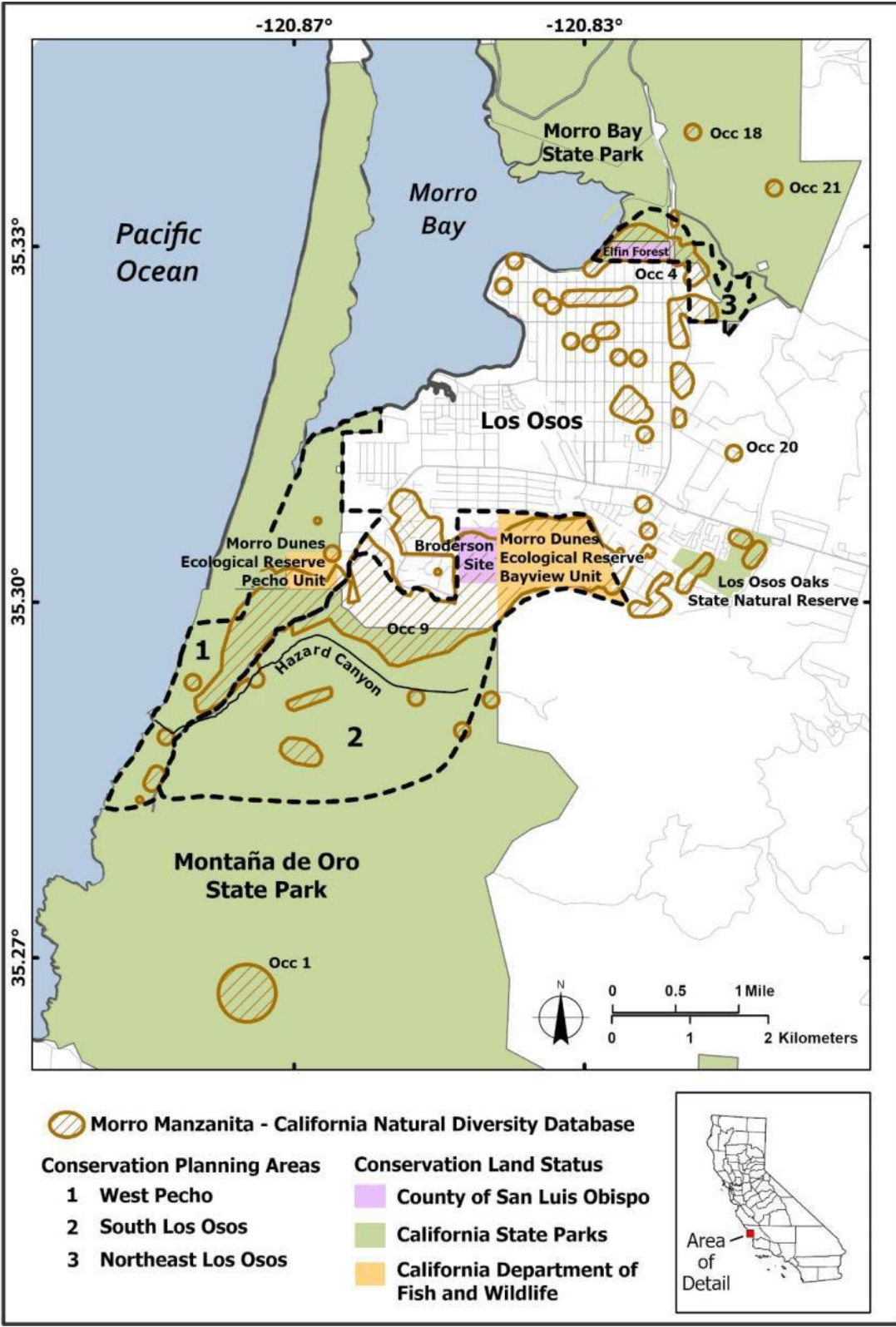


Figure 1. Map of the range and distribution of Morro manzanita as provided in Figure 4 of the petition. Occurrences from the California Natural Diversity Database (CNDDDB) are labeled with CNDDDB occurrence numbers. Some occurrences consist of multiple polygons.

The petition describes Morro manzanita as being restricted to the coastal area of San Luis Obispo County, in and around the town of Los Osos. There are six occurrences of Morro manzanita documented in the California Natural Diversity Database (CNDDDB). The petition notes that an additional occurrence, not yet reflected in the CNDDDB, was found in 2023 for a total of seven documented occurrences of Morro manzanita. The petition states that one of the occurrences is based on a historic collection that may be erroneous (CNDDDB occurrence 1), one occurrence is likely extirpated (CNDDDB occurrence 20), three occurrences are small and consist of a single or small number of polygons (CNDDDB occurrences 18, 21, and the new occurrence), and the remaining two occurrences consist of multiple polygons representing at least 98% of the distribution of Morro manzanita (CNDDDB occurrences 4 and 9).

### **3.3 Habitat**

This section summarizes the information in the petition regarding the kind of habitat necessary for species survival (Fish & G. Code, § 2072.3; Cal. Code Regs., tit. 14, § 670.1, subd. (d)(1)).

#### *3.3.1 Scientific Information in the Petition*

The petition discusses the kind of habitat necessary for Morro manzanita survival in the “Kind of Habitat Necessary for Survival” section on page 13. The petition describes Morro manzanita as being restricted to coastal San Luis Obispo County at elevations below 200 m (656 ft). The petition notes that Morro manzanita primarily occurs on stabilized sand dunes of Baywood fine sand, with a few outlying populations growing on shale or volcanic igneous substrates. The petition states that temperatures in the vicinity of Morro manzanita occurrences range from 6.5 to 23.5°C (43.7 to 74.3°F) and mean annual rainfall is 42.1 cm (16.6 in).

### **3.4 Abundance and Population Trend**

This section summarizes the information in the petition regarding the species’ abundance and population trend (Fish & G. Code, § 2072.3; Cal. Code Regs., tit. 14, § 670.1, subd. (d)(1)).

#### *3.4.1 Scientific Information in the Petition*

The petition discusses abundance for Morro manzanita in the “Range, Distribution, and Abundance” section on pages 5 through 8, and discusses population trend in the “Population Trends” section on page 8.

The petition indicates that abundance of Morro manzanita is difficult to estimate due to its growth form and habit. Morro manzanita shrubs can have multiple stems at the base

of the plant and often occur in dense stands that are difficult to access. However, the petition mentions that the population size of Morro manzanita has been extrapolated from measures of area occupied, percent cover, and shrub size. Using this method, Morro manzanita has been estimated to have a total population size of 86,000 to 153,000 individuals (LSA Associates, Inc. 1992; McGuire and Morey 1992; Crawford, Multari & Clark Associates 2004).

The petition indicates Morro manzanita is experiencing a declining population trend based on a reduction in its historical range and based on its current known distribution. The petition discusses how the historical range of Morro manzanita was estimated by the USFWS to be between 800 and 1,100 ha (1,977 and 2,718 ac) based on the distribution of Morro manzanita's preferred substrate, Baywood fine sand (USFWS 1994). By 2013, the USFWS estimated that development had eliminated as much as 75% of historically suitable habitat (USFWS 2013). The petition also compares the historical range of Morro manzanita with more recent estimates of occupied area that indicate Morro manzanita currently occupies less than 162 ha (400 ac) (Tyler and Odion 1996).

### **3.5 Threats**

This section summarizes the information in the petition regarding the factors affecting the ability of the species to survive and reproduce, and the degree and immediacy of threat (Fish & G. Code, § 2072.3; Cal. Code Regs., tit. 14, § 670.1, subd. (d)(1)).

#### *3.5.1 Scientific Information in the Petition*

The petition discusses threats affecting Morro manzanita's ability to survive and reproduce in the "Factors Affecting Ability to Survive and Reproduce" section on pages 13 through 14 and discusses the degree and immediacy of threat for Morro manzanita in the "Degree and Immediacy of Threat" section on pages 14 through 16.

The petition identifies the following factors as threats to Morro manzanita: (1) clearing of habitat for residential development, (2) non-native, invasive plant species, (3) stochastic events, (4) climate change, and (5) sudden oak death pathogen *Phytophthora ramorum*.

#### Clearing of habitat for residential development

The petition describes clearing of habitat for residential development as an immediate and ongoing threat to Morro manzanita. There are large Morro manzanita stands that occur on private lands threatened with development. Development would require the direct removal of Morro manzanita shrubs, reducing the population size and contributing to habitat fragmentation. In addition, clearing of excess or dead vegetation around existing residences may negatively impact Morro manzanita. The petition also

notes that the California Department of Forestry and Fire Prevention has constructed a firebreak near a housing estate in the vicinity of a Morro manzanita stand and has proposed an extension to the firebreak.

#### Non-native, invasive plant species

The petition indicates that non-native, invasive plant species are an ongoing threat to Morro manzanita. In particular, *Eucalyptus* trees, as explained in the petition, were planted throughout the Los Osos area in the early 1900s with many of these trees presumably planted in areas that once contained Morro manzanita. The petition notes that the *Eucalyptus* stands continue to expand and few Morro manzanita persist under the trees. The petition discusses how *Eucalyptus* and other non-native invasive plant species in the area, such as veldt grass (*Ehrharta calycina*), are highly flammable and could result in altered fire regimes that are detrimental to Morro manzanita.

#### Stochastic events

The petition indicates that environmental and demographic stochastic events are a threat to Morro manzanita mainly due to the species' low seedbank density, poor seed viability, and small, isolated populations. As discussed in the petition, an environmental stochastic event of particular concern for Morro manzanita is wildfire. If wildfires occur at too frequent intervals, there may not be enough time post-fire for a Morro manzanita stand to re-establish, become reproductive, and build up an adequate seedbank between fires to sustain the population. The petition discusses how demographic stochastic events (related to fluctuations in reproduction and mortality) are especially detrimental for small, fragmented populations like those present in Morro manzanita. If pollinators are not able to move between populations (and cross-pollinate), Morro manzanita may experience increased genetic drift and inbreeding effects. The petition mentions that Morro manzanita may already be experiencing negative genetic effects from its small, isolated populations as evidenced by low seed viability in an isolated Morro manzanita stand at the Elfin Forest Preserve (part of CNDDDB occurrence 4).

#### Climate change

The petition indicates that Morro manzanita may not be able to tolerate or adapt to the increase in temperatures, drought, and wildfires that are expected to occur on the central California coast in the future as a result of climate change. The petition notes that low rainfall may be the reason for mortality and stem die-off of several large Morro manzanita shrubs at the Elfin Forest Preserve since 2015. The petition also indicates that Morro manzanita is a habitat specialist which will likely restrict the species' ability to disperse to other locations in the face of a warming climate.

### Sudden oak death pathogen *Phytophthora ramorum*

The petition indicates that, while not an immediate threat, the sudden oak death pathogen (*Phytophthora ramorum*) is a potential future threat to Morro manzanita. The sudden oak death pathogen, as discussed in the petition, is responsible for the killing of over 50 million trees in California and Oregon and while it primarily targets tanoak and coast live oak, studies have shown that the sudden oak death pathogen can infect manzanita. In a study that tested the susceptibility of several manzanita species to the sudden oak death pathogen, Morro manzanita showed an intermediate susceptibility (Garbelotto et al. 2020). The petition notes that no Morro manzanita have yet been identified as being infected with the sudden oak death pathogen in the wild; however, the pathogen is present in the area and has been documented to occur in several streams in coastal San Luis Obispo County. Since the sudden oak death pathogen can be carried through air, water, soil, and litter, spread of the pathogen to areas with Morro manzanita is a possibility in the future (Peterson et al. 2014; Grunwald et al. 2019).

## **3.6 Existing Management**

This section summarizes the information in the petition regarding the impact of existing management efforts on the species (Fish & G. Code, § 2072.3; Cal. Code Regs., tit. 14, § 670.1, subd. (d)(1)).

### *3.6.1 Scientific Information in the Petition*

The petition discusses existing management for Morro manzanita in the “Impact of Existing Management Actions” section on pages 16 and 17. The petition indicates that current regulatory mechanisms are not adequate to protect Morro manzanita from immediate and ongoing threats. Morro manzanita is listed as threatened under the ESA; however, the ESA provides little protection for federally listed species on private land. The petition discusses how various private properties with Morro manzanita have been purchased and protected from development since the species was federally listed in 1994, but a substantial portion of the remaining Morro manzanita stands still occur on private land. In addition, Morro manzanita is a covered species in the Los Osos Habitat Conservation Plan (HCP). The Los Osos HCP was approved in February 2024 and the USFWS has issued an incidental take permit to the County of San Luis Obispo to authorize take/impacts to covered species associated with covered activities (Jodi McGraw Consulting 2022). The petition indicates that the Los Osos HCP would allow residential development and construction of firebreaks on private lands that currently contain dense, intact Morro manzanita stands.



### **3.7 Future Management**

This section summarizes the information in the petition regarding suggestions for future management (Fish & G. Code, § 2072.3; Cal. Code Regs., tit. 14, § 670.1, subd. (d)(1)).

#### *3.7.1 Scientific Information in the Petition*

The petition suggests future management actions for Morro manzanita in the “Suggestion for Future Management” section on pages 17 and 18. The petition recommends the following specific actions:

- Conserve and protect existing stands of Morro manzanita.
- Discuss fuel reduction activities impacting Morro manzanita stands in Los Osos with the USFWS.
- Survey for Morro manzanita across its range and collect data on abundance.
- Develop and implement site specific management plans for Morro manzanita within preserves.
- Develop protocols for long-term restoration of Morro manzanita, including conducting research on seed viability and germination requirements to aid in restoration.
- Identify potential restoration sites and investigate options for restoring connectivity between fragmented populations.
- Conduct research on the genetic diversity within and among Morro manzanita stands.
- Remove *Eucalyptus* and re-establish Morro manzanita stands where feasible.
- Coordinate and share information across agencies, researchers, and citizen groups who are involved with outreach and conservation of Morro manzanita.
- Further study the relationship of Morro manzanita with fire.
- Conduct prescribed burns in the Los Osos area.
- Conduct modeling to anticipate the effects of climate change on Morro manzanita.
- Collect seeds of Morro manzanita for conservation seed banking.
- Introduce Morro manzanita into living collections at botanic gardens.

### **3.8 Availability and Sources of Information**

This section summarizes the information in the petition regarding availability and sources of information (Fish & G. Code, § 2072.3; Cal. Code Regs., tit. 14, § 670.1, subd. (d)(1)).

### *3.8.1 Scientific Information in the Petition*

The petition provides a list of sources for Morro manzanita in the “References and Sources of Information” section on pages 18 through 21. The petitioners provided electronic copies of sources from the petition to the Commission.

### *3.8.2 Other Relevant Scientific Information*

The Department evaluated additional sources of information in its possession as it relates to the petition. The Department concluded that none of the additional information contradicts or undercuts the conclusions made in the petition at this juncture of the listing process. These sources can be found in the Literature Cited section of this document.

## **4 Sufficiency of Scientific Information to Indicate the Petitioned Action May Be Warranted**

The Department evaluated the petition components set forth in Fish and Game Code section 2072.3 and California Code of Regulations, title 14, section 670.1, subdivision (d)(1) for sufficiency of information pursuant to Fish and Game Code section 2073.5. The Department finds that sufficient scientific information was provided for the petition components.

## **5 Recommendation to the Commission**

Pursuant to Fish and Game Code section 2073.5, the Department evaluated the petition on its face and in relation to other relevant information the Department possesses. In completing its petition evaluation, the Department determined that the petition, and other relevant information, provide sufficient scientific information to indicate that the petitioned action to list Morro manzanita as endangered may be warranted. Therefore, the Department recommends the Commission accept the petition for further consideration under CESA.

## **Acknowledgements**

This petition evaluation was prepared by Kristi Lazar in the Department’s Habitat Conservation Planning Branch, Native Plant Program.

## Literature Cited

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