

Arctostaphylos morroensis
(Morro Manzanita)

**5-Year Review:
Summary and Evaluation**



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

June 2013

5-YEAR REVIEW

***Arctostaphylos morroensis* (Morro Manzanita)**

I. GENERAL INFORMATION

Purpose of 5-Year Review:

The U.S. Fish and Wildlife Service (Service) is required by section 4(c)(2) of the Endangered Species Act (Act) to conduct a status review of each listed species at least once every 5 years to ensure that its classification as threatened or endangered provides the appropriate level of protection. We consider the best available scientific and commercial data on the species, and focus on new information since the species was listed. The purpose of our review is to evaluate whether or not the species' status has changed since listing, and whether reclassification or delisting should be considered. Our original listing of a species as endangered or threatened is based on the existence of one or more of the five threat factors described in section 4(a)(1) of the Act, and we must consider these same five factors in any subsequent reclassification or delisting of a species. A 5-year review contains an analysis of updated information on the species' biology and threats, and we interpret progress towards recovery in the context of eliminating or reducing the five threat factors. If we recommend a change in listing status based on the results of the 5-year review, we must propose to do so through a separate rule-making process defined in the Act that includes public review and comment.

Species Overview:

Arctostaphylos morroensis is a long-lived shrub in the heath (Ericaceae) family that is endemic to San Luis Obispo County, California. Its distribution is correlated with that of soils developed on ancient sand dunes that were deposited during the Pleistocene (i.e., Baywood fine sands). This species is found in association with coastal dune scrub, maritime chaparral, and coast live oak woodland on sites with low to moderate slopes. *Arctostaphylos morroensis* flowers in the winter, with fruit maturation and seed dispersal occurring in the fall. Unlike other species of manzanita, *A. morroensis* is an obligate seeder, lacking a woody burl from which it can resprout post-fire.

Methodology used to complete the review

This review was carried out by staff of the Ventura Fish and Wildlife Office. The information used to conduct this review includes the previous March, 2008, 5-year review and all sources therein, incorporating any new scientific papers, survey reports, personal communications, and letters to and from the Ventura Fish and Wildlife Office regarding this threatened plant species. This 5-year review contains updated information on the taxon's biology and threats, and a re-assessment of the information in the last 5-year review. We focus on current threats to the species that are attributable to the Act's five listing factors. The review synthesizes all this information to evaluate the listing status of the species and provides an indication of its progress towards recovery. Finally, based on this synthesis and the threats identified in the five-factor analysis, we

recommend a prioritized list of conservation actions to be completed or initiated within the next 5 years.

Contact Information:

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Federal Register (FR) Notice citation announcing initiation of this review:

A *Federal Register* notice was published on May 25, 2011 (76 FR 30377) initiating a 60-day request for information from the public. No information was received in response to this request.

Listing History:

Original Listing

FR Notice: 59 FR 64613

Date of Final Listing Rule: December 15, 1994

Entity Listed: Species (*Arctostaphylos morroensis*)

Classification: Threatened

Associated Rulemakings: None.

Review History: We conducted a brief review of the species' status during preparation of the draft and a final recovery plan for *Arctostaphylos morroensis* in 1997 and 1998 (Service 1997, 1998), respectively. This is the second 5-year review conducted for this species. The first 5-year review, prepared by Ventura Fish and Wildlife Office staff, was published in March, 2008 (Service 2008).

Species' Recovery Priority Number at Start of 5-Year Review: The first 5-year review assigned a new recovery priority number of 8 on a scale of 1 to 18. This number indicates a full species facing a moderate degree of threat and a high recovery potential.

Recovery Plan or Outline

Name of plan: *Recovery Plan for the Morro Shoulderband Snail and Four Plants from Western San Luis Obispo County, California.*

Date issued: September 26, 1998

Dates of previous revisions: We have not revised the recovery plan since its issuance in 1998.

II. REVIEW ANALYSIS

Application of the 1996 Distinct Population Segment (DPS) Policy

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

Information on the Species and its Status

Species Biology and Life History:

Arctostaphylos morroensis was first described in 1939 based on a specimen collected in Hazard Canyon, San Luis Obispo County (Wieslander and Schreiber 1939). There have been no changes in the taxonomic classification or nomenclature for this species. *Arctostaphylos morroensis* is a long-lived shrub in the heath family (Ericaceae), with mature individuals reaching 12 feet (4 meters) in height. *Arctostaphylos morroensis* produces white to pink downward-facing, urn-shaped flowers starting in December. Orange-red fruits mature in summer and contain 8 to 10 seeds each; seed dispersal occurs in the fall (McGraw 2005).

Although we do not know whether the flowers are self-compatible, extensive research revealed that pollination is required for reproduction. In 1998 and 1999, Tyler and Odion found that bumblebees (*Bombus vosnesenskii*) are the dominant pollinators, though anthophorid bees (*Anthophora urbana*), several bee flies (*Bombylius* spp.), and syrphid flies (family Syrphidae) are also known pollinators. The authors also noted surprisingly low pollinator activity for both years surveyed (Tyler et al. 1998 and 2000). Only 10 percent of flowers examined in 1998 produced fruits. Pollinator abundance and abiotic factors (i.e., climate) may play a role in annual and seasonal variation (Tyler et al. 1998).

Birds and large mammals (coyote (*Canis latrans*) and mule deer (*Odocoileus hemionus*)) are thought to aid *Arctostaphylos morroensis* in seed dispersal (Keeley and Hays 1976). This secondary dispersal (which occurs after the parent plant initially sets seed) is limited, however, as evidenced by 90 percent fewer seeds present in soil cores 5 feet (1.5 meters) away from *A. morroensis* compared to samples taken from beneath the canopy (Tyler and Odion 1996).

There is a clear difference in a basic life history trait that separates the genus *Arctostaphylos* into two functional groups. One group resprouts from a woody burl following canopy removal by fire or mechanical action. The other group has lost this ability to resprout and, as such, reproduce only by seed. Lacking a woody burl from which it can resprout, *A. morroensis* is an obligate-seeding species. Seeds of obligate seeders are long-lived and inhibited from germinating until primary dormancy is released by a specific mechanism. The dormancy mechanism allows the species to build up a seed bank that is persistent (Tyler and Odion 1996).

Fire Ecology

For *Arctostaphylos morroensis* and other obligate-seeding species of manzanita, maintenance and regeneration are dependent upon mass germination triggered by fire (Tyler and Odion 1996). Fire breaks seed dormancy and also creates open areas where seedlings can germinate and individuals establish. The life history of an obligate seeder can only be successful if the interval between fires is long enough for seeds to accumulate the quantity required to replace the parent generation. The number of seeds in the soil that must accumulate is very high, as seed mortality has been found to be substantial in chaparral burns (Tyler et al. 2000). However, suppressing fire for too long could lead to the development of climax, closed-canopy chaparral stands, eventually having an adverse effect on populations of *A. morroensis* by precluding expansion into otherwise suitable habitat and maintenance of even-aged, eventually-senescent stands; this is referred to as “senescence risk” (Ne’eman et al. 1999).

The time between fires is critical to the persistence of the species. If stands are burned too frequently, they may not accumulate an adequate seed bank to regenerate after the next fire; if they do not burn frequently enough, viability of the seed bank will decline over time. Due to very low seed viability in *Arctostaphylos morroensis*, in combination with high seed mortality in response to fire, Tyler and Odion (1996) suggest that stands burned at cycles greater than 40 years would have sufficient time to accumulate an adequate seed bank. In addition, they found that the depth of *A. morroensis* seeds in the soil plays a significant role in determining mortality after a burn. The seeds must be deep enough in the soil so that they do not die as a direct result of the fire, but shallow enough to trigger germination (Odion and Tyler 2002). In absence of additional information about the optimal fire interval, they suggest that land managers use caution in burning stands of chaparral containing *A. morroensis* until it can be demonstrated that the action would be beneficial to the population.

In those areas where it is not feasible to use prescribed fire or to allow for naturally-occurring fire, mechanical clearing has been suggested as a surrogate. Although mechanical clearing may serve to open up the canopy or provide seed scarification, fire may serve other purposes (e.g., nutrient cycling) that would not be duplicated (Tyler and Odion 1996). Additional research is necessary to determine whether mechanical clearing could be used as a tool to manage more fragmented *A. morroensis* habitat. This would be especially useful for populations in urban landscapes, where the risk associated with controlled burns is considered unacceptable.

Habitat

Arctostaphylos morroensis is found in association with coastal dune scrub, maritime chaparral, and coast live oak woodland communities (Service 1998). In openings between the shrubs, these communities support a diversity of native and nonnative herbaceous species. The nonnative veldt grass (*Ehrharta calycina*) has spread to the Los Osos and Morro Bay region. This species has not only invaded disturbed areas, such as vacant lots, road cuts, and utility corridors, but is becoming naturalized in native plant communities, including conserved lands owned and/or managed by the California Department of Fish and Wildlife (CDFW) and California Department of Parks and Recreation (CDPR) and that support *A. morroensis* (Calflora 2012).

Arctostaphylos morroensis is primarily found on Baywood fine sand soils (ancient wind-blown beach sands), though small stands have also been documented on Santa Lucia shaley clay loam

(Soil Conservation Service 1958, McGraw 2005). Baywood fine sands developed on ancient sand dunes deposited during the Pleistocene epoch. The species is found on a variety of slopes and aspects, though cover is most significant within two slope categories: 9 to 15 percent slopes, and 15 to 30 percent slopes (McGraw 2005, Tyler and Odion 1996). On steep slopes, particularly on the north-facing slopes of the Irish Hills, it can be found in almost pure stands. This narrow habitat preference makes this species particularly vulnerable to habitat loss and fragmentation. Approximately 75 percent of its historical habitat has been converted for residential use, resulting in highly fragmented populations. The limited dispersal abilities of this species further exacerbates the threat of habitat fragmentation.

Distribution

In this document, we use the term “population” as well as “stand”. In general, a population is a group of interbreeding individuals, and is a larger unit that comprises several distinct stands (individuals with similar characteristics, age, and condition, and considered to be a homogeneous unit). In the case of *Arctostaphylos morroensis*, we do not know precisely how many populations occur across the range of the species; however, for convenience, surveyors and researchers have typically referred to separate populations based on geographic separations within the range of the species.

Arctostaphylos morroensis ranges from the northeast side of Morro Bay to the southern end of Montaña de Oro State Park, a distance of less than 10 miles (16.1 kilometers) (See Figure 1). The distribution of *A. morroensis* is correlated with the distribution of Baywood fine sands. Based on the distribution of these sands, the historical distribution of *A. morroensis* is estimated to have comprised between 2,000 and 2,700 acres (809 and 1,092 hectares (ha)).

Much of the historical area of Baywood fine sands found on gentle to moderate slopes has been converted to urban development, primarily in the communities of Los Osos, Baywood Park, and Cuesta-by-the-Sea. Limited development has also occurred on the steeper north-facing slopes of the Irish Hills.

At the time of listing, LSA (1992) estimated there were 840 to 890 acres (340-360 ha) of *Arctostaphylos morroensis* habitat (LSA 1992); they based this on aerial photos and surveys. Tyler and Odion (1996) recalculated acreage to account for the fact that, in the previous estimates, stands with a sparse cover of *A. morroensis* were equally weighted with stands with high cover. Using their method, they estimate that the area actually covered by *A. morroensis* may be less than 400 acres (162 ha) (Tyler and Odion 1996). We have no information regarding any more recent estimates.

Abundance

Because stands of *Arctostaphylos morroensis*, and maritime chaparral in general, grow so densely, it is difficult to count numbers of individuals during surveys. As variation in stand density and the growth habits of the species make demographic studies difficult, actual abundance may have been significantly lower than those reported by LSA (1992) (McGuire and Morey 1992). Therefore, estimates of abundance have typically been based on the density of cover instead. During their surveys in 1991, LSA Inc. (1992) used five cover classes and

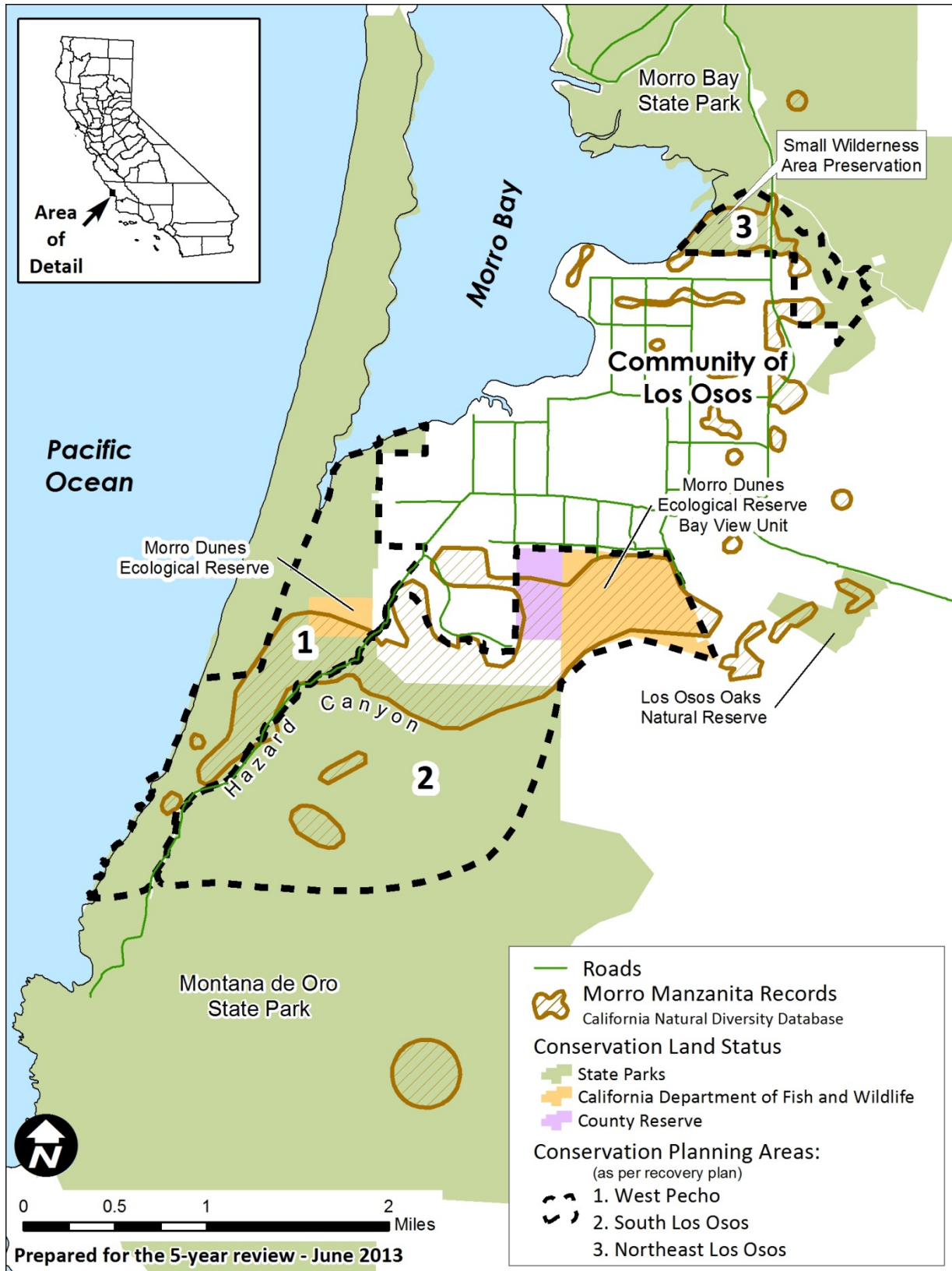


Figure 1: Distribution of *Arctostaphylos morroensis* in the Morro Bay Area.

assigned stands or patches of *A. morroensis* accordingly. The five cover classes were: 75 to 100 percent, 50 to 75 percent, 25 to 50 percent, 5 to 25 percent, and 1 to 5 percent.

Based on this approach, LSA estimated approximately 153,000 *Arctostaphylos morroensis* plants occurred across the species' range at the time of listing. LSA made these estimates based on a helicopter flyover and walkover surveys of *A. morroensis* populations within Montaña de Oro State Park and above Cabrillo Estates. LSA assumed that an individual plant covered approximately 100 square feet (9.3 square meters) or 11.3 feet (3.4 meters) in diameter. However, McGuire and Morey produced a lower estimate than LSA (using a 15-foot diameter per individual), estimating that the total species population would be closer to 86,500 individuals (McGuire and Morey 1992).

By far, the largest concentration of *Arctostaphylos morroensis* plants is between Hazard Canyon and Los Osos, accounting for 80 percent of all *A. morroensis* plants, with 75 to 100 percent estimated coverage. South of this population, three other stands have been reported within Montaña de Oro State Park; estimates of abundance for two of these have ranged from large (LSA 1992) to very few (McGuire and Morey 1992); we could find no information concerning the third stand. Individuals of *A. morroensis* have been destroyed or removed since the time of listing (see discussion in Factor A below); however, in comparison with the total number of extant individuals, these losses represent an insubstantial amount.

An accurate estimate of *Arctostaphylos morroensis* abundance throughout its range was unavailable at the time of this review. Note that while dense patches of individuals may be important for the long term persistence of the species, patches with low densities of individuals may be equally as important, especially if they contain other components of the ecosystem that contribute to long term persistence, such as open spaces between other maritime chaparral shrubs for recruitment of new individuals.

Habitat Conservation Achieved

At the time of listing, approximately 65 percent of habitat for *Arctostaphylos morroensis* was in private ownership, much of which had cover values of 75 to 100 percent (Crawford, Multari, and Clark Associates 2004). Since this time, approximately 400 acres have been secured from development, 47 percent of which are considered suitable habitat for *A. morroensis* (J. Vanderwier, U.S. Fish and Wildlife Service, pers. comm. 2011). Figure 1 depicts an amended version of the conservation planning areas, identified by the Service and explained in detail in the 1998 recovery plan. These areas were delineated to focus conservation activities on lands that support numerous listed and sensitive species and where recovery potential is high. They are not necessarily legally protected, government owned or controlled, or designated as critical habitat.

West Pecho Conservation Planning Area (labeled 1 on Figure 1): Within this area, the majority of the land has been conserved since the time of listing and includes a portion of Montaña de Oro State Park, other lands under the jurisdiction of the CDPR (i.e., Hotel and Butte Drive parcels), and a 40-acre (16.2 ha) parcel owned by the CDFW (Morro Dunes Ecological Reserve). Depending upon the source, chaparral in this conservation planning unit contains low density *A.*

morroensis stands at cover values between 1 and 5 percent (LSA 1992), or 5 and 25 percent (Mullany 1990).

Northeast Los Osos Conservation Planning Area (labeled 3 on Figure 1): Lands within this area are predominantly conserved and include the Elfin Forest Reserve (owned by CDPR and the County, and managed by Small Wilderness Area Preservation (SWAP)) and lands under the jurisdiction of the CDPR in Morro Bay State Park (i.e., Attman, Garris, Powell, and Pismo parcels). *Arctostaphylos morroensis* cover typically ranges from 1 to 25 percent, although a portion of land owned by the CDFW contains chaparral with cover values for *A. morroensis* estimates at greater than 50 percent (Mullany 1990, LSA 1992). Remaining private lands consist of only a few parcels that range in size from 3 to 6 acres (1.2 to 2.4 ha) and contain lower cover values (less than 5 percent) of *A. morroensis* (Mullany 1990).

South Los Osos Conservation Planning Area (labeled 2 on Figure 1): This area comprises a mixture of conserved and privately owned lands. The majority of the land is conserved and includes a portion of Montaña de Oro State Park found east of Pecho Valley Road, lands under the jurisdiction of the CDFW (Morro Dunes Ecological Reserve), and two 40-acre (16.2-ha) parcels (known as the Broderson parcels) owned by the County of San Luis Obispo and conserved pursuant to the California Environmental Quality Act (CEQA) and the coastal development permit processes during the development of the Los Osos Wastewater Project. The County of San Luis Obispo is also working with the Service to develop a habitat conservation plan (HCP) for these parcels; the HCP will include *Arctostaphylos morroensis* as a covered species. The highest cover values of *Arctostaphylos morroensis* are found in Montaña de Oro State Park (50 to 100 percent cover), with the Bayview unit of the Morro Dunes Ecological Reserve and the Broderson parcels providing habitat for *A. morroensis* at cover values of 50 to 75 percent. Remaining lands under private ownership include several larger parcels (greater than 20 acres (8 ha)) with cover values of *A. morroensis* that range from 75 to 100 percent (Mullany 1990). Just to the east of the South Los Osos Conservation Planning Area, portions of several other small stands of *A. morroensis* occur on the Los Osos Oaks State Natural Reserve, managed by the CDPR.

In summary, the conservation of additional parcels of land in the Los Osos area since listing increases the likelihood that we can meet certain recovery planning goals. The largest block of contiguous habitat supporting *Arctostaphylos morroensis* contains cover classes that range between 50 and 100 percent and includes a portion of Montaña de Oro State Park, the Morro Palisades Reserve, the Broderson parcels, and private lands south of Rodman Drive. Acquiring these parcels was the first important step toward achieving protection for this habitat. However, these conserved parcels will require specific management and maintenance to sustain and enhance extant *A. morroensis* stands.

Genetics

In their investigation of seed viability, Tyler and Odion (1996) found that 45 percent of the seeds examined lacked embryos. This likely contributed to the low 5 percent seed viability observed across four study sites. The authors hypothesized that the low viability may be due to inbreeding as a consequence of small effective population sizes.

Five-Factor Analysis

The following five-factor analysis describes and evaluates the threats attributable to one or more of the listing factors outlined in section 4(a)(1) of the Act.

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

At the time of listing, we noted that loss of habitat from development constituted a primary threat to *Arctostaphylos morroensis*. Although much of the occupied habitat is owned and managed by the CDPR (i.e., Montaña de Oro State Park) and CDFW, we recognized that more lands needed to be secured. Since the time of listing, additional private lands have been purchased by, or turned over to, the CDFW and CDPR to be managed for their resource values, some of which include habitat for *A. morroensis*.

Areas of habitat with high cover of *Arctostaphylos morroensis* are still at risk on private lands that could be developed in the future. For example, in 2010, a privately owned parcel containing this species in Cabrillo Estates was developed for a private residence. This parcel supported a small and isolated population, completely surrounded by a residential neighborhood. However, other small patches of individuals can still be important for maintaining connectivity between the denser stands, especially if they are still associated with otherwise undisturbed native habitat.

The *Arctostaphylos morroensis* population within the Elfin Forest was thought to be the oldest living stand, based on aerial photos obtained in 1949 and dendrochronology, a scientific method of dating based on tree rings (McGraw 2005, Tyler and Odion 1996). The majority of this population was destroyed on May 25, 2009, in an act of vandalism (P. Sarafian, SWAP, *in litt.* 2009). In an effort to mitigate this and the loss at the Cabrillo Estates lot, 100 plants were outplanted in January 2011 in the Elfin Forest and continue to be maintained by Dr. Sarafian and SWAP.

As discussed in the Habitat section above, the spread of nonnative species, particularly veldt grass, has altered the composition of the plant communities associated with *Arctostaphylos morroensis* habitat. This in turn is likely altering the fire cycle, potentially increasing the frequency of fires, and decreasing the viability of existing seed banks.

In summary, the acquisition of lands reduces the threat of destruction of habitat from development. However, the continued spread of nonnative species throughout *Arctostaphylos morroensis*' range and the fire cycle needs particular to the species (discussed below in Factor E) necessitate land management that is not currently in place; alteration of habitat from nonnative species is increasing. Therefore, at the time of this 5-year review, we conclude that the threat to the species from habitat destruction and alteration is, on balance, the same as it was at the time of listing.

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

Under Factor B in the final listing rule, we did not consider overutilization to be a threat to this species. Although specimens identified as *Arctostaphylos morroensis* are available in limited numbers for sale as nursery stock, we do not believe that overutilization is a threat to *A. morroensis* because it is not being collected from the wild.

FACTOR C: Disease or Predation:

Under Factor C in the final listing rule, we stated that neither disease nor predation was known to be a threat to *Arctostaphylos morroensis*. However, in 2011, Dr. Sarafian reported that small branches of recently planted *A. morroensis* individuals in the Elfin Forest were likely snapped off by herbivores, likely deer or small mammals such as rabbits (Sarafian 2011). As a preventative measure, workers installed cages; after caging, only 1 out of the 100 planted individuals died. Unidentified small worms or insect larvae were observed in roots during the same revegetation effort (Sarafian 2011). The plants used for this revegetation project were nursery grown; we do not know the extent to which naturally occurring *A. morroensis* is affected by insects. However, since no other observations of diseased or dying plants have been reported, we conclude that disease or predation do not constitute a threat to the species at this time.

FACTOR D: Inadequacy of Existing Regulatory Mechanisms:

Under Factor D in the final listing rule, we discussed that the existing regulatory mechanisms were doing little to reduce or remove impacts to *Arctostaphylos morroensis* from habitat alteration and destruction (Factor A).

State Regulations

While *Arctostaphylos morroensis* remains unlisted by the State of California, both the CDFW and the California Coastal Commission consider this species to be sensitive and any loss of individuals to be significant pursuant to CEQA. The Coastal Commission considers the presence of *A. morroensis* (as a federally listed species) in its determination of environmentally sensitive habitat areas. Environmentally sensitive habitat areas are subject to section 30240 of the Coastal Act, which requires their protection against any significant disruption of habitat values.

County Regulations

The County of San Luis Obispo considers impacts to *Arctostaphylos morroensis* to reach the level of significance pursuant to CEQA when losses approach 5 to 10 percent of a population. The County coordinates with the CDFW regarding the significance of the impact and necessary mitigation (J. Eliason, County of San Luis Obispo, *in litt.* 2006). Mitigation for *A. morroensis* most often consists of replacing affected individuals at a ratio of 4:1 or 5:1 by outplanting new individuals; however, the location of the replacement plantings can be wholly in a landscape setting. This strategy does not support the preservation of *A. morroensis* in a natural habitat landscape and, therefore, does little to contribute to the species' recovery.

Federal Regulations

The Service's responsibilities include administering the Act, including sections 7, 9, and 10. Section 7(a)(2) of the Act requires all federal agencies to consult with the service to ensure that any actions they fund, authorize, or implement are not likely to jeopardize the continued existence of the species or destroy or adversely modify any designated critical habitat. To date, we have not conducted any consultations on *Arctostaphylos morroensis*.

Section 9 of the Act describes prohibited activities with regard to listed species. Under section 9, it is unlawful to: (1) the remove and reduce to possession (i.e., collection) of endangered plants from lands under Federal jurisdiction; (2) maliciously damage or destroy any such species on any such area; or (3) remove, cut, dig up, damage, or destroy endangered plants on any other area in knowing violation of a state law or regulation. We are not aware of any section 9 violations with regard to this species.

Under section 10(a)(1)(B) of the Act, the Service can issue incidental take permits for nonfederal actions that would result in the death of individuals of listed animal species. Although we do not issue such permits for plants, the Service must consider the effects of their issuance on any listed plant species during the section 7 process. The Service has participated in efforts to develop an HCP with the County of San Luis Obispo for the community of Los Osos (see discussion under Habitat Conservation Achieved).

In summary, given the existing regulations, we have seen some benefit from State, County, and Federal regulations to *Arctostaphylos morroensis*. The acquisition of additional lands by CDFW was due in part to State and County regulations. One HCP is under development, and may result in mitigation of the effects that their actions have on *A. morroensis*. Therefore, existing regulatory mechanisms have been somewhat effective in protecting this species against habitat destruction. However, there are no laws or regulations that specifically address other threats to *A. morroensis* habitat, particularly habitat alteration caused by the spread of invasive, nonnative species, and that will need habitat management and restoration to ameliorate the threat.

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

In our discussion of Factor E in the final listing rule, we considered that the introduction and invasion by nonnative plants into native plant communities in the Morro Bay region, including maritime chaparral, adversely affected *Arctostaphylos morroensis*. We discussed the infrequency of recruitment events of *A. morroensis* in the final rule and in the previous 5-year review, but did not address it as a threat. In this 5-year review, we discuss population dynamics as a potential threat. We also discuss climate change, which is a new threat identified since the time of listing and the last 5-year review.

Population Dynamics

Regeneration of *Arctostaphylos morroensis* requires mass germination triggered by fire. For a population to have adequate turnover, Odion and Tyler (2002) proposed that fire cycles longer than 40 years would be optimal. With a shorter fire interval, the species may face "immaturity risk" – that is, widespread mortality of plants prior to their maturity may reduce the reproductive

potential of the population (Zedler 1995, de Gouvenain and Ansary 2006). Conversely, a “senescence risk” may occur if the fire interval is longer than the lifespan of plants within the population, resulting in lower population vitality and reduced seedling establishment (Ne’eman et al. 1999). Longer burn cycles may also allow for growth of other woody vegetation, creating closed canopy chaparral stands. This could prevent *A. morroensis* from expanding into suitable habitat.

Land managers have not planned any prescribed burns for *Arctostaphylos morroensis* habitat. The U.S. Army Corps of Engineers burned and cleared shrubs in Montaña de Oro State Park in 1958; however, we have no knowledge or evidence of prior burns (Odion and Tyler 2003). Montaña de Oro State Park performs controlled burns as needed and when possible, but burning *A. morroensis* habitat is inhibited by the nature of the landscape. The fuel requirements, steepness of the slopes, limited accessibility, and proximity to residential areas make a prescribed burn for *A. morroensis* difficult to perform (V. Cicero, California State Parks, *in litt.* 2012)). The most recent wildfire within the State Park occurred in 1997, but did not burn *A. morroensis* stands. Wildfires for this maritime chaparral habitat are estimated to occur about every 50 to 200 years (Cicero *in litt.* 2012). For these reasons, the limited ability to manage fire cycles hinders efforts to reduce the threat of altered fire cycles to *A. morroensis*.

Competition with Nonnative Species

The nonnative veldt grass (*Ehrharta calycina*) has spread to the Los Osos and Morro Bay region. This species has not only invaded disturbed areas, such as vacant lots, road cuts, and utility corridors, but is becoming naturalized in native plant communities, including conserved lands owned and/or managed by the CDFW and CDPR for *Arctostaphylos morroensis* (J. Vanderwier, U.S. Fish and Wildlife Service, pers. obs., 2006). Members and volunteers associated with Small Wilderness Area Preservation use manual removal to fight veldt grass in the Elfin Forest and continue to make progress (Sarafian 2011). Although veldt grass more likely competes for resources with herbaceous species than with established perennials, its presence may also increase the frequency and risk of fire that would negatively affect *A. morroensis* by reducing the abundance and viability of its seed bank. Veldt grass is not currently invading established *A. morroensis* stands in Montaña de Oro State Park, although it may prevent recruitment in areas where it has already invaded the habitat (Cicero *in litt.* 2012). We do not clearly understand the long-term effects of veldt grass on the dynamics of native communities.

In the final listing rule, we also recognized that stands of *Arctostaphylos morroensis* in Montaña de Oro State Park were being overtopped by spreading eucalyptus (*Eucalyptus* spp.) planted in the early 1900s. We noted that *A. morroensis* is not able to survive such encroachment due to reduction in available soil moisture, increased shading, and the effects of growth-inhibiting terpenes that are released from eucalyptus (California Invasive Plant Council 2006-2011). Although the general plan for Montaña de Oro State Park calls for the removal of exotic species, including eucalyptus, this program has only been partially implemented. In past years, eucalyptus removal efforts generally focused on removing seedlings from outside the bounds of the original groves and not specifically from habitat that supports *A. morroensis* (Service 1998). Recently, efforts to control eucalyptus have been undertaken and have been successful in preventing further recruitment. However, fluctuations in the park’s budget in coming years may

hinder these efforts; therefore, we still consider competition with eucalyptus to be a threat (Cicero *in litt.* 2012).

Other invasives not mentioned at the time of listing, including narrow-leafed iceplant (*Conicosia pugioniformis*), are encroaching upon Elfin Forest populations of *Arctostaphylos morroensis*. (We did, however, note an iceplant relative, *Mesembryanthemum chilense*, as a potential threat in the listing.) Throughout *A. morroensis*' habitat, iceplant aggressively invades in canopy gaps. It outcompetes *A. morroensis* seedlings, and thus prevents the regeneration or establishment of new stands (McGraw 2005). Colonies of narrow-leafed iceplant were observed in the Elfin Forest groves in the vicinity of the 100 individuals outplanted as mitigation. Permit holders noted that it is not uncommon to observe iceplant under dead manzanitas. In the habitat maintained by SWAP, iceplant is managed mechanically and manually removed whenever it is encountered on site (Morro Group Inc. 2005).

Bridal creeper (*Asparagus asparagoides*) is also posing a threat in the Elfin Forest. Due to the vine's deep root system, SWAP uses herbicide (Aquamaster) rather than manual removal. However, as the herbicide can only reach the tubers at ground surface, this method at most helps control, but does not eradicate, the invasive vine (Sarafian 2011).

Climate Change

Current climate change predictions for terrestrial areas in the northern hemisphere indicate warmer air temperatures, more intense precipitation events, and increased summer continental drying (Field et al. 1999, Cayan et al. 2005, Intergovernmental Panel on Climate Change 2007). *Arctostaphylos morroensis*' small and isolated range increases its vulnerability to random fluctuations in annual weather patterns and environmental disturbances such as those that may result from climate change. Recently, Loarie et al. (2008) discussed the potential impacts of climate change on the flora of California. Based on climate modeling, they predicted that species' distributions will shift in response to climate change and that species will "move" to higher elevations and northward, depending on the ability of each species to do so. Broadly, indirect ecological impacts caused by fog and variation in humidity could alter pollinator activity, soil moisture, and phenology of the species. In general, the scientific community lacks adequate information to make specific and accurate predictions regarding how climate change, in combination with other factors such as limited geographical distribution, will affect federally listed species. Small-ranged species, however, are more vulnerable to extinction due to these changing conditions (Loarie et al. 2008); we consider *A. morroensis* to be such a species.

In summary, we conclude that the threat incurred by natural factors, particularly invasive species and the effect of altered fire cycles on population dynamics, is the same as it was at the time of listing. We also recognize climate change as a new potential threat to the species.

III. RECOVERY CRITERIA

Recovery plans provide guidance to the Service, States, and other partners and interested parties on ways to minimize threats to listed species, and on criteria that may be used to determine when recovery goals are achieved. There are many paths to accomplishing the recovery of a species

and recovery may be achieved without fully meeting all recovery plan criteria. For example, one or more criteria may have been exceeded while other criteria may not have been accomplished. In that instance, we may determine that, over all, the threats have been minimized sufficiently, and the species is robust enough, to downlist or delist the species. In other cases, new recovery approaches and/or opportunities unknown at the time the recovery plan was finalized may be more appropriate ways to achieve recovery. Likewise, new information may change the extent that criteria need to be met for recognizing recovery of the species. Overall, recovery is a dynamic process requiring adaptive management, and assessing a species' degree of recovery is likewise an adaptive process that may, or may not, fully follow the guidance provided in a recovery plan. We focus our evaluation of species status in this 5-year review on progress that has been made toward recovery since the species was listed (or since the most recent 5-year review) by eliminating or reducing the threats discussed in the five-factor analysis. In that context, progress towards fulfilling recovery criteria serves to indicate the extent to which threat factors have been reduced or eliminated.

Criteria for delisting are included in the Service's recovery plan for the species (Service 1998). Factors A, D, and E are addressed in the recovery criteria. Factors B and C were not considered to be relevant to the listing.

The recovery objective for *Arctostaphylos morroensis* is to delist the species. Text from the recovery plan states that the species can be considered for delisting when the three following criteria have been achieved:

Delisting Criterion 1: Ninety percent of existing acreage supporting high (75 to 100 percent) and medium (25 to 74 percent) cover of *Arctostaphylos morroensis* and 85 to 90 percent of low (1 to 24 percent) cover supporting *A. morroensis* is secured from human-induced threats in preserves in the Northeast Los Osos, South Los Osos, and West Pecho Conservation Planning Areas with no greater fragmentation by roads, residences, or other areas of human use than existed in 1998 (addresses Factors A and D).

As discussed in the Habitat Conservation section, since the time of listing, lands have been acquired by the CDPR Moñtana de Oro State Park, and the CDFW, and continue to support *Arctostaphylos morroensis*. Therefore, we consider this criterion appropriate to the recovery of the species and very close to being achieved.

Delisting Criterion 2: There is evidence that the acreage and approximate cover classes of *Arctostaphylos morroensis* in preserves can be maintained over time, and that preserves are not made unmanageable by small size, proximity to urban development, or fragmentation (addresses Factors A and E).

We consider this criterion appropriate with respect to the species; however, monitoring programs to collect evidence that populations are being maintained need to be developed and implemented. (See Recommendations for Recovery Actions below.)

Delisting Criterion 3: Site-specific management plans have been successfully implemented for the preserves (addresses Factor E).

We consider this criterion appropriate with respect to the recovery of the species; however, it has not been met. With the exception of the Elfin Forest Reserve, none of the conserved areas have site-specific or species-specific management plans in place.

IV. SYNTHESIS

The current status of *Arctostaphylos morroensis* is not markedly different than what was summarized in the final listing rule published in 1994, the final recovery plan completed in 1998, or the most recent 5-year review, released in 2008. The primary change from the time of listing is that the risk of habitat loss from development has been reduced by the transfer of lands that provide habitat for the species out of private ownership; however, the majority of these conserved lands do not incorporate specific management guidelines for *A. morroensis*. The removal of the threat of development on additional parcels through their transfer of ownership to the CDFW or CDPR represents an important step towards the recovery of this species; however, *A. morroensis* populations on these lands are still vulnerable to other threats.

The threats to *Arctostaphylos morroensis*, as identified in the listing rule, included loss of habitat from development, competition from nonnative invasive plant species, and inadequate regulatory mechanisms. Compared to the time of listing, fewer areas of habitat are now at risk, due to more lands being conserved for this species, and most extant occurrences appearing to be stable. Habitat in Los Osos continues to be degraded by the incursion of invasive nonnative plant species (e.g., eucalyptus and veldt grass). Although the CDPR is working to control eucalyptus, there is no monitoring for *A. morroensis* occurring in Moñtana de Oro State Park (Cicero *in litt.* 2012).

After securing habitat for *Arctostaphylos morroensis*, one of the primary issues regarding the recovery of this species is its need for some form of disturbance to regenerate and revitalize populations. It is commonly held that the germination cue for most manzanitas is fire, potentially establishing a need for prescribed fires. Although extensive research has increased our understanding of *A. morroensis* ecology, implementation of this knowledge into recovery actions has proven to be difficult. The time between fires is critical to the persistence of the species, and Tyler et al. (2000) recommend that stands not be burned at cycles less than 40 years in order to accumulate an adequate seed bank. Extant stands of *A. morroensis* are even-aged dating back to the time of the most recent fire. However, suppressing fire for too long could lead to senescence risk and development of closed canopy chaparral stands, further degrading potentially suitable habitat and precluding the expansion of this species.

Although substantial progress has been made in protecting chaparral containing *Arctostaphylos morroensis* from development, some areas are still threatened by development, some preserved areas are threatened by nonnative invasive species, and existing regulatory mechanisms appear inadequate to ameliorate these threats. Additionally, threats associated with climate change may further impact *A. morroensis*. Therefore, we conclude that the species still meets the definition of threatened (i.e., is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range), and no status change is needed.

IV. RESULTS

A. Recommended Listing Action:

- Downlist to Threatened
- Uplist to Endangered
- Delist
- No change is needed

New Recovery Priority Number and Brief Rationale: N/A

V. RECOMMENDATIONS FOR ACTIONS OVER THE NEXT 5 YEARS

1. Additional lands with high densities of *Arctostaphylos morroensis* should be secured from the threat of development in Northeast Los Osos, West Pecho, and South Los Osos conservation planning areas.
2. All secured lands should be managed to ensure ecosystem function. Active management is needed to maintain and enhance populations of *Arctostaphylos morroensis*; therefore, the development and implementation of management plans that identify specific actions for the species are critical to its recovery. At a minimum, these plans need to address: 1) regeneration requirements for the species; and 2) an assessment of the extent of the threat of competition from nonnative invasive plant species. The Service should work with CDPR, CDFW, and other relevant partners to encourage the development and implementation of these management plans.
3. Ensure that management actions are implemented and ongoing by securing and using funding sources. Engage partners (State Parks and/or the County of San Luis Obispo) in an effort to work with them toward the common goal of securing the long-term persistence of *Arctostaphylos morroensis*.

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of *Arctostaphylos morroensis* (Morro manzanita)

Current Classification: Threatened

Recommendation resulting from the 5-Year Review:

- Downlist to Threatened
- Uplist to Endangered
- Delist
- No change needed

Appropriate Listing/Reclassification Priority Number, if applicable: N/A

Review Conducted By: Jenna Castle

FIELD OFFICE APPROVAL:

Field Supervisor, Fish and Wildlife Service

Approve Diana K. Noble Date 6/24/13