Arctostaphylos pallida
(pallid manzanita)

5-Year Review:
Summary and Evaluation

Photograph by Martha Lowe.

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

November 2010

5-YEAR REVIEW

Arctostaphylos pallida (pallid manzanita)

I. GENERAL INFORMATION

Purpose of 5-Year Reviews

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. The purpose of a 5-year review is to evaluate whether or not the species' status has changed since it was listed (or since the most recent 5-year review). Based on the 5-year review, we recommend whether the species should be removed from the list of endangered and threatened species, be changed in status from endangered to threatened, or be changed in status from threatened to endangered. Our original listing of a species as endangered or threatened is based on the existence of threats attributable to 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 consideration of reclassification or delisting of a species. In the 5-year review, we consider the best available scientific and commercial data on the species, and focus on new information available since the species was listed or last reviewed. 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 pallida is a diploid, obligate seeding, shade-intolerant, shrub-form plant found on soils that are thin, well drained at the surface, and deficient in many essential plant nutrients. It occurs in the maritime chaparral vegetation type, in the Oakland/Berkeley Hills in western Contra Costa and Alameda Counties, in areas that experience a high frequency of summer fog. Obligate seeding *Arctostaphylos* spp. tend to have fire-dependent seedling recruitment; and mature stands tend to be even-aged, exhibiting no regeneration during fire-free intervals, except perhaps where light incidence at the soil surface is high. In the absence of fire, the environmental conditions that trigger seed germination in *A. pallida* are not known. Mechanical disturbance may be an alternative to fire under certain conditions.

There are approximately 1,350 mature *Arctostaphylos pallida* plants distributed between two naturally occurring populations and a single naturalized population. The Huckleberry Ridge population is the largest known population of *A. pallida* and exists as a large colony with several satellite colonies. The largest colony at Huckleberry Ridge (747 mature plants, 176 seedlings) is a string of stands, occurring partly within East Bay Regional Park District's (EBRPD) Huckleberry Botanic Regional Preserve (Huckleberry Preserve) and partly on private property within the urban development along Skyline Boulevard in the City of Oakland. The second largest population (454 plants) occurs at Sobrante Ridge, within EBRPD's Sobrante Ridge Ecological Preserve.

Methodology Used to Complete This Review

This review was prepared by the Sacramento Fish and Wildlife Office (SFWO), following the Region 8 guidance issued in March 2008. We used information from the Draft Recovery Plan for Chaparral and Scrub Community Species East of San Francisco Bay (Service 2002), survey information from experts who have been monitoring various localities of this species, and the California Natural Diversity Database (CNDDB) maintained by the California Department of Fish and Game (CDFG). Personal communications with experts and published literature were our primary sources of information used to update the species' status and threats. We received one letter from the public in response to our Federal Notice initiating this 5-year review. This 5-year review contains updated information on the species' biology and threats, and an assessment of that information compared to that known at the time of listing. 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

Lead Regional Office: Larry Rabin, Deputy Division Chief for Listing, Recovery, and Habitat Conservation Planning, Region 8, California and Nevada; (916) 414-6464.

Lead Field Office: Josh Hull, Recovery Branch, Sacramento Fish and Wildlife Office; (916) 414-6600.

Federal Register (FR) Notice Citation Announcing Initiation of This Review

A notice announcing the initiation of the 5-year review of this taxon and the opening of a 60-day period to receive information from the public was published in the Federal Register on March 25, 2009 (Federal Register 74:12878-12883).

Listing History

Original Listing

FR Notice: Federal Register 63:19842-19850
Date of Final Listing Rule: April 22, 1998
Entity Listed: *Arctostaphylos pallida*, a plant species
Classification: Threatened

State Listing

Arctostaphylos pallida was listed as endangered by the State of California in November 1979.

Review History

Since the original listing in 1998, no 5-year reviews have been conducted for this species.

Recovery Priority Number at Start of 5-Year Review

The recovery priority number for *Arctostaphylos pallida* is 11C according to the Service's 2010 Recovery Data Call for the Sacramento Fish and Wildlife Office, based on a 1-18 ranking system where 1 is the highest-ranked recovery priority and 18 is the lowest (Endangered and Threatened Species Listing and Recovery Priority Guidelines, 48 FR 43098, September 21, 1983). This number indicates this taxon is a species, faces a medium degree of threat, has a low potential for recovery, and there is, or may be, some degree of conflict between the species' recovery efforts and economic development.

Recovery Plan or Outline

Name of Plan or Outline: Draft Recovery Plan for Chaparral and Scrub Community Species East of San Francisco Bay, California

Date Issued: December 2002

II. REVIEW ANALYSIS

Application of the 1996 Distinct Population Segment (DPS) Policy

The Endangered Species 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 listing 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

Historic Distribution

Arctostaphylos pallida was originally described from a specimen collected in 1902 in the "East Oakland Hills", "hills back of Piedmont" (Eastwood 1934), "on Moraga Ridge" (Adams 1940). Based on extensive searches and a review of literature and old maps, the Moraga Ridge site is believed to refer to Huckleberry Ridge (B. Johnson *in litt*. 1983; Amme et al. 1987). A second population was believed to have been first reported in the 1940's or 1950's from Sobrante Ridge in Contra Costa County (Amme et al. 1987). Based on a personal communication with the founding director of the EBRPD's Botanic Garden, the late James Roof, Amme et al. (1987) noted that Mr. Roof planted several dozen *A. pallida* (in the period between 1939-1940 (B. Johnson *in litt*. 1983)) along Shasta Road and Golf Course Drive in Tilden Park.

Current Distribution

There are two extant naturally occurring populations of *Arctostaphylos pallida* (Table 1): Huckleberry Ridge in Alameda County and Sobrante Ridge in Contra Costa County. A single naturalized population occurs near the Tilden Park Botanical Garden in Contra Costa County. The Huckleberry Ridge population is the largest known population of *A. pallida* and exists as a large colony with several satellite colonies. The large colony is a string of stands, occurring partly within EBRPD's Huckleberry Preserve and partly on private property within the urban development along Skyline Boulevard; primarily on northeast facing slopes, extending southwest over the top of the ridge down to Skyline Boulevard (Kanz *in litt.* 2004). An inventory and assessment in the mid-1980's indicated the large colony at Huckleberry Preserve numbered an estimated 2,400 to 2,700 plants (Amme et al. 1987). A census of all colonies of *A. pallida* occurring on EBRPD lands was conducted in 2004 by EBRPD biologists, during which each individual plant's location and canopy radius was mapped. Based on these results, there were 747 plants with a canopy cover that occupied 2.01 acres at Huckleberry Preserve. The extent to which the number of plants within the Huckleberry Preserve colony has decreased since the estimate from the mid-1980s is not known. Based on a personal communication with W. Legard (2010), Amme et al. (1987) likely overestimated the number of plants at this site, because signs of a population die-off of this magnitude are not apparent.

According to Kanz (*in litt.* 2004), suburban development in the early 1970's in the Manzanita Drive area of Huckleberry Ridge is estimated to have impacted half of the historic Huckleberry Preserve colony. The extent to which the large stand occupied the southwest side of the ridge is not known. A drought in the late 1970's followed by the heavy rains of early 1980's is believed to be responsible for the conditions that lead to a fungal outbreak at Huckleberry Ridge (Amme and Havlik 1987). Samples of dead and dying branches and roots were taken to a plant pathologist, who believed a root fungus, possibly a *Botryosphaeia* spp., was the cause of dieback. The root fungus caused branch and stem dieback, turning the leaves and stems reddish the first year and white-grey the following year (B. Johnson *in litt.* 1983, Amme and Havlik 1987). Despite the presence of dead and dying branches on plants within the Huckleberry Preserve colony, Amme et al. (1987) noted the remaining healthy branches and meristems exhibited good vigor and produced a large crop of seeds. More recently, dead and dying *Arctostaphylos pallida* plants at Huckleberry Preserve and Big Trees Trail have been confirmed to be infected with the fungal water mold *Phytophthora cinnamomi* (Swiecki et al. 2007; Phytosphere Research 2010). The sensitivity of *A. pallida* to this pathogen and the extent of the infestation are not known at this time; however based upon the 100 percent mortality rate observed in populations of other *Arctostaphylos* species and the lack of population recovery at infested sites, it is reasonable to expected high mortality and loss of occurrences in *A. pallida*.

In the summers of 2004 and 2005, approximately 500 square feet (152 square meters) were cleared at Huckleberry Preserve, leaving only *Arctostaphylos pallida* plants. Cut material and dead wood were placed into piles. On February 27 and March 1, 2007, the piles were burned. In 2008, there were 176 seedlings that had sprouted within the burned area.

The Huckleberry Ridge satellite colonies occur on other properties managed by EBRPD, including Robert Sibley Volcanic Regional Preserve and Redwood Regional Park, and at Joaquin

Miller Park, which is managed by the City of Oakland. There are also several satellite colonies that occur on privately owned property on Skyline Boulevard, Ascot Drive, Manzanita Drive, and Exeter Drive in the City of Oakland and above Pinehurst Road on lands owned by East Bay Municipal Utility District (EBMUD).

Of the Huckleberry Ridge satellite colonies occurring on public lands, the two largest are at Joaquin Miller Park and are referred to as "Chabot" and "Big Trees Trail". The Chabot colony is located at the Chabot Space and Science Center (Science Center). The number of plants at the site has declined from 21 in 1994 to 10 in 2006, and the condition of many of the remaining plants continue to decline due to shading from native trees and possibly due to infection from *Phytopthora cinnamomi*. A 1995 Environmental Impact Report (EIR) prepared for the construction of the Science Center required an *Arctostaphylos pallida* management plan be created and implemented. The plan was finalized in September 2009 and proposes to restore habitat and maintain a minimum of 21 plants at the site. According to the management plan, restoration activities were to begin in October 2009; however, implementation has not been initiated at this time.

Of all of the Huckleberry Ridge satellite colonies of *Arctostaphylos pallida*, the Big Trees Trail colony has the largest number of mature plants (Table 1). Between 1989 and 2006, 14 mature plants died. Since then, additional mature plants have died and the condition of many of the remaining plants continue to decline due to shading by *Pinus radiata* (Monterey pine), *Cupressus macrocarpa* (Monterey cypress), and *Arbutus menziesii* (Pacific madrone). The Big Trees Trail colony may have sustained greater mortality if not for vegetation management activities conducted by a local volunteer watershed restoration organization, the Friends of Sausal Creek (FOSC). FOSC conducts surveys of the site and occasionally removes both native and nonnative plants that shade *A. pallida* plants. The management of the Big Trees Trail colony was included in the Chabot management plan to allow for a memorandum of understanding between FOSC and California Department of Fish and Game (CDFG) to permit FOSC to conduct restoration activities at both colonies.

A small number of *Arctostaphylos pallida* seeds have germinated at the Big Trees Trail site in the absence of fire. Seed germination is likely due to soil disturbance caused by vegetation removal activities that scarified the seed coats. However, several mature plants that were among the healthiest in the spring of 2010, died in the summer and fall of 2010 (personal observation, B. Solvesky 2010). These plants did not exhibit the slow branch die-back over multiple years that is typical of a decline from shading. In contrast, over a period of a few months, all of the leaves within a group of plants turned yellow and speckled, then brown. Soil samples collected from the base of a dead seedling and dead mature *A. pallida* plant tested positive for *Phytophthora cinnamomi* (Phytosphere Research 2010).

The second largest population of *Arctostaphylos pallida* occurs at Sobrante Ridge, within EBRPD's Sobrante Ridge Ecological Preserve. This population is relatively isolated from all other colonies, occurring five miles (eight kilometers) north of the naturalized population at Tilden Park and 9.5 miles (15 kilometers) north of the Huckleberry Ridge Population. The Sobrante Ridge population was not afflicted with a root fungus in the 1980s, nor is a root fungus currently known to afflict the site today. Kanz (2004) noted that shading of the site by native

trees is gradually increasing and that numerous plants along the trail were pruned. A status survey in the mid-1980s indicated the Sobrante Ridge colony had an estimated 1,700 to 2,000 plants (Amme et al. 1987). However, 2004 survey results by EBRPD biologists indicated there were 454 plants with a canopy cover that occupied 1.33 acres at Sobrante Ridge. Based on a personnel communication with W. Legard (2010), Amme et al. (1987) likely overestimated the number of plants at this site, because signs of a population die-off of this magnitude are not apparent.

Survey results by Amme and Havlak (1987) and Kanz (2004) attributed mortality or decline to: (1) removal for wildfire fuel reduction purposes (Manzanita Drive); (2) herbicide use below Pacific Gas and Electric (PG&E) powerlines (Manzanita Drive); (3) shading by native plant species (*Arbutus menziesii* (Pacific madrone), *Quercus* spp. (oak spp.) and *Sequoia sempervirens* (coast redwood) at Huckleberry Preserve, Redwood Park, Chabot, Manzanita Flat, Sequoia-Bayview, Wildcat Canyon Road, Big Trees Trail, and Sobrante Ridge) and non-native plant species (*Pinus radiata*, *Genista monspessulana* (French broom), *Cupressus macrocarpa*, and *Euclaptus* spp. at Exeter Drive, Manzanita Drive, Big Trees Trail, and Huckleberry Preserve); (4) removal for the purpose of development (Manzanita Drive, Exeter Drive, and Ascot Drive); (5) goat grazing (Manzanita Flat and Big Trees Trail); (6) root fungus (Huckleberry Preserve, Manzanita Flat, other colonies within the Huckleberry Ridge population); and (7) trail maintenance (Sobrante Ridge).

Reproduction and Demography

Arctostaphylos pallida is diploid, obligate seeding, and shade-intolerant, and bees (insects in the superfamily Apoidea) appear to be important pollinators (Amme and Havlik 1987). Obligate seeding *Arctostaphylos* spp. may require 5 to 15 years before substantial seed crops are produced (Keeley and Zelder 1978). Two basic life history patterns are found within the genus *Arctostaphylos*; plants either survive wildfire and resprout from a basal burl (sprouter) or plants are killed by fire and regenerate from seeds stored in the soil (obligate seeder). In addition to being an obligate seeder, *A. pallida* can reproduce vegetatively by layering. Layering occurs when branches become partially or fully buried in soil or litter and produce roots. Some extensive clones of *A. pallida* have developed in this manner within the Sobrante Ridge population (Amme and Havlik 1987). *A. tomentosa crustacean*, a tetraploid, sprouter, and co-occurring native species, is known to hybridize with *A. pallida*. Hybridization between *A. pallida* and nonnative diploid *Arctostaphylos* spp. planted within the urban area along Manzanita Drive and Skyline Boulevard likely occurs.

Obligate seeding *Arctostaphylos* spp. tend to have fire-dependent seedling recruitment; and mature stands tend to be even-aged, exhibiting no regeneration during fire-free intervals, except perhaps where light incidence at the soil surface is high (Safford and Harrison 2004). In the absence of fire, the environmental conditions that trigger seed germination in *A. pallida* are not known. Mechanical disturbance may be an alternative to fire under certain conditions. The regeneration of seedlings at four colonies where vegetation management activities disturbed the soil and increased light levels, in the absence of fire, indicates fire is not required for seed germination to occur. However, based on the large number of seedlings that occur at the

Huckleberry Preserve colony after prescribed fire, compared to other colonies with seedlings, fire is likely a more thorough means of stimulating germination.

The understory of mature *Arctostaphylos pallida* stands, and chaparral vegetation in general, is typically free of vegetation, including regeneration. Seeds of *Arctostaphylos* spp. are relatively long-lived, remaining viable in the soil for more than 100 years (Keeley 1987). The cause of the lack of vegetation beneath chaparral species has been attributed to allelopathy (inhibitory biochemical interactions between plants), small mammal herbivory, and/or fire dependant seed banks. Keeley and Keeley (1989) concluded that in nature, a substantial proportion of the seed pool of some chaparral species is unlikely to germinate in the absence of fire and that dormancy mechanisms minimize seed germination during periods of low survival probability. However, they also note that a portion of the seed pool is potentially capable of germinating in the absence of fire.

A study comparing the regeneration and recolonization of *Arctostaphylos* spp. obligate seeders and *Arctostaphylos* spp. sprouters after fire found that the seedlings of obligate seeders did not compete well against sprouters post-fire; thus, seedlings are adapted to openings in chaparral after fire (Keeley and Zelder 1978). Based on this observation, Keeley and Zelder (1978) hypothesized that longer fire-free periods favor obligate seeders by creating more and larger openings in chaparral post-fire, because: (1) longer fire-free periods result in higher fuel loads and more intense fires, thereby reducing the number of resprouters that survive fire; and (2) long fire-free periods allow for increased stem-exclusion, thereby reducing the density of potential resprouters after a fire. In support of this hypothesis, Odion and Davis (2000) found that chaparral with dense canopy cover prior to fire tended to be barren after fire, where heating was relatively high, except for the occasional obligate seeding *Arctostaphylos* spp. and obligate seeding *Ceanothus* spp. The authors also noted that obligate seeders tended to have deeply buried seeds, allowing them to withstand prolonged soil heating. A study of the effects of prescribed fire on *A. morroensis*, a closely related species to *A. pallida* (Boykin et al. 2005) and a Federally endangered obligate seeding species from Morro Bay, California, found that *A. morroensis* may require considerably longer than 40 years between fire to establish an adequate seed bank to compensate for mortality and prevent population decrease or local extinction (Odion and Tyler 2002).

Habitat and Community Associations

Arctostaphylos pallida is found between 200 to 445 meters (656 to 1,460 feet) elevation, as a component of the maritime chaparral vegetation type, in areas that experience a high frequency of summer fog. Fog reduces transpiration and increases soil moisture during a period of time when precipitation is uncommon. In addition, a substantial amount of fog moisture can condense on the leaves of *Arctostaphylos* spp. and it is possible some *Arctostaphylos* spp. are capable of absorbing this moisture through foliar uptake (M. Vasey, personal communication 2010). The Huckleberry Preserve and the Sobrante Ridge colonies grow on Middle Miocene cherts and shales of the Monterey Group (Amme and Havlik 1987). These soils are thin, well drained at the surface, and deficient in many essential plant nutrients. However, the fractured and bedded rocks below hold water that is accessible by deep roots. Satellite colonies along Skyline Boulevard occur on Pinehurst Shale and the Joaquin Miller Formation (Radbruch 1969), both

substrates are mixtures of shale, sandstone, and minor conglomerate. The colony along Exeter Drive occurs on soft sandstone. *A. pallida* appears to only grow on these soils in areas that experience maritime summer fog, and have not been found on the same substrates where summer air and soil temperatures are higher (B. Johnson *in litt*. 1983).

Arctostaphylos pallida is shade intolerant and will slowly die when shaded by larger trees and shrubs. However, based on the results of vegetation management activities conducted in the mid 1980s at Huckleberry Preserve and in the mid 2000s at Redwood Regional Park and Big Trees Trail, *A. pallida* responds positively to activities that reduce light competition and disturb the soil. The species appears to be co-dominant with other woody shrubs and shrub-form trees, including *A. tomentosa crustacean* (brittle leaf manzanita), V*accinium ovatum* (California huckleberry), *Chrysolepis chrysophylla minor* (golden chinquapin), and several shrub-form *Quercus* spp.

Four vegetation types exist on Sobrante Ridge: maritime chaparral, oak woodland, coastal scrub, and grassland (Amme and Havlik 1987). The area outside of the shale soil formation is dominated by open park-like coast live oak woodland, interspersed with grassland and coastal scrub; while the area within the shale soil formation is dominated by maritime chaparral, including *Arctostaphylos pallida* and *A. tomentosa crustacean*. Within the approximately 3.6-hectare (9-acre) shale soil formation, primarily along the edges, are *A. t. crustacean*; within the center of the formation is the largest concentration of *A. pallida*, occurring on both east- and southwest-facing slopes.

There are two vegetation types within the Huckleberry Preserve stand: maritime chaparral and oak/bay (*Quercus* spp./*Umbellularia californica*) woodland. As is the case at Sobrante Ridge, the most barren soils at Huckleberry Preserve are occupied by the largest concentrations of *Arctostaphylos pallida*. *A. pallida* occupies approximately 8 hectares (20 acres) of the site, on 30- to 40-degree slopes (Amme and Havlik 1987). Unlike the large stand at Huckleberry Preserve and the Sobrante Ridge population, the soils of the satellite stands of the Huckleberry Ridge population are more developed and less nutrient deficient, capable of supporting redwood and coast live oak vegetation types. As such, the *A. pallida* at these sites occur mainly on roadcuts and other forest gaps.

Changes in Taxonomic Classification or Nomenclature

The Service is not aware of any changes in the taxonomic classification or nomenclature of *Arctostaphylos pallida* since its listing.

Genetics

A genetic study of 38 species of *Arctostaphylos*, including *A. pallida*, was conducted by Boykin et al. (2005). Their results suggest morphological characters may not consistently represent monophyletic groups and a thorough reexamination of the genus is warranted.

Species-specific Research and/or Grant-supported Activities

We are not aware of any research or grant supported activities that focus on *Arctostaphylos pallida*.

Five-Factor Analysis

The following five-factor analysis describes and evaluates the threats attributable to one or more of the five 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 (Service 1998), we did not find there to be any Factor A threats to the species, because most of the remaining population at Huckleberry Ridge and the population at Sobrante Ridge were on lands owned by EBRPD and not subject to further residential development. However, construction began in 1996 on the 8,200 square meter (88,000 square foot) Chabot Space and Science Center, adjacent to a small colony of *Arctostaphylos pallida*, on land that likely contained a viable seed bank. The potential exists for City of Oakland or EBRPD funded projects (i.e., museums or recreation support facilities) to remove or modify habitat. At this time, habitat loss from home improvement projects in the housing development adjacent to Huckleberry Preserve represents a minor threat to the species.

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

Overutilization for any purpose was not known to be a factor in the 1998 final listing rule (Service 1998). Overutilization for any purpose does not appear to be a threat at this time.

FACTOR C: Disease or Predation

At the time of listing, we cited an unidentified fungal pathogen, possibly a *Botryosphaeia* spp., which affected approximately 50 percent of the Huckleberry Ridge population of *Arctostaphylos pallida* as a threat. Recently, it has been confirmed that the Huckleberry Preserve colony is infected with the pathogen *Phytophthora cinnamomi*. To our knowledge, the amount or extent of the infestation of *A. pallida* has not been quantified at this time.

Phytophthora cinnamomi is considered to be a serious pathogen of agricultural crops and native plant communities. In California, it is known to infect orchard trees, ornamental plants, and Christmas tree farms (Swiecki and Bernhardt 2003). More recently *P. cinnamomi* was identified to be partially responsible for mortality in *Quercus agrifolia* (coast live oak) (Garbelotto et al. 2006). *Phytophthora cinnamomi* is a disease that causes root and crown rot and is responsible for killing off large patches of *Arctostaphylos myrtifolia* in the Ione area. In *A. myrtifolia*, once infected by this pathogen, the root system begins to decay until the loss of roots and/or water-conducting tissues causes the plant to desiccate (Swiecki and Bernhardt 2003). Additionally, *P. cinnamomi* can also infect the leaves and stems of plants, providing the same symptoms as other

fungal infections, making it difficult to determine which disease is affecting a particular plant (Swiecki and Bernhardt 2003).

The pathogenic activity of *Phytophthora cinnamomi* is favored by free moisture and under wet conditions, multiple infection cycles are likely to occur. *Phytophthora cinnamomi* is primarily spread to new areas through the movement of infested soil by humans, particularly through the use of vehicles (Swiecki and Bernhardt 2003). Once the disease has been introduced into an area, the movement of the pathogen is facilitated by water flow. Swiecki *et al*. (2005) noted that the local spread of *P. cinnamomi* occurs during the wet season at a cross slope and upslope rate of approximately 0.25 meters (0.8 foot) per year. Down slope spread has been calculated at 2 meters (6.5 feet) per year, presumably due to transport via flowing water (Swiecki et al. 2005).

Introduction of *Phytophthora cinnamomi* into *Arctostaphylos pallida* habitat represents a long-term and substantial threat, due to its long persistence in the soil. *P. cinnamomi* can persist in the environment in the absence of susceptible hosts. This pathogen survives in the soil in infected roots, or as long-lived resident spores (Swiecki and Bernhardt 2003). There is no known cure or prevention for this disease.

The susceptibility of *Arctostaphylos pallida* to diseases could be exacerbated by other threats, such as shading by native and nonnative invasive species and lack of fire. There is no known cure for *Phytophthora cinnamomi* and it is capable of remaining in the soil and killing seedlings. Since *P. cinnamomi* is not known to infect the Sobrante Ridge population at this time and because it is easily transported to new sites, the spread of *P. cinnamomi* to Sobrante Ridge represents a substantial threat to the species. *A. pallida* plants at the Big Trees Trail colony are dying from both shading and from a disease (personal communication R. Kanz 2010).

FACTOR D: Inadequacy of Existing Regulatory Mechanisms

At the time of listing (Service 1998), regulatory mechanisms thought to have some potential to protect *Arctostaphylos pallida* included: listing under the California Endangered Species Act (CESA) in 1979, the California Environmental Quality Act (CEQA), and the Native Plant Protection Act (NPPA). In addition to State of California regulatory mechanisms, *A. pallida* is protected by the National Environmental Protection Act (NEPA) and the Federal Endangered Species Act (Act). A lack of regulatory mechanisms is not considered a threat at this time. The following is a summary of the regulatory mechanisms protecting *A. pallida*.

State Protections in California

The State's authority to conserve rare wildlife and plants is comprised of four major pieces of legislation: CESA, NPPA, CEQA, and the Natural Community Conservation Planning Act.

CESA and NPPA: The CESA (California Fish and Game Code, section 2080 *et seq*.) prohibits the unauthorized take of State-listed threatened or endangered species. The NPPA (Division 2, Chapter 10, section 1908) prohibits the unauthorized take of State-listed threatened or endangered plant species. The CESA requires State agencies to consult with the California Department of Fish and Game on activities that may affect a State-listed species and mitigate for

any adverse impacts to the species or its habitat. Pursuant to CESA, it is unlawful to import or export, take, possess, purchase, or sell any species or part or product of any species listed as endangered or threatened. The State may authorize permits for scientific, educational, or management purposes, and to allow take that is incidental to otherwise lawful activities.

Furthermore, with regard to prohibitions of unauthorized take under NPPA, landowners are exempt from this prohibition for plants to be taken in the process of habitat modification. Where landowners have been notified by the State that a rare or endangered plant is growing on their land, the landowners are required to notify the California Department of Fish and Game 10 days in advance of changing land use in order to allow salvage of listed plants.

CEQA: The CEQA requires review of any project that is undertaken, funded, or permitted by the State or a local governmental agency. If significant effects are identified, the lead agency has the option of requiring mitigation through changes in the project or to decide that overriding considerations make mitigation infeasible (CEQA section 21002). Protection of listed species through CEQA is, therefore, dependent upon the discretion of the lead agency involved.

Federal Protections

NEPA: NEPA (42 U.S.C. 4371 *et seq*.) provides some protection for listed species that may be affected by activities undertaken, authorized, or funded by Federal agencies. Prior to implementation of such projects with a Federal nexus, NEPA requires the agency to analyze the project for potential impacts to the human environment, including natural resources. In cases where that analysis reveals significant environmental effects, the Federal agency must propose mitigation alternatives that would offset those effects (40 C.F.R. 1502.16). These mitigations usually provide some protection for listed species. However, NEPA does not require that adverse impacts be fully mitigated, only that impacts be assessed and the analysis disclosed to the public.

Endangered Species Act of 1973, as amended: The Act is the primary Federal law providing protection for this species. Since listing, the Service has analyzed the potential effects of Federal projects under section 7(a)(2), which requires Federal agencies to consult with the Service prior to authorizing, funding, or carrying out activities that may affect listed species. A jeopardy determination is made for a project that is reasonably expected, either directly or indirectly, to appreciably reduce the likelihood of both the survival and recovery of a listed species in the wild by reducing its reproduction, numbers, or distribution (50 CFR 402.02). A non-jeopardy opinion may include reasonable and prudent measures that minimize adverse affects to listed species associated with a project.

With regard to Federally listed plant species, section 7(a)(2) requires Federal agencies to consult with the Service to ensure any project they fund, authorize, or carry out does not jeopardize a listed plant species. Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the "take" of Federally endangered wildlife; however, the take prohibition does not apply to plants. Instead, plants are protected from harm in two particular circumstances. Section 9 prohibits (1) the removal and reduction to possession (i.e., collection) of endangered plants from lands under Federal jurisdiction, and (2) the removal, cutting, digging, damage, or

destruction of endangered plants on any other area in knowing violation of a state law or regulation or in the course of any violation of a state criminal trespass law. Federally listed plants may be incidentally protected if they co-occur with Federally listed wildlife species.

Local Protections

EBRPD: EBRPD manages over 40,000 hectares (100,000 acres) within 65 regional parks, recreation areas, wilderness, shorelines, preserves, and land bank areas. The core mission of EBRPD is to, "acquire, develop, manage, and maintain a high quality, diverse system of interconnected parklands which balances public usage and education programs with protection and preservation of our natural and cultural resources." The majority of stands and the largest stands of *Arctostaphylos pallida* occur on EBRPD properties. Although lands managed by EBRPD are protected from commercial and residential development, management is not ecosystem centered and may include the development of trails and facilities for human recreation purposes.

EBMUD: A single colony of *Arctostaphylos pallida* occurs on EBMUD property near San Leandro Canyon. There are currently no trails, roads, fences, or routine activities in the area. *A. pallida* is included in a Habitat Conservation Plan (HCP). According to the HCP, EBMUD will conduct habitat restoration activities and control invasive plants around the site. The site is not subject to commercial or residential development.

City of Oakland

Three of the largest satellite colonies of *Arctostaphylos pallida* occurred within Joaquin Miller Park, which is owned and managed by the City of Oakland. According to Kanz (2004), the Manzanita Flat colony, already weakened from a root fungus and shading, was extirpated due to grazing by domestic goats (*Capra aegagrus*), which the City of Oakland uses as a tool to reduce fuel loads and wildfire hazard. The Chabot colony continues to decline, despite having an *A. pallida* management plan.

The City of Oakland has a Protected Tree Ordinance, which requires a permit before removing a protected tree. A protected tree is *Quercus agrifolia* (coast live oak) four inches or larger in diameter, measured four and a half feet above the ground, or any other species nine inches in diameter or larger, except *Eucalyptus* spp. and *Pinus radiata*. The minimum fee for a non-development related application is $45. Up to ten trees may be listed on an application for the minimum fee. An extra $8 per tree is charged for the 11th through 100th tree. This ordinance makes removing native trees that shade *Arctostaphylos pallida* plants more difficult and expensive.

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

Fire Frequency

At the time of listing, we cited past and present fire suppression policies and inactive or ineffective fire management plans as one of the greatest threats to the continued existence of the

species. We believed a lack of frequent, but small fires to stimulate regeneration and reduce fuel loads within stands of chaparral represented one of the greatest threats to the species. There has been considerable debate about the effects of decades of fire suppression on chaparral ecosystems (Moritz 2003). One side of the debate believes fire suppression has increased fuel loads and leads to fewer, but larger wildlfires. This theory is supported by studies contrasting shrubland fire regimes north and south of the U. S.-Mexican border (Minnich 1983, 1995, 2001), arguing that the pattern of small fires south of the boarder is a model of what fire regimes were like north of the boarder prior to fire suppression policy. Based on this assumption, proponents of this theory suggested that California-shrubland Wildland Urban-Interface (WUI) management should de-emphasize fire suppression and reestablish an age mosaic of shrublands to return the landscape to a condition in which fire size is constrained by discontinuities in fuels due to smaller, more frequent fires.

In contrast, others believe relatively large stand-replacing crown fires are a natural part of these ecosystems and that urban expansion into these ecosystems has increased the rate of fire incidence through human ignition sources, resulting in more frequent and destructive fires. This theory is supported by research that has shown that extremely large, stand replacing crown fires in California shrubland ecosystems predate fire suppression policy (Keeley and Fotheringham 2001, Keeley and Zedler 2009); much more area has burned by wildfires in recent decades than before active fire suppression (Moritz 1997, Conrad and Weise 1998, Keeley et al. 1999); large fires are not dependent on stand age (Keeley et al. 1999, Moritz 2003); and when wildfires occur under severe fire conditions they burn through all but the youngest age-class of chaparral and coastal scrub (Keeley et al. 1999, Keeley 2002).

Because fire is essential to the natural regeneration of *Arctostaphylos pallida*, the lifespan of the seed bank is not known, and regeneration can be difficult in the absence of fire, fire suppression remains a threat. However, the vast majority of fires in Alameda and Contra Costa Counties are not naturally ignited by lightning (Keeley 2005), rather they are most often human caused; thus, the natural fire return interval is likely no longer within the evolutionary bounds of the species. Based on Odion and Tyler's (2002) study of *A. morroensis*, which indicates that a fire return interval of 40 years or less would likely result in the extirpation of the species, and other studies on obligate seeding *Arctostaphylos* spp. found that long fire free intervals (less than 100 years) likely do not represent a significant threat (Keeley and Zelder 1978, Odion and Davis 2000); too long of a fire return interval does not represent as significant a threat as we previously thought. Rather, too frequent of a fire return interval, one that depletes the seed bank before it can be replenished is a greater threat to *A. pallida*.

The Huckleberry Preserve site has likely not experienced a stand-replacing fire for more than 80 years and would benefit from management activities that stimulated regeneration and reduced competition. The Sobrante Ridge site likely experienced a stand-replacing fire 30 to 40 years ago (Service 1998) and appears to be healthy and vigorous. EBRPD does not typically use prescribed fire in the Wildland Urban-Interface due to the threat of escape and liability. Thus, instigating regeneration naturally is not considered a management option at this time. The unwillingness to use fire to instigate regeneration of *Arctostaphylos pallida* represents a significant threat to the species, because the effectiveness of soil disturbance to stimulate

regeneration has not been proven to provide adequate regeneration to replace mortality at this time.

Wildfire Fuel Reduction Treatments

Mediterranean-climate shrublands of California are one of the most fire hazardous landscapes in North America. For example, the Tunnel Fire of 1991 started in the WUI of the Oakland/Berkeley Hills under severe fire hazard conditions. The Tunnel Fire burned 1600 acres of coastal scrub, maritime chaparral, and other vegetation types; killed 25 people, destroyed 3354 homes and 456 apartments, and resulted in an estimated $1.5 billion in damages. Of primary concern to the municipalities and land management agencies in the WUI is reducing wildfire hazard to protect property and human lives. One of the only effective means of reducing this threat is to reduce the amount and/or structure of fire carrying fuels. All of the known colonies of *Arctostaphylos pallida* occur in the WUI; the Huckleberry Preserve colony abuts a housing development and the El Sobrante population is within 50 meters (165 feet) of urban development.

EBRPD's Wildfire Hazard Reduction and Resource Management Plan: According to EBRPD's Wildfire Hazard Reduction and Resource Management Plan (LSA Associates, Inc. *in litt*. 2009) (WHRRMP) the maritime chaparral vegetation type represents an extreme wildfire hazard. To reduce the hazard, the WHRRMP aims to focus mechanical fuel treatment efforts on key locations, including areas occupied by *Arctostaphylos pallida*. According to the plan, stands of maritime chaparral will be thinned to create clumps of shrubs, with a distance between clumps to be greater than approximately twice the height of the tallest shrub crown. This thinning includes removing "shrubs of low vigor, and all dying or dead shrubs, including *A. pallida*." The plan also calls for the conversion of maritime chaparral to "lighter fuel types, e.g., grass, especially in maintained fuel reduction zone areas." The definition of a "dying" *A. pallida* shrub was not provided in the plan nor were criteria for regeneration. All stands of *A. pallida* that occur on EBRPD lands could be subject to these management activities.

Chaparral and coastal scrub wildfire hazard is relatively independent of stand age (Moritz 1999), and when wildfires occur in these vegetation types under severe fire conditions they burn through all but the youngest age classes (Keeley et al. 1999, Keeley 2002). Based on this, if *Arctostaphylos pallida* seedling germination occurs within the gaps created by fuel treatments, as would be expected, the effectiveness of the plan to reduce wildfire hazard, without removing healthy *A. pallida* shrubs or seedlings, would be relatively short-lived.

In contrast to the proposed removal of *Arctostaphylos pallida* shrubs as a component of the WHRRMP, the plan also includes the removal of both native and nonnative vegetation that grows within and adjacent to stands of *A. pallida* to reduce wildfire hazard. Shading by native and nonnative species poses a significant threat to the existence of *A. pallida* (see Factor E section on Succession and Nonnative Invasive Species); thus, the WHRRMP reduces a significant threat to *A. pallida*, while increasing another threat to the species.

Goat Grazing: Both EBRPD and the City of Oakland have used domestic goat (*Capra aegagrus*) grazing as a tool to reduce fuel loads and wildfire hazard within the WUI. Due to the

relatively indiscriminant food selection preferences of the domestic goat, this practice poses a serious, yet easily avoidable, threat to *Arctostaphylos pallida*. According to Kanz (2004) goat grazing by the City of Oakland is responsible for the extirpation of the Manzanita Flat colony and has caused damage to *A. pallida* plants at the Big Trees Trail site. The WHRRMP specifically excludes the use of goat grazing near stands of *A. pallida.*

Defensible Space: In January 2005, a new California state law became effective that extended the defensible space clearance around homes and structures from 9 meters (30 feet) to 30 meters (100 feet). Proper clearance to 30 meters dramatically increases the chance of a structure surviving a wildfire. This defensible space also provides for firefighter safety when protecting homes during a wildfire. Since the largest stand of *Arctostaphylos pallida*, Huckleberry Preserve, occurs within the 30 meter defensible clearance space, plants nearest homes are threatened with removal by homeowners in the area who are concerned about protecting their homes and their lives from wildfire. This threat is also of particular concern for the colonies that occur within the City of Oakland urban neighborhood; where all *A. pallida* plants occur within the yards of private residences.

Succession and Nonnative Invasive Species

Succession of maritime chaparral to oak/bay (*Quercus* spp./*Umbellularia californica*) woodland and shading by nonnative invasive species such as *Eucalyptus* spp. and *Pinus radiata* were cited as significant threats to *Arctostaphylos pallida* at the time of listing and continue to represent one of the most significant threats to the species. Mosaics of grassland, oak woodland, coastal scrub, and chaparral, in some locations, have been reported to correlate with geological substrate (Cole 1980) and soil characteristics (Harrison et al. 1971). However, Callaway and Davis (1993) found each of these vegetation types represented abundantly on most soil depths, slope aspects, and all geological substrates. Cyclical changes between chaparral, oak woodland, grassland, and coastal scrub do occur. However, the interactions between variables responsible for type conversion and the rate of conversion are complex and site specific. Callaway and Davis (1993) found that transition rates varied with substrate and topographic position, indicating fire, grazing, and the physical environment interacted to determine direction and rate of transition. Variation in transition on different substrates suggests that only portions of the vegetation on the landscape may be dynamic, with some patches in certain combinations of environment and disturbance that change rapidly, and other patches that remain static as edaphic or topographic climax communities. As an extreme generalization, in the absence of disturbance and on sites with environmental factors that allow for transition from one vegetation type to another, grasslands tend to transition to coastal scrub, coastal scrub to chaparral or oak woodland, chaparral to oak woodland, and oak woodland to grassland (Callaway and Davis 1993).

Arctostaphylos pallida is highly shade intolerant and the invasion of tree-form plant species creates shade that causes *A. pallida* shrubs to slowly die over several years if management action is not taken. All of the colonies of *A. pallida*, to some degree, show signs of succession to oak/bay (*Quercus* spp./*Umbellularia californica*) woodland and/or are being shaded by nonnative trees. The Huckleberry Preserve colony and all of the satellite colonies of the Huckleberry Ridge population are in severe decline due to shading via native species and nonnative invasive species. For example, the Chabot colony will likely be extirpated within a

decade if action is not taken that addresses this issue. However, *A. pallida* stands that experience 100 percent mortality will likely have a viable seed bank for a decade or longer.

Nitrogen Deposition

Atmospheric nitrogen deposition is a complex process by which reactive chemical species of nitrogen (N), nitrogen oxides (NO_X), ammonia (NH_3), and their reaction products are deposited onto surfaces and enter ecosystems as N-fertilizer. As a consequence of anthropogenic inputs, the global nitrogen cycle has been significantly altered over the past century. The added N has been shown to allow nutrient-poor soils, such as serpentine, to be invaded by both native and non-native species that require added nutrients to survive. Although it has been posited that the succession of maritime chaparral to oak/bay (*Quercus* spp./*Umbellularia californica*) woodland in the East San Francisco Bay is due to fire exclusion or is a natural process, it is also possible N-deposition has created conditions that have allowed vegetation-type conversion, from maritime chaparral to oak-bay woodland, to occur on the nutrient deficient soils that are typical of *Arctostaphylos pallida*.

Landscaping

Arctostaphylos pallida plants that occur within the yards of private residences (less than 57 plants) in City of Oakland residential neighborhoods are highly susceptible to mortality from landscaping activities. The large majority of these plants will likely be lost in the foreseeable future due to these activities and a lack of regeneration if management action is not taken. However, the genetic integrity of the seed bank is questionable due to hybridization with non-locally endemic *Arctostaphylos* spp.

Hybridization

Hybridization between *Arctostaphylos pallida* and other *Arctostaphylos* spp. was cited as a threat at the time of listing and continues to threaten the species today. Hybridization is known to occur naturally between *A. pallida* and *A. tomentosa crustacean*. However, the genetic integrity of *A. pallida* is threatened by hybridization with other species of *Arctostaphylos* introduced into the vicinity of *A. pallida* populations. At least three non-locally endemic species of *Arctostaphylos* have been used for landscaping on private lands within the urban development adjacent to Huckleberry Preserve. Hybrids have been observed between *A. pallida* and *A. glauca* (bigberry manzanita). Hybridization may also be occurring in areas where residents have planted *A. pajaroensis* (Pajaro manzanita) along Huckleberry Ridge. This calls into question the genetic integrity of the seed bank in these areas. If the seed bank in this area, including that of the Huckleberry Preserve colony which is adjacent to the City of Oakland colonies of *A. pallida*, has been genetically compromised by hybridization, any regeneration in the area could result in a hybrid swarm and a blurring of the genetic integrity of all future stands of *A. pallida* in the area.

Herbicide Use

At the time of listing, herbicide use for the purpose of controlling roadside vegetation in the residential development adjacent Huckleberry Preserve was cited as a threat to *Arctostaphylos*

pallida. Kanz (2004) indicates *A. pallida* plants below the Pacific Gas and Electric Company power lines, between Manzanita Drive and Skyline Boulevard, exhibited evidence of herbicide use. Herbicide use continues to be a minor threat to *A. pallida*, particularly within the urban development and associated *A. pallida* colonies adjacent to Huckleberry Preserve.

Small Population Size and Stochasticity

Because *Arctostaphylos pallida* exists as three populations with only two large colonies and several small satellite colonies, it is highly susceptible to inbreeding depression and stochastic events. Inbreeding depression can result in reduced fitness, which may result in a higher susceptibility to stochastic events, such as excessive rain, drought, and landslides, that further increase the likelihood of loss of genetic variability. Stochastic events, such as prolonged rainy periods, can also increase susceptibility to other threats, such as fungal diseases.

Climate Change

Impacts to this species as a result of climate change are unclear. A trend of warming in the mountains of western North America is expected to decrease snowpack, hasten spring runoff, and reduce summer stream flows, and increased summer heat may increase the frequency and intensity of wildfires (IPCC 2007). While it appears reasonable to assume that the species may be affected, we lack sufficient certainty on knowing how and to what degree climate change will affect the species, the extent of average temperature increases in California/Nevada, or potential changes to the level of threat posed by drought, fire, etc. The most recent literature on climate change includes predictions of hydrological changes, higher temperatures, and expansion of drought areas, resulting in a northward and/or upward elevation shift in range for many species (IPCC 2007).

A modeling study completed by Loarie et al. (2008) provides an evaluation of potential trends to California's floristic communities under climate change scenarios. In general, large numbers of plant species will tend to move to higher elevations, towards the coast, or northwards. The models suggest that climate change has the potential to break up local floras, resulting in new species combinations, with new patterns of competition and biotic interactions (Loarie et al. 2008). Based on these models, *Arctostaphylos pallida* plants would likely be unable to shift their range naturally because of their dependence on specific soil types and a maritime climate and due to the presumably low dispersal potential of the species.

Climate change may also affect summer fog frequency and have a substantial impact on *Arctostaphylos pallida*, which is dependent on a fog influenced maritime climate. According to M. Vasey (personal communication 2010), coastal endemic *Arctostaphylos* spp. are more vulnerable to summer drought stress than interior species, and if the frequency of coastal fog declines, the hydrologic regime of coastal *Arctostaphylos* spp. will likely become more challenging as they are not well adapted to water stress. In addition, summer fog increases plant, soil, and atmospheric moisture, which decreases fire hazard and decreases the threat of too frequent of fire. Johnstone and Dawson (2010) found direct evidence for moderate fog reductions since 1951, with interannual and multidecadal variations governed largely by ocean-atmosphere circulation and temperature anomalies. However, these conclusions differ from

those by observational (Bakun 1990, Lebassi 2009) and modeling studies (Diffenbaugh et al. 2004, Snyder et al. 2003) suggesting increases in northern California coastal fog in response to increased carbon emissions.

III. RECOVERY CRITERIA

The draft recovery plan for *Arctostaphylos pallida* (Draft Recovery Plan for Chaparral and Scrub Community Species East of San Francisco Bay, California) was approved in November 2002 (Service 2002).

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, overall, 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 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.

According to the draft recovery plan (Service 2002); the following are the delisting criteria for *Arctostaphylos pallida*:

1. *Secure and protect specified recovery areas from incompatible uses:*

    a. *Existing populations: Oakland Hills metapopulation including all populations on EBRPD lands, EBMUD lands, and City of Oakland lands; and Sobrante Ridge metatpopulation along with adjacent unoccupied habitat and a 460-meter (1,500-foot) buffer.*

    b. *5 additional populations (either newly discovered, reintroduced, or introduced populations) along with adjacent unoccupied habitat and a 460-meter (1,500-foot) buffer.*

Is criterion still valid: a. No. According to the draft recovery plan, a "*buffer*" involves, "*securing the populations in perpetuity themselves and a minimum of a 460-meter (1,500-feet) around each population, where possible, to reduce external influences and allow expansion of the populations.*" This definition does not clearly describe the purpose of a buffer or what a buffer would look like; "external influences", "incompatible uses", and how a buffer would protect the species from these threats need to be defined. According to Appendix D of the draft

recovery plan, this criterion is meant to address the threat of "*habitat loss from urban development*" and the threat of "*stochastic events.*" The entire Huckleberry Preserve and Sobrante Ridge colonies, along with many of the smaller satellite colonies, occur within 460-meters of urban development. Other than the *Arctostaphylos pallida* stands that occur within City of Oakland housing developments, all stands, including those on EBRPD lands, EBMUD lands, and City of Oakland lands, are relatively secure and protected from urban development, including adjacent unoccupied and undeveloped habitat within 460-meters. The composition of an effective buffer and how it would reduce the threat of stochastic events needs to be defined before it would be possible to determine if the criterion has been met. b. No. The definition of a "population" has not been defined. It is not clear if the two new occurrences of *A. pallida* at Redwood Regional Park, a single mature plant and several seedlings and a cluster of seedlings, would each count toward the goal of 5 additional populations.

Listing factors addressed: According to the draft recovery plan, this criterion addresses listing factor E. However, based on its intent to reduce the threat of habitat loss from urban development, it also addresses listing factor A.

Has criterion been met: Without clarification, it is not clear if this criterion has been met.

2. *Management plan approved and implemented for recovery areas, including survival and recovery of the species as the objectives:*

    a. *Existing populations: Oakland Hills metapopulation including all populations on EBRPD lands, EBMUD lands, and City of Oakland lands; and Sobrante Ridge metatpopulation along with adjacent unoccupied habitat and a 460-meter (1,500-foot) buffer.*

    b. *5 additional populations (either newly discovered, reintroduced, or introduced populations) along with adjacent unoccupied habitat and a 460-meter (1,500-foot) buffer.*

Is criterion still valid: Yes.

Listing factors addressed: Listing Factor D.

Has criterion been met: No. A management plan for the Chabot colony has been approved, but has yet to be implemented. A species specific management plan was developed by Amme and Havlik (1987) for CDFG. The focus of the plan is to reduce competition with native and nonnative invasive plants and to establish additional stands. Full implementation of the plan was not achieved.

3. *Monitoring in recovery areas demonstrates:*

    a. *Population monitoring is stable or increasing with evidence of natural recruitment for a period of 3 fire cycles (approximately 120 years) that include normal disturbances.*

b. *Habitat monitoring shows a mosaic of multi-age class stands, and anthropogenically created habitat does not occur within any Recovery Unit over current (2001) conditions.*

Is criterion still valid: a. No. The use of 3 fire cycles as a measure of stability is not appropriate because the ability of managers to use fire as a management tool is questionable and because the contemporary fire return interval is likely more erratic than the pre-European settlement fire return interval and outside the range of natural variability. b. No. The vast majority of peer-reviewed scientific literature indicates that chaparral, and *Arctostaphylos* spp. in particular, do not naturally occur as multi-age class stands (they almost always burn in stand-replacing fires). However, in the absence of fire, through soil disturbance and vegetation management activities that increase light levels, it is possible to establish multi-age class stands. In addition, Recovery Units for *A. pallida* were not designated in the draft recovery plan.

Listing factors addressed: According to the draft recovery plan, this criterion is meant to reduce the threat of habitat fragmentation, listing factor E.

Has criterion been met: No.

4. *Monitoring in recovery areas demonstrates:*

   a. *Ameliorate or eliminate threats.*

   b. *Re-establish natural fire frequency.*

   c. *Study importance of different fire techniques for habitat management.*

   d. *Store seeds of disjunct populations in at least two Centers for Plant Conservation certified facilities.*

   e. *Enhance existing population at Sobrante Ridge, Huckleberry Preserve, and Joaquin Miller Park.*

   f. *Evidence that the preserves are not made unmanageable by small size, proximity to urban development, or fragmentation.*

Is criterion still valid: a. Yes. b. No. Because California shrublands burn in stand-replacing fires, it is difficult to reconstruct precise fire histories using dendroecological methods (Keeley and Fotheringham 2001). Determining the natural fire regime is also complicated because humans have set fires in the region for hundreds to thousands of years (Keeley and Fotheringham 2003). Further, due to increased human ignition sources caused by urbanization in these fire-prone shrubland ecosystems, the contemporary fire return interval is likely more erratic than the pre-European settlement fire return interval and outside the range of natural variability. Due to the threat that too short of a fire return interval represents to the species (i.e., depletion of the seed bank), an adequate seed bank needs to be established prior to burning. Research is needed to determine when an adequate seed bank has been established. A "burn box" (a metal frame, approximately 2 meters long, 2 meters wide, and 1 meter high (6.5 by 6.5 by 3.25 feet), open on

the bottom and the top, used to contain small fires), could be used to stimulate seed germination on several test plots within a stand to determine the level of seedling recruitment in the following years. This would likely provide enough evidence to show if a stand has established a seed bank capable of replacing the entire stand. c. Yes. Experiments using a"burn box" and other techniques to instigate seed germination should be conducted. d. No. It is not appropriate to include "seed storage" as a goal that can be demonstrated by monitoring. e. Yes. f. Yes. However, this is redundant to *4a* and determining when this criterion has been met is subjective and benchmarks for its achievement should be defined.

Listing factors addressed: a. Factors A, B, C, D, and E. b. Factor E. c. Factor E. d. Factor E. e. Factor E. f. Factor E.

Has criterion been met: a. No. b. No. c. No. d. Unknown. e. No. Enhancement activities at the Big Trees Trail stand at Joaquin Miller Park have occurred, but further enhancement is needed. The Chabot stand is in poor health and the Manzanita Flat colony has been extirpated. Enhancement activities at Sobrante Ridge are not needed at this time. Enhancement activities have not occurred at Huckleberry Preserve for more than a decade and are needed. f. No.

IV. SYNTHESIS

There are two relatively large colonies of *Arctostaphylos pallida*, Huckleberry Preserve has 747 mature plants and 176 seedlings that occupy 8 hectares (20 acres) and Sobrante Ridge has 454 mature plants that occupy 3.6 hectares (9 acres). Together, the two largest colonies represent 89 percent of the total number of mature *A. pallida* plants in existence. Due to an over estimation in the number of plants at the two largest colonies and the loss and decline of several smaller colonies, the known number of *A. pallida* plants has decreased from as many as 4,986 at the time of listing in 1998 and the issuance of the draft recovery plan in 2002, to approximately 1,350 mature plants today. Three colonies have been extirpated (21 plants) and many other colonies have experienced declines (approximately 154 plants, excluding the two largest colonies), primarily due to shading from native and nonnative plants and fungal pathogens. *Phytophthora cinnamomi* has been found to be infecting plants within the largest stand of *A. pallida*. *P. cinnamomi* is associated with the decline of other *Arctostaphylos* spp. With the exception of Sobrante Ridge, which is not known to have been infected with any fungal pathogens, all colonies have experienced severe to moderate declines in the number of mature plants. At this time, Sobrante Ridge is the only colony of *A. pallida* that does not require immediate management attention to stimulate regeneration and remove native and nonnative invasive plants that suppress vigor and significantly contribute to the death of plants.

Although previously unidentified as a threat, too frequent a fire return interval represents a significant threat to all colonies of *Arctostaphylos pallida*. It is highly probable one or more colonies of *A. pallida* will experience a stand-replacing fire in the foreseeable future due to the extreme wildfire hazard this vegetation type inherently represents. Once a colony has experienced an initial stand-replacing fire that stimulates germination of the seed bank, the colony would be susceptible to extirpation from an untimely second fire, because it may require considerably longer than 40 years to establish an adequate seed bank capable of compensating for mortality caused during the initial fire. Management actions implemented to reduce the

extreme wildfire hazard of stands of *A. pallida*, through fuel removal treatments, could require reducing the number of mature plants and limiting regeneration in the gaps between plants. Due to the extreme wildfire hazard it represents and because all colonies occur within the WUI, it is also a target for removal by homeowners protecting their properties and lives.

Due to the limited distribution of *Arctostaphylos pallida*, severe plant health declines and death due to fungal diseases, the loss of several colonies and decline of many others to shading by native and nonnative species and goat grazing, threats associated with wildfire fuel management, an overall lack of regeneration for more than 30 years, and the potential loss of its seed bank to too frequent a fire return interval caused by increased human ignition sources, we believe *Arctostaphylos pallida* is in danger of extinction in the foreseeable future and should be uplisted from threatened to endangered.

V. RESULTS

Recommended Listing Action:

____ Downlist to Threatened
__X__ Uplist to Endangered
____ Delist (indicate reason for delisting according to 50 CFR 424.11):
    ____ *Extinction*
    ____ *Recovery*
    ____ *Original data for classification in error*
____ No Change

New Recovery Priority Number and Brief Rationale: No change.

VI. RECOMMENDATIONS FOR ACTIONS OVER THE NEXT 5 YEARS

1. Implement the Chabot management plan as required by the EIR.
2. Remove native and nonnative vegetation that shades *Arctostaphylos pallida* plants and remove dead *A. pallida* plants at the Huckleberry Preserve and the Big Trees Trail colonies, stimulate seed germination by disturbing soils with high concentrations of seeds in an attempt to scarify the seed coat or by using a burn box.
3. Work with the City of Oakland to eliminate the use of goat grazing in areas occupied by *A. pallida* and to waive the Protected Tree Ordinance fee for restoration activities.
4. Work with the City of Oakland and EBRPD to develop a management plan for *A. pallida*.
5. Remove native and nonnative vegetation that shades the former Manzanita Flat colony, and disturb the soil or use a burn box to stimulate seed germination.
6. Expand colonies at Redwood Regional Park through seed collection, planting, and germination techniques.
7. Work with EBRPD to develop protocol to prevent the spread of fungal pathogens to the Sobrante Ridge colony.

VII. REFERENCES CITED

Adams, J. E. 1934. Some observations on two species of Arctostaphylos. Madroño 2:147-152.

Amme, D. and N. Havlik. 1987. Alameda manzanita management plan. Endangered Plant Project. California Department of Fish and Game. 37 pp.

Amme, D., C. Rice, and N. Havlik. 1987. Inventory and assessment of *Arctostaphylos pallida*, Alameda and Contra Costa Counties. Design Associates Working with Nature. 27 pp.

Bakun, A. 1990. Global climate change and intensification of coastal ocean upwelling. Science 311:63-66.

Boykin, L. M., M. C. Vasey, V. T. Parker, and R. Patterson. 2005. Two lineages of Arctostaphylos (Ericaceae) identified using the internal transcribed spacer (ITS) region of the nuclear genome. Madroño 52:139-147.

Callaway, R. M., and F. W. Davis. 1993. Vegetation dynamics, fire and the physical environment in coastal California. Ecology 74:1567-1587.

Cole, K. 1980. Geological control of vegetation in the Purisima Hills, California. Madroño 27:79-89.

Conrad, S. G., and D. R. Weise. 1998. Management of fire regime, fuels, and fire effects in southern California chaparral: lessons from the past and through the future. *In*: Pruden, T. L., and L. A. Brennan, eds. Fire ecosystem management: shifting the paradigm from suppression to prescription. Pages 342-350. Tall Timbers Fire.

Diffenbaugh, N. S., M. A. Snyder, and L. C. Sloan. 2004. Could CO_2-induced land-cover feedbacks alter near-shore upwelling regimes? Proceedings of the National Academy of Sciences U.S.A. 101:27-32.

Eastwood, A. 1934. A revision of *Arctostaphylos* with key and descriptions. Leaflets of Western Botany 1:105-128.

Garbelotto, M., D. Hüberli, and D. Shaw. 2006. First report on an infestation of *Phytophthora cinnamomi* in natural oak woodlands of California and its differential impact on two native oak species. Plant Disease 90:685

Harrison, A., E. Small, and H. Mooney. 1971. Drought relationships and distribution of two Mediterranean-climate California plant communities. Ecology 52:869-875.

Intergovernmental Panel on Climate Change (IPCC). 2007. Climate change 2007: the physical science basis. Summary for policymakers. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, IPCC

Secretariat, World Meteorological Organization and United Nations Environment Programme, Geneva, Switzerland.

Keeley, J. E. 1987. Role of fire in seed germination of woody taxa in California chaparral. Ecology 68:434-443.

_____. 2002. Fire management of California shrubland landscapes. Environmental Management 29:395-408.

_____. 2005. Fire history of the San Francisco East Bay region and implications for landscape patterns. International Journal of Wildland Fire 14:285-296.

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

Keeley, J. E., and C. J. Fotheringham. 2003. Impact of past, present, and future fire regimes on North American Mediterannean shrublands. *In* Veblen, T. T., W. L. Baker, G. Montenegro, and T. W. Swetnam, eds. Fire and climatic change in temperate ecosystems of the western Americas. Pages 218-262. Springer-Verlag, New York, New York.

Keeley, J. E., C. J. Fotheringham, and M. Morais. 1999. Reexamining fire suppression impacts on brushland fire regimes. Science 284:1829-1832.

Keeley, J.E., and S.C. Keeley. 1989. Allelopathy and the fire induced herb cycle. *In*: Keeley, S. C., ed. The California chaparral–paradigms reexamined. pages 65-72. Proceedings of the symposium. Science Series 34. Los Angeles, California: Natural History Museum of Los Angeles County 154-164.

Keeley, J. E., and P. H. Zelder. 1978. Reproduction of chaparral shrubs after fire: a comparison of sprouting and seeding strategies. American Midland Naturalist 99:142-161.

_____. 2009. Large, high-intensity fire events in southern California shrublands: debunking the fire-grain age patch model. Ecological Applications 19:69-94.

Lebassi, B., J. Gonzalez, D. Fabris, E. Maurer, N. Miller, C. Milesi, P. Switzer, and R. Bornstein. 2009. Observed 1970-2005 cooling of summer daytime temperatures in coastal California. Journal of Climate 22:3558-3573

Loarie, S.R., Carter, B.E., Hayhoe, K., McMahon, S., Moe, R., Knight, C.A., and D.D. Ackerly. June 2008. Climate change and the future of California's endemic flora. PLOS One 3:1-10.

Minnich, R. A. 1983. Fire mosaics in southern California and northern Baja California. Science 219:1287-1294

_____. 1995. Fuel-driven fire regimes of the California chaparral. *In*: Keeley, J. E., and T. Scott, eds. Brushfires in California wildlands: ecology and resource management. International Association of Wildfire, Fairfield, Washington.

_____. 2001. An integrated model of two fire regimes. Conservation Biology 15:1549-1553.

Moritz, M. A. 1997. Analyzing extreme disturbance events: fire in the Los Padres National Forest. Ecological Applications 7:1252-1262.

_____. 2003. Spatiotemporal analysis of controls on shrubland fire regimes: age dependency and fire hazard. Ecology 84:357-361.

Odion, D. C., and F. W. Davis. 2000 Fire, soil heating, and the formation of vegetation patterns in chaparral. Ecological Monographs 70:149-169.

Odion, D., and C. Tyler. 2002. Are long fire-free periods needed to maintain the endangered, fire-recruiting shrub *Arctostaphylos morroensis* (Ericaceae)? Conservation Ecology 6:4.

Radbruch, D. 1969. Aerial and engineering geology of the Oakland east quadrangle. U. S. Geological Survey.

Phytosphere Research. 2010. Soil baiting to test for presence of *Phytophthora cinnamomi*. Diagnostic testing report to the U. S. Fish and Wildlife Service.

Safford, H., and S. Harrison. 2004. Fire effects on plant diversity in serpentine and sandstone chaparral. Ecology 85:539-548.

Snyder, M. A., L. C. Sloan, N. S. Diffenbaugh, and J. S. Bell. 2003. Future climate change and upwelling in the California Current. Geophysical Research Letters, Volume 30, 4 pp.

Swiecki, T. J. and E. Bernhardt. 2003. Diseases threaten the survival of Ione manzanita (*Arctostaphylos myrtifolia*). Phytosphere Research, Vacaville, California.

Swiecki, T. J., E. A. Bernhardt, M. Garbelotto, and E. J. Fichtner. 2007. The exotic plant pathogen *Phytophthora cinnamomi*: a major threat to rare *Arctostaphylos* and much more. Unpublished Report to the California Native Plant Society. 8 pages.

U.S. Fish and Wildlife Service (Service). 1998. Determination of threatened status for one plant, *Arctostaphylos pallida* (pallid manzanita), from the northern Diablo range of California. Final Rule. Federal Register 63:19842-19850.

_____. 2002. Draft recovery plan for chaparral and scrub community species east of San Francisco Bay, California. Portland, Oregon.

Personal Communications

Michael Vasey. 2010. Assistant Professor, Department of Biology, San Francisco State University.

Ralph Kanz. 2010. Conservation Director, Alameda Creek Alliance.

Wilde Legard. 2010. East Bay Regional Park District, Oakland, California.

In Litt.

Johnson, B. 1983. Letter to The Nature Conservancy Endangered Plant Program Coordinator: Observations and recommendations for *A. pallida* management. 27 pp.

Kanz, R. 2004. Status of pallid Manzanita (Arctostaphylos pallida) in the Sausal Creek Watershed. Prepared for the Restoration Committee of the Friends of Sausal Creek.

LSA Associates, Inc. 2009. Wildfire Hazard Reduction and Resource Management Plan. Prepared for East Bay Regional Parks.

Solvesky, Ben. 2010. Fish and Wildlife Biologist, Sacramento Fish and Wildlife Office, U.S. Fish and Wildlife Service.

Table 1. *Arctostaphylos pallida* plant count survey results.

Huckleberry Ridge Population	Ownership	First Survey Year	Plant Count	Recent Survey Year	Plant Count
Huckleberry Botanical Preserve	EBRPD*	1985	Estimated 2,400 to 2,700	2004	747 mature, 176 seedlings
Redwood Park #1	EBRPD*	1985	1	2010	1 mature, 12 seedlings
Redwood Park #2	EBRPD*	2010	1 mature, 60 seedlings	2010	1 mature, 60 seedlings
Redwood Park #3	EBRPD*	2010	1	2010	1
Sibley Volcanic Preserve	EBRPD*	1992	3	2004	1
Pinehurst Rd.	EBMUD**	1985	25	2010	7 mature, 7 seedlings
Joaquin Miller Park, Manzanita Flat	City of Oakland	1989	19	2004	0
Joaquin Miller Park, Chabot	City of Oakland	1994	21	2006	10
Joaquin Miller Park, Big Trees Trail***	City of Oakland	1989	65	2006	51 mature, 40 seedlings
Joaquin Miller Park, Sequoia-Bayview	City of Oakland	1999	1	2010	0
Manzanita Dr.	Private	1985	< 100	2004	< 50
Exeter Dr.	Private	2001	NA	2004	7
Ascot Dr.	Private	1986	1	2004	0
Huckleberry Population Total					876 mature 295 seedlings

Table 1 (continued). *Arctostaphylos pallida* plant count survey results.

Sobrante Ridge Population	Ownership	Survey Year	Plant Count	Survey Year	Plant Count
Sobrante Ridge	EBRPD*	1985	Estimated 1,700 to 2,000	2004	454

Tilden Park Population	Ownership	Survey Year	Plant Count	Survey Year	Plant Count
Park Hill Rd./Shasta Rd.	EBRPD*	1981	< 50	2004	12
Wildcat Canyon Rd.	EBRPD*	1986	NA	2004	8

All Known Plants	1350 mature, 295 seedlings

**East Bay Regional Park District

**East Bay Municipal Utility District

***Referred to as "Roberts" in CNDDB

U.S. FISH AND WILDLIFE SERVICE 5-YEAR REVIEW

***Arctostaphylos pallida* (pallid manzanita)**

Current Classification: Threatened

Recommendation Resulting from the 5-Year Review:

____ Downlist to Threatened
__X__ Uplist to Endangered
____ Delist
____ No change needed

Review Conducted By: Ben Solvesky, Sacramento Fish and Wildlife Office

FIELD OFFICE APPROVAL:

Lead Field Supervisor, U.S. Fish and Wildlife Service

Approve Susan C Moore Date 4/29/2011

REGIONAL OFFICE APPROVAL:

Lead Assistant Regional Director, Ecological Services, U.S. Fish and Wildlife Service, Region 8

Approve _____ Date 4/29/2011