Arctostaphylos confertiflora
(Santa Rosa Island Manzanita)

5-Year Review:
Summary and Evaluation

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

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5-YEAR REVIEW

Arctostaphylos confertiflora (Santa Rosa Island 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 confertiflora (Santa Rosa Island manzanita) is a perennial shrub in the heath family (Ericaceae) that normally reaches 2 meters (6.5 feet) and occasionally up to 6 meters (20 feet) in height. It occurs in both prostrate and upright forms, with the prostrate form most likely resulting from climatic influences and herbivory. This species is endemic to Santa Rosa Island in the northern Channel Islands of southern California, where it is found in only three populations. *Arctostaphylos confertiflora* occurs as a component of mixed chaparral, mixed woodland, and island pine (*Pinus torreyana, P. muricata*) woodland vegetation types (Service 2000). The Service listed *Arctostaphylos confertiflora* as endangered because of soil loss, low reproductive success, and herbivory by deer and elk (Service 1997). As of December 2011, nearly all deer and elk have been removed from the island and herbivory no longer occurs.

Methodology used to complete the review

This review was prepared by the Ventura Fish and Wildlife Office, following guidance issued by Region 8 in March 2008. To update the status of *Arctostaphylos confertiflora,* we considered information from the recovery plan (Service 2000), information from our files, published and unpublished literature; personal communications with land managers and experts (especially staff of the National Park Service (NPS) and the U.S. Geological Survey-Biological Resources Discipline (USGS) at the Channel Islands National Park (Park)), 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. 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 and since 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 provide 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.

As part of a settlement agreement, in 1998, *Arctostaphylos confertiflora* was selected as a target species for purposes of tracking the impacts from ungulates as well as the recovery of the species and its habitat over a 7-year period. The previous 5-year review (Service 2008) contained lengthy and detailed monitoring information regarding the health and vigor of the populations resulting from this monitoring effort. We have omitted this information where it seemed redundant and would not contribute to the current review. The reader is referred to the previous review if interested in this information (Service 2008).

Contact Information

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Federal Register Notice Citation Announcing Initiation of This Review: We published a notice announcing initiation of the 5-year review of this taxon and the opening of a 60-day period to receive information from the public in the Federal Register (FR) on May 25, 2011 (76 FR 30377). We did not receive any information in relation to this species.

Listing history:

> **Original Listing**
> **FR notice:** 62 FR 40957
> **Date listed:** July 31, 1997
> **Entity listed:** *Arctostaphylos confertiflora* (species)
> **Classification:** Endangered

Review History: We conducted the only formal status review of *Arctostaphylos confertiflora* in the most recent 5-year review (Service 2008), and we recommended no change in the listing classification as endangered.

Species' Recovery Priority Number at Start of 5-Year Review: The recovery priority number for *Arctostaphylos confertiflora* is 2 according to the Service's 2011 Recovery Data Call for the Ventura 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). Recovery priority number 2 indicates that the taxon is a species that faces high threats and has a high recovery potential.

Recovery Plan or Outline

> **Name of Plan:** Thirteen Plant Taxa from the Northern Channel Islands Recovery Plan
> **Date Issued:** September 26, 2000
> **Dates of Previous Revisions:** No revisions have been made.

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 limits listing as distinct population segments only to vertebrate species of 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.

Updated Information and Current Species Status, Biology, and Habitat

Description and Taxonomy

Arctostaphylos confertiflora is a long-lived perennial chaparral shrub in the heath family (Ericaceae). Individuals in the upright form normally reach 2 meters (6.5 feet) and occasionally up to 6 meters (20 feet) in height. The species also occurs in a prostrate form most likely resulting from climatic influences (e.g., wind exposure) and/or herbivory and trampling. Clusters of white to pale cream urn-shaped flowers are borne on the tips of the branches. Each flower has the potential to produce a berry-like fruit containing 2 to 10 seeds. There have been no changes to the taxonomy in the most recent treatment of the genus in the Jepson Manual (Parker et al. 2012).

Life History

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 (such as browsing). The other group has lost this ability to resprout and, as such, reproduce only by seed (obligate seeder) (Tyler and Odion 1996). *Arctostaphylos confertiflora* falls into this latter group. Obligate seeders produce seeds annually, and a small proportion of the seeds may germinate each year. Dormant seeds are long-lived and accumulate in leaf litter and soil over time creating a long-term seed bank. Masses of seedlings are seen when environmental conditions trigger the dormant seeds to germinate (McEachern 2001). Often in chaparral, the trigger is a fire; although we do not know the exact germination triggers for *A. confertiflora*, there is no reason to think it is different for this species of *Arctostaphylos.*

The Ransom Seed Lab (2007) tested the viability of *Arctostaphylos confertiflora* seeds and observed viability rates between 91.4 and 98.4 percent; however, none of the seeds germinated

under standard lab conditions (cold stratification method). On Santa Rosa Island, individual seedlings of *A. confertiflora* are rare, and masses of seedlings have not been seen.

Pollination and seed production in *Arctostaphylos confertiflora* are not well understood. Researchers studying *A. pringlei* (a closely related obligate seeder) observed that the species was pollinated by solitary bees, bumblebees (*Bombus* spp.), and syrphid flies (family Syrphidae); and the heaviest visitation was from honey bees (*Apis* spp.). They also observed successful self-pollination in *A. pringlei* (Fulton and Carpenter 1979).

Distribution

Arctostaphylos confertiflora is endemic to Santa Rosa Island and its distribution remains unchanged since our last status review (Service 2007). At listing in 1997, the species was known from two populations: the northeast portion of the island near and east of Black Mountain; and at South Point on the south side of the island (see Figure 1) (Service 1997). During surveys conducted from 1996 to 1998, NPS staff located a third population on the southeast side of the island at a site known as Sierra Pablo (Service 2000; McEachern, *in litt.* 2006). No other populations have been found since then. The NRCS (2006) surveyed Santa Rosa Island in 2006 to more accurately identify the outer boundaries of the three populations. The results indicate that, historically, *A. confertiflora* used to be more widely distributed on Santa Rosa Island (Rodriguez pers comm. 2007, 2012). The distribution of the three known populations is generally the same as it was at the time of listing; we know this because establishment of new individuals is a rare event, and all known individuals have been established for many decades. Therefore, the population located in the 1996-1998 surveys also likely existed at the time of listing in a similar distribution.

Ungulates were only recently removed from Santa Rosa Island, and animal trails are likely still present at all three populations. According to the NPS, browsing and trailing was a source of intra-population fragmentation, creating gaps between individual *Arctostaphylos confertiflora* plants (Rodriguez, *in litt.* 2006a). These gaps between plants are more susceptible to erosion (Rodriguez, *in litt.* 2006a), but it is not clear how separation might otherwise affect distribution.

Abundance

The listing rule cited McEachern and Wilken (1996) reporting that an estimated 400 plants were estimated to exist in 1996. The recovery plan (Service 2000) reported fewer than 400 plants at Black Mountain and approximately 200 plants at the South Point site. Surveys from 1996 to 2001 by USGS and NPS staff identified additional individuals and estimated that there were about 2,500 plants in existence (McEachern, *in litt.* 2001). In 2001, a scientific panel began monitoring the Sierra Pablo population (Schreiner et al. 2002). After surveys completed in January and February 2006, 4,700 to 6,700 plants were estimated to occur at Black Mountain, amounting to 4,300 to 6,300 more individuals than known at the time of listing from this site. Approximately 1,700 plants were counted at Sierra Pablo in 2006, amounting to 700 additional plants than were reported in 2000 (Rodriguez, *in litt.* 2006b). Plant numbers at South Point did not change. The increase in number of individuals reported reflects an increase in the accuracy of survey estimates, not an actual increase in size of populations (see Table 1 below).

Table 1: Estimated number of individuals in 3 *Arctostaphylos confertiflora* populations.

	1996	2000	2001	2006
Black Mountain	unspecified	<400	unspecified	4,700 - 6,700
South Point	unspecified	200	unspecified	200
Sierra Pablo	--	--	unspecified	1,700
Total	400	600	2,500	6600 - 8600

In 2008, the size of the Sierra Pablo population was reduced when several individuals died following defoliation by tussock moth caterpillars (family = Lymantriidae) (McEachern and Rodriguez 2008).

Population Trends

Arctostaphylos confertiflora is a long-lived perennial (individuals of the species may live 100 years or longer (Schreiner et al. 2006; D. Rodriguez, NPS, *in litt.* 2013)), and long term monitoring is necessary to identify meaningful population trends. This is because both recruitment (successful germination and establishment of new individuals) and mortality may not occur often enough to be observed frequently. Recruitment has been nearly zero at all three population locations for as long as monitoring has occurred. Only two seedlings were found in 2005, one inside and one outside the Sierra Pablo exclosure, and no seedlings have become established on any site, inside or outside the exclosures, since 1998 (Schreiner et al. 2006; D. Rodriguez, NPS, *in litt*. 2013). There has also been little change in the number of adult plants detected since our 2007 status review. The size of the Sierra Pablo population was reduced in 2008 when as few as seven individuals died following defoliation by tussock moth caterpillars, and several others died by unknown causes (McEachern and Rodriguez 2008).

As discussed in the Life History section above, the survival strategy for *Arctostaphylos confertiflora* includes long-term seed banking in areas suitable for survival of seedlings that germinate as a result of a suitable environmental trigger. Since the removal of ungulates, there has been an increase in the number of flowers and fruits (D. Rodriguez, NPS, *in litt*. 2013), and it is likely that the size of the seed bank is also increasing. At this time, some components of this survival strategy, specifically seed production, are improving. However, other components, such as availability of a suitable seed bed for germination is degraded or missing in much of the habitat.

It is not possible to determine population trends (based on recruitment and mortality rates) at this time for *Arctostaphylos confertiflora*. This is because the species is long-lived and will only recruit new individuals into the populations when triggered by fire or some other event that triggers germination. Even though we cannot determine population trends at this time, the health and vigor of the individuals within the populations appears to be improving, in absence of browsing pressure. Although data are not yet available, the NPS and USGS continue to monitor metrics such as the growth rates and production of flowers and fruits that were previously monitored by the scientific panel; these metrics show individual *A. confertiflora* are improving in comparison to a decade ago (McEachern pers. comm. 2013; also see monitoring data in Service 2008).

Habitat or Ecosystem

Santa Rosa Island is 26.5 miles (42.6 km) from the mainland and receives an average of 15 inches (38.1 cm) of rain annually (http://www.nps.gov/chis/planyourvisit/island-facts-santa-rosa-islands.htm). *Arctostaphylos confertiflora* is found on Monterey shales, San Miguel volcanic sediments, and sandstone outcrops as mapped by Weaver et al. (1969). The island experiences significant wind and, in some instances, this contributes to prostrate forms of *A. confertiflora.* The species is a member of the island chaparral community, occurring as a component of mixed chaparral, mixed woodland, and pine woodland vegetation types (Service 2000).

All but a few non-native ungulates were removed from Santa Rosa Island in 2011 (Rodriguez pers. comm. 2012), and direct habitat destruction and curtailment by these animals is no longer a threat. However, because the ungulates were removed only recently, their impact on *Arctostaphylos confertiflora* habitat has not yet been reversed. Remaining indirect effects of ungulates to *A. confertiflora* include edge effects from game trails, as well as wind and water erosion continuing to affect the seed bank, seed bed for future germination, and leaf litter.

Genetics

We are not aware of any genetic studies of *Arctostaphylos confertiflora.*

Species-specific Research and/or Grant-supported Activities

In 2008, surveys were conducted for *Arctostaphylos confertiflora* in potentially suitable chaparral habitat on Santa Rosa Island, but no new individuals were discovered (McEachern and Rodriguez 2008). In 2009 and 2011, the NPS conducted a series of surveys across the island to identify potential restoration sites. Although no additional *A. confertiflora* were found, they identified sites that contain suitable habitat for the species (Hiebert et al. 2013). In addition, the NPS and USGS have collected demographic data for *A. confertiflora* each year since our 2007 status review (McEachern 2011). The NPS and USGS are currently conducting a study to determine the best way to promote germination of *A. confertiflora* seeds (Rodriguez pers. comm. 2012). We are unaware of any other species-specific research or grant-supported activities for *A. confertiflora*.

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 its habitat or range:

The listing rule for *Arctostaphylos confertiflora* identified soil loss (via erosion) and habitat alteration by non-native mammal species as Factor A threats to the species. All non-native ungulates excepting a few deer were removed from Santa Rosa Island in 2011 (Rodriguez pers. comm. 2012), and direct habitat destruction and curtailment by these animals is no longer a threat. However, because the ungulates were removed only recently, their impacts on *A. confertiflora* have not yet been reversed. Remaining indirect effects of ungulates on *A. confertiflora* habitat include edge effects from game trails, as well as wind and water erosion

continuing to affect the seed bank, seed bed, and leaf litter. Although small increases in litter cover have occurred in some areas since monitoring started in 2001 (Schreiner et al. 2006), the ground underneath arborescent *A. confertiflora* individuals is exposed and accumulated leaf litter tends to be removed by wind (Rodriguez pers. comm. 2012).

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

The listing rule did not identify overutilization for any purpose as a threat to *Arctostaphylos confertiflora*, and we know of no commercial, recreational, scientific, or educational activities that currently threaten *A. confertiflora*.

FACTOR C: Disease or Predation:

Damage from ungulates

The 1997 listing rule and the 2007 5-year review identified herbivory (predation) as one of the primary threats to *Arctostaphylos confertiflora*. The NPS and USGS documented browsing on *A. confertiflora* flowers, fruit, and woody tissue and theorized that this damage stunted individual plant growth, largely precluded seed production, and eliminated recruitment.

Under a court-approved settlement agreement (United States District Court for the Central District of California 1997), the numbers of cattle, elk, and deer were to be reduced through a phased approach to complete removal by 2011. Cattle were removed from Santa Rosa Island in 1998, and nearly all remaining ungulates were removed by December 2011. Implementation of this agreement alleviated the primary threat to *Arctostaphylos confertiflora* and facilitated NPS' habitat management efforts on Santa Rosa Island.

Starting in 2008, deer and elk herds were culled according to a phased reduction schedule, ending with nearly all non-native ungulates removed by the end of 2011. Following this phased culling, the NPS observed decreased browsing of *Arctostaphylos confertiflora* and increased flower, fruit, and seed production (Rodriguez pers. comm. 2012). There are a small number of radio-collared deer on Santa Rosa Island that are being tracked by the NPS. The NPS expects that the collared deer will herd with any deer missed by the removal efforts, at which point the balance of deer will be removed (Rodriguez pers. comm. 2012). Although direct predation by deer and elk is no longer a threat, the previous damage caused by these browsers is still evident and likely will be for some time.

Damage from other predators

Our 2007 5-year review reported insect damage to individuals of *Arctostaphylos confertiflora* in all three populations. Damage included fruit and seed predation (Rodriguez, pers. comm. 2006a, 2012) and leaf damage (Dale-Cesmat, *in litt.* 2005; Rodriguez, pers. comm. 2006b, 2012). The NPS correlated apparently higher levels of "die-back" with insect damage at Black Mountain (Rodriguez, *in litt.* 2006c). In late 2007, the NPS and USGS observed defoliation of *A. confertiflora* individuals by tussock moth caterpillars. In the following spring, at least seven individuals appeared to have died as a result (McEachern and Rodriguez 2008). The individual plants killed by the moths were already stressed by other factors, and it is likely that healthy *A.*

confertiflora would be resilient to defoliation by tussock moths (Rodriguez pers. comm. 2012). Tussock moths appear on *A. confertiflora* in an irregular, multi-annual cycle. We are uncertain regarding the extent to which insect damage represents a threat to the species; however, tussock moths can rapidly defoliate plants (Brubaker 1978, Harrison and Maron 1995) and could pose a threat to species such as *A. confertiflora* that have a restricted range and low reproductive success.

The NPS has observed the Santa Rosa Island fox (*Urocyon littoralis santarosae*) consuming *Arctostaphylos confertiflora* seeds, although the seeds appear to pass through the fox digestive system intact (Rodriguez, *in litt.* 2007). The island fox is likely having minimal impact on *A. confertiflora* individuals or the species as a whole. Seed viability testing was conducted on seeds contained in island fox scat; results indicate that there was no loss of viability in these seeds compared to the viability of undigested seeds (Ransom Seed Lab 2007).

FACTOR D: Inadequacy of Existing Regulatory Mechanisms:

The listing rule identified several Federal laws and NPS policies and guidelines that apply to the management of NPS lands. These laws and guidelines include the National Environmental Policy Act (NEPA), the Federal Endangered Species Act, the enabling legislation that established the Park (Public Law 96-199), NPS guidelines for natural resources management (NPS 1991), the NPS Statement for Management (NPS 1985), and a Resource Management Plan specific to Santa Rosa Island (NPS 1997). Our 2007 5-year review summarized the regulatory mechanisms thought to have some potential to protect *Arctostaphylos confertiflora,* and this analysis appears to remain valid.

Our 2007 5-year review also discussed additional regulatory tools that were not available at the time of listing. Specifically, a court-ordered settlement agreement called for the establishment of a scientific panel to monitor target species (including *Arctostaphylos confertiflora*) and habitat conditions over a 7-year period. Also pursuant to the settlement agreement, cattle were removed in 1998 and the ungulate numbers were to be reduced through a phased approach to complete removal by 2011 (United States District Court for the Central District of California 1997). Implementation of this agreement alleviated the primary threat to *A. confertiflora* and facilitated NPS' habitat management efforts on Santa Rosa Island. Though not a regulatory document, the Park also developed a draft NPS Conservation Strategy (Coonan et al. 1996) that included specific guidelines for *A. confertiflora* that has assisted NPS in these efforts.

As of 2013, the Park is preparing to release a draft of the revised general management plan for Channel Islands National Park. Because most non-native ungulates have been removed from Santa Rosa Island, a revised general management plan will allow the Park to focus on management issues relating to restoration of native habitats and the sensitive species that depend upon them.

At the time of listing, the fact that *Arctostaphylos confertiflora*, along with 12 other species, had been classified as an endangered species under the Act provided additional impetus to the Park and other partners to utilize existing regulations to improve management of the lands the species depends on. With the removal of most non-native ungulates from Santa Rosa Island, the current

threats to the species have shifted to other factors including erosion, low reproductive success, stochastic events, and potential effects of climate change. While these factors still pose challenges to the recovery of the species, they are ones that are unlikely to be addressed through the regulatory authority of the Act.

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

The listing rule identified low reproductive success as a threat to *Arctostaphylos confertiflora*. In this 5-year review, we also identify stochastic events and climate change as threats.

Low Reproductive Success

Both the listing rule and the 2007 5-year review linked the species' low reproductive success to browsing pressure; at that time, we were referring to the recruitment of new *Arctostaphylos confertiflora* individuals into the population. Challenges to successful recruitment are twofold: the lack of seed production, and the lack of germination.

Seed production: A large and viable seed bank is critically important. During a fire, all seedlings and adult plants could perish, leaving the only chance of the population's survival through the germination of the seeds in the seed bank. In some locations, the past browsing pressure resulted in plants that never had the opportunity to fruit, flower, and produce seed. In other locations, plants had become arborescent through browsing of the lower portions of the plant; in this case, even if the plants produced seed, the increased erosion under and around stands did not provide suitable conditions for seed retention and germination. These effects compromised the seed bank and reduced the quality of germination sites. The magnitude of the effect is greater at some sites than others.

Germination: The Ransom Seed Lab (2007) completed a study on the viability of *Arctostaphylos confertiflora* seeds since our 2007 5-year review. The study found that the viability rate for living, mature seeds was between 91.4 and 98.4 percent, but the germination rate during standard lab testing was zero. These results are not uncommon for *Arctostaphylos* species (Rodriguez pers. comm. 2012), because members of this genus typically require a specific trigger (such as scarification from a fire event) to break seed dormancy and allow germination to occur.

Since ungulate removal, increases in the number of flowers and fruits have been observed (D. Rodriguez, NPS, *in litt*. 2013), and although not measured quantitatively, a qualitative increase in seed production has been observed. Although seed production and germination have been low for many decades, ungulate removal is nearly complete, which has alleviated browsing pressure on the plants. As a result, flowering and fruiting has increased, as has seed production and, presumably, contributions to the seed bank. To date, increased seed production has not resulted in any observable increase in germination and establishment of new individuals. However, the accumulation of a seed bank over time would be important for ensuring that seeds are available for germination and establishment whenever an appropriate trigger event occurs in the future.

Stochastic Events

Although the extant populations of *Arctostaphylos confertiflora* are not particularly small, there

are only three. Rarity, including a small number of populations, makes a species vulnerable to stochastic events. *Arctostaphylos confertiflora* is a long-lived species and there are 6,500 to 8,500 individuals on Santa Rosa Island. Therefore, most natural stochastic events are unlikely to extirpate all three populations. One exception is fire. Although the species is an obligate seeder and likely requires fire for large-scale germination, mature plants of this species do not regenerate when damaged by fire as do burl-forming species of *Arctostaphylos*. In addition, the species' depleted seed bank may preclude large-scale germination required to replace destroyed mature plants. Therefore, a large enough fire could extirpate one or more of the three known *A. confertiflora* populations.

Climate Change

Since the last 5-year review, we have recognized climate change as a potential new threat. Current climate change predictions for terrestrial areas in the northern hemisphere indicate warmer air temperatures, more intense precipitation events, increased summer continental drying, and increased fire frequency (Field et al. 1999; Cayan et al. 2005; Westerling et al. 2006; IPCC 2007). Increased fire frequency could have positive or negative impacts on *Arctostaphylos confertiflora*. Recently, Loarie et al. (2008) modeled the potential impacts of climate change on the flora of California. They predicted that species' distributions will shift in response to climate-driven habitat changes. Specifically, they predicted that, in general, species will shift northward and to higher elevations, and may experience a reduction in the extent of available habitat. Species will redistribute with shifting habitat, depending on the ability of each species to do so. Species diversity will also shift with a general trend of diversity increasing towards the coast and northwards, with these areas becoming de facto future refugia. Given the narrow geographic range of *A. confertiflora*, the species will have limited ability to disperse in response to climate change.

Predictions of climatic conditions for California and for smaller sub-regions such as the California Channel Islands remain uncertain (Loarie et al. 2008, CNRA 2009). At the species level, McEachern et al. (2009) found a significant negative correlation between temperature and population size of an endemic perennial (*Castilleja mollis*) on Santa Rosa Island. Although these results do not directly translate to *Arctostaphylos confertiflora*, they suggest a possible response of *A. confertiflora* to changing climate. While we recognize that climate change is an important issue with potential effects to listed species and their habitats, we lack adequate information to make accurate predictions regarding its effects to particular species at this time.

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.

The Service completed the final recovery plan for *Arctostaphylos confertiflora* in September, 2000 (Service 2000). The recovery plan includes criteria that should be met to downlist and delist the species. Table 2 displays downlisting criteria, the delisting criterion, and conservation actions identified in the Recovery Plan, as well as the current status/progress of those recovery actions.

Criteria to downlist
Maintain three stable or increasing populations on Santa Rosa Island with evidence of natural recruitment for a 30-year period including the normal precipitation cycle.

This criterion addresses Factors A, C, and E. This criterion has not been fully met. Although the three *Arctostaphylos confertiflora* populations have been largely stable, they have not increased in size, seed production is limited, successful recruitment has not been documented, and mature individuals have died.

This criterion is relevant to the species' current status and current threats, and progress towards achieving this criterion has been made in two ways. First, since the listing rule, the NPS surveyed for *Arctostaphylos confertiflora* and documented a third population. Second, the NPS alleviated the primary threat to *A. confertiflora*, its habitat, and survival of seeds, seedlings, and young plants by removing all but a few ungulates from the Island in late 2011. Third, although the populations have not increased in size, they have regained some growth and vigor, which in time, may lead to increased capacity to reproduce.

Our 2007 5-year review included Factor D as one of the Factors addressed by this criterion, because NPS previously had been unable to satisfactorily address threats to *Arctostaphylos confertiflora* with the existing regulatory mechanisms. Non-native ungulates, the primary threat to the species and the source of two other threats identified at listing (low reproduction and erosion) have been removed. With the primary threat alleviated, we expect existing regulatory mechanisms to provide a framework within which the remaining threats may be addressed.

Criterion to delist
No decline in populations for 10 years after downlisting.

This criterion addresses Factors A, C, and E. This criterion cannot be achieved until *Arctostaphylos confertiflora* is downlisted.

Table 2: Status of delisting/downlisting criteria and conservation actions identified in the Recovery Plan.

Downlisting Criterion	**Current Status of the Criterion/Action**
Maintain three stable or increasing populations on Santa Rosa Island with evidence of natural recruitment for a 30-year period including the normal precipitation cycle. This criterion addresses Factors A, C, D, and E.	This criterion has not been met, although three populations of *Arctostaphylos confertiflora* occur on Santa Rosa Island. The species appears stable, but seed production is limited, successful recruitment has not been documented, and mature individuals have died.
Delisting Criteria	
No decline for 10 years after downlisting. This criterion addresses Factors A, C, D, and E.	This criterion has not yet been met.
Ensure all potential habitat is surveyed. This criterion addresses Factors A, C, and E.	Some surveys have been done, so this criterion has been partially met
Conservation Actions from Recovery Plan	
Store seed in Center for Plant Conservation cooperating facilities.	Seeds have not been stored in these facilities
Understand seed germination, propagation techniques, and fire ecology.	A seed viability analysis was completed. A germination/propagation study is underway.
Develop and maintain a natural seed bank.	NPS is researching the presence of a natural seed bank on site. Limited seed banks exist to widely varying degrees at each population.
Develop a fire management plan.	The NPS completed a fire management plan in June 2006. The plan requires the NPS to consider measures to prevent, protect, and mitigate potential adverse impacts of wild land fire (National Park Service 2006).
Protect *Arctostaphylos confertiflora* from browsing to allow reproduction.	The removal of non-native ungulates from Santa Rosa Island has eliminated browsing pressure on *A. confertiflora*. This action has been completed.
Conduct life history research and incorporate into recovery criteria.	This action is partially complete. Monitoring is ongoing but analysis is not complete; data will eventually contribute to understanding of life history.
If declining, determine cause and reverse the trend.	The species appears stable, but seed production is limited, successful recruitment has not been documented, and mature individuals have died. The primary causes of decline were/are herbivory and a lack of a germination trigger. The NPS has taken steps to reverse this trend by removing non-native ungulates and researching the species' reproductive biology.

IV. SYNTHESIS

In the listing rule and the 2007 5-year review, we discussed that *Arctostaphylos confertiflora* was threatened by soil loss, low reproduction, and herbivory. All of these threats were caused primarily by non-native ungulates. In late 2011, the NPS completed removal of all but a few ungulates from Santa Rosa Island. Although not enough time has passed since the ungulates were removed for any new population trends to develop, the direct causes of habitat loss and predation of *A. confertiflora* have been alleviated.

Compared to what we knew at the time of listing, we now know that there are more populations and more numbers of individuals of *Arctostaphylos confertiflora*. The listing rule reported 2 populations and 400 individuals, and we currently know of three populations and estimate 6,600 to 8,600 individuals of *A. confertiflora* on Santa Rosa Island. Despite the increase in populations and individuals, the species' recovery is challenged by relative rarity (e.g., small number of populations), lack of recruitment, and stochastic events. Additional potential threats include insect damage and climate change. That said, the increase in the number of known populations and individuals decreases the risk from stochastic events and improves our confidence in the species' ability to eventually recover.

In addition to its rarity and potential threats from climate change and stochastic events, the lack of observed germination and establishment is a concern. *Arctostaphylos confertiflora* is a long-lived species, and we now know the population is substantially larger than we knew it to be at the time of listing. Browsing, the primary cause of the species' decline, has been removed; this has resulted in an increase in flowering, fruiting, and seed production. We think it is likely that contribution to the seed bank has also increased. A larger seed bank would be one factor that would contribute to successful germination and establishment of new individuals in the future when triggered by appropriate conditions. However, the species has yet to demonstrate recruitment or long-term population stability, and the downlisting criterion has not been met. Therefore, we determined that *A. confertiflora* continues to meet the definition of endangered, and we recommend no change in listing status.

V. RESULTS

A. Recommended Classification:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist (*Indicate reasons for delisting per 50 CFR 424.11):*
____ *Extinction*
____ *Recovery*
____ *Original data for classification in error*
__X_ No change is needed

B. New Recovery Priority Number and Brief Rationale: 8. In the Recovery Plan, we designated the recovery priority number of 2; this indicates a species with a high degree of threat and a high recovery potential. In the 2007 5-year review, we recommended no change.

With this review, we recommend changing the recovery priority number to 8; this designates a species with a moderate degree of threat and a high recovery potential. We now think the threats are moderate in degree because the primary threat (browsing) to *Arctostaphylos confertiflora* has been alleviated, and we now know that there are more individuals than we knew about at the time of listing.

IV. RECOMMENDATIONS FOR FUTURE ACTIONS.

1. We recommend that the NPS conduct a threats assessment for insect damage to *Arctostaphylos confertiflora*. If the assessment indicates insect damage is a concern, the NPS could consider a trial insect control program and additional monitoring to track the extent of insect damage.

2. *Arctostaphylos confertiflora* seeds may require episodic disturbances to stimulate seed germination. These conditions are critical for the establishment and survival of new generations and recovery of the species. Additional research should be done to identify germination cues using methods that are more appropriate for fire-adapted seeds. Once germination cues are better understood, the NPS could explore ways to enhance these conditions in the field through activities such as controlled burns and erosion control.

3. Because this species is an obligate seeder and regeneration is sporadic without the presence of disturbance such as fire, an important measure of recovery is the size and viability of the seed bank. The seed bank should be monitored at regular intervals (such as every 3 years) by surveying the amount of seeds in the soil seed bank and conducting seed viability analysis on the seed samples collected during the surveys.

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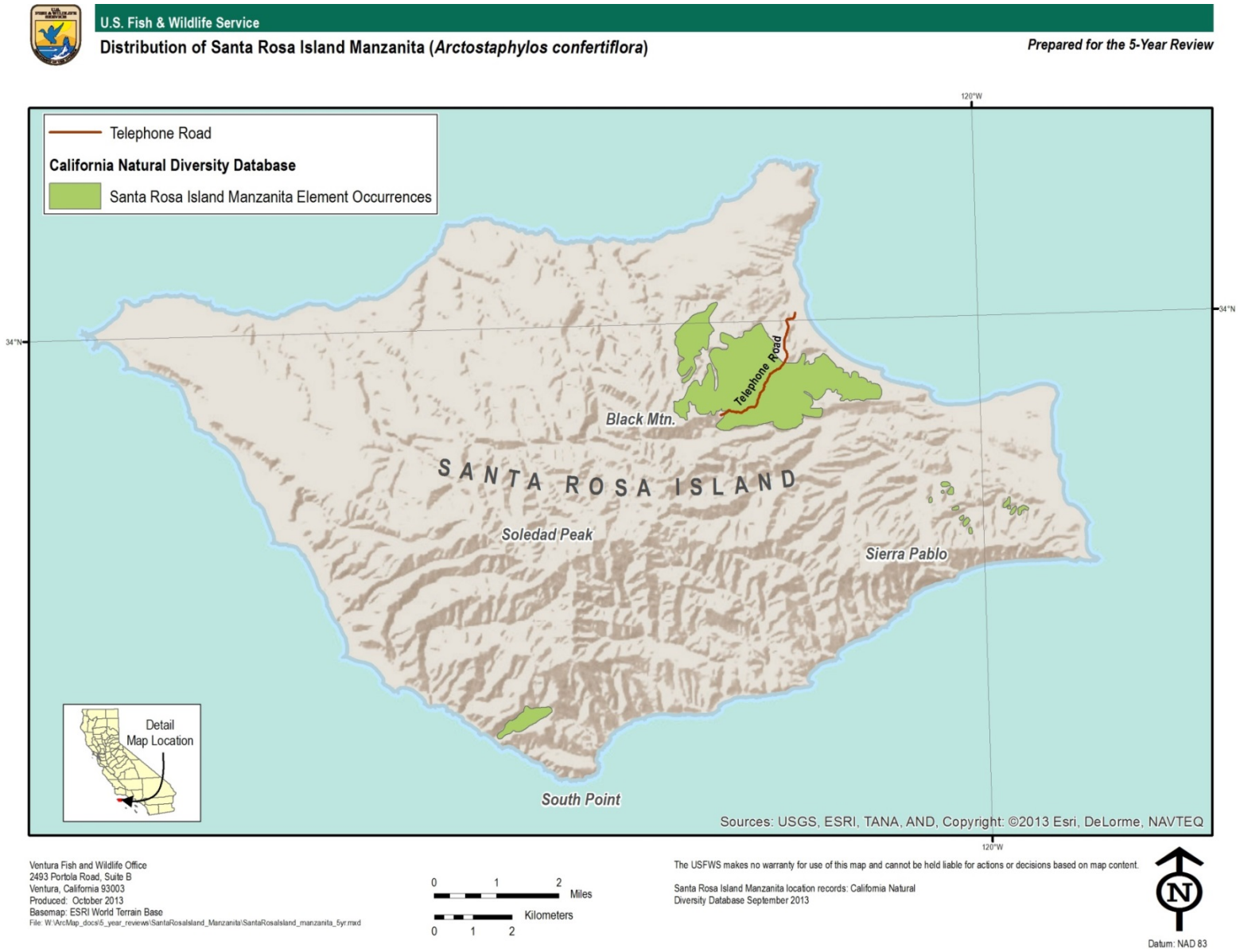

Figure 1: *Arctostaphylos confertiflora* distribution on Santa Rosa Island.

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

***Arctostaphylos confertiflora* (Santa Rosa Island Manzanita)**

Current Classification: Endangered

Recommendation resulting from the 5-Year Review:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
_X__ No change is needed

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

Review Conducted By: David Simmons

FIELD OFFICE APPROVAL:

Field Supervisor, Fish and Wildlife Service

Approve _____ Date 7/30/14