Santa Rosa Island Manzanita (*Arctostaphylos confertiflora*)

5-Year Review: Evaluation and Summary

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

July 2024

5-YEAR REVIEW
Santa Rosa Island Manzanita (*Arctostaphylos confertiflora*)

GENERAL INFORMATION:

Species: Santa Rosa Island manzanita **(***Arctostaphylos confertiflora* Eastw.)
Date listed: July 31, 1997
Federal Register (FR) citation: 62 FR 40957
Classification: Endangered

Critical Habitat Designation:
We have not designated critical habitat for Santa Rosa Island manzanita.

State Listing: None (CNDDB 2024).

BACKGROUND:

Species overview:
Santa Rosa Island manzanita is a shrub in the heath family (Ericaceae) that can grow up to 2 meters (6 feet) high and wide (Parker et al. 2023). The urn-shaped flowers are produced in late winter and early spring, and the 8–11 millimeter (0.3–0.5 inches) wide globular fruits contain several seeds in stony segments that may or may not be fused. The species is found on sandstone outcrops, in maritime island chaparral, and in close-coned pine and island oak forests (Kauffmann et al. 2021, p. 54)

Santa Rosa Island manzanita occurs on Santa Rosa Island in Santa Barbara County, California. The island is entirely owned by Channel Islands National Park (CINP), and the land is managed for natural resource conservation. There is a single specimen collected in 1930 from adjacent Santa Cruz Island; we discuss this specimen below. Santa Rosa Island has no native ungulate herbivores; however, starting in the early 1800s, ranching brought several non-native ungulate herbivore species to the island (Livingston 2016, pp. 143–254). All these non-native ungulate herbivores have been removed from the island, mostly following the establishment of CINP in 1980. Sheep were removed in the 1960s; pigs in 1993; cattle in 1998; deer and elk from 2011 to 2014 (McEachern *et al*. 2016, pp. 759–760); and the final horses died in 2021 (Andrew Adams pers. comm.). The current primary threats to Santa Rosa Island manzanita are residual effects from non-native ungulate herbivores.

Most recent status review:
[Service] U.S. Fish and Wildlife Service. 2021. Santa Rosa Island manzanita (*Arctostaphylos confertiflora*). 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service, Ventura Field Office, Ventura, California. 10 pp.

In our 2021 status review, we recommended no status change from endangered for Santa Rosa Island manzanita.

FR notice citation announcing this status review:
[Service] U.S. Fish and Wildlife Service. 2023. Endangered and Threatened Wildlife and Plants; Initiation of 5-Year Status Reviews of 47 Species in California, Nevada, and Oregon. Federal Register 88:56042–56044.

ASSESSMENT:

Information acquired since the last status review:
The U.S. Fish and Wildlife Service's (Service) Ventura Fish and Wildlife Office conducted this 5-year review. We announced the review through a Federal Register notice on August 17, 2023 (Service 2023). We did not receive any information from the public in response to our Federal Register Notice announcing this 5-year review. We conducted a literature search and a review of information in our files, and also contacted botanists at US Geological Survey (USGS), CINP, Santa Barbara Botanic Garden (SBBG), and other botanists to request any data or information we should consider in our review.

We have updated information on Santa Rosa Island manzanita distribution and abundance, and have new information on seed germination research, conservation seed banking, recovery planting, and threats.

Distribution and abundance:
The California Natural Diversity Database (CNDDB) defines an Element Occurrence (EO) as a group of plants separated from the next group of conspecifics by at least ¼ mile (400 meters, CNDDB 2018, entire). We call a group of plants that fits the definition of an EO, but is not recorded by CNDDB, simply an *occurrence*, and for simplicity call occurrences or EOs taken together *occurrences*. Some documents use the term *population*; we interpret a population to be an occurrence. However, although we reference EO numbers in this document, researchers in CINP generally do not use EO numbers, and do not report repeat visits to sites to CNDDB. Instead, these researchers track plant visits in an internal USGS/CINP geodatabase (McEachern et al. 2021).

CNDDB has not updated the EOs for Santa Rosa Island manzanita since 2013, before the last two 5-yr reviews (Service 2014, 2021). There are currently 4 EOs recognized by CNDDB, all on Santa Rosa Island (Figure 1, Table 1). These are on Black Mountain and vicinity (EO #1), South Point (EO #6), and Sierra Pablo East and West (EOs #8 and #9). While CNDDB lists the two Sierra Pablo EOs as separate, in CNDDB reports they are often considered together, and it is likely that Santa Rosa Island manzanita distribution bridges the two EOs such that they should actually be considered as a single occurrence (Ken Niessen pers. obs).

Beginning in 2015, researchers successfully transplanted about 24 Santa Rosa Island manzanita plants from a mix of cuttings and seedlings (McEachern and Gados 2023, p. 7–8, McEachern and Gados 2024, p. 8) to a cloud forest restoration area on Soledad Ridge on Santa Rosa Island (McEachern et al. 2016) A few other plants naturally germinated in the area and have grown without assistance, for a total of about 30 plants. Six plants from cuttings have reached reproductive maturity, while plants from seedlings remained alive in 2024 but have not become reproductive. We consider this location as another occurrence (Figure 1, Table 1) on Santa Rosa Island.

Although typically considered endemic to only Santa Rosa Island, there is one Santa Rosa Island manzanita specimen attributed to adjacent Santa Cruz Island in the Consortium of California Herbaria (CCH) online database (CCH2 2024). The specimen is Hoffmann 125, CAS:BOT-BC23611, collected on December 7, 1930, from Dick's Harbor, Santa Cruz Island, Santa Barbara County (Figure 1). From a digital image provided by the California Academy of Sciences (Emily Magnaghi in litt.), this specimen does appear to be Santa Rosa Island manzanita. Botanists have annotated the herbarium sheet twice to that effect, but questioned the Santa Cruz Island location. We are also uncertain where and when the specimen was actually collected, given Hoffmann collected several other Santa Rosa Island manzanita specimens the day before on Santa Rosa Island, someone else likely mounted and labeled the specimen after Hoffmann's unexpected 1932 death, and Hoffman did not keep known field notebooks that others could reference (Ken Niessen, pers. obs., Steve Junak pers. comm.). It is likely that the issue can never be definitively resolved, and at this time we consider the collection to be a valid occurrence on Santa Cruz Island. The occurrence location is on property of The Nature Conservancy, and is managed for resource conservation.

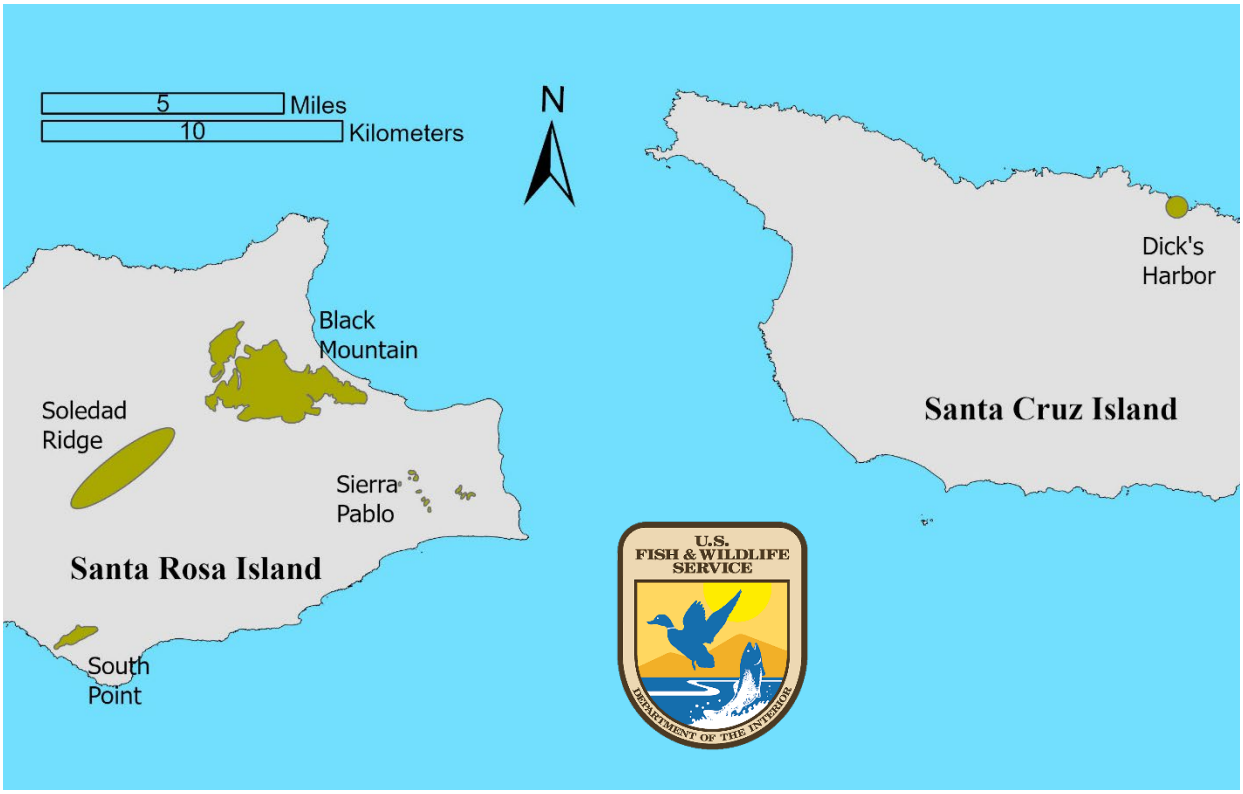

Figure 1. Locations of Santa Rosa Island manzanita occurrences (CCH 2024, CNDDB 2024, McEachern et al. 2016).

Table 1. Santa Rosa Island manzanita occurrences. (CCH 2024, CNDDB 2024, Reyes et al. 2016 geodatabase, McEachern and Gados 2024).

Island	Site	CNDDB Element Occurrence Number	Number of plants at last count and year of that count	Area of *Arctostaphylos confertiflora* dominated polygons (hectares)
Santa Rosa	Black Mountain	1	4,700–6,700 (2006)	117.90
Santa Rosa	South Point	6	about 200 (2006)	0.18
Santa Rosa	Sierra Pablo West and East	8 and 9 combined	1700 (2006)	no polygons
Santa Rosa	Soledad Ridge	none	about 30 (2024)	no polygons
Santa Cruz	Dick's Harbor	none	at least 1 (1930)	no polygons

There are no available censuses for Santa Rosa Island manzanita EOs since those reported in the 2008 5-year review (Service 2008, pp. 5–6), which used data collected in 2006 (Table 1). However, the general impression is that there are more plants currently in 2024 (Kathryn McEachern pers. comm.) This is supported by vegetation monitoring transect data that show that the species has increased in cover and density between 1990 and 2023 (Cameron Williams in litt.), corresponding to the removal of pigs (1983), cattle (1998), elk (2011) and mule deer (2014). Although density has increased, there have been almost no observations of seedlings in the vegetation monitoring transects. However, in the last few years, researchers observed seedlings and young plants in areas outside of the established transects. CINP and USGS plan to develop a monitoring protocol to document seedlings more effectively. Additionally, there are about 30 Santa Rosa Island manzanitas planted or naturally occurring along Soledad Ridge on Santa Rosa Island, and possibly at least one plant on Santa Cruz Island at Dick's Harbor in 1930 (Table 1).

In 2011, CINP began a detailed vegetation mapping project on Santa Rosa Island (Reyes et al. 2016, entire and geodatabase). The report and geodatabase remain unpublished, but the draft version shows that Santa Rosa Island manzanita-dominated polygons totaled 117.90 hectares (291.34 acres) on Black Mountain and 0.18 hectares (0.45 acres) on South Point (Table 1). Santa Rosa Island manzanita was not common enough at Sierra Pablo to be a defining component of vegetation polygons at that time. The vegetation map should be useful in the future as a baseline for evaluating the change in distribution of Santa Rosa Island manzanita across Santa Rosa Island.

Our overall conclusion is that while there are probably increases in distribution and especially abundance of Santa Rosa Island manzanita since listing and the 2021 5-year review, we lack recent rigorous census data and repeat monitoring and mapping to accurately describe the increases.

Soil seed bank, seed germination, and seedlings:
While there is an increase in inflorescences and presumably fruits and seeds on Santa Rosa Island manzanita adults since the removal of non-native ungulate herbivores (Schneider and Carson 2022, p. 12), major obstacles for evaluating the recovery of Santa Rosa Island manzanita are uncertainties related to the soil seed bank and requirements for germination. Recent sampling

shows that there are more seeds in the soil seed bank than when non-native ungulate herbivores were present, but given variability among samples, the differences are not statistically significant (Schneider and Carson 2022, pp. 91–92).

Adult Santa Rosa Island manzanitas lack a fire-resistant burl (Kauffmann et al. 2021, p. 54), and manzanitas that lack a burl are killed when adult plants burn to ground level. After fires, manzanita individuals of species that lack a burl must be replaced by seedlings. While not specifically shown for Santa Rosa Island manzanita, it is likely that Santa Rosa Island manzanita would follow the same post-fire replacement pattern if burned, and thus the soil seed bank is critical to re-establish an above-ground population. For manzanitas in general, fire stimulates germination of seeds in the soil seed bank (Kauffmann et al. 2021, pp. 15–17).

About 60% of Santa Rosa Island manzanita seeds are viable (McEachern and Gados 2022, p. 1), but not all viable seeds germinate. In controlled germination trials in 2021 (McEachern and Gados 2022, p. 4), exposure of seeds to liquid smoke concentrate yielded about 22% germination, while sandpaper scarification and boiling treatments had about 4% germination each, and blender scarification, cold soaking, and no treatment all had 0% germination. Additional trials have continued into 2022 and 2023 (McEachern and Gados 2023, pp. 7–8; 2024, p.8). The trials show that seed germination is facilitated by smoke products, but that some seeds can germinate without exposure to smoke products. Even though germination rates may be low, a long-lived plant will produce tens of thousands of seeds over its lifespan, and only a very small fraction of a percent of seeds needs to germinate to replace the individual and also expand the population slowly.

Of germinated seed produced in the nursery, about 20 resulting seedlings were robust enough for researchers to plant in the field on Soledad Ridge in 2023 (McEachern and Gados 2024, p. 8.) These plants were still alive in early 2024. There are plans (Kathryn McEachern pers. com.) to germinate more seeds and plant the resulting nursery-grown seedlings in the field. Despite the recent work on the soil seed bank, germination, and seedlings, our understanding of natural seedling survival and how that contributes to population increase remains limited (Schneider and Carson 2022, p. 111.).

Conservation seed banking and ex-situ collections:

The uncertainty of the magnitude of the soil seed bank makes conservation seed banking an important safeguard for Santa Rosa Island manzanita. However, accessions of Santa Rosa Island manzanita seed stored in Center for Plant Conservation (CPC) approved facilities, as reported by California Plant Rescue (CaPR 2024), are few, somewhat data deficient, and limited to the Black Mountain occurrence (Table 2).

Table 2. Conservation seed bank collections. (California Plant Rescue 2024; Schneider and Carson 2022, p. 54). CBG = California Botanic Garden, SBBG = Santa Barbara Botanic Garden.

Occurrence	Collection Date	Housed At	# maternal lines	# seeds
Black Mountain	6/5/2015	CBG	1	22
Black Mountain	6/6/2015	CBG	2	140
Black Mountain	6/6/2015	CBG	3	761
Black Mountain	6/29/2015	SBBG	5	2632
Black Mountain	7/24/2020	SBBG	50	1927
Black Mountain	unreported	SBBG	unreported	unreported
Black Mountain	unreported	SBBG	unreported	unreported

Santa Rosa Island manzanita seeds were also collected for the ongoing germination research and restoration planting (McEachern and Gados 2024, p. 5). While it is unclear exactly how many of these seeds exist, at least several hundred were used in the germination experiments (McEachern and Gados 2024, p. 8).

Mainland ex-situ living collections of plants can provide some degree of redundancy in case of a catastrophic island event, such as a major fire, when the soil seed bank is depleted and no comprehensive conservation seed bank exists. As reported in the 2021 5-year review (Service 2021, p. 4), the Santa Barbara Botanic Garden maintains and is expanding the living collection of Santa Rosa Island manzanita at their facilities on the mainland. As a result of mainland germination trials, more than a dozen more plants are now in mainland nursery facilities of CINP, and a few have been planted for display at park headquarters (McEachern and Gados 2023, pp. 7–8).

Threats:

At the time of listing (Service 1999 p. 40958), the primary threats to Santa Rosa Island manzanita were soil loss and habitat alteration by non-native mammal species, low reproductive success because of browsing on reproductive structures by deer and elk, herbivory by deer and elk, inability for occurrences to recover after fire because of absent or depleted seed banks, and extinction from random naturally occurring events due to the species limited distribution and small population sizes. We did not add any new threats in the recovery plan (Service 2000). We added insect leaf, fruit, and seed predation as a threat in the 2008 5-year review (Service 2008), and climate change as a threat in the 2014 5-year review (Service 2014), but did not identify new threats in the 2021 5-year review (Service 2021). This 2024 5-year discusses potential threats of increased backcountry visitor use on Santa Rosa Island to the Santa Rosa Island manzanita, particularly wildfire. We briefly review the status of all identified threats to Santa Rosa Island manzanita below.

With the removal of all non-native ungulate herbivores, the condition of the Santa Rosa Island vegetation and soil is gradually improving, much like what has happened on neighboring Santa Cruz Island after its last non-native ungulates were removed by 2007 (Beltran *et al.* 2014, entire). The threat of lingering soil loss and alteration remains but appears to be decreasing (Summers et al. 2018, entire).

Additionally, and as recognized in the 2014 5-year review, removal of non-native ungulate herbivores eliminated the direct threats of low reproductive success because of browsing on reproductive structures and of herbivory. Accordingly, the number of inflorescences on monitored plants has increased.

As discussed above, observations and experimentation have shown that the soil seed bank is increasing, germination requirements are becoming better understood, and there are naturally-occurring seedlings in the field. More work needs to be done to improve understanding, but the threat of absent or depleted soil seed banks has been lessened since the listing and the 2021 5-year review, and we expect soil seed banks to increase as soil improves over time.

The concern that populations would be unable to recover following fire has lessened with the improvement of the seed bank and the elimination of non-native animals that browse flowers, fruits, and seedlings. However, it will take additional time to completely remove the threat of fire killing established plants without the occurrences having a sufficient soil seed bank to ensure occurrence recovery. This is especially true for the Sierra Pablo and South Point occurrences, which have relatively few individuals.

There is a lack of redundancy for Santa Rosa Island manzanita because the species is likely restricted to a single island, and most of the individuals of the species are in the Black Mountain occurrence, with relatively small numbers of plants at South Point or Sierra Pablo. This has not changed since listing, and is unlikely to change. The restricted range and few occurrences, coupled with possibly depleted seed banks, means that stochastic extirpation of small populations leading to species extinction remains a threat.

No research has been conducted on the occurrence or magnitude of insect leaf, fruit, and seed predation. There is a study beginning to investigate the leaf galling aphids (Don Miller in litt.), but the emphasis is on insect genomics, not herbivory. This potential threat of insect predation on Santa Rosa manzanita remains unchanged.

As in our 2014 and 2021 5-year reviews (Service 2014, p. 10; 2021, p. 6), we recognize that climate change may have important potential effects on Santa Rosa Island manzanita and its habitat. A recent synthesis for the islands in CINP (Gonzales 2020, pp. 12–14, 20–23) predicts increasing temperatures under several different emissions scenarios, and greater likelihoods of episodic intense rain and drought, erosion, aridification, and increases of invasive plants and wildfire. While we lack adequate biological information to make accurate predictions regarding the effects of these and other aspects of climate change on Santa Rosa Island manzanita, we expect that increases in temperatures, episodic precipitation on annual and greater time scales, drought, and wildfire will have an overall negative effect on the species in the future. The threat of climate change remains similar to that discussed in the 2021 5-year review.

Natural fires are infrequent (at intervals of up to several hundred years) on the California Channel Islands (Pigati et al. 2014, pp. 43–45, CINP 2023, p. 17). Changes in vegetation that may occur under future climate conditions, including increased annual grass cover (Sandel and Dangremond 2012, entire; Syphard et al. 2019, pp. 97–99), may make the vegetation more prone to burn. In addition, there has been an observed increase in recreational backcountry use. With

increased backcountry visitor use comes an increased chance of human-caused wildfire and its potential negative effects on island plants, including Santa Rosa Island manzanita. CINP is developing a new backcountry wilderness management plan to address the increase in recreational backcountry use.

Evaluation of Recovery Criteria (Service 2000 p. 64):

Downlisting criteria for Santa Rosa Island manzanita:

Population Standards

1. Maintain three populations on Santa Rosa Island that are stable or increasing with evidence of natural recruitment for a period of 30 years that includes the normal precipitation cycle.
    - The areal extents of the populations do not appear to have decreased since the publication of the recovery plan. However, this is not well documented. There do appear to be increases in cover and density of individuals. More robust census and population monitoring protocols need to be developed, including for seedling recruitment. This criterion has been partially met.

Other Actions

2. Seed stored in CPC (Center for Plant Conservation) cooperating facilities.
    - Seeds banked for conservation are from relatively few maternal individuals and not all populations are represented. Conservation seed banks are not funded in perpetuity. This criterion has not been met.
3. Seed germination, propagation techniques, and fire ecology understood.
    - There have been studies of the soil seed bank and seed germination, and there has also been propagation from cuttings and then successful outplanting both seed and cutting derived plants. This criterion has been met.
4. Natural seed bank developed and maintained.
    - Soils continue to improve following ungulate removal. There is evidence that the soil seed bank is increasing, and natural seedlings are becoming more frequent, also indicating the presence and function of a soil seedbank. However, both the soil seed bank and numbers of seedlings have not been rigorously documented. The status of this criterion is uncertain.
5. Fire management plan developed.
    - CINP completed a draft fire management plant (CINP 2023). The plan recognizes that threatened and endangered species need to be protected from adverse effects of wildfire (p. 17). This criterion has been met.
6. Protected from browsing to allow reproduction.
    - No non-native ungulates remain on Santa Rosa Island. This criterion has been met.
7. Life history research conducted and incorporated into recovery criteria.
    - Many facets of the species biology, including reproductive output, the soil seed bank, seed viability, seed germination, and seedling requirements have been investigated. This criterion has largely been met.
8. If declining, determine cause and reverse trend.
    - While the natural populations appear to be stable or increasing, because of infrequent censuses and irregular monitoring this is not well documented. A

robust census and population monitoring protocol needs to be developed. This criterion has not been adequately met.

Delisting criteria for *Arctostaphylos confertiflora*:

Population Standard

1. No decline after downlisting for 10 years.
    - Not currently applicable.

Other Actions

2. All potential habitat surveyed.
    - Santa Rosa Island has been extensively surveyed during vegetation mapping (Reyes et al. 2016, entire), and the distribution of the species on Santa Rosa Island is well understood. This criterion has been met.

Conclusion:

After reviewing the best available scientific information, and the evaluation of threats affecting the species under the factors in 4(a)(1) of the Endangered Species Act, and analysis of the status of the species, we conclude that Santa Rosa Island manzanita remains an endangered species. The major direct threat, non-native ungulate herbivores, has been removed, with some residual effects of the herbivores still remaining but decreasing. Other threats, particularly associated with climate change and increased backcountry visitor use, still remain. There are ongoing recovery efforts for the species, habitat and occurrences are improving, and knowledge of soil seed banks, germination, and seedling recruitment and survival is increasing. However, there is a current lack of knowledge of abundance and distribution of both mature plants and seedlings. At this time, we recommend no change for Santa Rosa Island manzanita from its endangered status.

RECOMMENDATIONS FOR FUTURE ACTIONS:

1. Develop census and monitoring plans to better track occurrence sizes and of Santa Rosa Island manzanita, especially of seedlings.

2. Continue to develop methods to assess and enhance the soil seed bank.

3. Continue research on seed germination and seedling recruitment requirements, particularly under natural conditions.

4. Bolster conservation seed banks with additional maternal lines from all occurrences.

5. Search the Dick's Harbor area on Santa Cruz Island for the species.

Lead Field Supervisor, Ventura Fish and Wildlife Office

Approved STEPHEN HENRY Digitally signed by STEPHEN HENRY Date: 2024.07.18 15:58:51 -07'00'

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