

Island Barberry (*Berberis pinnata* subsp. *insularis*)

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



Photo: Ken Niessen USFWS

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

May 2022

GENERAL INFORMATION:

Species: *Berberis pinnata* subsp. *insularis*
FR citation: 62 FR 40954
Date listed: July 31, 1997
Classification: Endangered

BACKGROUND:**Most recent status review:**

U.S. Fish and Wildlife Service. 2013. Island Barberrry (*Berberis pinnata* subsp. *insularis*) 5-Year Review: Summary and Evaluation. Ventura Fish and Wildlife Office. Ventura, California.

FR Notice citation announcing this status review:

Initiation of 5-Year Status Reviews of 76 species in California and Nevada. Notice of initiation of reviews; request for information (86 FR 27462), May 20, 2021.

Critical Habitat Designation:

No critical habitat has been designated.

State Listing:

This taxon was listed as endangered by the State of California in 1979.

ASSESSMENT:**Information acquired since the last status review:**

This 5-year review was conducted by the U.S. Fish and Wildlife Service (Service), Ventura Fish and Wildlife Office. Initiation of this review was announced through a Federal Register notice on May 20, 2021. We also contacted land managers and species experts to request any data or information we should consider in our review. Additionally, we conducted a literature search and a review of information in our files. Since the previous 5-year review in 2013, we have new information on the island barberry as a result of recent research, studies, and surveys and monitoring.

Background:*Nomenclature*

No taxonomic changes for island barberry (*Berberis pinnata* subsp. *insularis*) have been made since our most recent 5-year review in 2013 (Service 2013, p. 3).

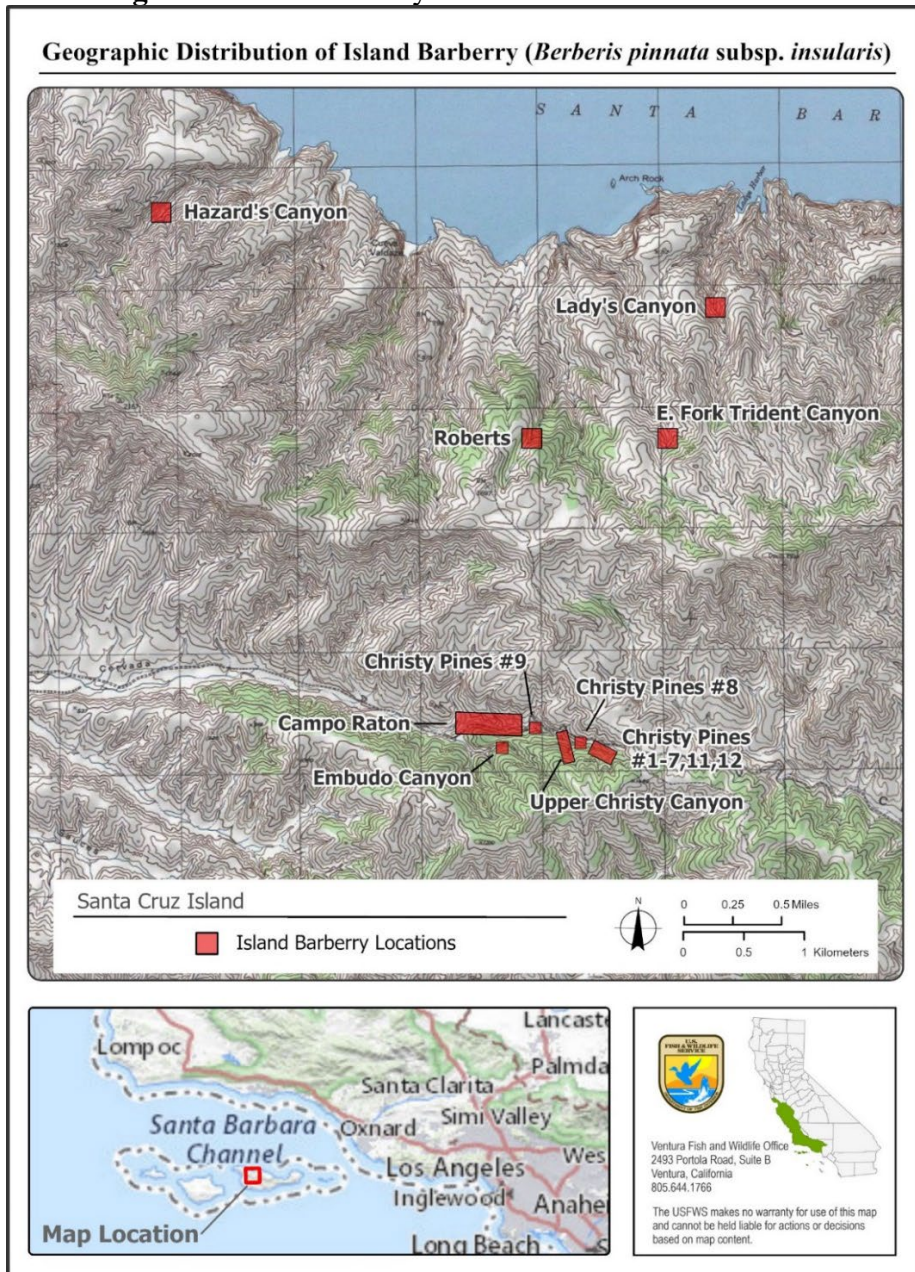
Range

Historically, island barberry occurred on Santa Cruz Island and Anacapa Island, and likely occurred on Santa Rosa Island, of the northern Channel Islands off the coast of California. Currently, island barberry solely occurs on Santa Cruz Island.

Distribution

Currently, island barberry is known to occur in isolated locations in two areas of Santa Cruz Island (Figure 1): (1) drainages and canyons along the rugged north slope of the western portion of the island, and (2) the interior of the island in the area of Christy Canyon.

Figure 1. Island barberry locations on Santa Cruz Island



Habitat

On Santa Cruz Island, island barberry is known from north facing, rocky slopes in chaparral, oak woodlands, and pine forests (Service 2000, p. 28). It has been reported to be associated with chaparral species including poison oak (*Toxicodendron diversilobum*), monkeyflower (*Diplacus* (formerly *Mimulus*) sp.), coyote bush (*Baccharis pilularis* goldenbush (*Hazardia detonsa*), island alum-root (*Heuchera maxima*), and wild cucumber (*Marah macrocarpus*) (Service 2000, p. 28).

Abundance and Population Trends:

Currently, island barberry occurs solely on Santa Cruz Island. Island barberry was collected from West Anacapa Island in 1940 and this plant was last observed alive in 1980. When researchers visited it in 1994, they discovered it had died (Service 2000, p. 28). Island barberry was reported from Santa Rosa Island in 1930 (Service 2013, p. 5). The record from 1930 is the only recorded occurrence from Santa Rosa Island and since then it has not been rediscovered (Service 2000, p. 26; McEachern *et al.* 2010, p. 9; Schneider and Carson 2019, pp. 42-43). Surveys were conducted for island barberry on Santa Rosa Island between 1993 and 1998 and it was not found (Service 2000, pp. 27-28). The lack of accurate record keeping and discordance between the location referenced in the 1930 record and inability to compare the collection record to contemporary maps and place names led botanists to question the validity of the collection from Santa Rosa Island, postulating that it may have been mistakenly recorded and collected from Santa Cruz Island instead, which coincides with other botanical collections taken from Santa Cruz Island during the same timeframe (Service 2013, p. 5). Additional surveys were conducted on Santa Rosa Island in 2018 and 2019 and again, island barberry was not found (Schneider and Carson 2019, pp. 42-43). While our 2013 5-year review questions the validity of historical collection of island barberry from Santa Rosa Island, here we accept that the specimens did come from Santa Rosa Island until evidence proves otherwise.

While in some of our previous documents we characterized the number of known island barberry “populations,” new information indicates that it is more accurate to refer to each discrete plant or cluster of plants in a given geographic area as an island barberry “location” because each of these groups of plants may not be a biological population and the presence of multiple stems at a location is likely clonal spread of a single genetic individual. Therefore, instead of referring to island barberry in terms of populations, we will identify each as a location and/or individual.

At the time of listing under the Endangered Species Act (Act) in 1997, lack of sexual reproduction or recruitment was identified as limiting island barberry abundance and distribution – this continues to the current day. Recent genetic studies have confirmed that island barberry is able to spread clonally (Washburn 2019, entire). Longevity and vegetative spread of individual clones may assist in island barberry’s ability to persist with few locations or plants.

At time of listing, island barberry was identified to occur at three locations on Santa Cruz Island: (1) north slope of Diablo Peak (Lady’s Canyon location), (2) Campo Raton, and (3) Hazard’s Canyon (Service 1997, p. 40958). Each location was represented by one plant. The location described above as Diablo Peak in the listing rule is now presumed to be the same as what is currently referred to as the Lady’s Canyon location, which was discovered in 1985 (McEachern *et al.* 2010, p. 9). The Campo Raton location was discovered in 1927, and the Hazard’s Canyon

location was discovered in 1983 (McEachern *et al.* 2010, p. 9). In the 2000 recovery plan, island barberry was identified from these same three locations (Service 2000, p. 28).

Since 2000, work has been conducted to better understand island barberry and its locations. The information in early field notes makes it sometimes uncertain when discoveries were made or the island barberry location being discussed. Additionally, we have found that some locations may have been discovered prior to listing but were not synthesized into the understanding of island barberry at that time.

In 2010, researchers published a thorough synthesis of island barberry locations based on a review of field notes, collections, and other records, combined with information from recent surveys (McEachern *et al.* 2010, entire). From this work, we have learned that there are, at minimum, seven historical island barberry locations. In addition to the three locations we knew from the time of listing above (Lady's Canyon, Campo Raton, and Hazard's Canyon), McEachern *et al.* (2010) recognized the following historical locations:

- A fourth island barberry location from the upper Christy Canyon area near the Centinela Grade. This location is referred to as the Upper Christy Canyon location among researchers. While the date of discovery of this location is not certain, it was known dating from the 1970s or 1980s (McEachern *et al.* 2010, p. 9).
- A fifth island barberry location from the east fork of Trident Canyon; discovered in 1984 (McEachern *et al.* 2010, p. 9).
- A sixth island barberry location from west fork Trident Canyon, referred to as the Roberts location; discovered in 1984 (McEachern *et al.* 2010, p. 9).
- A seventh island barberry location collected in 1979 and described in field notes as being from the Christy Pines region, between the Valley and Ridge roads, Upslope of Campo Raton (McEachern *et al.* 2010, p. 9). This location is referred to as the Upslope of Campo Raton location among researchers. Unfortunately, the whereabouts of this location is unknown due to the general and non-specific descriptions in field notes. A live specimen of island barberry from this location is at the University of California (UC) Santa Cruz Arboretum (McEachern *et al.* 2010, p. 9).

In our 2013 5-year review, island barberry was known to be extant in five of seven historical locations in the wild on Santa Cruz Island (Campo Raton, Upper Christy Canyon, Hazard's Canyon, East Fork Trident Canyon, Roberts), each containing one plant (Service 2013, p. 5). Two historical locations were not surveyed, and the status of these locations was unknown (Lady's Canyon, Upslope of Campo Raton) (McEachern *et al.* 2010, table 7, p. 10).

New information since the 2013 5-year review

Since our 2013 5-year review, new information on island barberry includes: a better understanding of historical locations, results from genetic analysis of plants, discovery of additional plants/locations, marking and cataloging of the newly discovered plants, collection of

demographic data, and studies on propagation and pollinators. Additionally, a series of attempts to locate island barberry on Santa Rosa Island were made in 2018 and 2019.

Our review of information has found that there is an additional potential eighth historical island barberry location at Embudo Canyon, on Santa Cruz Island. This island barberry location was observed by researchers in 1979 (Junak SC-208) and was rediscovered in 2017.

New Discoveries and Genetic Analysis

Since the 2013 5-year review, researchers conducted genetic analysis of all known, recently surveyed wild island barberry plants (McEachern and Washburn 2017, entire). These same plants were known in the 2013 5-year review: (1) Campo Raton, (2) Hazard's Canyon, (3) Upper Christy Canyon, (4), East Fork Trident Canyon, and (5) Roberts. Samples of island barberry from the other two historical locations, Lady's Canyon and Upslope of Campo Raton, were not available and therefore could not be part of this study. This study also included several *ex situ* island barberry plants to try to determine their sources; seven botanic gardens and arboreta have living island barberry plants. Samples were from Rancho Santa Ana Botanic Garden (now California Botanic Garden), Tilden Botanic Garden, Santa Barbara Botanic Garden, UC Berkeley Botanical Garden, UC Davis Arboretum, and San Francisco Botanical Garden; however, samples from the UC Santa Cruz Arboretum were not included because accession records show that Rancho Santa Ana Botanic Garden has a clone of the single plant at the UC Santa Cruz Arboretum (McEachern and Washburn 2017, pp. 3-4). Additionally, samples from the cultivar Shnilemoon in horticultural trade were included; this cultivar was developed from cuttings brought from the island in 1979 (McEachern and Washburn 2017, p. 4).

Of the wild plants, the researchers found that (1) Campo Raton, (2) Hazard's Canyon, (3) Upper Christy Canyon, (4), East Fork Trident Canyon, and (5) Roberts were each genetically unique (McEachern and Washburn 2017, p. 5; Washburn 2019, pp. 6-7). The results for the *ex situ* plants found that Shnilemoon was genetically unique from all other known island barberry plants/locations (McEachern and Washburn 2017, p. 5). The plant from which clones were taken for Shnilemoon is called the Upslope of Campo Raton location, and has not been rediscovered in the wild, in part because its precise source location is unknown. The other *ex situ* study plants were found to be clones from Campo Raton (McEachern and Washburn 2017, p. 5; Washburn 2019, figure 4 p. 7). Individuals from the Hazard's Canyon, Upper Christy Canyon, East Fork Trident Canyon, and Roberts locations are not represented in any botanic garden or arboreta living collections (McEachern and Washburn 2017, p. 5). The extirpated west Anacapa Island plant is not represented in any *ex situ* garden collection (McEachern and Washburn 2017, p. 5).

Also in 2017, island barberry was discovered in 14 newly recorded locations in the Christy Pines area on Santa Cruz Island; these plants were referred to as locations/plants #1-14 in the initial report on the discovery (Khalsa 2017, entire) and the follow-up report on genetic analysis referred to them by these numbers (Washburn 2019, entire). We will use this numerical naming convention when discussing these new locations/plants below. Washburn (2019, entire) conducted genetic analysis of tissue collected from each newly reported location. Results indicate that plant #10 is Campo Raton (Washburn 2019, p. 2). Genetic analysis of plants #1-14 found that some of the newly discovered locations are genetically the same plant, but four new genotypes were discovered – indicating four newly discovered individuals. Therefore, in addition

to the five previously known genetically unique plants, we now know of a total of nine genetic individuals from Santa Cruz Island (Washburn 2019, p. 7). Genetic analyses of Lady's Canyon and Upslope of Campo Raton have not been completed, but at this time we presume they are unique based on what we know from other island barberry locations. The four new genetic individuals are locations/plants: (1) #1-7, 11, 12, (2) #8, (3) #9, and (4) #13-14. The plants from #13-14 are a rediscovery, and confirmation, of the historical Embudo Canyon location that had not been relocated since 1979. We now know that island barberry has been observed at 11 locations at some point in time on Santa Cruz Island. With the addition of the genetically unique *ex situ* Shnilemoon, there are a total of 10 unique island barberry plants known living at this time.

Additional Surveys and Monitoring

In 2019, researchers conducted surveys and monitoring at 9 of 11 island barberry locations on Santa Cruz Island (Olthof 2019, entire). They gathered tissue and demographic data, recorded locations at submeter accuracy, and permanently marked most locations with a hoop made of steel cable with an aluminum identification tag (Olthof 2019, entire). They collected a total of 257 samples for future genetic analysis and placed 61 hoops with identification tags (Olthof 2019, p. 3 of 55). Surveys and monitoring were not conducted in Lady's Canyon, and the Upslope of Campo Raton location was not rediscovered.

Additionally, another location discovery was made in close proximity to Christy Pines #12 during the surveys and monitoring in 2019 (Wildlands Conservation Science 2019, geodatabase). Tissue was taken and genetic analysis is needed to determine if this is a known individual or a newly discovered unique island barberry plant.

In 2021, surveys for island barberry at Santa Cruz Island were performed from helicopter; no new locations were discovered (Schneider *et al.* 2021, p. 6).

Island Barberry Studies

Over the past several years, researchers have begun investigations to inform management actions that could address the lack of recruitment in wild island barberry plants. These research studies included propagation, pollination, germination, and tissue culture.

Propagation Study

In 2016, researchers investigated how to propagate plants from root and shoot cuttings. The researchers used 50 cuttings from two island barberry plants; 20 of the cuttings rooted, and 7 survived past 1 year (Knapp 2021, pp. 2-3, table 1). In 2017, a second rooting study expanded variation among experimental treatments. Rooting success and survival were greatest with cuttings from old growth (Knapp 2021, pp. 3-4, table 2). In 2020, propagation research continued using 85 wild cuttings collected from seven island barberry locations: Hazard's Canyon, East Fork Trident Canyon, Roberts, Campo Raton, Embudo Canyon, Upper Christy Canyon, and (Christy Pines) plant/location #1 (Lady's Canyon was searched but island barberry could not be found) (Knapp 2021, pp. 4-9). Further processing resulted in 188 cuttings for the study; however, survival was low (11 individuals from three of seven wild locations) (Knapp 2021, pp. 6-9, table 3). The researchers noted that low survival may be attributed to time of year or plant condition from when cuttings were taken (Knapp 2021, p. 7). As of December 2021, eight cuttings from

three island barberry locations survive: (Christy Pines) plant/location #1, Embudo Canyon, and Hazard's Canyon (Schneider *et al.* 2021, p. 28, table 5). These three locations represent novel genetics that are not currently represented in living collections at botanic gardens. Plans are in place to continue conducting propagation research in 2022 (Schneider *et al.* 2021, p. 28).

Pollination Study

In 2016, researchers conducted pilot studies of island barberry pollination biology and seed set (Knapp 2021, pp. 10-12). They found that lack of pollinators significantly reduced fruit production and seed set (Knapp 2021, p. 12).

Researchers are currently conducting an island barberry pollination study in *ex situ* living collections from the Santa Barbara Botanic Garden (Schneider *et al.* 2021, p. 2). Seeds from this study will be used to investigate germination in this difficult-to-propagate plant (Schneider *et al.* 2021, p. 2). The goal is to compare reproductive success between self-pollinated and cross-pollinated island barberry plants (Schneider *et al.* 2021, p. 34). Seeds produced from the pollination studies are being used in a germination study (Schneider *et al.* 2021, p. 2).

Seed Germination Study

In 2021, researchers collected seeds of unknown paternity from the living collection at the Santa Barbara Botanic Garden to pilot a seed germination study using multiple treatments (Schneider *et al.* 2021, pp. 35-36). The first seeds germinated at the end of November 2021 and the seedlings were transplanted to plug trays in December 2021 (Schneider *et al.* 2021, pp. 35-36). While these plants are not suitable for out-planting into the wild population due to their unknown paternity, the germination results are encouraging and likely applicable to other island barberry seeds.

Tissue Culture Study

Since our previous 2013 5-year review, pilot research into tissue culture of island barberry was initiated. Researchers were able to get shoot growth from the callus, but were unable to get root growth and no transplantable plantlets were produced (Knapp pers. comm. 2022). Bacterial contamination was observed and may have affected the results (Knapp pers. comm. 2022).

Santa Rosa Island

In 2018 and 2019, surveys were conducted for island barberry in several canyons and drainages of northeastern Santa Rosa Island. These surveys covered suitable habitat in the area where the single 1930 Santa Rosa Island record may have been collected. The canyons surveyed included: Windmill Canyon, Cherry Canyon, and Water Canyon. No island barberry plants were found (Schneider and Carson 2019, pp. 42-43). Island barberry appears to be extirpated from Santa Rosa Island.

Anacapa Island

In 2016, the island barberry location on West Anacapa Island was visited using guidance provided by field notes and advice from the botanist who collected from the plant in 1980 and 1990, and who had seen the plant as late as the mid-1990s, although it was discovered to have died in the last visit (McEachern and Washburn 2017, p. 5). No plant was found in 2016, although the botanists conducting the search were certain that they were looking in the spot

where the plant was seen in the past (McEachern and Washburn 2017, p. 5). Island barberry appears to be extirpated from Anacapa Island.

Current Status

Island barberry is likely extirpated from both Anacapa Island and Santa Rosa Island. Based on what we now know from genetic analyses (McEachern and Washburn 2017, entire; Washburn 2019, entire), it is more appropriate to refer to island barberry by location name for each genetically unique individual, rather than use the term “population” or characterize status by the number of populations as that is not well understood. Over time, 11 island barberry plants (genetically unique individuals) have been observed on Santa Cruz Island. Each plant occurs in a separately identified location. Based on surveys during 2017 to 2020, island barberry was observed and known to be alive at 9 locations on Santa Cruz Island.

Surveys were conducted in portions of Lady’s Canyon in 2020, but no island barberry plants were found and its status is unknown. The Upslope of Campo Raton location was not well defined in field notes and we currently do not know its precise location. This island barberry plant has not been rediscovered and its current status is unknown. Live specimens of island barberry from Upslope of Campo Raton are at the UC Santa Cruz Arboretum and California Botanic Garden – this is Shnilemoon in the horticultural trade (or the parental island lineage of Shnilemoon) (Washburn 2019, p. 6). Future work may be able to determine if this location is still extant if additional discoveries are made and genetic information shows a plant with the same genetics as Shnilemoon.

Island barberry is long-lived, and we presume the observations from the surveys conducted over the past 5 years are representative of its current status.

In Table 1, below, we identify island barberry status from listing in 1997 to this 5-year review in 2022.

Table 1. Island barberry locations and status on Santa Cruz Island: at listing in 1997, in the 2000 recovery plan, in the 2008 5-year review, in the 2013 5-year review, and currently in this 2022 5-year review.

Island Barberry Location Name	Year Discovered	Status in 1997 Listing	Status in 2000 Recovery Plan	Status in 2008 5-yr Review	Status in 2013 5-yr Review	Current Status (2022)	Notes
Lady's Canyon	1985	Extant	Extant	Extant	Unknown	Unknown	Surveyed in 2020, not found. No samples were available for genetic studies.
Campo Raton	1927	Extant	Extant	Extant	Extant	Extant	Genetically unique individual.
Hazard's Canyon	1983	Extant	Extant	Extant	Extant	Extant	Genetically unique individual.
East Fork Trident Canyon	1984	*	N/A	N/A	Extant	Extant	Genetically unique individual.
Upper Christy Canyon	1970s-1980s	*	N/A	N/A	Extant	Extant	Genetically unique individual.
Upslope of Campo Raton	1979	*	N/A	N/A	(Location and Status) Unknown	(Location and Status) Unknown	No samples were available for genetic studies, but it is presumed to be the plant from which Shnilemoon was cloned.

Roberts (west fork Trident Canyon)	1984	*	N/A	N/A	Extant	Extant	Genetically unique individual.
Embudo Canyon (#13, 14)	1979, rediscovered 2017	*	N/A	N/A	N/A	Extant	Genetically unique individual.
Christy Pines: #1-7, 11, 12	2017	**	**	**	**	Extant	Genetically unique individual.
Christy Pines: #8	2017	**	**	**	**	Extant	Genetically unique individual.
Christy Pines: #9	2017	**	**	**	**	Extant	Genetically unique individual.

* This island barberry location was discovered prior to the 1997 listing rule, but was not discussed in the rule and appears to not have been understood as a location until McEachern *et al.* (2010, entire).

**Location had not been discovered and was not known as a location at the time of finalization of this Service document.

N/A = not applicable

Ex Situ Collections

Island barberry plants are currently maintained at seven California botanic gardens and arboreta representing collections from Santa Cruz Island (McEachern and Washburn 2017, pp.3-4; Washburn 2019, p. 3):

- California Botanic Garden (formerly Rancho Santa Ana Botanic Garden),
- Tilden Botanic Garden,
- Santa Barbara Botanic Garden,
- UC Berkeley Botanical Garden,
- UC Davis Arboretum,
- San Francisco Botanical Garden, and
- UC Santa Cruz Arboretum.

Of the known wild island barberry plants, the Campo Raton plant is the only individual represented. The plant from which clones were taken for Shnilemoon, which is also in botanic gardens and arboreta, has not been rediscovered in the wild. According to records it was collected from Upslope of Campo Raton.

Evaluation of Threats:

At the time of listing in 1997, island barberry was threatened by soil loss, habitat alteration caused by feral pig rooting, and stochastic events due to its small population size (Service 1997, pp. 40958-40970). The 2000 recovery plan reiterated the same threats (Service 2000, p. 27). As of 2007, feral pigs were the last of the non-native ungulates to be removed from Santa Cruz Island (Service 2008, p. 6). In the 2008 5-year review, we reiterated that island barberry remained threatened by soil loss and stochastic events, and that despite the recent removal of non-native feral pigs, island barberry continued to be threatened by the past alteration of its native habitat (Service 2008, pp 6, 9). In the 2013 5-year review, we again reiterated that island barberry remained threatened by soil loss and stochastic events; however, we determined that because feral pigs and other non-native animals had been removed from the islands, island barberry was not at risk from habitat alteration due the time elapsed to allow for recovery (Service 2013, p. 7). Additionally, in the 2013 5-year review, climate change was identified as a new threat (Service 2013, pp. 9-10).

Currently in 2022, island barberry remains threatened by stochastic events and effects from a changing climate. Additionally, fire is a potential threat to island barberry. With the complete removal of non-native ungulates from Santa Cruz Island, soil in areas where island barberry occurs has recovered. Soil loss is no longer a threat.

Stochastic Events

Island barberry remains threatened by stochastic events due to few individuals on solely Santa Cruz Island – there are no more than 11 living genetically unique plants in the wild. Currently, the threat of extirpation of individuals or extinction from random naturally occurring events due to small population size and limited distribution remains.

Climate Effects

The 2013 5-year review introduced climate change as a threat to island barberry (Service 2013, pp. 9-10). Expected climate change for the geographic region of the Channel Islands predicts both rising annual temperatures (Langridge 2018 pp. 13-15) and more episodic rainfall (Langridge 2018 pp. 16-17). Changes in climate could threaten island barberry as habitat may shift with climate change. The lack of recruitment in wild island barberry plants could result in an inability to disperse to suitable habitat, causing declines in abundance and possible extirpations.

Some island barberry plants occur in areas with a shaded understory and are likely better suited to handle direct effects of climate change. These areas are moist, have a canopy that buffers rain and high temperatures, and there is ample leaf litter over the soil to buffer increases in runoff or high flow from episodic, heavy rain events. However, the Roberts location occurs in a gully that could be affected directly by potential high flows associated increased episodic rain events. The Hazard's Canyon location has been directly and indirectly affected by a large coast live oak tree (*Quercus agrifolia*) that partly fell on the island barberry plant and left part of it exposed to sun and desiccation.

Fire

The island barberry locations in the Christy Pines area of Santa Cruz Island are at risk if fire were to occur in the area. Christy Pines is a forested area that has many dead trees where fire could possibly spread to a large area. Areas that have burned on Santa Cruz Island have included two other pine groves, but were not near any island barberry locations. Given what we know of the recent past history of fire on Santa Cruz Island, fire is infrequent and quickly contained, the overall chance of fire in an island barberry location on the island is low. In mainland California, an increase in forest fires has been linked to warming associated with a changing climate (Williams *et al.* 2019, entire). Based on this information, effects from a changing climate could also result in an increased future risk of fire in forested areas on the Channel Islands, including the island barberry locations in the Christy Pines. Island barberry response to fire is unknown.

Summary of threats:

Island barberry continues to be threatened from stochastic events and effects from a changing climate. Additionally, fire is a potential threat to island barberry.

Over time, 11 island barberry plants (genetically unique individuals) have been observed on Santa Cruz Island. Each plant occurs in a separate location – meaning there is no location where different individual plants occur adjacent to one another. These individuals continue to be threatened from stochastic events due to the few individual plants and limited distribution.

The tolerance of island barberry to changes in climate are unknown. If changes fall within the tolerance range of the species, then the threat of climate change could be low. However, if changes fall outside the tolerance of the species, effects may be severe due to the lack of suitable habitat outside the current range.

This 5-year review identifies fire as a potential threat to island barberry. If fire were to occur in the Christy Pines area, which has many dead trees where fire could possibly spread to a large

area, and where the majority of the species locations occur, many island barberry plants/locations could be lost.

EVALUATION OF DOWNLISTING AND DELISTING CRITERIA

The current status of criteria in the 2000 Recovery Plan (Service 2000, pp. 64-65) is as follows:

Downlisting criteria for island barberry:

1. Discover or establish five populations on Santa Rosa Island and Santa Cruz Island

This criterion has been partially met. With the discovery of new plants on Santa Cruz Island since our 2013 5-year review, there are now 9 confirmed, and up to 11, genetically unique individuals on Santa Cruz Island.

Island barberry appears to be extirpated from Santa Rosa Island and no new locations have been established.

2. Discover or establish two to three populations on Anacapa Island

This criterion has not been met. Island barberry remains extirpated from Anacapa Island.

3. Populations are stable or increasing with evidence of natural recruitment for a period of 15 years that includes the normal precipitation cycle

This criterion has not been met. No natural recruitment of seedlings has been observed for over a decade.

4. Seed is stored in Center for Plant Conservation (CPC) cooperating facilities

This criterion has not been met. While some island barberry seed is stored in a CPC facility, the range of genetic diversity in the species is not represented. According to the California Plant Rescue (CaPR 2022) database, the only seeds from a known island barberry location are from a single *ex situ* plant derived from clones from the Campo Raton location – 100 seeds.

5. Seed germination and propagation techniques are understood

This criterion has not been met. Studies have investigated germination and propagation, but techniques are not well understood to consistently result in successful outcomes.

6. Successful outplanting techniques have been developed

This criterion has not been met. Research on outplanting techniques is needed; no outplantings have been attempted in the wild.

7. Life history research has been conducted

This criterion has been partially met. Additional research is needed to further understand the life history of island barberry, in particular more information is needed on pollination, fruit set, and development from seed.

8. Causes of seedling mortality are understood

This criterion has not been met. No studies have evaluated seedling mortality.

9. A living collection is maintained at a CPC facility

This criterion has not been met. While some island barberry plants are living at CPC facilities (CaPR 2022), the range of genetic diversity in the species is not represented. These botanic gardens and arboreta house plants derived clones from the Campo Raton location and the Upslope Campo Raton (Shnilemoon) location.

Delisting criteria for island barberry:

1. Discover or outplant five additional populations per island in addition to the recovery criteria to meet downlisting

This criterion has not been met. No outplantings have been attempted.

2. No decline after downlisting for 10 years. If declining, determine cause and reverse trend

This criterion has not been met. Not applicable, island barberry has not been downlisted.

3. All potential habitat has been surveyed

This criterion has been partially met. Surveys have occurred in some potential habitat for island barberry, but additional surveys are needed to cover all potential habitat.

CONCLUSION

The evaluation of threats affecting the species under the factors in 4(a)(1) of the Act and the analysis of the status of the species in our 2013 5-year review remain accurate reflections of the species current status. After reviewing the best available scientific information, we conclude that island barberry remains an endangered species.

RECOMMENDATIONS FOR FUTURE ACTIONS:

1. Continue monitoring of known island barberry locations.

2. Conduct a thorough survey of Lady's Canyon to attempt to relocate the historical island barberry plant(s) and better understand the status of this location. If island barberry is found, collect samples for genetic analysis.
3. Conduct exploratory surveys for island barberry in areas of suitable habitat that have not been surveyed, or areas that have not been surveyed within the past 5 years. These efforts should focus on the canyons/drainages on the north slope of Santa Cruz Island.
4. Conduct research to investigate the lack of natural recruitment in island barberry. This may include aspects of pollination, seed set, dispersal, germination, and seedling survival.
5. Conduct additional research on conventional propagation techniques.
6. Conduct additional research to investigate tissue culture as a potential means for island barberry controlled propagation.
7. Implement outplanting at historical locations on Santa Cruz Island.
8. Implement reintroduction outplanting at historical location(s) on Anacapa Island.
9. Investigate reintroduction outplanting on Santa Rosa Island. Outplanting would require identification of suitable habitat and should not be initiated until after outplanting has been successful on Santa Cruz and Anacapa Islands.
10. Create an *ex situ* propagation population of island barberry plants that represents the breadth of genetic diversity in the wild. Of the known island barberry locations, the Campo Raton location is solely represented in California botanic gardens and arboreta.

APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approved _____ Date 5/9/2022
Acting for Stephen P. Henry, Field Supervisor

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