Island Rush-Rose (*Crocanthemum* [*Helianthemum*] *greenei*)

5-Year Review:
Evaluation and Summary

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

June 2024

5-YEAR REVIEW

Island Rush-Rose (*Crocanthemum* [*Helianthemum*] *greenei*)

GENERAL INFORMATION:

Species: Listed as *Helianthemum greenei* B.L. Robb; current accepted name is *Crocanthemum greenei* (B.L. Robb) Sorrie (Sorrie and Rosatti 2013). For the purpose of this 5-year review, we continue to use *Helianthemum greenei*.

Date listed: 31 July 1997

Federal Register (FR) citation(s): 62 FR 40954

Classification: Threatened

Critical Habitat Designation: There is no critical habitat designated for *Helianthemum greenei.*

State Listing: Not listed.

BACKGROUND:

Species overview:
Island rush-rose (*Helianthemum greenei*) is a short-lived perennial subshrub in the rockrose family (Cistaceae). The currently accepted scientific name is *Crocanthemum greenei*, but the change is not yet recognized in Service documents, and we continue to use the genus *Helianthemum*. The plant grows to about 30 centimeters (1 foot) tall and wide, and it is distinguished from the closely related *Crocanthemum scoparium* (with which it may co-occur and hybridize) by reddish glandular herbage and a wider corolla diameter. Island rush-rose is generally found in open areas with thin soils and little vegetation cover on ridges or within chaparral, often where there has been a fire or some other disturbance. Locations typically have few above-ground individuals. Often, above-ground individuals will only be found for a few years at a site. The nature of soil seed banks for this species is unknown, but it is suspected that the seeds are relatively long-lived.

Island rush-rose is found on the California Channel Islands on Santa Catalina Island (Los Angeles County), and Santa Cruz and Santa Rosa islands (Santa Barbara County). It has been collected once from San Miguel Island (Santa Barbara County), in 1932. Santa Catalina Island plants are all on land owned by the Catalina Island Conservancy (CIC), Santa Cruz Island is owned by Channel Islands National Park (CINP, the eastern 24%) and The Nature Conservancy (TNC, the western 76%), Santa Rosa Island is owned by CINP, and Santa Miguel Island is owned by the U.S. Navy but is administered by CINP.

Non-native ungulate herbivore disturbance was the primary threat historically (Service 1997, p. 40960). All non-native ungulate herbivores have been removed from Santa Cruz, Santa Rosa, and San Miguel islands. Mule deer and bison remain sources of herbivory on Santa Catalina Island (McEachern et al. 2016, pp. 758–760).

Most recent status review:
[Service] U.S. Fish and Wildlife Service. 2019. Island rush-rose (*Helianthemum greenei*). 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service, Ventura Field Office, Ventura, California. 10 pp.

We did not recommend a status change in the 2019 status review.

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 (VFWO) 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 the Catalina Island Conservancy, The Nature Conservancy, Channel Island National Park, the U.S. Geological Survey (USGS), Santa Barbara Botanic Garden (SBBG), and the U.S. Fish and Wildlife Service Carlsbad Field Office to request any data or information we should consider in our review.

The species has updated information on distribution and abundance, and new information on germination requirements, population genomics, and conservation seed banking.

Distribution and abundance:
Island rush-rose is found on Santa Catalina, Santa Cruz, and Santa Rosa islands, and has historically been found on San Miguel Island. There is not a single spatial database that accurately reflects current location information. We collated data from the California Natural Diversity Database (CNDDB 2023), SBBG (Schneider and Carson, 2022), TNC (John Knapp *in litt.*), CIC (Aaron Kreisberg *in litt.*), and USGS (McEachern et al. 2022). CNDDB defines an *element occurrence* (EO) as being a group of plants that is at least one quarter mile (400 m) away from the any other group of plants of the same species (CNDDB 2018, entire). However, there are reports of groups of plants that fit the definition of an EO but are not currently in the CNDDB records. For discussion within this document, we use the term occurrence to refer to both EOs and to other groups of plants that match that definition. There are 86 mapped occurrences of island rush-rose across its range (Figure 1, Table 1), compared to the 15 reported when listed (Service 1997).

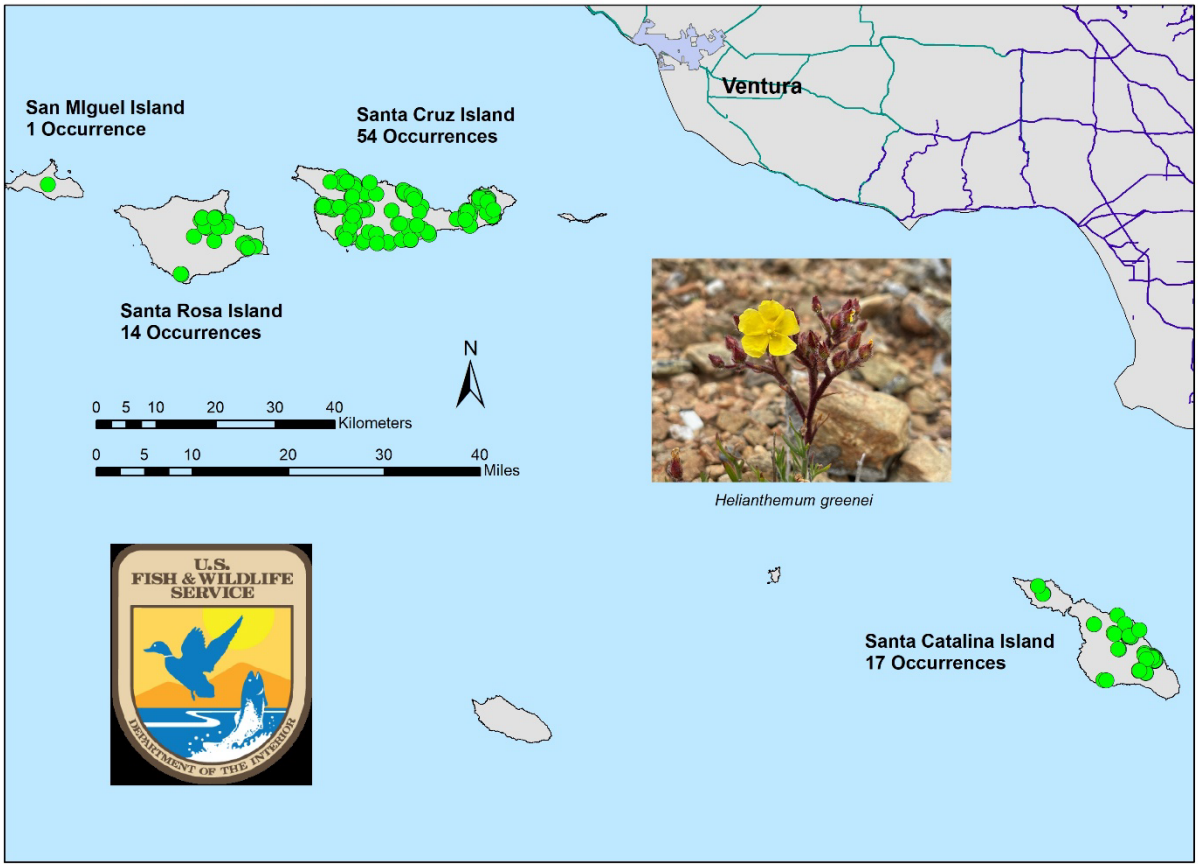

Figure 1. Distribution of island rush-rose occurrences. Data are from CNDDB 2024, SBBG (Schneider and Carson, 2023), TNC (John Knapp, TNC, *in litt.*), CIC (Aaron Kreisberg *in litt.*) and USGS (McEachern et al. 2022).

Table 1: Number of island rush-rose occurrences by island. Data are from CNDDB (2024), SBBG (Schneider and Carson, 2023), TNC (John Knapp, TNC, *in litt.*), CIC (Aaron Kreisberg *in litt.*) and USGS (McEachern et al. 2022).

Island	CNDDB Element Occurrences	Occurrences in Addition to CNDDB Element Occurrences	Total Occurrences per Island
San Miguel	1	0	1
Santa Rosa	6	8	14
Santa Cruz	42(44*)	12	54
Santa Catalina	15	2	17
All Islands	64	22	86

*CNDDB lists 44 Santa Cruz Island element occurrences, but in this table, two element occurrences are merged with adjacent occurrences that are within 400 m of each other.

Directed searches for island rush-rose have resulted in an increased number of known occurrences on Santa Rosa and Santa Cruz islands since the last 5-yr review (Service 2019,

Schneider and Carson 2023; J. Knapp, TNC, pers. comm.). The number of reported occurrences on Santa Rosa Island has increased from two at listing, to 9-10 in 2019, to 14 currently. Santa Cruz Island occurrences have increased from 14 at listing, to 42 in 2019 (44 in CNDDB 2023, with 2 occurrences aggregated with adjacent occurrences), to 54 in this 5-year review. The 2019 Santa Cruz Island number used here is greater from that used in the last 5-yr review (25 occurrences; Service 2019, p. 5) because in the 2019 5-year review we reported only occurrences surveyed from 2001–2016 (McEachern and Niessen 2018, p. 6) while here we also include occurrences last seen before 2001. It is biologically appropriate to include all occurrences, even those currently without documented above-ground plants, because seeds of plants in Cistaceae have hard seed coats and may be remain viable in the soil seed bank for many years (Thanos et al. 1992, p. 260).

Santa Catalina Island had 38 occurrences reported in the last 5-year review (Service 2019), more than the 17 reported here. This apparent decrease in occurrences seems to result from a broad definition of an "occurrence" used on the island, compared to the strict CNDDB definition of an Element Occurrence. Fieldwork on Santa Catalina Island in the early 2010s (Catalano 2013, entire; Dvorak and Catalano 2016, entire) used "occurrence", "population", and "location" interchangeably to describe some groups of plants less than 400 m apart. CNDDB only lists 15 EOs for Santa Catalina Island, and examination of CNDDB Santa Catalina Island records suggests that CNDDB may have combined some "occurrences". We do not believe that the reduction in number of CNDDB reported occurrences reflects a decline in abundance or distribution.

The single EO on San Miguel Island represents the 1932 collection of island rush-rose. Despite irregular and opportunistic searches for the species, it has not been found there since.

Abundance was not quantified at listing or in the 2019 5-year review (Service 1997, Service 2019). Current abundance data continue to be vague and incomplete given the wide range in quality and coverage of survey methods. Examination of records of recent surveys confirms that occurrences generally have few above-ground plants. For example, of the six reported 2023 plant counts on Santa Rosa and Santa Cruz islands, four had 10 or fewer plants, one had 51 or fewer plants, and one had about 220 plants spread sparsely along a ridge. Another ongoing challenge to describing abundance is that the above-ground expression of an occurrence may only last for a few years, and eventually the occurrence may have no visible plants, even though there may be seeds in the soil seed bank. A more biologically meaningful assessment of abundance should include representation in the soil seed bank; however, this does not exist for island rush-rose.

The overall conclusion is that, since listing, we have knowledge of more island rush-rose occurrences across all islands, except San Miguel Island. Despite increased awareness of the species' distribution throughout the range, we have no reliable data from which to draw conclusions on population trends.

Germination requirements and disturbance:
Previous observations (Service 1997 p. 40950; Service 2000, p. 43) have suggested that fire is important in the life cycle of the species by stimulating germination. The Santa Barbara Botanic Garden has been investigating germination requirements for island rush-rose (Schneider 2023, pp. 2–4). Seed treatments mimicking the effects of fire (heat treatment and liquid smoke

application) did not result in germination proportions higher than the control. However, both nicking and scarifying treatments yielded significantly higher germination proportions than the controls and were not significantly different from each other. This suggests that heating or smoke from fire is not a primary germination cue, but that mechanical abrasion from erosion after a fire or other disturbances may be important. More work needs to be done to confirm this hypothesis, especially in field trials. If fire itself is not required for germination, management activities meant to breach island rush-rose seed coats and stimulate soil seed bank germination would need to be updated.

Population genomics and hybridization:
In conjunction with a Section 6 grant, SBBG studied conservation genomics of island rush-rose from all the islands from which it is known to be extant (Namoff et al. 2022, entire). The study found that plants of the northern Channel Islands of Santa Rosa and Santa Cruz form a genetic cluster moderately differentiated from the Santa Catalina Island plants of the southern Channel Islands, with some evidence of gene flow from Santa Cruz Island to Santa Catalina Island; Santa Rosa Island plants group tightly with Santa Cruz Island plants (Namoff et al. 2022, pp. 25–28). Within-island genetic diversity is highest on Santa Cruz Island. The northern Channel Islands were all physically contiguous above sea level until about 10,000 years ago (Braje et al. 2010, p. 1.4), and the current distance between Santa Rosa Island and Santa Cruz Island is about 5 kilometers (3 miles), as is the current distance between Santa Rosa and San Miguel Island. This suggests that seeds from Santa Cruz Island plants could be used for occurrence augmentation on Santa Rosa Island, and occurrence establishment on Santa Rosa and San Miguel islands. The authors suggest more samples of island rush-rose from Santa Rosa Island need to be analyzed to better support this conclusion.

The study also showed recent hybridization between co-occuring island rush-rose and *Crocanthemum scoparium* (formerly *Helianthemum scoparium*) on Santa Catalina Island (Namoff et al. 2022, p. 31). The authors state that while hybridization could potentially result in the genetic swamping and extinction of a species, both island rush-rose and *Crocanthemum scoparium* naturally co-occur on several Channel Islands, and more investigation is needed to assess the actual threat of hybridization to island rush-rose.

Conservation seed banking:
Currently there are 39 georeferenced seed accessions in facilities approved by Center for Plant Conservation (CPC) for conservation seed banking (CaPR 2024). Of these, 38 are from Santa Cruz Island and one is from Santa Rosa Island. There are seven recent collections from Santa Rosa Island (Schneider and Carson 2022, p. 55) that are not yet represented in the CaPR online database. The accessions from Santa Cruz Island seem well dispersed over time and space, while the collections from Santa Rosa Island are all recent. There are no accessions from Santa Catalina Island or San Miguel Island in CPC approved conservation seed banking facilities.

Threats:
We have identified the following threats to island rush-rose: effects of non-native ungulate herbivores (Service 1997, p. 40960), altered fire frequency (Service 1997, p. 40960; Service 2000, p. 43), climate change (Service 2010, p. 13; 2019, p. 5), and hybridization (Service 2019, p. 4).

At listing (Service 1997), non-native ungulate herbivores (e.g., pigs; Appendix A) were the primary threat to island rush-rose. Non-native ungulate herbivores reduced abundance through herbivory, and indirectly negatively affected the species through erosion of topsoil and increased competition with non-native species that increased in the presence of ungulates. The direct effect of herbivory has been eliminated on Santa Cruz, Santa Rosa, and San Miguel islands (e.g., as demonstrated in Beltrane et al. 2014, entire; Summers et al. 2018, entire), and many of the indirect effects have generally been reduced but linger. Mule deer and bison remain on Santa Catalina Island, and the direct negative effects of these non-native ungulate herbivores have been clearly demonstrated (Dvorak and Catalano 2016, entire; Dvorak et al. 2016, entire). Currently, there is an effort by the CIC to remove mule deer from Santa Catalina Island (CIC 2023) in support of the CIC rare plant conservation program (Dennhardt et al. 2023). Bison on Santa Catalina Island have been reduced to fewer than 100 individuals and are restricted in where they graze.

The Recovery Plan (Service 2000, p. 43) for island rush-rose considered reduced fire frequency as a threat to the species and described the species as a successional component on regenerating burn sites; a mechanism for this was not suggested. Germination trials have shown that seed germination is significantly less with either dry heat or smoke treatment, compared to nicking or scarifying the seed coat (Schneider 2023, pp. 2–4). This suggests that physical disturbance of the substrate and seeds during a fire, or by other causes, stimulates germination, not the heat of fire or chemicals in smoke. More field research is needed to determine if fire is a necessary component of recovery, or if general ground disturbance would be an adequate management technique.

The 2010 and 2019 5-year reviews discussed the threat of climate change and recognized that at both times there was insufficient information to make accurate predictions about climate change for a particular species (Service 2010, p. 13; Service 2019, p. 5). Expected climate change for the geographic region of the islands predicts both rising annual temperatures (Langridge 2018 pp. 13–15) and less frequent, more episodic rainfall (Langridge 2018 pp. 16–17). While the more episodic rainfall is likely to lead to more powerful runoff and erosion, and combine with higher temperatures to cause drier soils, the effect of this on island rush-rose could also be positive, given the need for mechanical abrasion of the seed coat, and that the species is usually found in open exposed areas. Another prediction with increasing annual temperature in California is an increasing dominance by non-native annual grasses (Sandel and Dangremond 2012, entire) in certain situations. If non-native grass cover increases in what are now open exposed areas, the presumed competitive effects of increased grass cover could reduce island rush-rose abundance through inhibition of germination, decreased seedling survival, or increased adult plant mortality.

Investigation of the potential threat of hybridization between island rush-rose and *Crocanthemum scoparium* was recommended in the last 5-year review (Service 2019, p. 4). While Namoff et al. (2022, entire) established that hybridization does occur, they suggest that more research is needed to assess whether hybridization can operate at a scale that could lead to the loss of species identity of island rush-rose, and whether this is an acceptable outcome given that both species naturally occur together on the islands. It is unclear whether hybridization is a current threat.

Evaluation of Recovery Criteria:
Delisting criteria for *i*sland rush-rose

1. *Maintain existing stable populations on Santa Cruz and Santa Catalina Islands for a period of 15 years that includes the normal precipitation cycle.*
    - This criterion has not been met. Populations are not comprehensively monitored, so the temporal variation in the number of above-ground plants is not known. Because seed germination, and thus the number of above-ground plants, depends on disturbance, and individual plants are short lived, it is likely that above-ground evidence of populations might be lacking, even though there is a substantial but unknown soil seed bank.
2. *Seed stored in CPC cooperating facilities.*
    - This criterion has been met for Santa Cruz Island, but not comprehensively for Santa Rosa or Santa Catalina islands.
3. *Seed germination and propagation techniques understood.*
    - Seed germination has been investigated (Schneider 2023, entire), but comprehensive nursery propagation techniques have not been determined. This criterion has been partially met.
4. *Successful outplanting techniques developed.*
    - Successful outplanting techniques have not been developed, so this criterion has not been met.
5. *Life history research conducted.*
    - There has been some life history research conducted on the effects of grazing (Dvorak and Catalano 2016, entire; Dvorak et al. 2016, entire) and cues for seed germination (Schneider 2023, entire). Genomic research indicates that the northern Channel Islands plants are distinct from the Santa Catalina Island plants. This criterion has been at least partially met.
6. *Experimental use of fire for population enhancement researched and applied.*
    - This criterion has not been met. Preliminary seed germination experiments suggest it is mechanical disturbance associated with fire or other causes that stimulate germination, not heat or smoke; however, no field experiments have been conducted to verify the nursery results in the field. At this point, using fire to manage island rush-rose populations is premature.

Conclusion:
After reviewing the best available scientific information, evaluating threats affecting the species under the factors in 4(a)(1) of the Endangered Species Act, and analyzing the status of the species, we conclude that island rush-rose remains a threatened species. While there are more occurrences than at listing known from all islands except San Miguel Island, the number of individuals within these occurrences is not well documented. This is likely because of the irregular survey intervals, seed banks of unknown size, and that there are generally few above-ground plants at any location at any time. The species remains directly threatened by herbivory from non-native ungulates on Santa Catalina Island, and possibly by hybridization with *Crocanthemum scoparium*. The exact nature of the effects of fire or other disturbance, and the possible effects of climate change, on the life history of the species is also unknown.

RECOMMENDATIONS FOR FUTURE ACTIONS:

1. Manage the habitat throughout the geographic range of island rush-rose to provide suitable habitat for the species to complete its life cycle. This should include removal of deer and bison from Santa Catalina Island, and appropriate landscape recovery efforts.

2. Eliminate non-native ungulate herbivore pressure on island rush-rose by removing deer and bison from Catalina Island. In the interim, maintain reinforced fencing around existing occurrences so that they can serve as a source to repopulate the island as herbivory pressure is reduced.

3. Expand the distribution of the species by establishing fence-protected occurrences on the west end of Santa Catalina Island. Additionally, the number of occurrences on Santa Rosa Island could be increased, and the species reestablished on San Miguel Island. Population genomics indicate that seed from Santa Cruz or Santa Rosa islands could be used to reestablish the species on San Miguel Island.

4. Experiment with controlled burns and other disturbances in the field to evaluate their effectiveness as a means of increasing the number and size of occurrences of the species.

5. Establish a uniform protocol of regular repeat monitoring of known occurrences of island rush-rose, especially after land disturbance events (e.g., fire), to document the number of plants present and the extent of occurrences. Additional directed surveys in identified potential habitat should occur, especially on Santa Rosa Island and San Miguel Island.

6. Evaluate existing genomic data and genetic management frameworks to assess the potential threat of hybridization where island rush-rose and *Crocanthemum scoparium* co-occur. As needed, conduct additional studies of hybridization extent and develop management strategies.

7. Continue addition of seed to conservation seed banks, especially from Santa Catalina and Santa Rosa islands.

Lead Field Supervisor, Ventura Fish and Wildlife Office

Approved STEPHEN HENRY Digitally signed by STEPHEN HENRY Date: 2024.06.12 08:00:30 -07'00'

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APPENDIX A: Herbivore Presence

Table A1. Non-native ungulate herbivores on Santa Catalina Island (SCA), Santa Cruz Island (SCZ), Santa Rosa Island (SRI) and San Miguel Island (SMI; McEachern *et al*. 2016 pp. 759-760, Andrew Adams pers. comm. 2021). Bold text indicates animals present on the islands after island rush-rose listing in 1997.
[1]One radio-collared mule deer swam from Santa Rosa Island to San Miguel Island in 2013.
[2]While horses are present on Santa Catalina Island, they are not free-ranging.

species	scientific name	SCA dates	SCZ dates	SRI dates	SMI dates
elk	*Cervus canadensis*	never introduced	never introduced	1879–**2011**	never introduced
mule deer	*Odocoileus hemionus*	1928–**present**	never introduced	1880–**2015**	never introduced[1]
fallow deer	*Dama dama*	never introduced	never introduced	1890–1949	never introduced
horse	*Equus ferus caballus*	1863–**present**[2]	1830–**2009**	1844–**2020**	1851–1948
donkey	*Equus africanus asinus*	1886–1903?	never introduced	1800s	1950s–1976
pig	*Sus scrofa domestica*	1932–**2004**	1852–**2006**	1853–1993	1851–1897?
cattle	*Bos taurus*	1854–1970s	1830–**1999**	1844–**1998**	1851–1917?
bison	*Bison bison*	1924–**present**	never introduced	never introduced	never introduced
blackbuck	*Antilope cervicapra*	1972–**2011**	never introduced	never introduced	never introduced
Barbary sheep	*Ammotragus lervia*	1973–late 1970s	never introduced	never introduced	never introduced
sheep	*Ovis aries*	1850s–1920s	1853–**2001**	1844–1960s	<1850–1970s
goat	*Capra aegagrus hircus*	pre-1827–**2005**	1880s, 1919–1920	1883–Early 1900s	1880s