

5-YEAR REVIEW
Short Form Summary
Species Reviewed: *Gardenia mannii* (nānū)

Current Classification: Endangered

Federal Register Notice announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2022. Endangered and Threatened Wildlife and Plants; Initiation of 5-Year Status reviews for 167 Species in Oregon, Washington, Idaho, Montana, California, Hawaii, Guam, and the Northern Mariana Islands. Federal Register 87(90):28031–28034, May 10, 2022.

Lead Region/Field Office:

Region 1/Pacific Islands Fish and Wildlife Office (PIFWO), Honolulu, Hawai‘i

Name of Reviewer:

Cheryl Phillipson, Biologist, PIFWO
Lauren Weisenberger, Plant Recovery Coordinator, PIFWO
Megan Laut, Recovery Program Manager, PIFWO

Methodology used to complete this 5-year review:

This review was conducted by staff of the Pacific Islands Fish and Wildlife Office (PIFWO) of the U.S. Fish and Wildlife Service (Service) beginning in October 2023. The review was based on a review of current, available information since the last 5-year review for *Gardenia mannii* (USFWS 2019). The evaluation by Cheryl Phillipson, Biologist, was reviewed by Lauren Weisenberger, Plant Recovery Coordinator, and Megan Laut, Recovery Program Manager.

Background:

For information regarding the species’ listing history and other facts, please refer to the Fish and Wildlife Service’s Environmental Conservation On-line System (ECOS) database for threatened and endangered species (<http://ecos.fws.gov/ecp/species/753>).

Review Analysis:

Please refer to the previous 5-year reviews for *Gardenia mannii* published in the Federal Register on January 18, 2008, August 5, 2013, and September 26, 2019 (available at https://ecos.fws.gov/docs/tess/species_nonpublish/1171.pdf, https://ecos.fws.gov/docs/tess/species_nonpublish/2074.pdf, and https://ecos.fws.gov/docs/tess/species_nonpublish/2871.pdf) for a complete review of the species’ status, threats, management efforts, and references cited. We are not aware of any significant new information regarding the species’ biological status since listing to warrant a change in the Federal listing status of *G. mannii*.

This short-lived perennial tree in the Rubiaceae (coffee) family is endangered and is known from the island of O‘ahu. The status and trends for *Gardenia mannii* are provided in the tables below.

New Status Information:

- In 2019, there were fewer than 70 wild individuals in 11 populations in both the Wai‘anae and Ko‘olau mountains of O‘ahu (USFWS 2019). The number of wild individuals continues to decline. Currently, there are eight wild populations, mostly in the Ko‘olau mountains, totaling 46 to 55 mature and 2 immature individuals (ANRPO 2023a, appendices p. 331; ANRPO 2023b; Plant Extinction Prevention Program [PEPP] 2019–2023). Only three of these populations have nine or more individuals, and the other populations are limited to only one to three individuals each, severely limiting reproduction of this dioecious species.
- Thirty-two founders from seven populations (Helemano, Kalua‘a, Kawai Nui, Mālaekahana-Kea‘aulu, ‘Ōpae‘ula, Pa‘ala‘a Uka, Poamoho, and Schofield Barracks East and West are represented in seed collections and nursery plants (ANRPO 2023b).

New Threats:

- None reported.

New Management Actions:

- Feral ungulate monitoring and control—ANRPO manages feral ungulates at the reintroduction sites at ‘Ōpae‘ula, Helemano, Poamoho, Hale‘au‘au, Pe‘ahināi‘a, and in Schofield Barracks West with fencing and trapping (ANRPO 2020 appendices, pp. 153, 172, 175–176, 427; ANRPO 2021 appendices, p. 410; ANRPO 2022 appendices, p. 524; ANRPO 2023a appendices, p. 372).
- Nonnative invasive plant monitoring and control—ANRPO conducts nonnative plant control at Poamoho, ‘Ōpae‘ula, Hale‘au‘au, Pe‘ahināi‘a and Schofield Barracks West and replaces them with common native species to expand buffer areas and improve habitat conditions (ANRPO 2020, pp. 33, 94, appendices, pp. 176, 427; ANRPO 2021, p. 89, appendices, p. 410; ANRPO 2022, pp. 58, 87, appendices, p. 524; ANRPO 2023a, pp. 69, 102, appendices, p. 372).
- Predation and herbivory—
 - ANRPO conducts rodent control at Hale‘au‘au, Pe‘ahināi‘a, and at the Schofield Barracks West reintroduction sites (ANRPO 2020 appendices, pp. 177, 427; ANRPO 2021 appendices, p. 410; ANRPO 2022 appendices, p. 524; ANRPO 2023a appendices, p. 372).
 - ANRPO had initiated invertebrate (slug) control at the Schofield Barracks West fenced sites but discontinued because of the presence of native snails (ANRPO 2020 appendices, p. 180).
- Collection and propagation for genetic storage and reintroduction—
 - In 2023, ANRPO reported 10 founders from five populations (Helemano, Kalua‘a, Kaukonahua, ‘Ōpae‘ula, and Pa‘ala‘a Uka) are represented by 4,039 seeds in storage (more than 4,000 seeds from one subpopulation at Helemano). Thirty-two founders from 10 populations are represented by 153 propagules in storage (ANRPO 2023b).
 - In 2019, the Pahole Rare Plant Facility reported storage of two plants representing two founders from an unspecified source (Pahole Rare Plant Facility 2019).

- In 2020, the State’s Native Ecosystems Protection & Management Program (NEPM) reported storage of 350 seeds representing five founders and propagation of 233 explants representing the same five founders (NEPM 2020).
- Reintroduction and augmentation—There are two reintroduction sites and one *inter situ* site in the Ko‘olau mountains at Helemano, ‘Ōpae‘ula, and Wahiawā Botanical Garden (Kaukonahua), respectively. There are four reintroduction sites in the Wai‘anae mountains, at Schofield Barracks West and north Hale‘au‘au. At Helemano, 13 of the 34 individuals remain, at ‘Ōpae‘ula, 28 of the 128 remain, and at Kaukonahua, 18 of the 37 remain. At the three Schofield Barracks West sites, 5 of 42 remain, 167 of 225 remain, and 2 of 5 remain; and at Haleauau, 57 mature and 117 immature remain (ANRPO 2020, p. 109, appendices, pp. 153, 172; ANRPO 2021, p. 96; ANRPO 2023b).
- Reproduction and seed and pollen viability research—ANRPO is testing whether *Gardenia mannii* seedlings may require epiphytic conditions (such as a nurse log) for germination and growth. ANRPO planted 14 seedlings on nurse logs or similar sites rich in organic matter and currently all 14 are surviving (ANRPO 2023a, p. 111, appendices pp. 38, 51). ANRPO is testing hand-pollination for viable seed production using collected and stored pollen during rare flowering events (ANRPO 2023a, p. 112).
- Partnership projects—The Stewardship Program of Kualoa Ranch on the windward side of O‘ahu is currently receiving funding for a USFWS Partners project for habitat protection and restoration for rare and endangered species that occur or are historic to Ranch property including *Cyanea acuminata*, *C. crispa*, *C. truncata*, *Pteralyxia macrocarpa*, and *Schiedea kaalae*. *Gardenia mannii* was recorded from a gulch on ranch property over 20 years ago and remains a priority species to survey for in hopes of rediscovery. This species may benefit from management of the wet forest habitat on the Ranch (Lee 2022, p. 35).

Table 1. Status and trends of *Gardenia mannii* from listing through current 5-year review. Table 1a shows progress according to Interim Stabilization Goals; Table 1b shows progress according to Preventing Extinction Goals.

Table 1a.

Date	No. wild individuals	No. Outplanted	Stabilization Criteria identified in Recovery Plan	Stabilization Criteria Completed?
1996 (listing)	70–100	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 25 mature individuals each	No

2008 (5-year review)	108–110	0	All threats managed in all 3 populations	Partial
			Complete genetic storage	Partial
			3 populations with 25 mature individuals each	Partial, 1 population
2013 (5-year review)	96	0	All threats managed in all 3 populations	Partial
			Complete genetic storage	Partial
			3 populations with 25 mature individuals each	Partial

Table 1b.

Date	No. wild individuals	No. outplanted	*Preventing Extinction Targets identified by HPPRCC	*Preventing Extinction Targets Completed?
2019 (5-year review)	<70	92	All threats managed in all 3 populations	Partial
			Complete genetic storage	Partial
			Reproduction (i.e., viable seeds, seedlings, saplings) at all 3 populations	No
			3 populations with 100 mature individuals each	No
2024 (5-year review)	46 to 55 mature 2 immature	472; currently ca 233 survive	All threats managed in all 3 populations	Partial, 4 populations fenced, nonnative plant control at 5 populations, rodent control at 3 populations

			Complete genetic storage	Partially, 32 founders represented
			Natural reproduction at all 3 populations	No
			3 populations with 100 mature individuals each	No

* The Preventing Extinction Stage was established in 2011. Prior to 2011, the Interim Stabilization Stage was the first stage towards recovery (now it is the second stage after Preventing Extinction).

Table 2. Threats to *Gardenia mannii* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Degradation and destruction of habitat by feral ungulates	A, C	Ongoing	Partial, 4 populations partially fenced
Established ecosystem altering invasive plant species degradation of habitat and competition	A, E	Ongoing	Partial, management at 5 areas
Fire destruction and degradation of habitat	A	Ongoing	Partial, fire management plan for Army training areas; large fire in Ko'olau mountains in 2023 outside of Army training area
Climate change degradation or loss of habitat	A	Ongoing	None
Predation and herbivory by rodents	C	Ongoing	Partial, rodent control at 1 population
Predation by insects and disease	C	Ongoing	None
Military activities	E	Ongoing	Partial, reintroduction and fencing
Small populations and lack of reproductive vigor	E	Ongoing	Partial, seed storage, propagation, and mixed reintroductions

Synthesis:

Currently, eight populations total 46 to 55 mature and 2 immature wild individuals. Four populations are at least partially within a fenced area. There is some nonnative invasive plant control for five populations, and rodent control at three reintroduction sites.

ANRPO follows a fire management plan for training areas. Breeding biology studies for pollination and seed viability are ongoing. Approximately 32 founders from seven populations are represented in seed collections and nursery plants.

Stabilizing (interim), and downlisting and delisting criteria are provided in the Recovery Plan for the O‘ahu Plants (USFWS 1998) and preventing extinction targets have been added and criteria updated according to the draft revised recovery objective guidelines developed by the Hawai‘i and Pacific Plants Recovery Coordinating Committee (HPPRCC 2011). The HPPRCC identifies an additional initial objective, the Preventing Extinction Stage, in addition to the Interim Stabilization, Delisting, and Downlisting objectives. Furthermore, life history traits such as breeding system, population size fluctuation or decline, and reproduction type (sexual or vegetative), have been included in the calculation of goals for the number of populations and reproducing individuals for each stage. The goals for each stage remain grouped by life span defined as annual, short-lived perennial (fewer than 10 years), or long-lived perennial.

Gardenia mannii is a short-lived perennial tree and apparently dioecious (individuals with male or female flowers). To prevent extinction, which is the first milestone in recovering the species, the taxon must be managed to control threats (e.g., fenced) and have 50 individuals (or the total number of individuals if fewer than 50 exist) from each of three populations represented in *ex situ* (secured off-site, such as a nursery or seed bank) collections that are well managed. In addition, a minimum of a total of three populations should be documented on O‘ahu where they now occur or occurred historically and each of these populations must be naturally reproducing (i.e., viable seeds, seedlings) with a minimum of 100 mature, reproducing individuals per population.

The preventing extinction goals for this species have not been met. The number of wild individuals continues to decline. No populations total at least 100 mature individuals, and no recruitment is reported (Table 1). Genetic storage goals have not been met. Only four populations are at least partially within a fenced area, five have management of nonnative invasive plants, and one has rodent control implemented (Table 2). Wildfire is an increasing threat to the species as there was a large fire in the Ko‘olau mountains in 2023 (Table 2). Therefore, *Gardenia mannii* meets the definition of Endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:

No significant new information regarding the species’ biological status has been reported since the last 5-year review in 2019. Thus, the following recommendations for future actions are updated or reiterated for the 5-year review for 2024.

- Surveys and monitoring—Monitor known populations.
- Ungulate monitoring and control—Continue to construct and maintain exclosures to provide protection from the negative impacts of habitat degradation and browsing by feral ungulates.

- Nonnative invasive plant monitoring and control—Continue to control established ecosystem-altering nonnative invasive plant species, and those that compete with *Gardenia mannii*, at all populations.
- Fire monitoring and control—Continue to implement fire management plans for all populations, develop fire management plans for occurrences outside of Army training areas.
- Climate change adaptation strategy—Assess the modeled effects of climate change on this species and use to determine future landscape needed for its recovery.
- Predator and herbivore monitoring and control—
 - Implement control methods for rats at all populations.
 - Research effects of invertebrate damage (black twig borer, scale) and diseases (sooty mold) and determine and implement effective control methods if necessary.
- Captive propagation for genetic storage and reintroduction—
 - Continue collection and propagation efforts for maintenance of genetic stock and for reintroduction.
 - Continue to assess genetic variability within the extant populations and develop a plan for conserving the species’ genetic diversity in *ex situ* and reintroduced populations.
- Reintroduction and augmentation—Continue to establish new populations and augment existing populations of *G. mannii* in suitable habitat within historical range that is being managed for known threats to this species.
- Build resiliency, redundancy, and representation—Increase species’ viability through habitat restoration, threat control, and reintroduction and translocation to reduce impacts of slugs, climate change, and low seed production and viability.
- Population biology research—Continue to develop effective propagation protocols and breeding programs to enhance availability of viable seeds.
- Alliance and partnership development—Continue to work with ANRPO, NEPM, and other land managers and partners to initiate planning and contribute to implementation of ecosystem-level restoration and management to benefit this species.

References:

- [ANRPO] Army Natural Resources Program of O‘ahu. 2020. 2020 Status report for the Mākua and O‘ahu Implementation Plans. Office of the Vice President for Innovation and Research, University of Hawai‘i. 214 pp. + appendices, 516 pp.
- [ANRPO] 2021. 2021 Status report for the Mākua and O‘ahu Implementation Plans. Office of the Vice President for Innovation and Research, University of Hawai‘i. 207 pp. + appendices, 623 pp.
- [ANRPO] 2022. 2022 Status report for the Mākua and O‘ahu Implementation Plans. Office of the Vice President for Innovation and Research, University of Hawai‘i. 228 pp. + appendices, 690 pp.

- [ANRPO] 2023a. 2023 Status report for the Mākua and O‘ahu Implementation Plans. Prepared by Army Natural Resources Program, O‘ahu, Office of the Vice President for Innovation and Research, University of Hawai‘i. 255 pp. + appendices, 534 pp.
- [ANRPO] 2023b. Report on controlled propagation of listed species, as designated under the U.S. Endangered Species Act. Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawai‘i.
- [HPPRCC] Hawai‘i and Pacific Plants Recovery Coordinating Committee. 2011. Revised recovery objective guidelines. 8 pp.
- Lee, J. 2022. Stewardship annual report, January 1, 2022, through December 31, 2022. 82 pp.
- [NEPM] Native Ecosystems Protection & Management. 2020. Report on controlled propagation of listed species, as designated under the U.S. Endangered Species Act. Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawai‘i.
- Pahole Rare Plant Facility. 2019. Report on controlled propagation of listed species, as designated under the U.S. Endangered Species Act. Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawai‘i.
- [PEPP] Plant Extinction Prevention Program. 2019-2023. Plant Extinction Prevention Program fiscal years 2019 to 2023 interim performance report (October 1, 2018-September 30, 2023). U.S. Fish and Wildlife Service CFDA Program \$15.657 Endangered Species Conservation—Recovery Implementation Funds, Cooperative Agreement: F18AC00502 (Final performance report), University of Hawai‘i at Mānoa, Pacific Cooperative Studies Unit. 105 pp.
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- [USFWS] 2008. *Gardenia mannii* 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI.
https://ecos.fws.gov/docs/five_year_review/doc/1171.pdf.
- [USFWS] 2013. *Gardenia mannii* 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI.
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U.S. FISH AND WILDLIFE SERVICE
SIGNATURE PAGE for 5-YEAR REVIEW of *Gardenia mannii* (nānū)

Pre-1996 DPS listing still considered a listable entity? N/A

Recommendation resulting from the 5-year review:

- Delisting
- Reclassify from Endangered to Threatened status
- Reclassify from Threatened to Endangered status
- X No Change in listing status

For Field Supervisor, Pacific Islands Fish and Wildlife Office

_____ Date_____