5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Cyanea superba* (hāhā)

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 *Cyanea superba* (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/4451*).

Review Analysis:

Please refer to the previous 5-year reviews for *superba* published in the Federal Register on August 2, 2007, August 28, 2012, and September 25, 2019 (available at *https://ecos.fws.gov/docs/tess/species_nonpublish/1098.pdf, https://ecos.fws.gov/docs/tess/species_nonpublish/2113.pdf,* and *https://ecos.fws.gov/docs/tess/sepcies_nonpublish/2842.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 *C. superba*.

This short-lived perennial palm-like tree in the Campanulaceae (bellflower) family is endangered and is known from the island of O‘ahu. The status and trends for *Cyanea superba* are provided in the tables below.

New Status Information:

- There are no known wild individuals of *Cyanea superba. Cyanea superba* subsp. *regina* is not represented in cultivation, and *Cyanea superba* subsp. *superba* is represented in cultivation and translocations. Over 2,000 individuals of *Cyanea superba* subsp. *superba* have been translocated, of which 400 currently survive throughout the five population units (Kahanahāiki, Kaluaʻa, Kapuna-Pahole, Palikea, and Mākaha) in the Waiʻanae mountains of Oʻahu (Army Natural Resources Program of Oʻahu [ANRPO] 2023a). Since the last five-year review, over 600 plants have been reintroduced. Including the 66 naturally-recruited individuals, there are currently 108 mature and 354 immature plants in these population units (ANRPO 2023a; ANRPO 2023b appendices, p. 300; Plant Extinction Prevention Program [PEPP] 2019–2023).
- Currently, 18 reintroduced individuals from three populations (Kapuna, Mākaha, and Mākua Military Reservation [Kahanahāiki]) are represented in *ex situ* storage and propagation of collections including more than 123,000 seeds in seed banks, 108 explants in tissue culture, and 25 individuals at two botanical gardens (ANRPO 2023a; Lyon Arboretum 2022; Oʻahu Native Ecosystems Protection & Management [NEPM] Rare Plant Nursery 2020; PEPP 2019–2023; Pahole Rare Plant Facility 2019; Waimea Arboretum 2018). This *ex situ* representation includes two to three wild individuals.

New Threats:

- In 2020, a new invertebrate pest, the passionvine hopper (*Scolypopa australis*), was observed on *Cyanea superba*; however, deleterious effects caused by this invertebrate were not reported (ANRPO 2020, p. 202). The passionvine hopper is a sap sucker and can harm the vigor of plants, transmit diseases, and excrete honeydew leading to sooty mold growth on plant leaves (Department of Agriculture 2022). Further observations and study are needed to determine if management may be required.
- Introduced Galliformes or landfowl (Erckel's francolin [*Pternistis erckelii*] and Kalij pheasant [*Lophura leucomelanos*]) are observed disturbing plants and eating fruit; the ANRPO recommends that control methods for this predation should be investigated (ANRPO 2023b appendices, pp. 64, 152).

New Management Actions:

- Monitoring and surveys—The ANRPO and the State's NEPM program monitor reintroduced populations of *Cyanea superba*.
- Ungulate monitoring and control—Feral ungulates are controlled at all reintroduction sites (ANRPO 2023 appendices, p. 344).
- Invasive nonnative plant monitoring and control—
    - The ANRPO conducts nonnative plant control at Kahanahāiki, Kaluaʻa, Palikea, and Mākaha and the State now directs weed control at a management subunit at Pahole–Kapuna (ANRPO 2020 appendices, p. 75; ANRPO 2022 appendices, p. 496). ANRPO's focal site for public outreach is Kaluaʻa-Waiʻeli, with volunteers maintaining the area by weeding and outplanting common native plants (ANRPO 2023b appendices, p. 128).

    - In 2021, PEPP reported conducting nonnative plant control for unspecified populations of *Cyanea superba* (PEPP 2021, p. 18).
- Rodent control—The ANRPO conducts rodent control at Kahanahāiki, Mākaha, and Palikea, with partial control at Kaluaʻa (ANRPO 2020, p. 197; ANRPO 2021, p. 183; ANRPO 2023b, pp. 105, 207–208). Trap grids at Pahole now being managed by NEPM (ANRPO 2023b appendices, p. 64). Rodent control was added to the managed area at Kaluaʻa-Waiʻeli (ANRPO 2023 appendices, p. 105). Rodent predation is high at Pahole and efforts for control will be shifted to more successful management areas including Kapuna and Palikea (ANRPO 2023b appendices, p. 87).
- Invertebrate monitoring and control—
    - In 2020, a new pest, the passion vine hopper (*Scolypopa australis*) was observed on *C. superba* at Palikea, a new record for Hawaiʻi (ANRPO 2020, p. 202). However, deleterious effects were not reported at that time and no control has been initiated (see New Threats, above).
    - The ANRPO conducts slug control using molluscicides at Kahanahāiki, Kaluaʻa-Waiʻeli, and Palikea, but not in areas where there are native snails (ANRPO 2020, pp. 203–205; ANRPO 2021, p. 196; ANRPO 2023, p. 244, appendices p. 344).
- Collection and propagation for genetic storage and reintroduction—
    - The ANRPO reported collection and storage of 84,775 seeds representing four reintroduced plants in one population (Kahanahāiki) (ANRPO 2023a). One reintroduced plant is represented by 36 explants and all of those reintroduced founders are also represented by 180 nursery plants (ANRPO 2023a).
    - In 2018, the Waimea Arboretum reported five plants in storage (no source information) and in 2023, there were six individuals in the living collection (ANRPO 2023a).
    - In 2019, the Pahole Rare Plant Facility (PRPF) reported 20 plants in storage representing two reintroduced founders from unspecified populations (PRPF 2019).
    - In 2021, the Lyon Arboretum Micropropagation Laboratory reported storage of 36 explants representing one reintroduced founder at Kahanahāiki (Lyon Arboretum 2022). From 2012 through 2017, the Lyon Arboretum Seed Conservation Laboratory reported storage of more than 30,000 seeds representing nine reintroduced founders from one subpopulation at Kapuna and 871 seeds representing four reintroduced founders at a second subpopulation at Kapuna (Lyon Arboretum 2022).
    - In 2001, the State's NEPM Program reported propagation of 36 seedlings representing one reintroduced founder at Kahanahāiki (Oʻahu NEPM Nursery 2020).
- Reintroduction and augmentation—
    - Currently, ANRPO reintroduces individuals to five managed areas (see New Information Status, above).
    - The ANRPO discontinued reintroductions at Pahole and Manuwai as they are not successful and research showed that expansion of restoration sites to areas outside of historical range (higher elevations) were better for recruitment (see

Reintroduction research, below) (ANRPO 2023b appendices, pp. 149, 155, 171).
    - In 2020, PEPP reported reintroduction of five plants at Kapuna and two plants at Pahole (PEPP 2020, p. 11).
- Seed viability research—ANRPO conducted a laboratory trial to assess the effect of fruit retainment on viability of seeds of *Cyanea longiflora* (ANRPO 2020 appendices, p. 390). The study showed that there was a reduction in germination of those seeds retained and that recruitment is impacted by fruit/seed dispersal limitations as previously found for *C. superba* and *C. grimesiana* ssp. *obatae* in studies from 2016 and 2017 (ANRPO 2020 appendices, p. 390).
- Reintroduction research—An outplanting program tested 20 sites with translocation of almost 2,000 individuals of *C. superba* (Adamski et al. 2020 in ANRPO 2021 appendices, pp. 35–38). Monitoring indicated higher overall survival after five years at sites outside of historic range of the species. Factors found to be limiting recruitment were low viability of seeds after two weeks of maturity and consumption of seeds by rats. Otherwise, plants were found to grow vigorously and recruit new individuals (Adamski et al. 2020 in ANRPO 2021 appendices, pp. 35–38). Therefore, expanding reintroduction sites to higher elevations and improving habitat by removing invasive nonnative plants and restoring common native plants increases the natural recruitment and survival of *C. superba* (Adamski et al. 2020 in ANRPO 2021 appendices, pp. 35–38).

Table 1. Status and trends of *Cyanea superba* 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?
1991 (listing)	<20	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
2007 (5-year review)	0	109	All threats managed in all 3 populations	Partial
			Complete genetic storage	Partial

			3 populations with 50 mature individuals each	No
2012 (5-year review)	0	67	All threats managed in all 3 populations	No
			Complete genetic storage	Partial
			3 populations with 50 mature individuals each	No

Table 1b.

Date	**No. wild individuals**	**No. outplanted**	***Preventing Extinction Targets identified by HPPRCC**	***Preventing Extinction Targets Completed?**
2019 (5-year review)	0	ca 2,000, 170 mature	All threats managed in all 3 populations	Partial
			Complete genetic storage	Complete
			Reproduction (i.e., viable seeds, seedlings) at all 3 populations	Partial
			3 populations with 50 mature individuals each	None
2024 (5-year review)	0	>2,000 planted; 462 remain	All threats managed in all 3 populations	Partial, reintroduced populations within exclosures
			Complete genetic storage	Complete
			Natural reproduction at all 3 populations	Partial. recruitment at 1 reintroduced population
			3 populations with 50 mature individuals each	None

* 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 *Cyanea superba* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Degradation and destruction of habitat by feral ungulates	A	Ongoing	Complete, all reintroduced populations fenced
Established ecosystem altering invasive plant species degradation of habitat and competition	A, E	Ongoing	Partial, nonnative plant control at all reintroduced populations
Fire destruction and degradation of habitat	A	Ongoing	Partial, fire management plan for Army training areas
Climate change degradation or loss of habitat	A	Ongoing	None
Predation and herbivory by rodents	C	Ongoing	Partial, rodent control in 4 managed area
Predation by invertebrates—Passionvine hopper	C	Potential	Recommendation for further research
Predation by landfowl	C	Potential	Recommendation for determination of effective control methods
Lack of adequate hunting regulations	D	Ongoing	Partial, all reintroduced populations fenced but game birds not controlled
Reduced viability due to small populations	E	Ongoing	Partial, seed collection, propagation, and translocation
Trampling and human activity	E	Ongoing	Partial, all reintroduced populations fenced

Synthesis:
Currently there are 108 mature and 354 immature reintroduced individuals of *Cyanea superba* in five populations. Over 2,000 individuals have been reintroduced. All reintroduced populations are fenced to protect them from feral ungulates and invasive nonnative plants are partially controlled. Four reintroduced populations have rodent control. Seed collection, propagation, and reintroduction are ongoing, with some recruitment reported. Research regarding seed viability and survival at reintroduction locations was performed.

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.

Cyanea superba is a short-lived perennial palm-like tree. 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 50 mature, reproducing individuals per population.

The preventing extinction goals for this species have not been met. The last known wild founders are represented in collections, from propagated individuals, and in translocated populations (Table 1). Currently, there are no populations totaling at least 50 reproducing individuals even with some recruitment (Table 1). The effects of climate change and human activities are not addressed (Table 2). The threats of nonnative plant competition, and rat and slug predation are not completely addressed, in addition to control of wildfires. Predation by an invertebrate and by landfowl are potential threats. Therefore, *Cyanea superba* meets the definition of Endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:
The presence and impacts of introduced passionvine hopper and game fowl are new significant information regarding the species’ biological status that has been reported since the last 5-year review in 2019. Thus, the following recommendations for future actions are new, updated, or reiterated for the 5-year review for 2024.

- Surveys and monitoring—Continue to monitor translocated populations of *Cyanea superba*.
- Ungulate monitoring and control—Continue to construct and maintain exclosures to protect populations from the negative impacts of habitat degradation and browsing by feral ungulates.
- Nonnative invasive plant monitoring and control—Continue control of established ecosystem-altering nonnative invasive plant species, and those that compete with *C. superba*.
- Fire monitoring and control—Continue to implement the fire management plan for all reintroduced populations.

- Climate change adaptation strategy—Assess the modeled effects of climate change on the viability of this species and use to determine future landscape needed for its recovery.
- Predator and herbivore monitoring and control—
  - Continue to implement effective control methods for rodents at all populations.
  - Continue to implement effective methods for control of slugs/snails.
  - Investigate the potential effects of predation by the new invertebrate pest species, the passionvine hopper (*Scolypopa australis*).
  - Investigate the potential effects of introduced Galliformes or landfowl on *C. superba* and determine 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.
  - Assess genetic variability at outplanting sites and implement a plan for conserving species' genetic diversity in reintroduced populations.
- Reintroduction and translocation—Continue reintroduction into 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 fires and human impacts.
- Alliance and partnership development—Continue to work with ANRPO and the Native Ecosystems Protection & Management program and other land managers to implement ecosystem-level restoration and management to benefit this species.

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U.S. FISH AND WILDLIFE SERVICE
SIGNATURE PAGE for 5-YEAR REVIEW of *Cyanea superba* (hāhā)

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**

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