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. 2017. Endangered and threatened wildlife and plants; initiation of 5-year status reviews for 138 species in Hawaii, Oregon, Washington, and California. Federal Register 82(75): 18665–18668, April 20, 2017.

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, Conservation & Restoration Team 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 2018. The review was based on a review of current, available information since the last 5-year review for *Cyanea superba* (USFWS 2012). The evaluation completed by Cheryl Phillipson, Biologist, was reviewed by Lauren Weisenberger, Plant Recovery Coordinator, and Megan Laut, Conservation and Restoration Team 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/tess_public*).

Review Analysis:

Please refer to the previous 5-year reviews for *Cyanea superba* published in the Federal Register on August 2, 2007 and August 28, 2012 (available at *https://ecos.fws.gov/docs/five_year_review/doc1131.pdf* and *https://ecos.fws.gov/docs/five_year_review/doc4253.pdf*) for a complete review of the species' status, threats, and management efforts. 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 endemic to O‘ahu. The current status and trends for *Cyanea superba* are provided in the tables below.

New Status Information:

- Currently, there are still no known wild individuals of *Cyanea superba* subsp. *superba*. However, there are several reintroduction sites that represent three wild founders that had fruit collections made prior to the plants' demise, and these collections have been represented in *ex situ* storage for over twenty years.
- In 2012, three critical habitat units in the lowland mesic ecosystem were designated for *Cyanea superba* in the Waiʻanae mountains of Oʻahu (5,864 ac, 2,373 ha) (77 FR 57648, September 18, USFWS 2012b).
- Subspecies *regina* was last documented from the southeastern Koʻolau mountains in 1932. No collections were maintained in *ex situ* storage and this subspecies is considered extinct. The remainder of this review discusses only subspecies *superba*.

New Threats:

- Climate change loss or degradation of habitat—Climate change may pose a threat to this species. Fortini *et al.* (2013) conducted a landscape-based assessment of climate change vulnerability for native plants of Hawaiʻi using high resolution climate change projections. Climate change vulnerability is defined as the relative inability of a species to display the possible responses necessary for persistence under climate change. The assessment by Fortini *et al.* (2013) concluded that (at the species level) *Cyanea superba* is extremely vulnerable to the impacts of climate change, with a vulnerability score of 0.936 (on a scale of 0 being not vulnerable to 1 being extremely vulnerable to climate change). In addition, this species has no overlap between current and future climate envelopes, and is unlikely to tolerate expected changes in climate at its current location. This means that this species must persist within suitable microrefugia, or move to newly available climate-compatible areas to avoid extinction. Therefore, additional management actions are needed to conserve this taxon into the future, such as identifying suitable microsites where climate change is anticipated to occur more slowly and considering suitable habitat in areas outside of its known range.

New Management Actions:

- Ungulate monitoring and control—The Army's Natural Resources Program-Oʻahu (ANRP) undertakes stabilization and management of endangered species to fulfill the requirements of the 2003 and 2008 Biological Opinions for U.S. Army activities in the Mākua and Oʻahu training areas (USFWS 2008). These actions include fencing and ungulate controlling management units that benefit the translocations of *Cyanea superba* in these areas (U.S. Army Garrison 2010; U.S. Army 2018). Currently, there are seven fenced management units containing outplanted individuals: Pahole, Upper Kapuna, Kahanahāiki, Manuwai, Mākaha, and Palikea (U.S. Army Garrison Hawaiʻi 2010; U.S. Army 2018).
- Invasive plant monitoring and control—The ANRP controls nonnative invasive plants in the above-mentioned management units (U.S. Army Garrison Hawaiʻi 2010).
- Captive propagation for genetic storage and reintroduction—

    - Lyon Arboretum Micropropagation Laboratory reports 18 propagules in storage representing one individual from the reintroductions at Kahanahāiki in the Mākua Military Reservation (Lyon Arboretum 2018). The Lyon Seed Conservation Laboratory reports storage of more than 38,000 seeds representing eight individuals from reintroductions at Pahole and four individuals from reintroductions at Upper Kapuna (Lyon Arboretum 2018).
    - The ANRP propagates individuals from the extirpated wild individuals and from reintroductions. Currently, there are two plants in storage in the nursery from two individuals from the Kahanahāiki (MMR) reintroduction and over 86,000 seeds in storage representing three founders from the extirpated wild Mākua population (U.S. Army 2018).
    - Pahole Rare Plant Facility (PRPF) reports three plants in storage (PRPF 2018).
- Translocation—The ANRP reintroduced almost 2,000 individuals at Manuwai, Upper Kapuna, Mākaha, Kahanahāiki, Pahole, Palikea, and Waimea Botanical Garden (16 sites, representing all three founders) and currently between 670 and 1,000 individuals survive (ANRP 2018; U.S. Army 2018).

Synthesis:
Currently there are no wild individuals of *Cyanea superba.* A landscape-based assessment of climate change vulnerability for native plants of Hawai‘i using high resolution climate change projections was made by Fortini *et al.* (2013) and their analysis showed that *C. superba* is extremely vulnerable to the effects of climate change. Thousands of seeds are in storage representing reintroductions of propagules from the last wild individual. Almost 2,000 individuals have been translocated since 2012 with approximately half currently surviving. All translocated individuals are within fenced and managed areas. Outplants do produce viable seeds, and seedlings have been observed periodically at some reintroductions sites. Despite this, there are few immature plants (and no mature plants) that have naturally recruited at any translocation.

Stabilizing (interim), downlisting, and delisting objectives were provided in the Recovery Plan for the O‘ahu Plants (USFWS 1998), and have been 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 step 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. In addition, a minimum 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, saplings) and increasing in number, with a minimum of 50 mature, reproducing individuals per population.

The preventing extinction goals for this species have not been met (Table 1). Most threats are being managed within seven exclosures containing outplanted individuals, and genetic representation goals have been met. There are seven translocated populations, only one of which totals more than 50 mature individuals; however, translocated, mature outplanted individuals are not included in the population structure, but rather only mature plants at wild populations or mature plants from filial generations at reintroductions. Therefore, no populations have 50 reproducing individuals (Table 2). Therefore, *Cyanea superba* meets the definition of Endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:
Other than the new data on this taxon’s vulnerability to climate change, we are not aware of any new threats. There is no significant new information regarding the species’ biological status since the last 5-year reviews in 2007 and 2012. Thus, the following recommendations for future actions are reiterated for the 5-year review for 2019.

- Surveys and monitoring—Continue to conduct surveys in appropriate and historical habitat to determine if any wild populations of both subspecies (subsp. *regina* and subsp. *superba*) of *Cyanea superba* still exist.
- Ungulate monitoring and control—Continue to construct and maintain fenced exclosures to protect individuals from the negative impacts of habitat degradation and browsing by feral pigs.
- Invasive plant monitoring and control—Continue to control established ecosystem-altering nonnative invasive plant species, and those that compete with *Cyanea superba*.
- Fire destruction and degradation of habitat—Continue to implement fire management plan for Army training areas and develop and implement fire management plans for other reintroduction sites.
- Climate change adaptation strategy—Assess the modeled effects of climate change on this species and use to determine future landscape needed for the recovery of the species.
- Herbivory by rats—Continue to implement control methods for rats at all populations.
- Herbivory by slugs—Continue to research and implement control methods for slugs.
- 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 outplanting sites and implement a plan for conserving the species’ genetic diversity in *ex situ* and reintroduced populations.

- Reintroduction and translocation—Continue reintroduction into areas protected from known threats within historical range.
- Alliance and partnership development—Continue to work with the U.S. Army and other land managers to implement ecosystem-level restoration and management to benefit this species.

Table 1. Status and trends of *Cyanea superba* from listing through current 5-year review.

Date	No. wild individuals	No. outplanted	Stabilization Criteria identified in Recovery Plan	Stabilization Criteria Completed?
1991 (listing)	<20	0	All threats managed in all three populations	No
			Complete genetic storage	No
			Three populations with 50 mature individuals each	No
1998 (recovery plan)	5	40	All threats managed in all three populations	Partially
			Complete genetic storage	Partially
			Three populations with 50 mature individuals each	No
2003 (critical habitat)	0	140	All threats managed in all three populations	Partially
			Complete genetic storage	Partially
			Three populations with 50 mature individuals each	No
2007 (5-year review)	0	109	All threats managed in all three populations	Partially
			Complete genetic storage	Partially
			Three populations with 50 mature individuals each	No

2012 (5-year review)	54	67	All threats managed in all three populations	No
			Complete genetic storage	Partially
			Three populations with 50 mature individuals each	No
2012 (critical habitat)	0	169	All threats managed in all three populations	Partially
			Complete genetic storage	Yes
			Three populations with 50 mature individuals each	Partially
Date	**No. wild individuals**	**No. outplanted**	***Preventing Extinction Criteria identified by HPPRCC**	***Preventing Extinction Criteria Completed?**
2019 (5-year review)	0	ca 2,000; 170 mature	All threats managed in all three populations	Partially
			Complete genetic storage	Complete
			Reproduction (*i.e.* viable seeds, seedlings) at all three populations	Partially
			Three populations with 50 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 after Preventing Extinction).

Table 2. Threats to *Cyanea superba* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulate destruction and degradation of habitat	A	Ongoing	Partial, ungulates controlled at seven management units
Degradation of habitat by established ecosystem-altering invasive plant species	A	Ongoing	Partial, nonnative plants controlled at seven management units
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
Rodent predation or herbivory	C	Ongoing	Partial, rodent control in management units
Slug herbivory	C	Ongoing	Partial, slug control in management units
Lack of adequate hunting regulations	D	Ongoing	Partial, ungulates monitored and controlled at seven management units
Competition with established invasive plant species	E	Ongoing	Partial, nonnative plants controlled at management units
Reduced viability due to low numbers	E	Ongoing	Partial, captive propagation for genetic storage and reintroduction, population biology research, and reintroduction

References:

see previous 5-year reviews for a full list of references (USFWS 2007, 2012). Only references for new information are provided below.

[ANRP] Army Natural Resources Program-Oʻahu. 2018. 2018 status report for the Mākua and Oʻahu implementation plans. 217 pp.

Fortini, L., J. Price, J. Jacobi, A. Vorsino, J. Burgett, K. Brinck, F. Amidon, S. Miller, S. Gon II, G. Koob, and E. Paxton. 2013. A landscape-based assessment of climate change vulnerability for all native Hawaiian plants. Technical report HCSU-044. Hawaii Cooperative Studies Unit, University of Hawaii at Hilo, Hawaii. 134 pp.

[HPPRCC] Hawaiʻi and Pacific Plants Recovery Coordinating Committee. 2011. Revised recovery objective guidelines. 8 pp.

Lyon Arboretum. 2018. 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, Hawaii.

[PRPF] Pahole Rare Plant Facility. 2018, 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, Hawaii.

[PEPP] Plant Extinction Prevention Program. 2012. PEPP annual report fiscal year 2012 (July 1, 2011-June 30, 2012). 169 pp.

[U.S. Army] U.S. Army, Environmental Division. 2018. Report to the U.S. Fish and Wildlife Service for Oahu Army Natural Resource Program, Permit: TES-043638, Reporting period January 1, 2018-December 31, 2018. 16 pp.

U.S. Army Garrison Hawai‘i. 2010. Integrated natural resources management plan 2010-2014, Island of O‘ahu. 375 pp.

[USFWS] 2008. Amendment of the biological opinion of the U.S. Fish and Wildlife Service for military training at Makua Military Reservation (1-2-2005-F-356). 61 pp.

[USFWS] 2012. *Cyanea superba* 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI. *https://ecos.fws.gov/docs/five_year_review/doc4253.pdf.*

[USFWS] 2012. Endangered and threatened wildlife and plants; Endangered status for 23 species on Oahu and designation of critical habitat for 124 species; final rule. Department of the Interior, Federal Register 77 (181): 57648–57862, September 18, 2012.

[USFWS] 2017. Endangered and threatened wildlife and plants; initiation of 5-year status reviews for 138 species in Hawaii, Oregon, Washington, and California. Federal Register 82(75): 18665–18668, April 20, 2017.

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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