5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Neraudia angulata* (no common name)

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:

Daniel Adamski, 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 *Neraudia angulata* (USFWS 2019). The evaluation by Daniel Adamski, 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/2750*).

Review Analysis:

Please refer to the previous 5-year reviews for *Neraudia angulata* published in the Federal Register on January 18, 2008, (available at *https://ecos.fws.gov/docs/tess/species_nonpublish/1190.pdf*); August 9, 2013, (available at *https://ecos.fws.gov/docs/tess/species_nonpublish/2088.pdf*), and on September 30, 2019, (available at *https://ecos.fws.gov/docs/tess/species_nonpublish/2886.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 *N. angulata*.

This short-lived perennial shrub in the Urticaceae (nettle) family is endangered and is endemic to O‘ahu. *Neraudia angulata* has two varieties: var. *angulata* and var. *dentata*. Populations that appear to be intermediate between the two varieties are also known across the current distribution of the species. The Army Natural Resources Program on

Oʻahu (ANRPO) has not distinguished them separately in population surveys, and therefore totals are reported for the species as a whole. The status and trends for *Neraudia angulata* are provided in the tables below.

New Status Information:

- Currently, *Neraudia angulata* occurs in eight population units from Mākua to Hālona in the Waiʻanae mountains, with wild plants estimated with 76 mature and 18 immature individuals. However, 22 wild plants at 2 populations have not been monitored within the last 10 years (ANRPO 2023a; ANRPO 2023b, Appendix 4-1; Togikawa et. al., 2023). The largest wild population unit is Mākua, with 24 total individuals (ANRPO 2023b, Appendix 4-1).
- Currently, there are approximately 77 founder lines represented in *ex situ* storage and propagation collections, including seeds in seed banks and plants in a nursery or living collection (ANRPO 2023b, Appendix 4-3; Oahu Nursery 2023).

New Threats:

- None

New Management Actions:

- Monitoring and surveys—Plant Extinction Prevention Program (PEPP) and ANRPO monitor individuals of *Neraudia angulata* in the Waiʻanae mountains of Oʻahu at Keālia (ANRPO 2023a; PEPP 2023; Togikawa et. al., 2023).
- Ungulate monitoring and management—*Neraudia angulata* occurs in seven fenced population units and ungulates are managed by the ANRPO (ANRPO 2023b, Appendix 4-2).
- Nonnative plant control—Nonnative plants are controlled in four management units (Kaluakauila, Mākua, Mākaha, and Manuwai) (ANRPO 2023b, Appendix 4-2).
- Control of predation and herbivory by rats—The ANRPO controls rats using Goodnature™ A24 rat traps. (ANRPO 2023a, Appendix 4-2).
- Collection and propagation for genetic storage and reintroduction—
    - ANRPO reports 44 founders represented in seed storage with at least 10 seeds, and of those, 40 founders are in storage with more than 50 viable seeds. ANRPO also maintains a living collection with over 50 founders with at least one plant in propagation, and 40 founders with three or more individuals in propagation (ANRPO 2023b, Appendix 4-3).
    - The Oahu Nursery reports 15 individual plants in propagation, representing four founders (Oahu Nursery 2023).
    - PEPP collected 19 fruits and one cutting from three individuals in 2023, to be used for seed storage and plant propagation (Togikawa et. al., 2023).
- Reintroduction/ Augmentation/ Introduction—
    - In 2023, PEPP reintroduced 24 individual plants to an existing reintroduction population at Kaluakauila (PEPP 2023). Currently there are five reintroduction populations totaling 295 individuals, of which 107 are mature plants, and 188 are immature plants. The largest outplanting population is

Mākua, followed by Kaluakauila, which is the only population where seedlings are observed (ANRPO 2023b, Appendix 4-3).

Table 1. Status and trends of *Neraudia angulata* 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	Stability Goals identified in Recovery Plan	Stability Goals Completed?
1991(Listing)	<15	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
2008 (5-year review)	353	27	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	Partially
2013 (5-year review)	330–396	205	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	Partially

Table 1b.

Date	No. wild individuals	No. outplanted	*Preventing Extinction Criteria identified by HPPRCC	*Preventing Extinction Criteria Completed?
2019 (5-year review)**	58 mature; 27 immature	463 mature; 71 immature	All threats managed in all 3 populations	Partially
			Reproduction (i.e., viable seeds, seedlings, saplings) at all 3 populations	Unknown
			Complete genetic storage	Partially
			3 populations with 100 mature individuals each	Partially, one population >50
2024 (5-year review)	72-94	107 mature; 188 immature	All threats managed in all 3 populations	Partial
			Complete genetic storage	Partial
			Natural reproduction at all 3 populations	Partial, at 1 reintroduction
			3 populations with 100 mature individuals each	Partial

* 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).

**The number of wild individuals and outplanted individuals was incorrectly reported in 2019 as 548 wild, and 8 outplanted. The correct number of wild and outplanted individuals are as reported in this table.

Table 2. Threats to *Neraudia angulata* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Degradation and destruction of habitat by feral ungulates	A	Ongoing	Partial, ungulate control at seven management units
Established ecosystem altering invasive plant species degradation of habitat	A	Ongoing	Partial, nonnative plant control at four management units
Fire destruction and degradation of habitat	A	Ongoing	None
Climate change degradation or loss of habitat, including hurricanes	A	Ongoing	None
Ungulate predation and herbivory	C	Ongoing	Partial, ungulate control at seven management units
Rodent predation and herbivory	C	Ongoing	Partial, rodent control at two management units
Predation and herbivory by invertebrates—Slugs, snails, black twig borer	C	Ongoing	Monitoring only
Competition with established invasive plant species	E	Ongoing	Partial, nonnative plant control at four management units

Synthesis:
Currently there are 72 to 94 wild individuals of *Neraudia angulata* on Oʻahu. Individuals are provided protection by fencing, nonnative plant control, rodent control, and ungulate control. Seed collections, seed storage and propagation, and reintroductions are ongoing.

Stabilizing (interim), downlisting, and delisting objectives are provided in the Recovery Plan for the Oʻahu Plants (USFWS 1998) and have been updated according to the draft revised recovery objective guidelines developed by the Hawaiʻi 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.

Neraudia angulata is a short-lived, dioecious, perennial shrub. 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. Although genetic storage is partially completed (Table 1), there are no populations totaling at least 100 reproducing individuals (no population greater than 24 total individuals), and all threats are not being managed (Table 1, Table 2). Therefore, *Neraudia angulata* 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—
  - Continue monitor known populations of *Neraudia angulata*.
  - Determine suitable locations for reintroductions.
- Ungulate monitoring and control—Continue to maintain fenced exclosures to protect individuals from the negative impacts of browsing by ungulates.
- Invasive nonnative plant monitoring and control—Control established ecosystem-altering nonnative invasive plant species, and those that compete with *N. angulata*.
- Site and habitat protection—Continue to develop and implement effective threat control measures to reduce the impacts of invasive plants and invasive invertebrates.
- Fire prevention and control—Continue to develop and implement fire prevention management plans.
- Climate change adaptation strategy—Research suitability of habitat for viability of species, including where to conduct translocations in the future due to the impacts of climate change, including increasing temperatures, periods between rain events, and increasing frequency and intensity of hurricanes. Additional management actions may be needed, such as locating key microsites that overlap with current and future climate envelopes for translocation efforts.
- Predator, pest, and herbivore monitoring and control—Determine and implement effective methods to control rodents, slugs, and black twig borer.
- Captive propagation for genetic storage and reintroduction—Continue collection and propagation efforts for maintenance of genetic stock and for reintroduction.
- Build resiliency, redundancy, and representation — Increase species' viability through habitat restoration, threat control, and reintroduction and translocation into suitable habitat that is being managed for known threats to this species to reduce impacts of climate change degradation and nonnative plant competition.

- Alliance and partnership development—Continue to work with partners and other land managers in planning and implementation of ecosystem-level restoration and management to benefit this species.

References:

[ANRPO] Army Natural Resource Program on Oʻahu. 2023. 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, Hawaiʻi.

[ANRPO] Army Natural Resource Program on Oʻahu. 2023b. Appendices to the Status report for the Mākua and Oʻahu Implementation Plans, Army Natural Resources Program, Oʻahu, Office of the Vice President for Research and Innovation, University of Hawaiʻi.

[HBMP] Hawaii Biodiversity and Mapping Program. 2010. Plant species GIS data and Access database.

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

Oahu Nursery. 2023. 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, Hawaiʻi.

Togikawa, K., S. Ching-Harbin, N. Dunn, and P. Roman. 2023. Hawaiʻi Rare Plant Restoration Group (HRPRG) Field Data Form *in* PEPP 2023: Plant Extinction Prevention Program, FY 2023 Annual Report (Oct 1, 2022-Sep 30, 2023), USFWS CFDA Program #15.657, Endangered Species Conservation-Recovery Implementation Funds, Coop Agreement F19AC00532 (Interim Report), April 24, 2023, UH Mānoa, PCSU, PEPP. 22 pp.

[U.S. Fish and Wildlife Service] U.S. Fish and Wildlife Service. 1998. Recovery plan for the Oahu plants. U.S. Fish and Wildlife Service, Portland, Oregon. 207 pages, plus appendices.

[USFWS] 2008. *Neraudia angulata* 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI. *https://ecos.fws.gov/docs/five_year_review/doc1190.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] 2013. *Neraudia angulata* 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI. *https://ecos.fws.gov/docs/five_year_review/doc2088.pdf*.

[USFWS] 2019. *Neraudia angulata*. 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI. *https://ecos.fws.gov/docs/five_year_review/doc2886.pdf.*

[USFWS] 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.

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SIGNATURE PAGE for 5-YEAR REVIEW of *Neraudia angulata* (no common name)

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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