5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Nototrichium humile* (kuluʻī)

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, Hawaiʻi

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 *Nototrichium humile*(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/1001*).

Review Analysis:

Please refer to the previous 5-year reviews for *Nototrichium humile* published in the Federal Register on January 18, 2008, (available at *https://ecos.fws.gov/docs/tess/species_nonpublish/1194.pdf*); August 8, 2013, (available at *https://ecos.fws.gov/docs/tess/species_nonpublish/2087.pdf*), and on September 30, 2019, (available at *https://ecos.fws.gov/docs/tess/species_nonpublish/3170.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. humile*.

This short-lived perennial shrub in the Amaranthaceae (amaranth) family is endangered and found on the island of Oʻahu and is extirpated from Maui. The status and trends for *Nototrichium humile* are provided in the tables below.

New Status Information:

- Currently, there are estimated to be 815 wild individuals (531 mature and 284 immature) of *Nototrichium humile* across 13 population units in the Waiʻanae mountains of Oʻahu (Army Natural Resources Program on Oʻahu [ANRPO] 2023a, Appendix 4-1). However, only two wild populations have been monitored in the last 5 years, and three additional populations within the last 10 years. Therefore, only 438 individuals have been observed in the last 10 years. A majority of wild individuals are found in three population units, which include Waiʻanae Kai, Punapōhaku, and Keawaʻula, thought the Punapōhaku population has not been monitored since 2013 and its status unknown (ANRPO 2023b, Appendix 4-1).
- Currently, there are approximately 157 founder lines represented in *ex situ* storage collections, including seeds in seedbanks and plants in a nursery or living collection (ANRPO 2023b, Appendix 4-3).

New Threats:

- None

New Management Actions:

- Monitoring and surveys— The ANRPO monitors individuals of *Nototrichium humile* in the Waiʻanae mountains of Oʻahu (ANRPO 2023b, Appendix 4-1).
- Ungulate monitoring and management—Fencing is monitored and maintained and ungulates are controlled at eight population units (ANRPO 2023a, Appendix 4-2).
- Invasive nonnative plant management— The ANRPO controls non-native plants across four population units (ANRPO 2023b, Appendix 4-2).
- Control of predation and herbivory by rats— The ANRPO controls rats using Goodnature™ A24 rat traps. ANRPO reported control in the Kahanahāiki population unit (ANRPO 2023a, Appendix 4-2).
- Collection and propagation for genetic storage and reintroduction—
    - ANRPO reports 34 total founder plants in seed storage with at least 50 viable seeds, and 141 total founder plants with three or more individuals in propagation (ANRPO 2023b, Appendix 4-3).
    - Lyon Arboretum Seed Conservation Laboratory reports 679 seeds in storage from three founders (Lyon Arboretum 2023).
    - The Oʻahu Nursery reports seven total plants in propagation representing two founders (Oʻahu Nursery 2023).
- Reintroduction/ Augmentation/ Introduction—
    - There are 109 total surviving reintroduced individuals. The large majority of reintroduced plants (101 mature and 1 immature) are in the Manuwai population unit (ANRPO 2023b, Appendix 4-1).

Table 1. Status and trends of *Nototrichium humile* 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)	1,500–3,000 (O‘ahu) Unknown (Maui)	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)	1,245 (O‘ahu) extirpated (Maui)	0	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	No
2013 (5-year review)	1,021 (O‘ahu)	0	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	No

Table 1b.

Date	No. wild individuals	No. outplanted	*Preventing Extinction Criteria identified by HPPRCC	*Preventing Extinction Criteria Completed?
2020 (5-year review)	ca 880–950 (O‘ahu)	113	All threats managed in all 3 populations	Partially
			Reproduction (i.e., viable seeds, seedlings, saplings) at all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	No
2024 (5-year review)	438-815	109	All threats managed in all 3 populations	Partial
			Complete genetic storage	Partial
			Natural reproduction at all 3 populations	Partial
			3 populations with 50 mature individuals each	Partial, lacking recent monitoring

* 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 *Nototrichium humile* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Degradation and destruction of habitat by feral ungulates	A	Ongoing	Partial, fencing, and ungulate control in eight areas
Established ecosystem altering invasive plant species degradation of habitat	A	Ongoing	Partial, nonnative plant control in four areas
Climate change degradation or loss of habitat, including hurricanes	A	Ongoing	None
Degradation and destruction by fire	A	Ongoing	Partial, fire management (fuel breaks) plan and coordinated response efforts
Predation and herbivory by invertebrates—Slugs, snails, black twig borer	C	Ongoing	None
Competition with established invasive plant species	E	Ongoing	Partial, nonnative plant management in two areas
Reduced viability due to low numbers	E	Ongoing	Partial, propagation, seed storage, and reintroduction are ongoing

Synthesis:
Currently there are 438 to as many as 815 wild individuals of *Nototrichium humile* on O‘ahu. Some individuals are provided protection by fencing, nonnative plant control, rat control, and ungulate control. Seed collections, propagation, and outplanting are ongoing. More monitoring is needed to better understand the total population size and trends.

Stabilizing (interim), downlisting, and delisting objectives are 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.

Nototrichium humile is a short-lived 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 or Maui where they now occur or occurred historically and each of these populations must be naturally reproducing (i.e., viable seeds and seedlings) with a minimum of 50 mature, reproducing individuals per population.

The preventing extinction goals for this species have not been met. Although genetic storage is almost complete (Table 1), all populations are not reproducing, only two have 50 mature individuals with a third that has not been monitored recently to confirm population size, and all threats are not being managed (Table 1, Table 2). Therefore, *Nototrichium humile* 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 to monitor known populations of *Nototrichium humile*.
  - Determine suitable locations for reintroductions.
- Ungulate monitoring and control—Continue to maintain fenced exclosures and construct new fences to protect individuals from the negative impacts of browsing by ungulates.
- Invasive nonnative plant monitoring and control—Continue control of established ecosystem-altering nonnative invasive plant species, and those that compete with *N. humile*.
- Site and habitat protection—Develop and implement effective threat control measures to reduce the impacts of ungulates and slugs.
- 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 and herbivore monitoring and control—Determine and continue to implement effective methods to control rats and slugs.
- 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 O‘ahu. 2023a. 2023 status report for the Makua and Oahu implementation plans. 255 pp.

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

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

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

Lyon Arboretum. 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, Hawai‘i.

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, Hawai‘i.

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[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] U.S. Fish and Wildlife Service. 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. *Nototrichium humile* 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI. *https://ecos.fws.gov/docs/five_year_review/doc2087.pdf*.

[USFWS] 2020. *Nototrichium humile* 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI. *https://ecos.fws.gov/docs/five_year_review/doc3170.pdf.*

[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.

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SIGNATURE PAGE for 5-YEAR REVIEW of *Nototrichium humile* (kuluʻī)

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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