5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Nothocestrum peltatum* (‘aiea)

Current Classification: Endangered

Federal Register Notice announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2020. Endangered and Threatened Wildlife and Plants; Initiation of 5-Year Status reviews for 129 Species in Oregon, Washington, Idaho, Hawaii, Montana, California, and Nevada. Federal Register 85(48): 14240–14243, March 11, 2020.

Lead Region/Field Office:

Interior Region 12/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 or USFWS) beginning in October 2021. The review was based on a review of current, available information since the last 5-year review for *Nothocestrum peltatum* (USFWS 2017). The evaluation 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 (*https://ecos.fws.gov/ecp/species/5366*).

Review Analysis:

Please refer to the previous 5-year reviews for *Nothocestrum peltatum* published in the Federal Register on July 21, 2009, and September 16, 2017 (available at *http://ecos.fws.gov/docs/tess/species_nonpublish/1381.pdf* and *http://ecos.fws.gov/docs/tess/species_nonpublish/2481.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. peltatum*.

This long-lived perennial tree in the Solanaceae (nightshade) family is listed as endangered and is known from the island of Kaua‘i. The status and trends for *Nothocestrum peltatum* are provided in the tables below.

New Status Information:

- In 2020, three additional plants were found at upper Nu‘alolo (Kaua‘i Plant Extinction Prevention Program [KPEPP] 2021). Currently, there are eight subpopulations totaling 31 individuals of *Nothocestrum peltatum* on Kaua‘i (Wolkis et al. 2020).

New Threats:

- None reported.

New Management Actions:

- Surveys and monitoring—The National Tropical Botanical Garden (NTBG) and the Plant Extinction Prevention Program (PEPP) survey for and monitor populations of *Nothocestrum peltatum* on Kaua‘i (Kishida and Perlman 2017, 2018; NTBG 2017a, b, 2019; Perlman 2018, 2019; Perlman and Alevizos 2018; Perlman and Wood 2017; PEPP 2017, 2021).
- Ungulate monitoring and control—One reintroduced population is within an exclosure at Miloli‘i and a wild individual is in an exclosure at the Waimea Canyon rim (Perlman 2017; Perlman and Alevizos 2018).
- Nonnative invasive plant species monitoring and control—Nonnative plants are controlled at exclosures (Perlman and Alevizos 2018).
- Invertebrate monitoring and control—Insect control is conducted at Kōke‘e, Awa‘awapuhi, and Wai‘alae (Kishida and Perlman 2018; Kishida and Tangalin 2018; Perlman and Kishida 2015).
- Captive propagation for genetic storage and reintroduction—
    - PEPP conducts airlayering of plants from Miloli‘i, Kauhao, and Awa‘awapuhi, for propagation (Kishida and Perlman 2017, 2018; PEPP 2017).
    - PEPP and NTBG collect seeds and cuttings from plants at Wai‘alae, Nu‘alolo, and Waimea Canyon Rim for storage and propagation (Perlman 2018; Kishida and Perlman 2018; Kishida and Tangalin 2018).
    - In 2022, the Lyon Arboretum Seed Conservation Laboratory reported storage of 7,673 seeds representing one founder each at Mākaha and Wai‘alae (Lyon Arboretum 2022).
- Reintroduction and augmentation—In 2018, two individuals propagated by airlayering were reintroduced to an exclosure (Perlman and Alevizon 2018).

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

Date	No. wild individuals	No. outplanted	Stability Criteria identified in Recovery Plan	Stability Criteria Completed?
1994 (listing)	15	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 25 mature individuals each	No
1995 (recovery plan)	23	0	All threats managed in all 3 population	No
			Complete genetic storage	No
			3 populations with 25 mature individuals each	No
2003 (critical habitat	20	0	All threats managed in all 3 populations	No
			Complete genetic storage	Partially
			3 populations with 25 mature individuals each	No
2009 (5-year review	23	0	All threats managed in all 3 populations	No
			Complete genetic storage	Partially
			3 populations with 25 mature individuals each	No
Date	**No. wild individuals**	**No. outplanted**	***Preventing Extinction Criteria identified by HPPRCC**	***Preventing Extinction Criteria Completed?**
2017 (5-year review)	32–41	2	All threats managed in all 3 populations	No
			Complete genetic storage	Partially

			Reproduction (i.e., viable seeds, seedlings) at all 3 populations	No
			3 populations with 50 mature individuals each	No
2022 (5-year review)	31	2	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially, at least 5 founders from 5 populations represented
			Natural reproduction at all 3 populations	Unknown
			3 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 stage after Preventing Extinction).

Table 2. Threats to *Nothocestrum peltatum* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Degradation and destruction of habitat by feral ungulates	A	Ongoing	Partial, 2 populations within exclosures
Established ecosystem altering invasive plant species degradation of habitat and competition	A, E	Ongoing	Partial, nonnative plant control within exclosures
Fire destruction and degradation of habitat	A	Ongoing	None
Climate change degradation and destruction of habitat, including hurricanes	A	Ongoing	None
Rodent predation and herbivory	C	Ongoing	None
Invertebrate predation or herbivory	C	Ongoing	Partial, treatment for insects at 3 locations
Reduced viability due to low numbers	E	Ongoing	Partial, collection and propagation, including airlayering

Synthesis:
Currently, there are 31 wild individuals of *Nothocestrum peltatum* on Kaua‘i. Vegetative and fruit collections and propagation, including airlayering, are ongoing, representing at least five founders from five subpopulations. Two populations within exclosures are provided protection from ungulates with some nonnative invasive plant control. Reintroduction is ongoing at one exclosure.

Stabilizing (interim), downlisting, and delisting objectives are provided in the Kaua‘i Islandwide Recovery Plan (USFWS 2021) 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.

Nothocestrum peltatum is a long-lived perennial tree and an obligate outcrosser. 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 Kaua‘i where this species now occurs 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 *Nothocestrum peltatum* have not been met. There are only 31 wild individuals (Table 1). Collection and propagation, including airlayering, are ongoing with at least five founders represented (Table 1, Table 2). Two populations are within managed exclosures. However, this species is susceptible to the threats of habitat destruction by feral ungulates, nonnative plant competition, rodent and invertebrate predation and herbivory, fire, climate change, reduced viability due to small population size, and hurricanes (Table 2). Therefore, *N. peltatum* meets the definition of Endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:
No new threats and no significant new information regarding the species' biological status have been reported since the last 5-year review in 2017. Thus, the following recommendations for future actions are reiterated or updated for the 5-year review for 2022.

- Surveys and montoring—Continue to survey for populations of *Nothocestrum peltatum* in areas of potentially suitable habitat.

- Ungulate monitoring and control—Construct and maintain exclosures at all wild and reintroduced populations to protect again disturbance by feral ungulates.
- Nonnative invasive plant monitoring and control—Control established ecosystem-altering nonnative invasive plant species and those that compete with *N. peltatum* at the last known population.
- Fire monitoring and control—Develop and implement fire management plans for all wild and reintroduced populations.
- Climate change adaptation strategy—Research suitability of habitat for viability of species, including where to conduct translocations in the future due to impacts of climate change.
- Predator and herbivore monitoring and control—
    - Implement effective control measures for rats.
    - Implement effective control methods for insects.
- Captive propagation for genetic storage and reintroduction—Continue collection and propagation efforts for maintenance of genetic stock.
- Build resiliency and redundancy—Increase numbers of individuals and populations through habitat restoration and translocations where threats are controlled to reduce impacts of feral ungulates, predation, low numbers, climate change, and hurricanes.
- Population biology research—
    - Determine possible causes for the lack of regeneration in the wild and *ex situ*.
    - Study *N. peltatum* populations to determine viable population size and structure, geographical distribution, flowering cycles, pollination vectors, seed dispersal agents, longevity. specific environmental requirements, limiting factors, and threats.
- Genetic research—Assess genetic variability within extant populations.
- 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:

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[NTBG] 2019. NTBG database herbarium record detail for *Nothocestrum peltatum,* PTBG1000068902, 080545, 22 JAN 2019.

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U.S. FISH AND WILDLIFE SERVICE
SIGNATURE PAGE for 5-YEAR REVIEW of *Nothocestrum peltatum* (‘aiea)

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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