

## 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. 2015. Endangered and threatened wildlife and plants; initiation of 5-year status reviews of 133 species in Hawaii, Oregon, Idaho, and Washington. Federal Register 80(30): 8100–8103.

### **Lead Region/Field Office:**

Region 1/Pacific Islands Fish and Wildlife Office (PIFWO), Honolulu, Hawaii

### **Name of Reviewer(s):**

Cheryl Phillipson, Biologist, PIFWO

Lauren Weisenberger, Plant Recovery Coordinator, PIFWO

Gregory Koob, 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 (USFWS) beginning in January 2016. The review was based on a review of current, available information since the last 5-year review for *Nothocestrum peltatum* (USFWS 2009). The evaluation by Cheryl Phillipson, Biologist, was reviewed by Lauren Weisenberger, Plant Recovery Coordinator, and Gregory Koob, 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](http://ecos.fws.gov/tess_public)).

### **Review Analysis:**

Please refer to the previous 5-year review for *Nothocestrum peltatum* published in the Federal Register on July 21, 2009 (USFWS 2009, available at [https://ecos.fws.gov/docs/five\\_year\\_review/doc2445.pdf](https://ecos.fws.gov/docs/five_year_review/doc2445.pdf)) for a complete review of the species' status, threats, and management efforts. No significant new information regarding the species biological status have come to light since listing to warrant a change in the Federal listing status of *N. peltatum*.

This long-lived, perennial, small tree in the Solanaceae family is endangered and found on Kauai. The current status and trends for *Nothocestrum peltatum* are provided in the tables below.

### **New Status Information:**

In addition to those populations cited in the previous 5-year review, new observations include the following:

- At the time of the last 5-year review in 2009 there were seven populations totaling 23 individuals. Currently, individuals are reported from the same areas at Nualolo, Awaawapuhi, Makaha, and Waimea Canyon rim (NTBG 2012c-d, 2013a-b, 2015a-d, 2016a-c). New occurrences have been found at Kopakapaka (two individuals), Honopu (two to five individuals), Waiakoali stream (two individuals), and Nawaimaka stream (one individual) (NTBG 2009a-c, 2010a, 2012a-b, 2014, 2016c-d). These 8 to 11 populations total between 32 and 41 individuals.

#### New Threats:

- Ungulate degradation of habitat—Feral pigs (*Sus scrofa*), goats (*Capra hircus*), and black-tailed (mule) deer (*Odocoileus hemionus*) modify and degrade habitat by disturbing and destroying vegetative cover, trampling plants and seedlings, reducing or eliminating plant regeneration by damaging seeds and seedlings, and increasing erosion by creating large areas of bare soil (Loope 1998, van Riper and van Riper 1982). Feral pigs, goats, and black-tailed deer and evidence of their activities have been reported at all populations of *Nothoestrum peltatum* (NTBG 2009a-c, 2010a, 2012a-d, 2013a-b, 2014, 2015a-d, 2016a-b; PEPP 2010, 2011, 2012, 2013, 2014, 2015).
- 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 Hawaii 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 *Nothoestrum peltatum* is highly vulnerable to the impacts of climate change, with a vulnerability score of 0.917 (on a scale of 0 being not vulnerable to 1 being extremely vulnerable to climate change). Therefore, additional management actions are needed to conserve this taxon into the future.
- Rodent predation or herbivory—Herbivory by rats is noted to be a threat to *Nothoestrum peltatum* at the Waiakoali, Honopu, Nawaimaka, and Waimea Canyon rim populations (NTBG 2009a, 2010a, 2012a-d, 2013a-b, 2014, 2015a-d, 2016a-d). Rats eat virtually every part of plants and at every stage: fleshy fruits, seeds, flowers, stems, leaves, shoot, seedlings, and roots (Russell 1980; Cuddihy and Stone 1990). The effects on plants range from reduced vigor and decreased reproduction to mortality of individuals and complete lack of recruitment.
- Stochastic events—Reduced viability due to low numbers—Botanists have noted little to no germination of collected seeds and have not had success growing *Nothoestrum peltatum* from cuttings. Plants may be self-incompatible or there could be lack of pollination. Recently, aird layering has been attempted with some success (PEPP 2012, 2013, 2014).

#### New Management Actions:

- Captive propagation for genetic storage and reintroduction—
  - NTBG has collected and attempted to propagate hundreds of seeds from several different collections from Kopakapaka, Makaha, and Nawaimaka, but the seeds would not germinate, and probably not viable. The NTBG nursery has also received air layers from one plant along Nualolo trail in 2017 (NTBG 2017).

Lyon Arboretum Seed Bank has received six collections, but of the two collections in which they tried to germinate a subsample, no seeds, out of the 325 seeds sown, germinated (Lyon Arboretum 2017). The Lyon Arboretum Micropropagation Lab has been maintaining representation from two trees by subculturing seedlings from a 2001 fruit collection. This collection, from Puu Kapele, is the only collection where germination has been documented. Ten seeds from a collection of 250 seeds of varying sizes germinated from one tree, and 27 seeds from a collection of 50 seeds of uniform size germinated. This low viability and variation in seed size may indicate that this species produces a high percentage of unfilled (no embryo) seeds. There have been observations of flowers of *Nothocestrum peltatum* that suggest that this species is in fact dioecious (Perlman 2017, pers. obs.), and similar observations have been made on *Nothocestrum longifolium* on Oahu (Keir 2014, pers. obs.). This may be a possible explanation for reduced seed viability in these small remnant populations. PEPP has collected seeds, cuttings, and airdlayers for NTBG, KRPF, DOFAW, and Lyon Arboretum (PEPP 2010, 2011, 2012, 2013, 2014, 2015).

- An individual outplanted within a fenced enclosure at Waimea Canyon rim in 2010 has died (PEPP 2011).

### **Synthesis:**

Currently, there 8 to 11 populations of *Nothocestrum peltatum* totaling 32 to 41 individuals. A landscape-based assessment of climate change vulnerability for native plants of Hawaii using high resolution climate change projections was made by Fortini *et al.* (2013) and their analysis showed that *N. peltatum* is highly vulnerable to the effects of climate change. Seeds, cuttings, and airdlayers are in propagation, but with a low success rate.

Stabilizing (interim), downlisting, and delisting objectives were provided in the Recovery Plan for the Kauai Plant Cluster (USFWS 1995), and have been updated according to the draft revised recovery objective guidelines developed by the Hawaii 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 determination 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 small tree that may be self-incompatible and possibly dioecious. To reach preventing extinction objectives, 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 an *ex situ* (at other than the plant's natural location, such as a nursery or arboretum) collection. In addition, a minimum of three populations should be documented on Kauai 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 individuals per population.

The preventing extinction goals for this species have not been met (Table 1). There are no populations of 50 individuals, genetic representation is incomplete (Table 1), and threats are not being sufficiently managed throughout the range of the species (Table 2). Therefore, *Nothocestrum peltatum* meets the definition of endangered as it remains in danger of extinction throughout its range

### **Recommendations for Future Actions:**

Habitat destruction and herbivory by feral pigs, goats, and black-tailed (mule) deer is reported as a new threat to all populations of *Nothocestrum peltatum*. In addition, predation or herbivory by rats is reported to be a new threat at the Waiakoali, Honopu, Nawaimaka, and Waimea canyon rim populations. Botanists have observed little to no germination of collected seeds. No other significant new information regarding the species' biological status has been reported since the last 5-year review in 2009. Therefore, the following recommendations for future actions are added or reiterated for the 5-year review for 2017.

- Surveys and inventories—Survey for populations of *Nothocestrum peltatum* in areas of potentially suitable habitat.
- Ungulate monitoring and control—Construct large-scale fences around all naturally occurring and reintroduced individuals to control feral ungulates. Protect all occurrences against browsing and disturbances from feral ungulates.
- Invasive plant monitoring and control—
  - Control established ecosystem-altering nonnative invasive plant species around all populations.
  - Control invasive nonnative species that compete with the species around all populations.
- Fire monitoring and control—Develop and implement fire management plans for all wild and reintroduced populations.
- Predator and herbivore monitoring and control—Implement effective control methods for rodents.
- Captive propagation for genetic storage and reintroduction—Continue propagation efforts for maintenance of genetic stock.
- Genetic research—Assess genetic variability within extant populations.
- Population biology research—Research the lack of regeneration in the wild and *ex situ*.
- Reintroduction and translocation—Reintroduce individuals into suitable habitat within historic range that is being managed for known threats to this species.
- Population biology research—Study *Nothocestrum peltatum* populations to determine viable population size and structure, geographical distribution, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, limiting factors, and threats.

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

<b>Date</b>	<b>No. wild individuals</b>	<b>No. outplanted</b>	<b>Stabilization Criteria identified in Recovery Plan</b>	<b>Stabilization Criteria Completed?</b>
1994 (listing)	15	0	All threats managed in all three populations	No
			Complete genetic storage	No
			Three populations with 25 mature individuals each	No
1995 (recovery plan)	23	0	All threats managed in all three populations	No
			Complete genetic storage	No
			Three populations with 25 mature individuals each	No
2003 (critical habitat)	20	0	All threats managed in all three populations	No
			Complete genetic storage	Partially
			Three populations with 25 mature individuals each	No
2009 (5-year review)	23	0	All threats managed in all three populations	No
			Complete genetic storage	Partially
			Three populations with 25 mature individuals each	No
<b>Date</b>	<b>No. wild individuals</b>	<b>No. outplanted</b>	<b>*Preventing Extinction Criteria identified by HPPRCC</b>	<b>*Preventing Extinction Criteria Completed?</b>

2016 (5-year review)	32–41	2	All threats managed in all three populations	No
			Complete genetic storage	Partially
			Reproduction ( <i>i.e.</i> viable seeds, seedlings) at all three populations	No
			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 *Nothocestrum peltatum* and conservation efforts.**

<b>Threat</b>	<b>Listing factor</b>	<b>Current Status</b>	<b>Conservation/ Management Efforts</b>
Ungulate degradation of habitat	A	Ongoing	None
Established ecosystem altering invasive plant species degradation of habitat	A	Ongoing	None
Hurricane destruction and degradation of habitat	A	Ongoing	None
Climate change loss or degradation of habitat	A	Ongoing	None
Fire destruction or degradation of habitat	A	Ongoing	None
Ungulate predation or herbivory	C	Ongoing	Partial, one enclosure
Rodent predation or herbivory	C	Ongoing	None
Stochastic events—Reduced viability due to low numbers	E	Ongoing	Partial, various propagation techniques attempted

**References:**

See previous 5-year review in 2009 for a full list of references. Only references for new information are provided below.

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] Hawaii and Pacific Plants Recovery Coordinating Committee. 2011. Revised recovery objective guidelines. 12 pp.
- Keir, M.J. 2014. Personal observations of suspected dioecy in *Nothocestrum longifolium*.
- [NTBG] National Tropical Botanical Garden. 2009a. NTBG database herbarium specimen detail for *Nothocestrum peltatum*. 065186, 18 JUN 2009.
- [NTBG] 2009b. NTBG database herbarium specimen detail for *Nothocestrum peltatum*. 064591, 23 JUL 2009.
- [NTBG] 2009c. NTBG database herbarium specimen detail for *Nothocestrum peltatum*. 062187, 9 OCT 2009.
- [NTBG] 2010. NTBG database herbarium specimen detail for *Nothocestrum peltatum*. 064241, 31 MAR 2010.
- [NTBG] 2012a. NTBG database herbarium specimen detail for *Nothocestrum peltatum*. 062998, 9 AUG 2012.
- [NTBG] 2012b. NTBG database herbarium specimen detail for *Nothocestrum peltatum*. 063118, 9 AUG 2012.
- [NTBG] 2012c. NTBG database herbarium specimen detail for *Nothocestrum peltatum*. 065182, 4 OCT 2012.
- [NTBG] 2012d. NTBG database herbarium specimen detail for *Nothocestrum peltatum*. 067440, 5 DEC 2012.
- [NTBG] 2013a. NTBG database herbarium specimen detail for *Nothocestrum peltatum*. 067249, 17 JUL 2013.
- [NTBG] 2013b. NTBG database herbarium specimen detail for *Nothocestrum peltatum*. no number, 12 SEP 2013.
- [NTBG] 2014. NTBG database herbarium specimen detail for *Nothocestrum peltatum*. no number, 17 JAN 2014.
- [NTBG] 2015a. NTBG database herbarium specimen detail for *Nothocestrum peltatum*. no number, 6 SEP 2015.
- [NTBG] 2015b. NTBG database herbarium specimen detail for *Nothocestrum peltatum*. no number, 18 SEP 2015.

[NTBG] 2015c. NTBG database herbarium specimen detail for *Nothocestrum peltatum*. no number, 3 OCT 2015.

[NTBG] 2015d. NTBG database herbarium specimen detail for *Nothocestrum peltatum*. S071937, 3 DEC 2015.

[NTBG] 2016a. NTBG database herbarium specimen detail for *Nothocestrum peltatum*. no number, 31 MAR 2016.

[NTBG] 2016b. NTBG database herbarium specimen detail for *Nothocestrum peltatum*. no number, 31 MAR 2016,.

[NTBG] 2016c. NTBG database herbarium specimen detail for *Nothocestrum peltatum*. no number, 26 JUL 2016.

[NTBG] 2016d. NTBG database herbarium specimen detail for *Nothocestrum peltatum*. no number, 26 JUL 2016.

[NTBG] 2017. NTBG controlled propagation database report.

Perlman, S. 2017. Personal observations of suspected dioecy in *Nothocestrum peltatum*.

[PEPP] Plant Extinction Prevention Program. 2010. Annual report fiscal year 2010 (July 1, 2009-June 30, 2010). 121 pp.

[PEPP] 2011. Annual report fiscal year 2011 (July 1, 2010-June 30, 2011). 200 pp.

[PEPP] 2012. Annual report fiscal year 2012 (July 1, 2011-June 30, 2012). 169 pp.

[PEPP] 2013. Annual report fiscal year 2013 (July 1, 2012-June 30, 2013). 207 pp.

[PEPP] 2014. Annual report fiscal year 2014 (July 1, 2013-June 30, 2014). 185 pp.

[PEPP] 2015. Annual report fiscal year 2015 (July 1, 2014-June 30, 2015). 179 pp.

[USFWS] U.S. Fish and Wildlife Service. 2009. *Nothocestrum peltatum* 5-year review summary and evaluation. [https://ecos.fws.gov/docs/five\\_year\\_review/doc2445.pdf](https://ecos.fws.gov/docs/five_year_review/doc2445.pdf).

[USFWS] 2015. Endangered and threatened wildlife and plants; initiation of 5-year status reviews of 133 species in Hawaii, Oregon, Idaho, and Washington. 80 FR 8100, February 13, 2015.



**U.S. FISH AND WILDLIFE SERVICE**  
SIGNATURE PAGE for 5-YEAR REVIEW of *Nothocestrem 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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