

U.S. FISH AND WILDLIFE SERVICE SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

Scientific Name:

Nothocestrum latifolium

Common Name:

`aiea

Lead region:

Region 1 (Pacific Region)

Information current as of:

06/01/2013

Status/Action

Funding provided for a proposed rule. Assessment not updated.

Species Assessment - determined species did not meet the definition of the endangered or threatened under the Act and, therefore, was not elevated to the Candidate status.

New Candidate

Continuing Candidate

Candidate Removal

Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status

Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species

Range is no longer a U.S. territory

Insufficient information exists on biological vulnerability and threats to support listing

Taxon mistakenly included in past notice of review

Taxon does not meet the definition of "species"

Taxon believed to be extinct

Conservation efforts have removed or reduced threats

___ More abundant than believed, diminished threats, or threats eliminated.

Petition Information

___ Non-Petitioned

X Petitioned - Date petition received: 05/11/2004

90-Day Positive:05/11/2005

12 Month Positive:05/11/2005

Did the Petition request a reclassification? **No**

For Petitioned Candidate species:

Is the listing warranted(if yes, see summary threats below) **Yes**

To Date, has publication of the proposal to list been precluded by other higher priority listing?
Yes

Explanation of why precluded:

We find that the immediate issuance of a proposed rule and timely promulgation of a final rule for this subspecies has been, for the preceding 12 months, and continues to be, precluded by higher priority listing actions (including candidate species with lower LPNs). During the past 12 months, almost our entire national listing budget has been consumed by work on various listing actions to comply with court orders and court-approved settlement agreements, emergency listings, and essential litigation-related, administrative, and program management functions.

Historical States/Territories/Countries of Occurrence:

- **States/US Territories:** Hawaii
- **US Counties:** Honolulu, HI, Kauai, HI, Maui, HI
- **Countries:** United States

Current States/Counties/Territories/Countries of Occurrence:

- **States/US Territories:** Hawaii
- **US Counties:** Honolulu, HI, Kauai, HI, Maui, HI
- **Countries:** United States

Land Ownership:

Nothocestrum latifolium occurs within a few very small populations on private and Federal lands and several small to large populations occurring on State lands including Natural Area Reserves (NAR) and State game management areas. The single largest population of several hundred individuals occurs on State lands within the Kanaio NAR on Maui.

Lead Region Contact:

ARD-ECOL SVCS, Jesse D'Elia, 5032312349, jesse_delia@fws.gov

Lead Field Office Contact:

PACIFIC ISLANDS FISH AND WILDL OFC, Kristi Young, 503 231-6845, kristi_young@fws.gov

Biological Information

Species Description:

Nothocestrum latifolium is a small tree up to 33 feet (ft) (10 meters (m)) tall, with a gnarled trunk, rigid ascending branches, and young parts with yellowish brown pubescence. The thick, pubescent leaves, usually clustered toward the ends of the branches, are seasonally deciduous. Flowers occur in clusters on short spurs and have a greenish yellow corolla in which the tube is about twice as long as the calyx. Berries are yellowish orange, succulent, and depressed-globose (Symon 1999, p. 1,263).

Taxonomy:

Nothocestrum latifolium was described by Gray (1862). This species is recognized as a distinct taxon in Wagner et al. (1999, p. 1,263), the most recently accepted Hawaiian plant taxonomy.

Habitat/Life History:

Typical habitat is dry to mesic forest and diverse mesic forest (Hawaii Biodiversity and Mapping Program (HBMP) 2008).

Historical Range/Distribution:

Historically, *Nothocestrum latifolium* was known from Koele, Kaohai, and Maunalei Valleys on Lanai; the southwest rift zone of Haleakala on Maui; the Kawela and Kapaakea gulches on Molokai; and Waieli, Kaumokuni, and Kupehau gulches, and Makua in the Waianae Mountains of Oahu (HBMP 2008). It was never observed or collected on Kauai before 1987 but is assumed to have been there historically.

Current Range Distribution:

Currently, *Nothocestrum latifolium* is known from Kalalau on Kauai, Kanepuu on Lanai, Kapunakea Preserve in the west Maui Mountains, Auwahi to Puu Mahoe in the east Maui Mountains, Puu Kolekole and Makolelau on Molokai, and several gulches in the Waianae Mountains of Oahu (HBMP 2008).

Population Estimates/Status:

Nothocestrum latifolium is known from 18 populations totaling approximately 1,600 individuals. One population on east Maui is the largest, with an estimated 1,200 to 1,500 individuals in 1999 (HBMP 2008). The remaining populations consist of very few individuals each. There is 1 population of 1 individual on Kauai; 3 populations of 7 individuals on Lanai; 1 population with a total 31 individuals on west Maui; 2 populations totaling 43 to 48 individuals on Molokai; and 10 populations totaling 15 individuals on Oahu (Moses, in litt. 2006; Starr, in litt. 2006; Oppenheimer 2006, pers. comm.; HBMP 2008; Welton, in litt. 2010; Perlman, in litt. 2010; Kawakami, in litt. 2010; Kawelo, in litt. 2010; Oppenheimer, in litt. 2011). While the species has not been extirpated from any island, its range on each island has decreased dramatically (Oppenheimer 2006, pers. comm.; HBMP 2008; Kawelo, in litt. 2005 and 2010). For example, on Lanai, Duvall (in litt. 2011) has no knowledge of any trees surviving. Oppenheimer (in litt. 2011) could not find any individuals from the population near the State Cooperative Game Management Area at Kanepuu, Lanai, and will re-survey the three other population units (Kahue, Paomai, and Upper Paomai) near Kanepuu, Lanai.

According to the PEP program (in litt. 2013), no individuals were found within Lanai islands Kanepuu Preserve (Kahue Unit) during surveys in 2012, although there are plans to continue surveying the area and other suitable habitat. Additionally, on the island of Oahu, Manuwai Gulch contains one individual which is currently threatened by ungulates although a fence enclosure is planned for this site. Also on Oahu, the one individual at Kaluaa could not be relocated and the three individuals located at west Makaleha have died (PEP Program, in litt. 2013).

Threats

A. The present or threatened destruction, modification, or curtailment of its habitat or range:

Nothocestrum latifolium is threatened by feral pigs (*Sus scrofa*), goats (*Capra hircus*), and axis deer (*Axis axis*) that degrade and destroy habitat (HBMP 2008).

Pigs of Asian ancestry were introduced to Hawaii by the Polynesians, and the Eurasian type was introduced to Hawaii by Captain James Cook in 1778, with many other introductions thereafter (Tomich 1986, p. 121). Some pigs raised as food escaped into the forests of Hawaii, Kauai, Oahu, Molokai, Maui, and Niihau, and are now managed as a game animal by the State to optimize hunting opportunities (Tomich 1986, p. 125; State of Hawaii 2001). A study was conducted in the 1980s on feral pig populations in the Kipahulu Valley on Maui (Diong 1982, 408 pp.). This valley consists of a diverse composition of native ecosystems, from near sea level to alpine, and forest types ranging from mesic to wet, *Acacia koa* (koa) to *Metrosideros polymorpha* (ohia). Rooting by feral pigs was observed to be related to the search for earthworms, with rooting depths averaging 8 in (20 cm), greatly disrupting the leaf litter and topsoil layers, contributing to erosion and changes in ground topography (Diong 1982, pp. 143-150). The feeding habits of pigs created seed beds, enabling the establishment and spread of weedy species such as *Psidium cattleianum* (strawberry guava) (Diong 1982, pp. 164-165). The study concluded that all aspects of the food habits of pigs are damaging to the structure and function of the Hawaiian forest ecosystem (Diong 1982, pp. 166-167). The effects on mesic and wet forest habitat by foraging of feral pigs have also been reported in fencing studies. In a fencing study conducted in the montane bogs of Haleakala, it was found that when feral pigs were fenced out of an area the cover of native plant species increased from 6 percent to 95 percent within six years of protection (Loope et al. 1991, pp. i, 13).

The goat, a species originally native to the Middle East and India, was successfully introduced to the Hawaiian Islands in 1792. Currently, populations exist on Kauai, Oahu, Maui, Molokai, and Hawaii. Goats browse on introduced grasses and native plants, trample roots and seedlings, cause erosion, and promote the invasion of alien plants. Goats are able to forage in extremely rugged terrain and have a high reproductive capacity (Clarke and Cuddihy 1980, p. C20; van Riper and van Riper 1982, pp. 34-35; Scott et al. 1986, pp. 352-358; Tomich 1986, pp. 150-156; Culliney 1988, pp. 336-337; Cuddihy and Stone 1990, p. 64). A study of goat predation on the native *A. koa* forest on the island of Hawaii has shown that grazing pressure by goats can cause the eventual extinction of *A. koa* because it is unable to reproduce (Spatz and Mueller-Dombois 1973, p. 874). An enclosure analysis demonstrated that release from goat pressure by fencing resulted in an immediate recovery in height growth and numbers of vegetative resprouts of *A. koa* (Spatz and Mueller-Dombois 1973, p. 876). Another study at Puuwaawaa on the island of Hawaii demonstrated that prior to management actions in 1985, regeneration of endemic shrubs and trees in the grazed area was almost totally lacking, contributing to the invasion of the forest understory by exotic grasses and weeds. After the removal of grazing animals in 1985, *A. koa* and *Metrosideros* spp. seedlings were observed germinating by the thousands (Department of Land and Natural Resources (DLNR) 2002, p. 52).

Evidence of the activities of axis deer has been reported at the Kanepuu populations on Lanai (HBMP 2008). Axis deer were introduced to Lanai in 1920 (Hobdy 1993, p. 207). After goats were eradicated from Lanai, the deer began to occupy slopes and cliffs previously thought to be too steep for them (Hobdy 1993, p. 207).

On Lanai, as of 2007, axis deer number approximately 6,000 to 8,000, and damage to the landscape has increased dramatically (Leone, in litt. 2001; The Insider 2007; WCities 2007).

Hawaiian ecosystems, having evolved without hooved mammals, are susceptible to large-scale disturbance by feral pigs, goats, deer, and other introduced ungulates (Loope et al. 1991). Because of demonstrated habitat modifications by feral pigs, goats, and deer, such as destruction of native plants, disruption of topsoil leading to erosion, and establishment and spread of nonnative plants, the U.S. Fish and Wildlife Service (FWS) believes they are a threat to *N. latifolium*.

B. Overutilization for commercial, recreational, scientific, or educational purposes:

None known.

C. Disease or predation:

Predation by feral pigs, goats, and deer is a likely threat to *Nothocestrum latifolium* (HBMP 2008). In a study conducted in the 1980s, feral pigs were observed browsing on young shoots, leaves and fronds of a wide variety plants, of which over 85 percent were endemic species (Diong 1982, p. 138). A stomach content analysis in this study showed that the pigs food sources consisted of native plants, 60 percent of which were *Cibotium* spp. (tree ferns), alternating with *P. cattleianum* when it was available. Pigs were observed felling and removing the bark of *Clermontia*, *Cibotium*, *Coprosma*, *Psychotria*, and *Hedyotis* species (herbaceous and woody plants), and causing enough damage to kill larger trees over a few months of repeated feeding (Diong 1982, pp. 138, 144). Goats browse on introduced grasses and native plants, and are able to reach more remote and inaccessible areas than other ungulates. They thrive on a variety of food plants, and are instrumental in the decline of native vegetation in many areas (Cuddihy and Stone 1990, pp. 40, 61, 63-64). Deer are primarily grazers, but also browse numerous plant species including those grown as commercial crops (Waring, in litt. 1996, p. 3; Simpson, in litt. 2001).

Because Hawaii's native plants evolved without any browsing or grazing mammals present, many lost natural defenses to such impacts (Carlquist 1980, pp. 173). Browsing by ungulates has been observed on many other native species, including common and rare or endangered species (Cuddihy and Stone 1990, pp. 63-64; Loope et al. 1991, p. 3). Therefore, even though we have no evidence of browsing for this species, it is likely that pigs, goats, and deer impact this species directly as well as the surrounding habitat.

As of May 2013, we do not have information to indicate that disease poses a threat to *N. latifolium*.

D. The inadequacy of existing regulatory mechanisms:

Nothocestrum latifolium currently receives no protection under Hawaii's endangered species law (HRS, Sect. 195-D) or the Federal Endangered Species Act (16 U.S.C. §1531-1544).

Goats, pigs, and deer are managed in Hawaii as game animals, but many populate inaccessible areas where hunting is difficult, if not impossible, and therefore has little effect on their numbers (Hawaii Heritage Program 1990). Goat, pig, and deer hunting is allowed year-round or during certain months, depending on the area (Hawaii Department of Land and Natural Resources 1999, 2003); however, public hunting is not adequate to eliminate this threat to *N. latifolium*.

E. Other natural or manmade factors affecting its continued existence:

Many alien plant species threaten this species by competing with it and degrading its habitat (HBMP 2008). The nonnative plants reported to be the greatest threats to all of the populations of *Nothocestrum latifolium* are: *Fraxinus uhdei* (tropical ash), *Lantana camara* (lantana), *Melinis minutiflora* (molasses grass), *Psidium*

cattleianum, *Schinus terebinthifolius* (Christmas berry), and *Syzygium cumini* (java plum) (HBMP 2008).

Fraxinus uhdei is a tree up to 79 ft (24 m) tall, native to central and southern Mexico. In Hawaii, over 300,000 trees were planted by State foresters on all the main islands from 1924 to 1960 (Wagner et al. 1999, p. 991). *F. uhdei* reproduces by wind-dispersed seed. This species is considered a serious threat to the mesic *Acacia-Metrosideros* forests at Waikamoi (The Nature Conservancy 2006, p. A5). It spreads rapidly along watercourses and forms dense, monotypic stands (Holt 1992, p. 532). It can be controlled with herbicide application (Motooka et al. 2002).

Lantana camara, brought to Hawaii as an ornamental plant, is an aggressive, thicket-forming shrub which is now found on all of the main islands in mesic forest, dry shrubland, and other dry, disturbed habitats (Wagner et al. 1999, p. 1,320). The most effective control agents are the lace bug, *Teleonemia scrupulosa* Stal. (Tingidae); the chrysomelid beetles, *Octotoma scabripennis* Guerin-Meneville and *Uroplata girardi* Pi; the moths, *Hypena strigata* F., *Neogalea sunia* (Guenee) (Noctuidae), and *Salbia haemorrhoidalis* Guenee (Pyralidae). While biological control of lantana by most of the established insects appeared to have reached equilibrium by 1969, the overall impact of the phytophage complex has been a steady and considerable reduction in abundance of the weed, particularly in drought-prone areas. Although *L. camara* is considered generally to be under partial to substantial control in drier areas, it still remains a pest in some other environments, such as national parks (Hawaii Department of Agriculture 2006).

Melinis minutiflora is a grass native to Africa and now introduced to many parts of the tropics as a fodder plant. In Hawaii it is naturalized and common in dry to mesic disturbed open areas on all the main islands except Niihau. It is considered to be a serious pest, choking out and covering native vegetation and preventing seedling establishment (OConnor 1999, p. 1,562). The mats it forms fuel more intense fires (Cuddihy and Stone 1990, p. 89). We are unaware of any control methods for this species beyond herbicide application (University of Hawaii 2013).

Psidium cattleianum, a tree native to tropical America, has become widely naturalized on all the main islands of Hawaii. Found in mesic to wet forests, *P. cattleianum* develops into dense stands in which few other plants can grow, displacing native vegetation. The fruit is eaten by pigs and birds, which then disperse the seeds throughout the forest (Smith 1985, p. 200; Wagner et al. 1999, p. 971). To date, no biological control agents have been released against *P. cattleianum* in Hawaii, though insects for biocontrol are undergoing host-screening (Institute of Pacific Islands Forestry 2005). A biological control agent, *Tectococcus ovatus*, has undergone 15 years of testing, and there is a proposal to release this insect at Olaa Forest Reserve on the island of Hawaii (ScienceDaily 2008).

Schinus terebinthifolius, a shrub native to Brazil and introduced to Hawaii in 1911, is now naturalized in mesic areas (Wagner et al. 1999, p. 198). It forms dense thickets and grows even on steep slopes, and the red berries are attractive to birds (Smith 1989, p. 63). Seedlings grow very slowly and can survive in dense shade, exhibiting vigorous growth if the canopy is cleared, leading to the creation of open habitat and further influencing and increasing its rate of spread (Brazilian Pepper Task Force 1997). *S. terebinthifolius* is also a relative of poison ivy and may cause allergic skin reactions on sensitive persons. There are no released biocontrol agents to date (Brazilian Pepper Task Force 1997). This species is on the Hawaii noxious weed list (Hawaii Administrative Rules (HAR) Title 4, Subtitle 6, Chapter 68).

Syzygium cumini is a tree native to India, Ceylon, and Malesia, and is widely cultivated and naturalized. In Hawaii it is naturalized in mesic valleys and disturbed forests. This species forms a dense cover, excluding all other species, and prevents the reestablishment of native lowland forest. The large black fruit is dispersed by frugivorous birds and feral pigs (*Sus scrofa*) (Pacific Island Ecosystems at Risk (PIER) 2006). We are unaware of any control methods for this species beyond herbicide application (University of Hawaii 2013).

The original native flora of Hawaii consisted of about 1,400 species, nearly 90 percent of which were endemic. Of the current total native and naturalized Hawaiian flora of 1,817 taxa, 47 percent are introduced

species, and nearly 100 species of those are considered pests (Smith 1985, p. 180; Wagner et al. 1999, p. 45). Several studies (Cuddihy and Stone 1990, p. 74; Wood and Perlman 1997, p. 18; Robichaux et al. 1998, p. 4) indicate nonnative plant species may outcompete native plants similar to *N. latifolium*. Competition may be for space, light, water, or nutrients, or there may be a chemical produced that inhibits growth of other plants (Smith 1985, pp. 227-230; Cuddihy and Stone 1990, p. 74). In addition, nonnative pest plants found in habitat similar to that of this species have been shown to make the habitat less suitable for native species (Smith 1985, pp. 240-241; Loope and Medeiros 1992, pp. 7-8; Medeiros et al. 1992, p. 30; Ellshoff et al. 1995, pp. ii, 3-4; Meyer and Florence 1996, p. 778; Medeiros et al. 1997, pp. 23-24, Loope et al. 2004, p. 1,472). In particular, alien pest plant species degrade habitat by modifying availability of light, altering soil-water regimes, modifying nutrient cycling, or altering fire characteristics of native plant communities (Smith 1985, pp. 227-230; Cuddihy and Stone 1990, p. 74; Vitousek et al. 1997, pp. 6-10). Because of demonstrated habitat modification and resource competition by nonnative plant species in habitat similar to the dry to mesic forest habitat of *N. latifolium*, the FWS believes nonnative plant species are a threat to this species.

Although the reason is unknown, there is a lack of regeneration in *N. latifolium* (HBMP 2008). The likely pollinator of all species in this genus, *Manduca blackburni* (Blackburn's sphinx moth), is federally listed as endangered. This moth has been extirpated from several islands, and this may be one of the causes of decline of *N. latifolium*.

Conservation Measures Planned or Implemented :

The FWS has funded several projects on Maui that provide conservation benefits to *Nothoecstrum latifolium*. These projects include ungulate exclosure fences in the west Maui Mountains on State and private lands, and in the States Kahakuloa Game Management Area, which has been completed (FWS 2005). On east Maui, the FWS has provided funding for fencing on State land within the Kanaio NAR, which is still in the construction stage. In addition, the FWS has funded dryland forest restoration efforts on private land at Auwahi for the last ten years. In February 2010, the 151-acre (ac) (61 hectare (ha)) Auwahi III exclosure was completed, adding to the existing 10-ac (4 ha) Auwahi I and 23-acre (9.3 ha) Auwahi II exclosures, creating a total of 184 ac (74 ha) of lowland dry forest habitat protected for *N. latifolium* (Leeward Haleakala Watershed Restoration Partnership (LHWRP) 2010). Since 2000, over 1,000 *N. latifolium* individuals have been outplanted, and nonnative plant species such as balloon plant (*Asclepias physocarpa*), kikuyu grass (*Pennisetum clandestinum*), and *Bocconia frutescens* controlled within the exclosures at Auwahi (von Allmen 2007; Higashino, in litt. 2011). This species is also in propagation at Pahole Rare Plant Facility and at Haleakala National Park (20 individuals have been outplanted at Kaupo) (Haleakala National Park 2008, p. 10; Welton, in litt. 2010; Conry, in litt. 2012).

Summary of Threats :

Based on our evaluation of habitat degradation and loss by feral pigs, goats, deer, and nonnative plants, we conclude there is sufficient information to develop a proposed rule for this species due to the present and threatened destruction, modification, or curtailment of its habitat and range, and the displacement of individuals of *Nothoecstrum latifolium*, due to competition with nonnative plants for space, nutrients, water, air, and light. Predation by feral pigs, goats, and deer is a likely threat to *N. latifolium*. Reduced reproductive vigor, possibly due to the decline of its pollinator, is a likely threat to this species. We find that this species is warranted for listing throughout all of its range, and, therefore, find that it is unnecessary to analyze whether it is threatened or endangered in a significant portion of its range.

For species that are being removed from candidate status:

_____ Is the removal based in whole or in part on one or more individual conservation efforts that you determined met the standards in the Policy for Evaluation of Conservation Efforts When Making Listing Decisions(PECE)?

Recommended Conservation Measures :

- Survey for populations of *Nothocestrum latifolium* in areas of potentially suitable habitat.
- Control feral pigs, goats, and deer by removing these species from areas where *N.latifolium* populations exist and preventing reinvasion through the use of exclosures.
- Control alien plants through physical, mechanical, and biological control methods, as well as herbicides when necessary. Continue to conduct research into potential biocontrol species.
- Conduct research into lack of regeneration in the wild.
- Continue propagation efforts for maintenance of genetic stock.
- Reintroduce individuals into suitable habitat within historic range that is being managed for known threats to this species.
- Continue research into the pollinator species, *Manduca blackburni*, and consider potential reintroductions where extirpated.

Priority Table

Magnitude	Immediacy	Taxonomy	Priority
High	Imminent	Monotypic genus	1
		Species	2
		Subspecies/Population	3
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/Population	6
Moderate to Low	Imminent	Monotype genus	7
		Species	8
		Subspecies/Population	9
	Non-Imminent	Monotype genus	10
		Species	11
		Subspecies/Population	12

Rationale for Change in Listing Priority Number:

Magnitude:

This species is highly threatened by feral pigs, goats, and deer that degrade and destroy habitat, nonnative plants that compete for light and nutrients, and the loss of pollinators that negatively affect the viability of this species. Threats to the dry to mesic forest habitat of *Nothocestrum latifolium*, and to individuals of this species, occur throughout its range and are expected to continue or increase without control or eradication. In addition, little regeneration is observed in this species. Ungulates have been fenced out of some areas where *N. latifolium* occurs, but the fences must be continually maintained to prevent incursion. Nonnative plant numbers have been reduced in some populations that are fenced; however, these ongoing conservation efforts for this species will benefit only a few of the known populations. The species as a whole is still impacted by these threats and will require long-term monitoring and management to maintain threat-free areas.

Imminence :

Threats to *Nothocestrum latifolium* from feral pigs, goats, and deer; nonnative plants; and the loss of pollinators, are considered imminent because they are ongoing.

Yes Have you promptly reviewed all of the information received regarding the species for the purpose of determination whether emergency listing is needed?

Emergency Listing Review

No Is Emergency Listing Warranted?

The species does not appear to be appropriate for emergency listing at this time because the immediacy of the threats is not so great as to imperil a significant proportion of the taxon within the time frame of the routine listing process. In addition, the FWS has funded conservation actions that will benefit *Nothocestrum latifolium*, such as ungulate exclosure fences and dryland forest restoration efforts on State and private lands on Maui. This species is represented in ex situ collections. If it becomes apparent that the routine listing process is not sufficient to prevent large losses that may result in this species' extinction, then the emergency rule process for this species will be initiated. We will continue to monitor the status of *N. latifolium* as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures.

Description of Monitoring:

Much of the information on this form is based on the results of a meeting of 20 botanical experts held by the Center for Plant Conservation in December of 1995. We incorporated additional information on this species from our files and the Manual of Flowering Plants of Hawaii (Wagner et al. 1999). In 2004, the Pacific Islands Office contacted the following species experts: Robert Hobdy, retired from the Hawaii Division of Forestry and Wildlife (DOFAW); Joel Lau, Hawaii Biodiversity and Mapping Program (HBMP); Arthur Medeiros, U.S. Geological Survey, Biological Resources Division (USGS-BRD); Hank Oppenheimer, resource manager for the Maui Land and Pineapple Company; and Steve Perlman and Ken Wood, National Tropical Botanical Garden (NTBG). No new information was provided. In 2005 we contacted species experts and confirmation of the status was provided by Kapua Kawelo, U.S. Army Environmental. In 2006 new status and range information was provided by Wailana Moses, The Nature Conservancy of Hawaii; Hank Oppenheimer, Plant Extinction Prevention Program (PEPP); Forest Starr, USGS-BRD; and Nellie Sugii, Lyon Arboretum, and was incorporated into this assessment. New information was received in 2008 from Roy Kam, HBMP database manager, for populations found on Oahu. In 2009 we received no new information. In 2010, we contacted the species experts listed below, and received new information from Patti Welton, Haleakala National Park, Steve Perlman, NTBG, Kapua Kawelo, U.S. Army Environmental, and Galen Kawakami, DOFAW. In 2011, we contacted the species experts listed below, and received new information from Susan Ching, PEPP-Oahu, Fern Duvall, DOFAW-Maui, Jennifer Higashino, USFWS-Maui, Kapua Kawelo, U.S. Army Environmental, and Hank Oppenheimer, PEPP-Maui Nui. In 2012, we received information from the State and incorporated it into this form.

List all experts contacted in 2011:

Name Date Affiliation

Agorastos, Nick 02/16/11 Division of Forestry and Wildlife, Hawaii
Bakutis, Ane 02/16/11 Plant Extinction Prevention Program, Molokai
Ball, Donna 02/16/11 U.S. FWS, Partners Program, Hawaii
Bily, Pat 02/16/11 The Nature Conservancy, Maui
Bio, Kealii 02/16/11 Plant Extinction Prevention Program, Hawaii
Caraway, Vickie 02/22/11 Hawaii Division of Forestry and Wildlife, Oahu
Ching, Susan 02/16/11 Plant Extinction Prevention Program, Oahu
Clark, Michelle 02/16/11 U.S. FWS, Partners Program, Kauai

Duvall, Fern 02/16/11 Hawaii Division of Forestry and Wildlife, Maui
Fay, Kerri 02/16/11 The Nature Conservancy, Maui
Garnett, Bill 02/16/11 National Park Service, Kalaupapa, Molokai
Haus, Bill 02/16/11 National Park Service, Haleakala NP, Maui
Higashino, Jennifer 02/16/11 U.S. FWS, Partners Program, Maui
Imada, Clyde 02/16/11 Bishop Museum, Botany Department
Kawelo, Kapua 02/16/11 U.S. Army, Environmental Division
McDowell, Wendy 02/16/11 Plant Extinction Prevention Program, Kauai
Medeiros, Arthur 02/16/11 U.S. Geological Survey
Moses, Wailana 02/16/11 The Nature Conservancy, Molokai
Oppenheimer, Hank 02/16/11 Plant Extinction Prevention Program, Maui Nui
Perlman, Steve 02/16/11 National Tropical Botanical Garden
Perry, Lyman 02/16/11 Division of Forestry and Wildlife, Hawaii
Pratt, Linda 02/16/11 U.S. Geological Survey, Biological Resources Division
Starr, Forest 02/16/11 U.S. Geological Survey
Stevens, Bryon 02/16/11 DLNR Natural Area Reserves, Maui
Ward, Joe 02/22/11 Puu Kukui Watershed Preserve
Welton, Patti 02/16/11 National Park Service, Haleakala NP, Maui
Wysong, Michael 02/16/11 DLNR Natural Area Reserves, Kauai

The Hawaii Biodiversity and Mapping Program identified this species as critically imperiled (HBMP 2006). Based on the International Union for Conservation of Nature and Natural Resources Red List of Threatened Species, this species is recognized as Endangered (facing a very high risk of extinction in the wild) (Bruegmann and Caraway 2003). *Nothocestrum latifolium* is included in the list of species in Hawaii's 2005 Comprehensive Wildlife Conservation Strategy (Mitchell et al. 2005).

Indicate which State(s) (within the range of the species) provided information or comments on the species or latest species assessment:

Hawaii

Indicate which State(s) did not provide any information or comment:

none

State Coordination:

On February 20, 2013, we provided the Hawaii Division of Forestry and Wildlife with copies of our most recent candidate assessments for their review and comment. No additional information or comments on this species were received from the State.

Literature Cited:

Brazilian Pepper Task Force. 1997. Brazilian Pepper Management Plan for Florida, Amy Ferriter (ed.), The Florida Exotic Pest Plant Council. 26 pp.

Bruegmann, M.M., and V. Caraway. 2003. *Nothocestrum latifolium*. In IUCN 2006 Red List of Threatened Species, <http://www.iucn.redlist.org>, accessed on December 18, 2006.

Carlquist, S. 1980. Hawaii: A natural history, second edition. Pacific Tropical Botanical Garden, Honolulu. 468 pp.

Clarke, G., and L.W. Cuddihy. 1980. A botanical reconnaissance of the Na Pali coast trail: Kee Beach to

Kalalau Valley (April 9-11, 1980). Division of Forestry and Wildlife, Department of Land and Natural Resources, Hilo, Hawaii. Pp. C14-C20.

Cuddihy, L.W., and C.P. Stone. 1990. Alteration of native Hawaiian vegetation; effects of humans, their activities and introductions. Cooperative National Park Resources Studies Unit, University of Hawaii, Honolulu. 138 pp.

Culliney, J.L. 1988. Islands in a far sea: nature and man in Hawaii. Sierra Club Books, San Francisco. 410 pp.

(DLNR) Department of Land and Natural Resources. 2002. Draft management plan for the ahupuaa of Puuwaawaa and the makai lands of Puuanahulu. State of Hawaii, Division of Forestry and Wildlife. P. 52.

Diong, C.H. 1982. Population biology and management of the feral pig (*Sus scrofa* L.) in Kipahulu Valley, Maui. Dissertation to the Zoology graduate division of the University of Hawaii. 408 pp.

Ellshoff, Z.E., D.E. Gardner, C. Wikler, and C.W. Smith. 1995. Annotated bibliography of the genus *Psidium*, with emphasis on *P. cattleianum* (strawberry guava) and *P. guajava* (common guava), forest weeds in Hawaii. Cooperative National Park Resources Studies Unit, University of Hawaii, Honolulu. Technical Report 95. 105 pp.

(FWS) U.S. Fish and Wildlife Service. 2001. Auwahi II: dryland forest restoration project. Partners for Fish and Wildlife (12200J006).

(FWS) U.S. Fish and Wildlife Service. 2005. West Maui Mountains fencing and ungulate removal; Partners for Fish and Wildlife (122000G012).

Gray, A. 1862. Characters of some new or obscure species of plants, of monopetalous orders, in the collection of the United States South Pacific Expedition under Captain Charles Wilkes, U.S.N. with various notes and remarks. Proceedings of the American Academy of Arts 6: 48.

Hawaii Department of Agriculture. 2006. *Lantana camara*. http://www.hawaiiag.org/hdoa/pi_ppc_bioprob.htm, accessed on downloaded on March 12, 2007.

Hawaii Department of Land and Natural Resources. 1999. Rules regulating game mammal hunting, updated 2003. 56 pp.

Hawaii Heritage Program. 1990. Management recommendations for Na Pali Coast State Park, island of Kauai. The Nature Conservancy, prepared for the Hawaii Department of Land and Natural Resources, Division of State Parks, Honolulu. 18 pp.

(HBMP) Hawaii Biodiversity and Mapping Program. 2008. Hawaii Biodiversity and Mapping Program species database, unpublished.

(HBMP) Hawaii Biodiversity and Mapping Program. 2006. *Nothocestrum latifolium*. <http://hbmp.hawaii.edu/printpage.asp?spp=PDSOL0P020>, accessed on April 14, 2007.

Hobdy, R. 1993. Lanaia case study: the loss of biodiversity on a small Hawaiian island. Pacific Science 47:201-210.

Holt, R.A. 1992. Control of alien plants on Nature Conservancy preserves. In Stone, C.P., C.W. Smith, and J.T. Tunison (eds.), Alien Plant Invasions in Native Ecosystems of Hawaii: Management and Research, Pp. 525-535.

Institute of Pacific Islands Forestry. 2005. *Tectococcus ovatus*. A biological control agent proposed for release against strawberry guava (waiawi), research update. Pacific Southwest Research Station, United States Department of Agriculture, Forest Service. 2 pp.

Leeward Haleakala Watershed Restoration Partnership. 2010. Final report for FY09 U.S. Fish and Wildlife Service projects (8J017 Nuu Mauka-Kaupo Ranch fencing and 7G007 Auwahi III fence), protecting core watershed forests of leeward Haleakala, progress from July 1, 2009 - June 30, 2010. 4 pp.

Loope, L.L., A.C. Medeiros, and B.H. Gagnon. 1991. Recovery of vegetation of a montane bog following protection from feral pig rooting. Cooperative National Park Resources Studies Unit, University of Hawaii, Honolulu, Technical Report 77. 23 pp.

Loope, L.L., and A.C. Medeiros. 1992. A new and invasive grass on Maui. Newsletter of the Hawaiian Botanical Society 31:7-8.

Loope, L., F. Starr, and K. Starr. 2004. Protecting endangered Hawaiian plant species from displacement by invasive plants on Maui, Hawaii. Weed Technology 18:1472-1474.

Medeiros, A.C., L.L. Loope, T. Flynn, S.J. Anderson, L.W. Cuddihy, and K.A. Wilson. 1992. Notes on the status of an invasive Australian tree fern (*Cyathea cooperi*) in Hawaiian rain forests. American Fern Journal 82:27-33.

Medeiros, A.C., L.L. Loope, P. Conant, S. McElvaney. 1997. Status, ecology, and management of the invasive plant, *Miconia calvescens* DC (Melastomataceae) in the Hawaiian Islands. Records of the Hawaii Biological Survey for 1996, Bishop Museum Occasional Papers 48:23-36.

Meyer, J.Y., and J. Florence. 1996. Tahiti's native flora endangered by the invasion of *Miconia calvescens* D.C. (Melastomataceae). Journal of Biogeography 23:775-781.

Mitchell, C., C. Ogura, D.W. Meadows, A. Kane, L. Strommer, S. Fretz, D. Leonard, and A. McClung. 2005. Hawaii's comprehensive wildlife conservation strategy. Department of Land and Natural Resources, Honolulu, Hawaii. 722 pp.

Motooka, P., L. Ching, and G. Nagai. 2002. Herbicidal weed control methods for pasture and natural areas of Hawaii. Cooperative Extension Service, College of Tropical Agriculture and Human Resources, University of Hawaii. CTAHR Publication WC-8.

OConnor, P.J. 1999. Poaceae, grass family. In Wagner, W.L., D.R. Herbst, and S.H. Sohmer (eds.), Manual of the Flowering Plants of Hawaii, University of Hawaii Press and Bishop Museum Press, Honolulu, Bishop Museum Special Publications 97. Pp. 1,481-1,604.

(PIER) Pacific Island Ecosystems at Risk. 2006. *Syzygium cumini*. http://www.hear.org/pier/species/syzygium_cumini.htm, accessed on November 20, 2006.

Robichaux, R., J. Canfield, F. Warshauer, L. Perry, M. Bruegmann, and G. Carr. 1998. Radiating plants-adaptive radiation. Endangered Species Bulletin November/December. Pp. 3-5.

ScienceDaily. 2008. Biological control: insect release proposed to control exotic strawberry guava. <http://www.sciencedaily.com/releases/2008/05/080522093339.htm>, accessed February 25, 2009.

Scott, J.M., S. Mountainspring, F.L. Ramsey, and C.B. Kepler. 1986. Forest bird communities of the Hawaiian Islands: their dynamics, ecology and conservation. Studies of Avian Biology 9:1-429.

- Smathers, G.A., and D.E. Gardner. 1978. Stand analysis of an invading firetree (*Myrica faya* Aiton) population, Hawaii. Proceedings of the Second Conference on Natural Science, Hawaii Volcanoes National Park. Pp. 274-288.
- Smith, C.W. 1985. Impact of alien plants on Hawaii's native biota. In Stone, C.P., and J.M. Scott (eds.), Hawaii's Terrestrial Ecosystems: Preservation and Management, Cooperative National Park Resources Studies Unit, University of Hawaii, Honolulu. Pp. 191-192.
- Smith, C.W. 1989. Non-native plants. In Stone, C.P. and D.B. Stone (eds.), Conservation Biology in Hawaii, Cooperative National Park Resources Studies Unit, University of Hawaii, Honolulu. Pp. 60-69.
- Spatz, G., and D. Mueller-Dombois. 1973. The influence of feral goats on koa tree reproduction in Hawaii Volcanoes National Park. Ecology 54:870-876.
- State of Hawaii. 2001. Game mammal hunting guide. http://hawaii.gov/dlnr/dofaw/hunting/game_summary, downloaded May 10, 2013.
- Symon, D.E. 1999. Solanaceae. In Wagner, W.L., D.R. Herbst, and S.H. Sohmer (eds.), Manual of the Flowering Plants of Hawaii, University of Hawaii Press and Bishop Museum Press, Honolulu, Bishop Museum Special Publication 97. Pp. 1,251-1,278.
- The Insider. 2007. Lanais top sights. <http://www.theinsider.com/Aloha/Lanai/lanaiSights.htm>, accessed on March 22, 2007.
- The Nature Conservancy. 2006. Waikamoi preserve, east Maui, Hawaii, long-range management plan fiscal years 2007-2012. 23 pp. + appendices.
- Tomich, P.Q. 1986. Mammals in Hawaii; a synopsis and notational bibliography. Bishop Museum Press, Honolulu. 375 pp.
- University of Hawaii. College of Tropical Agriculture and Human Resources. 2013. Weed Management in Hawaii for Agriculture and Conservation. <http://www.ctahr.hawaii.edu/invweed/weedsHi.html>. Accessed May 10, 2013.
- van Riper, S.G., and C. van Riper III. 1982. A field guide to the mammals in Hawaii. The Oriental Publishing Company, Honolulu. 68 pp.
- von Allmen, E. 2007. Auwahi dryland forest restoration, USFWS grant #122003G020 and 122004G035, annual report July 2006 - July 2007. 14 pp.
- Vitousek, P.M., C.M. DAntonio, L.L. Loope, M. Rejmanek, and R. Westerbrooks. 1997. Introduced species: a significant component of human-caused global change. New Zealand Journal of Ecology 21:1-16.
- Wagner, W.L., D.R. Herbst, and R.S.N. Yee. 1985. Status of the native flowering plants of the Hawaiian Islands. In Stone, C.P., and J.M. Scott (eds.), Hawaii's Terrestrial Ecosystems: Preservation and Management, Cooperative National Park Resources Studies Unit, University of Hawaii, Honolulu. Pp. 23-74.
- Wagner, W.L., D.R. Herbst, and S.H. Sohmer. 1999. Manual of the flowering plants of Hawaii. University of Hawaii Press and Bishop Museum Press, Honolulu. Bishop Museum Special Publications 97. 1,918 pp.
- Wagner, W.L., and D.R. Herbst. 2003. Electronic supplement to the manual of flowering plants of Hawaii, Version 3.1. December 12, 2003. <http://rathbun.si.edu/botany/pacificislandbiodiversity/hawaiianflora/supplement.htm>

Waring, G.H. 1996. Preliminary study of the behavior and ecology of axis deer on Maui, Hawaii. Department of Zoology, Southern Illinois University, Carbondale, <http://www.hear.org/AlienSpeciesInHawaii/waringreports/axisdeer.htm>, accessed on December 20, 2006.

WCities. 2007. Historical background, Lanai introduction guide. WCities.com, <http://hawaiianairlines.wcities.com/en/guide/history/593/guide.html>, accessed on March 22, 2007.

Wood, K.R., and S. Perlman. 1997. Maui 14 plant survey final report. National Tropical Botanical Garden. 25 pp.

Personal Communications and In Litteris

Ching, S., Plant Extinction Prevention Program, Oahu, Email regarding status of candidate plant species on Oahu, dated March 11, 2011.

Conry, P.J., Hawaii Division of Forestry and Wildlife, 2012 CNOR, request for comments on USFWS species assessment and listing priority assignment forms, April 9, 2012.

Duvall, F., Hawaii Division of Forestry and Wildlife, Maui, Email regarding status of candidate plant species on Maui Nui, dated February 22, 2011.

Higashino, J., U.S. Fish and Wildlife Service, Email regarding *Nothocestrum latifolium* out planted at Auwahi, April 8, 2011.

Kam, R., HBMP database manager, Electronic mail message and database report for *Nothocestrum latifolium* on Oahu, dated March 3, 2008.

Kawakami, G., DOFAW, Email regarding status of *Nothocestrum latifolium* on Kauai, dated February 9, 2010.

Kawelo, K., U.S. Army Environmental, Response to FY 2005 Candidate Status Information table, June 28, 2005.

Kawelo, K., U.S. Army Environmental, Email regarding status of candidate plant species on Oahu, dated February 10, 2010.

Kawelo, K., U.S. Army Environmental, Email regarding status of candidate plant species on Oahu, dated February 17, 2011.

Leone, D. Land Board to help with Lanai watershed plan, article in the Honolulu Star-Bulletin, July 14, 2001.
Moses, W., The Nature Conservancy, Response to request for candidate plant species information, September 15, 2006.

Oppenheimer, H., Plant Extinction Prevention Program, Telephone interview regarding plant candidate species information updates, September 15, 2006.

Oppenheimer, H., Plant Extinction Prevention Program, Maui Nui, Email regarding status of candidate plant species on Maui Nui, dated February 28, 2011.

Plant Extinction Prevention Program (PEPP). 2012. Plant Extinction Prevention Program Annual Report, Fiscal Year 2012 (July 1, 2011-June 30, 2012), Hawaii Department of Land and Natural Resources (DLNR)-Division of Forestry and Wildlife. 169 pp.

Perlman, S., NTBG, Email regarding status of candidate plant species, dated March 2, 2010.

Starr, F., UGSG-BRD, Response to request for candidate plant species information.

Sugii, N., Lyon Arboretum, Response to request for propagation information, August 30, 2006.

Welton, P., National Park Service, Email regarding status of candidate plant species in Haleakala National Park, dated March 15, 2010.

Approval/Concurrence:

Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve:



06/13/2013

Date

Concur:



10/28/2013

Date

Did not concur:

Date

Director's Remarks: