

5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Hibiscus waimeae* subsp. *hannerae* (kokio keokeo)

Current Classification: Endangered

Federal Register Notice announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2008. Endangered and threatened wildlife and plants; initiation of 5-year status reviews of 70 species in Idaho, Montana, Oregon, Washington, and the Pacific Islands. Federal Register 73(83):23264-23266.

Lead Region/Field Office:

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

Name of Reviewer(s):

Marie Bruegmann, Pacific Islands Fish and Wildlife Office, Plant Recovery Coordinator
Marilet A. Zablan, Pacific Islands Fish and Wildlife Office, Assistant Field Supervisor for Endangered Species
Jeff Newman, Pacific Islands Fish and Wildlife Office, Acting Deputy Field Supervisor

Methodology used to complete this 5-year review:

This review was conducted by staff of the Pacific Islands Fish and Wildlife Office of the U.S. Fish and Wildlife Service (USFWS), beginning on April 29, 2009. The review was based on the final critical habitat designation for *Hibiscus waimeae* subsp. *hannerae* (USFWS 2003) and other species from the island of Kauai, as well as a review of current, available information. The National Tropical Botanical Garden provided an initial draft of portions of the review and recommendations for conservation actions needed prior to the next five-year review. The evaluation of Tamara Sherrill, biological consultant, was reviewed by the Plant Recovery Coordinator. The document was then reviewed by the Assistant Field Supervisor for Endangered Species and Acting Deputy Field Supervisor before submission to the Field Supervisor for approval.

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).

Application of the 1996 Distinct Population Segment (DPS) Policy:

This Policy does not apply to plants.

Review Analysis:

Please refer to the final critical habitat designation for *Hibiscus waimeae* subsp. *hannerae* published in the Federal Register on February 27, 2003 (USFWS 2003) for a complete review of the species' status (including biology and habitat), threats, and management efforts. No new threats and 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 *H. waimeae* subsp. *hannerae*.

Hibiscus waimeae subsp. *hannerae* is a subspecies of tree endemic to Kauai, known to occur at only three locations: Limahuli Valley (National Tropical Botanical Garden 2008a; Perlman 2008; Tangalin 2008), Hanakapiai Valley (Perlman 2008), and Pohakuao (National Tropical Botanical Garden 2008a). One additional historical occurrence was documented at Kalihiwai by Lydgate in 1913 (Hawaii Biodiversity and Mapping Program 2008).

There is no new information about this species' biology or life history.

When *Hibiscus waimeae* subsp. *hannerae* was listed as endangered, two populations were known with a total of 75 to 125 individuals (USFWS 1996). These numbers remained the same when the recovery plan for the species was published (USFWS 1998). Since then another population has been discovered at Pohakuao. There are approximately 80 and 85 individuals currently reported from three areas: Limahuli Valley, Hanakapiai, and Pohakuao.

In Limahuli Valley, 25 to 30 individuals currently occur in both the lower and upper valley, where 50 to 100 scattered individuals were noted in 1991 (Hawaii Biodiversity and Mapping Program 2008). In the lower valley, plants occur along streams from 189 to 564 meters (620 to 1,850 feet) elevation. In the back of the lower valley below the falls, along the stream, about 30 mature individuals were recorded in 2002. In November 2005, about 20 to 25 mature individuals were noted from 219 to 259 meters (720 to 850 feet) elevation (National Tropical Botanical Garden 2008a; Perlman 2008; Tangalin 2008). In Upper Limahuli Valley near the falls, at 238 meters (780 feet) elevation, about ten naturally occurring mature individuals were observed at and around the base camp, and about five individuals were in an enclosure in 2004. There are also some outplanted individuals in the area. In the hanging valley to the west of Limahuli Falls there are 10 to 15 individuals as of 2007 (Tangalin 2008; Perlman 2008).

In Hanakapiai there are currently at least 25 individuals. At an elevation of 311 to 317 meters (1,020 to 1,040 feet), 50 individuals with additional seedlings and immature individuals were seen before Hurricane Iniki in 1992, while only 25 were seen after the hurricane (Hawaii Biodiversity and Mapping Program 2008; USFWS 1996). In 2001, about 25 mature individuals were seen at 381 meters (1,250 feet) elevation. In 2002, about 25 mature individuals were seen at 398 meters (1,276 feet) elevation. Another report in 2002 cited 25 mature individuals at 301 to 308 meters (988 to 1,010 feet) elevation. In 2005, 25 trees were counted at 381 meters (1,250 feet) (National Tropical Botanical Garden 2008a; Perlman 2008). The Hanakapiai plants were again visited in August 2007, and some plants in this area had flowers with a pink tinge, which has not been observed in the Limahuli population (Tangalin 2008). It is unclear whether the differences in reported elevations reflect additional numbers of trees, or whether there are just 25 trees in the entire Hanakapiai population.

In 2001, Ken Wood of the National Tropical Botanical Garden found 20 mature trees in Pohakuao above the main forested gulch at 61 meters (200 feet) elevation (Hawaii Biodiversity and Mapping Program 2008; National Tropical Botanical Garden 2008a).

There is no new information for this species regarding genetics, taxonomy, spatial distribution or historical range.

Recent surveys have updated reported ecosystem conditions for *Hibiscus waimeae* subsp. *hannerae*. The species seems to be an essentially riparian tree found almost exclusively along streams at all locations (M. DeMotta, National Tropical Botanical Garden, pers. comm. 2008; National Tropical Botanical Garden 2008a) except in the hanging valley to the west of the falls in upper Limahuli where it is wet, but not riparian.

The lower Limahuli Valley and Hanakapiai regions are degraded *Metrosideros polymorpha* (ohia) wet forest with associated native and Polynesian introduced species including *Aleurites moluccana* (candlenut), *Alyxia stellata* (maile), *Antidesma platyphylla* (hame), *Bidens forbesii* (kookoolau), *Bobea* sp. (ahakea), *Boehmeria grandis* (akolea), *Charpentiera densiflora* (papala), *Cheirodendron* sp. (olapa), *Christella cyatheoides* (kikawaio), *Cibotium* spp. (hapuu), *Colocasia esculenta* (taro), *Cordyline fruticosa* (ti), *Cyanea coriacea* (haha), *C. fauriei* (haha), *C. hardyi* (haha), *C. sylvestris* (haha), *Cyrtandra confertiflora* (haiwale), *C. wainihaensis* (haiwale), *Dicranopteris linearis* (uluhe), *Diospyros* sp. (lama), *Dryopteris sandwicensis* (no common name [NCN]), *Freycinetia arborea* (ie ie), *Gardenia remyi* (nanu), *Kadua acuminata* (au), *Kadua affinis* (manono), *Machaerina angustifolia* (uki), *Microsorium spectrum* ssp. *pentadactylum* (peahi), *Musa* sp. (maia), *Myrsine lessertiana* (kolea), *Nestegis sandwicensis* (olopua), *Perrottetia sandwicensis* (olomea), *Piper methysticum* (awa), *Pipturus* sp. (mamake), *Pisonia sandwicensis* (kaulu), *Pleomele aurea* (hala pepe), *Psychotria mariniana* (kopiko), *Psydrax odorata* (alahee), *Sadleria* sp. (amau), *Spathoglottis plicata* (ground orchid), *Syzygium sandwicensis* (ohia ha), *Tectaria gaudichaudii* (iwa iwa lau nui), and *Wikstroemia* sp. (akia) (National Tropical Botanical Garden 2008a; Perlman 2008; Tangalin 2008).

Upper Limahuli Valley is *Metrosideros polymorpha* – *Dicranopteris linearis* wet forest with *Antidesma platyphylla*, *Bobea elatior* (ahakea), *Boehmeria grandis*, *Cheirodendron* sp., *Freycinetia arborea*, *Gardenia remyi*, *Ilex anomala* (kawau), *Isodendron longifolium* (aupaka), *Kadua affinis*, *Melicope* spp. (alani), *Perrottetia sandwicensis*, *Pipturus ruber*, *Pisonia sandwicensis*, *Pittosporum kauaiensis* (hoawa), *Pritchardia limahuliensis* (loulu), *Psychotria* spp. (kopiko), *Syzygium sandwicensis*, and *Tetraplasandra waialealae* (NCN) (National Tropical Botanical Garden 2008a; Perlman 2008).

Pohakuao habitat includes *Chamaesyce celastroides* (akoko), *Diospyros sandwicensis* (lama), *Flueggea neowawraea* (mehamehame), *Isodendron longifolium*, *Kokia kauaiensis* (kokio), *Nototrichium sandwicense* (kului), *Metrosideros polymorpha*, *Myrsine lessertiana*, *Pleomele aurea*, *Pouteria sandwicensis* (alaa), *Rauvolfia sandwicensis* (hao), and *Wilkesia gymnoxiphium* (iliau) (National Tropical Botanical Garden 2008a).

Threats to *Hibiscus waimeae* subsp. *hannerae* are invasive introduced plant species (Factor E) which include *Ageratina riparia* (spreading mist flower), *Aleurites moluccana*, *Blechnum appendiculatum* (NCN), *Bryophyllum pinnatum* (airplant), *Buddleia asiatica* (dogtail), *Clidemia hirta* (Koster's curse), *Clusia rosea* (autograph tree), *Coffea arabica* (Arabian coffee), *Erigeron karvinskianus* (daisy fleabane), *Lantana camara* (lantana), *Oplismenus hirtellus* (basketgrass), *Pluchea* spp. (sourbush), *Psidium cattleianum* (strawberry guava), *Psidium guajava* (common guava), *Rubus rosifolius* (thimbleberry), *Schefflera actinophylla* (octopus tree), and *Sphaeropteris cooperi* (Australian tree fern) (National Tropical Botanical Garden 2008a; Perlman 2008; Tangalin 2008). Pigs (*Sus scrofa*) and goats (*Capra hircus*) are degrading the habitats where *Hibiscus waimeae* subsp. *hannerae* grows (Perlman 2008) (Factor A).

There is no new information regarding overutilization of this species for commercial, recreational, scientific, or educational purposes (Factor B).

Insect damage to the capsules has been reported (Factor C). White grubs of unidentified caterpillars, along with holes and frass (insect excrement), were noted in the seeds and capsules. Many green fruits were seen with damage, seeds seen with aborted embryos, and the few full sized fruits were filled with insect frass. Very few seeds were observed in good condition without holes, including immature fruits (National Tropical Botanical Garden 2008a; Tangalin 2008). Rats (*Rattus* spp.) are also noted as a problem (Perlman 2008).

Lack of pollinators, and loss of pollen production are cited as limiting factors to reproduction by one botanist (Factor E) (Perlman 2008). Only a few immature individuals have been observed (M. DeMotta, pers. comm. 2008). Most seed is destroyed by insects, however most cultivated plants are grown from seed, as cuttings are very difficult to start (Tangalin 2008).

Climate change may also pose a threat to *Hibiscus waimeae* subsp. *hannerae* (Factors A and E). However, current climate change models do not allow us to predict specifically what those effects, and their extent, would be for this species.

One hurricane or other stochastic environmental events impacting that small corner of northern Kauai where this species is found could reduce or eliminate the entire species, as was the case with Hurricane Iniki (Factor E). In addition to all of the other threats, species like *Hibiscus waimeae* subsp. *hannerae* that are endemic to small portions of a single island are inherently more vulnerable to extinction than widespread species because of the higher risks posed to a few populations and individuals by random demographic fluctuations and localized catastrophes such as hurricanes, landslides, flooding, and disease outbreaks (Factor E). The effects of these processes on this single-island endemic are exacerbated by anthropogenic threats, such as habitat loss for human development or predation by introduced species (Factor E) (USFWS 1998).

Propagation has been largely from seeds, and outplantings have occurred at the National Tropical Botanical Gardens at Limahuli and Lawai. Thirteen individuals from Limahuli stock were outplanted in Limahuli in the 2007 to 2008 period, and as of 2009 there are 44 individuals outplanted (National Tropical Botanical Garden 2007, 2008b, 2009). There are also a few individual specimen plants growing at various nurseries and botanical gardens (Hawaii Department of Land and Natural Resources 2008; Maui Nui Botanical Gardens 2008; Waimea Arboretum 2008). No seeds are currently in storage at the National Tropical Botanical Garden (M. Clark, National Tropical Botanical Garden, pers. comm. 2009) or at any other botanical garden.

While a new population of *Hibiscus waimeae* subsp. *hannerae* was discovered since the species was listed as endangered in 1996, the overall numbers of individuals have declined.

Stabilizing, downlisting, and delisting objectives are provided in the recovery plan titled “Kauai II: Addendum to the recovery plan for the Kauai plant cluster” for plants from the island of Kauai (USFWS 1998), based on whether the species is an annual, a short-lived perennial (fewer than 10 years), or a long-lived perennial. *Hibiscus waimeae* subsp. *hannerae* is a long-lived perennial, and to be considered stable, the taxon must be managed to control threats (*e.g.*, fenced) and be 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 the island of Kauai. Each of these populations must be naturally reproducing and increasing in number, with a minimum of 25 mature individuals per population.

The interim stabilization goals for this species have not been met (see Table 1). Although there are three populations, two of which have at least 25 mature trees and one of which has 20 mature trees, none of these populations are naturally reproducing and increasing in number (M. DeMotta pers. comm. 2008; Perlman 2008; Tangalin 2008). In addition, all threats are not being managed. Therefore, *Hibiscus waimeae* subsp. *hannerae* meets the definition of endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:

- Collect material for genetic storage and propagation for reintroduction.
- Resurvey Hanakapiai for an accurate count of individuals.
- Identify appropriate areas for protection of this species.
- Fence to prevent further degradation of habitat by feral pigs and goats.
- Once enclosed, manage areas to remove invasive introduced plant species.
- Propagate from representatives of all populations for augmentation and reintroduction.

- Increase genetic diversity of species' offspring by reintroducing from a mixture of genetic stocks into protected areas *in situ*, as well as *ex situ*, in order to increase reproductive vigor and genetic diversity.
- Manage the wild and any reintroduced populations to prevent insect predation, and, if necessary, hand pollinate, in order to produce viable seed.
- Work with Hawaii Division of Forestry and Wildlife and Hawaii State Parks to initiate planning and contribute to implementation of ecosystem-level restoration and management to benefit this species.

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- Tangalin, N. 2008. *Hibiscus waimeae* subsp. *hannerae*. National Tropical Botanical Garden, Kalaheo, Hawaii. Unpublished. 2 pages.

[USFWS] U.S. Fish and Wildlife Service. 1996. Endangered and threatened wildlife and plants; determination of endangered or threatened status for nineteen plant species from the island of Kauai, Hawaii; final rule. Federal Register 61(198):53070-53089.

[USFWS] U.S. Fish and Wildlife Service. 1998. Kauai II: Addendum to the recovery plan for the Kauai plant cluster. U.S. Fish and Wildlife Service, Portland, Oregon. 140 pages.

[USFWS] U.S. Fish and Wildlife Service. 2003. Endangered and threatened wildlife and plants; final designation or nondesignation of critical habitat for 95 plant species from the islands of Kauai and Niihau, Hawaii; final rule. Federal Register 68(39):9116-9479.

Waimea Arboretum. 2008. Report on controlled propagation of listed and candidate species, as designated under the U.S. Endangered Species Act. Waimea Arboretum, Waimea, Hawaii. Unpublished.

Personal Communications

Clark, Margaret A. 2008. Seed Bank Manager, National Tropical Botanical Garden, Kauai, Hawaii. Memo to files regarding *Hibiscus waimeae* subspecies *hannerae*. Received by U.S. Fish and Wildlife Service, July 10, 2008.

DeMotta, Michael. 2008. Assistant Director of Living Collections and Horticulture, National Tropical Botanical Garden, Kalaheo, Hawaii. E-mail to Margaret Clark, National Tropical Botanical Garden, dated October 30, 2008. Subject: *Hibiscus waimeae* subsp. *hannerae*.

Table 1. Status of *Hibiscus waimeae* subsp. *hannerae* from listing through 5-year review.

Date	No. wild indivs.	No. outplanted	Stability Criteria identified in Recovery Plan	Stability Criteria Completed?
1996 (listing)	75-125	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 25 mature individuals each	Partially
1998 (recovery plan)	75-125	13	All threats managed in all 3 populations	No
			Complete genetic storage	Partially
			3 populations with 25 mature individuals each	Partially
2003 (critical habitat)	27	unknown	All threats managed in all 3 populations	No
			Complete genetic storage	Partially
			3 populations with 25 mature individuals each	No
2009 (5-year review)	80-85	13	All threats managed	Partially
			Complete genetic storage	Partially
			3 populations with 25 mature individuals each	Partially

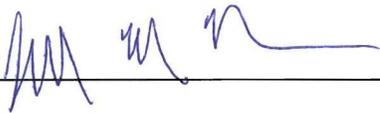
U.S. FISH AND WILDLIFE SERVICE
SIGNATURE PAGE for 5-YEAR REVIEW of *Hibiscus waimeae* subsp. *hanneriae*
(kokio keokeo)

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
- No Change in listing status

For **Field Supervisor, Pacific Islands Fish and Wildlife Office**



Date AUG 27 2010