

5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Hibiscus arnottianus* subsp. *immaculatus* (koki'o ke'oke'o)

Current Classification: Endangered

Federal Register Notice announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2009. Endangered and threatened wildlife and plants; initiation of 5-year reviews of 103 species in Hawaii. Federal Register 74(49):11130-11133.

Lead Region/Field Office:

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

Name of Reviewer(s):

Marie Bruegmann, Plant Recovery Coordinator, PIFWO

Jess Newton, Recovery Program Lead, PIFWO

Assistant Field Supervisor for Endangered Species, PIFWO

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 March 16, 2009. The review was based on final critical habitat designations for *Hibiscus arnottianus* subsp. *immaculatus* and other species from the island of Molokai (USFWS 2003) 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 Samuel Aruch, biological consultant, was reviewed by the Plant Recovery Coordinator. The document was then reviewed by the Recovery Program Lead and the Assistant Field Supervisor for Endangered Species 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 designations for *Hibiscus arnottianus* subsp. *immaculatus* published in the Federal Register on March 18, 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. arnottianus* subsp. *immaculatus*.

Hibiscus arnottianus subsp. *immaculatus* is endemic to East Molokai, and known only from three populations at Olokui above Waieheu, Papalaua, and Wailau. Historically, it was also known from Kalae on Molokai. While it was reported from Waihanau Valley, in the Kalaupapa National Historical Park on Molokai, this report has never been confirmed with voucher specimens (Hawaii Biodiversity and Mapping Program 2009). West of Papalaua Valley, above Kikipua Point, at 427 to 457 meters (1,400 to 1,500 feet) elevation six trees were seen in 1989 (Hawaii Biodiversity and Mapping Program 2009). In 1990, 20 or more trees were seen in a forested area above sea cliffs in Wailau Valley on a ridge leading to Olokui at 480 meters (1,575 feet) elevation (Perlman 2009a; Wood 2009a). On a helicopter survey from Pelekunu to Halawa in October 2009, Hank Oppenheimer of the Plant Extinction Prevention Program and Steve Perlman of the National Tropical Botanical Garden saw more than 100 individuals of *Hibiscus arnottianus* subsp. *immaculatus* on the sea cliffs of Wailau, below Olokui, near Wailele Falls; less than 20 plants east of Wailau towards Papalaua; and a single individual in Wailau Valley (Perlman 2009a; H. Oppenheimer, Plant Extinction Prevention Program, pers. comm. 2010). In December 2009, Perlman and Ken Wood of the National Tropical Botanical Garden were able to reach the Wailau cliff site and collect cuttings from a number of these trees at 520 meters (1,706 feet) elevation. These cuttings were given to Bill Garnett for propagation (Perlman 2009b; Wood 2009b). A single tree was observed at 366 meters (1,200 feet) elevation on the Anapuhi Cliffs, west of Kaaloa and Haupu Bay in 2002 (Perlman 2009a).

In total, there are approximately 125 individuals of *Hibiscus arnottianus* subsp. *immaculatus* in four populations.

The habitat in Wailau Valley on the ridge to Olokui where *Hibiscus arnottianus* subsp. *immaculatus* occurs is *Metrosideros polymorpha* (ohia) lowland mesic to wet forest with associated native plants including *Antidesma platyphylla* (hame), *Bobea* sp. (ahakea), *Boehmeria grandis* (akolea), *Broussaisia arguta* (kanawao), *Freycinetia arborea* (ie ie), *Cibotium* sp. (hapuu), *Cyrtandra grayi* (keokeo haiwale), *Dicranopteris linearis* (uluhe), *Dubautia plantaginea* (naenae), *Melicope molokaiensis* (alani), *Myrsine lessertiana* (kolea lau nui), *Neraudia melastomifolia* (maaloa), *Nestegis sandwicensis* (olopua), *Ochrosia compta* (holei), *Perrottetia sandwicense* (olomea), *Pipturus albidus* (mamake), *Pouteria sandwicensis* (alaa), *Pritchardia lowreyana* (loulu), *Psychotria hawaiiensis* (kopiko ula), *P. mariniana* (kopiko), *P. mauiensis* (opiko), *Strongylodon ruber* (nuku iiwi), *Syzygium sandwicense* (ohia ha), *Tetraplasandra oahuensis* (ohe mauka), *T. hawaiiense* (ohe), *Touchardia latifolia* (olona), *Urera glabra* (opuhe), and *Xylosma hawaiiense* (maua) (Perlman 2009a, b; Wood 2009a, b).

On the Anapuhi Cliffs, west of Kaaloa and Haupu Bay, the habitat where *Hibiscus arnottianus* subsp. *immaculatus* occurs is *Metrosideros polymorpha* – *Dicranopteris linearis* mesic forest with *Antidesma platyphylla*, *Bobea* sp., *Boehmeria grandis*, *Cheirodendron trigynum* (olapa), *Cibotium* sp., *Clermontia kakeana* (haha), *Cyanea solenocalyx* (pua kala), *Freycinetia arborea*, *Kadua affinis* (manono), *Myrsine lessertiana*, *Nestegis sandwicensis*, *Pipturus* sp. (mamake), *Pritchardia lowreyana*, *Syzygium sandwicense*, *Urera glabra*, and *Wikstroemia* sp. (akia) (Perlman 2009a).

Threats to *Hibiscus arnottianus* subsp. *immaculatus* include introduced invasive plant species such as *Ageratina adenophora* (sticky snakeroot), *A. riparia* (spreading mist flower), *Bryophyllum pinnatum* (airplant), *Buddleia asiatica* (dogtail), *Christella dentata* (downy wood fern), *Cyrtomium falcatum* (Japanese holly fern), *Clidemia hirta* (Koster's curse), *Melinis minutiflora* (molasses grass), *Pluchea carolinensis* (sourbush), *Rubus rosifolius* (thimbleberry), and *Tibouchina herbacea* (glory bush) (Listing Factors A and E). Feral pigs (*Sus scrofa*) and goats (*Capra hircus*) disturb and degrade the habitat and cause erosion and landslides, which further imperil this rare species (Listing Factors A, C and D) (Perlman 2009a, b; Wood 2009 a, b).

Rats (*Rattus* spp.) and slugs (unidentified species) are predators of this taxon (Perlman 2009a, b) (Listing Factor C).

Climate change may also pose a threat to *Hibiscus arnottianus* subsp. *immaculatus* (Listing Factors A and E). However, current climate change analyses in the Pacific Islands lack sufficient spatial resolution to make predictions on impacts to this species. The Pacific Islands Climate Change Cooperative (PICCC) has currently funded climate modeling that will help resolve these spatial limitations. We anticipate high spatial resolution climate outputs by 2013.

In addition to all of the other threats, species like *Hibiscus arnottianus* subsp. *immaculatus* 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 (Listing Factor E). The extent of these natural processes on this single island endemic are exacerbated by anthropogenic threats, such as habitat loss for human development or predation by introduced species (Listing Factor E) (USFWS 1992).

Seed production seems to be problematic in this species. Whether this is due to pollination issues (lack of pollinators) or predatory insects is unclear (Listing Factors E and C). Prior to recent collections of cuttings at Olokui, the plants which have been propagated on Molokai were from one original founder located at Pelekunu. With the use of hand pollination, Bill Garnett has been able to produce first generation seed from these plants (W. Garnett, Wiliwili Rare Plant Nursery, pers. comm. 2009).

According to Garnett, a 1991 collection from Papalaua and one from Waileia Gulch may have gone to Waimea Valley Arboretum for propagation. He would like to track down any surviving plants from these collections to broaden the genetic representation of the species. He has reintroduced about 175 individuals at the top of the Kalaupapa Trail above Kalae, which is within their historical range (W. Garnett, pers. comm. 2010).

Maui Nui Botanical Garden has 36 individuals in storage (Maui Nui Botanical Garden 2009). Waimea Valley Arboretum reports having 12 individual plants in storage (Waimea Valley Arboretum 2009). The National Tropical Botanical Garden has one

individual remaining in the Native Section of the McBryde Garden, grown from a 1992 collection at Wailau-Olokui (M. De Motta, National Tropical Botanical Garden, pers. comm. 2009). There are 25 plants growing in the National Tropical Botanical Garden nursery (National Tropical Botanical Garden 2009a, b).

In 2009, one million dollars in funds from the federal Department of Interior's Cooperative Endangered Species Conservation Fund was designated for use on Molokai, to help acquire a perpetual conservation easement containing over 248 hectares (614 acres) of strategic watershed on the eastern end of the island. The property has several federally listed threatened or endangered species as well as critical habitat in and around the proposed easement area. Among federally listed species benefiting from this protection are *Bidens wiebkei* (kookoolau), *Canavalia molokaiensis* (awikiwiki), *Hibiscus arnottianus* subsp. *immaculatus*, *Brighamia rockii* (puaala), *Cyanea dunbariae* (haha), *Gardenia brighamii* (nanu), *Pritchardia munroi* (loulu), and *Phyllostegia hispida* (USFWS 2009; C. Rowland, USFWS, pers. comm. 2010).

Stabilizing, downlisting, and delisting objectives are provided in the recovery plan for the Molokai pant cluster (USFWS 1996), based on whether the species is an annual, a short-lived perennial (fewer than ten years), or a long-lived perennial. *Hibiscus arnottianus* subsp. *immaculatus* is a long-lived perennial, and to be considered stabilized, which is the first step in recovering the species, the taxon must be managed to control threats (*e.g.*, fenced) and be represented in an *ex situ* (off-site) collection. In addition, a minimum of three populations should be documented on Molokai. For the species to be considered stable, 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 as only 1 of 4 populations have more than 25 mature wild individuals (Table 1), and not all threats have been managed (Table 2). Therefore, *Hibiscus arnottianus* subsp. *immaculatus* meets the definition of endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:

- Continue collecting seeds and/or cuttings from all wild individuals.
- Propagate for genetic storage and reintroductions.
- Continue reintroducing individuals into protected suitable habitat within historical range.
- Monitor existing populations to track the status of the species and at historical sites for new recruitment.
- Fence all populations to provide protection from the negative impacts of feral ungulates.
- Control introduced invasive plant species in all known populations.

- Control rats in the vicinity of these populations.
- Develop and implement methods to control slugs and insect pests.
- Research pollinators and seed distributors to determine limiting factors; investigate techniques to improve natural recruitment.
- Work with Hawaii Division of Forestry and Wildlife, National Park Service, and other land managers to initiate planning and contribute to implementation of ecosystem-level restoration and management to benefit this species.
- Assess the modeled effects of climate change on this species, and use to determine future landscape needed for the recovery of the species.

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Oppenheimer, Hank .L. 2010. Maui Nui Coordinator, Plant Extinction Prevention Program. E-mail to Sam Aruch, dated June 16, 2010. Subject: *Hibiscus arnottianus* subsp. *immaculatus*.

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Table 1. Status of *Hibiscus arnottianus* subsp. *immaculatus* from listing through 5-year review.

Date	No. wild indivs	No. outplanted	Stability Criteria identified in Recovery Plan	Stability Criteria Completed?
1992 (listing)	< 50	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 25 mature individuals each	No
1996 (recovery plan)	< 100	Unknown	All threats managed in all 3 populations	No
			Complete genetic storage	Partially
			3 populations with 25 mature individuals each	No
2003 (critical habitat)	20-30	Unknown	All threats managed in all 3 populations	No
			Complete genetic storage	Partially
			3 populations with 25 mature individuals each	Partially
2009 (5-year review)	~125	175	All threats managed in all 3 populations	No (Table 2)
			Complete genetic storage	Partially
			3 populations with 25 mature individuals each	No: only 1 of 4 populations have more than 25 individuals

Table 2. Threats to *Hibiscus arnottianus* subsp. *immaculatus*.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulates – habitat modification and herbivory	A, C, D	Ongoing	No
Landslides	A, E	Ongoing	No
Rats – herbivory	C	Ongoing	No
Slugs – herbivory	C	Ongoing	No
Invasive introduced plants	A, E	Ongoing	No
Invertebrates – seed predation	E	Ongoing	No
Loss of pollinators	E	Ongoing	No
Climate change	A, E	Increasing	No
Small population size	E	Ongoing	Partially: seed collections and small scale reintroductions

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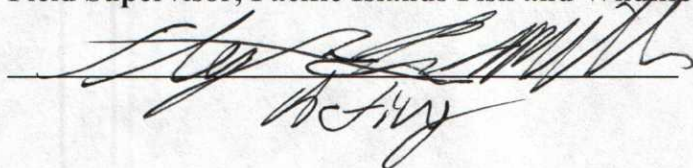
SIGNATURE PAGE for 5-YEAR REVIEW of *Hibiscus arnottianus* subsp. *immaculatus*
(koki'o ke'oke'o)

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

Field Supervisor, Pacific Islands Fish and Wildlife Office



Date 8/29/11