

5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Hedyotis st.-johnii* (Na Pali beach hedyotis)

Current Classification: Endangered

Federal Register Notice announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2007. Endangered and threatened wildlife and plants; initiation of 5-year reviews of 71 species in Oregon, Hawaii, Commonwealth of the Northern Mariana Islands, and Territory of Guam. Federal Register 72(45):10547-10550.

Lead Region/Field Office:

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

Name of Reviewer(s):

Christian Torres-Santana, Student Trainee Biologist

Marie Bruegmann, Plant Recovery Coordinator

Marilet A. Zablan, Recovery Program Leader and acting Assistant Field Supervisor for Endangered Species

Gina Shultz, 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 March 8, 2007. The review was based on the final critical habitat designation for *Hedyotis st.-johnii* and other species from the island of Kauai, as well as a review of current, available information (USFWS 2003). The Bernice P. Bishop Museum provided an initial draft of portions of the 5-year review. The evaluation of the status of the species was prepared by our lead PIFWO biologist and reviewed by the Plant Recovery Coordinator. The document was then reviewed by the Recovery Program Leader and acting Assistant Field Supervisor for Endangered Species, and 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 *Hedyotis st.-johnii* 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. st.-johnii*.

This succulent short-lived perennial herb was first collected in 1947 between Kalalau and Honopu Valleys, Kauai, and subsequently described in 1958. At the time *Hedyotis st.-johnii* was federally listed in 1991, it was known from five populations totaling fewer than 200 individuals. The populations occurred between Kalalau and Honopu Beaches and in Nualolo Valley, Nualolo Kai, and Milolii Beach where it was growing in crevices of vertical sea cliffs within the spray zone (USFWS 1991). Another population totaling ten individuals was discovered on Polihale Ridge in 1991 (USFWS 1995).

In 2001, a total of 84 individuals were reported within seven sub-populations: 28 individuals from Polihale, Kaaweiki, and Kauhau recorded in 1996; 44 individuals from Makaha and Milolii in 2000; seven mature individuals in Nualolo; and five individuals in Kalalau in 2001 (Wood *et al.* 2001). The critical habitat designation completed in 2003 indicates that the species had 10 populations containing 227 to 292 individuals occurring on State-owned land in Nualolo Valley, Nualolo Kai, Kaahole Valley, Keawanui, Kawaiula Valley, Milolii Spring, Makaha Point, Polihale Spring, Kalepa Valley, and Nakeikionaiwi Caves within the Na Pali Coast State Park and Puu Ka Pele Forest Reserve (USFWS 2003). As of February 2004, the species had declined to three populations containing 30 individuals in Milolii, Kalalau, and Nualolo (Perlman 2006). In 2004, an additional collection was recorded from Awaawapuhi (National Tropical Botanical Garden 2008) growing from coastal cliffs just northeast of the river mouth which may be a new locality. Two individuals were noted at this new locality (National Tropical Botanical Garden 2008). Numbers and populations have decreased since the species was listed in 1991 to now, with fewer than 50 plants remaining (Perlman 2006; National Tropical Botanical Garden 2008; USFWS 2008; K. Wood, pers. comm., June 2008).

Little is known about the life history of *Hedyotis st.-johnii*. Flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors are unknown (USFWS 1995). Observation from herbarium vouchers at the Bernice P. Bishop Museum and National Tropical Botanical Garden suggest that plants were flowering in January, March, April, May, and December; fruiting specimens were from February, March, May, July, August, and October (National Tropical Botanical Garden 2008; K. Wood, National Tropical Botanical Garden, pers. comm. 2008; C. Imada, Bernice P. Bishop Museum, pers. comm. 2008).

The species was originally described by B.C. Stone and I. Lane as *Hedyotis st.-johnii* in 1958 (Stone and Lane 1958). However, a recent scanning electron microscope study of the tribe Hedyotideae, to which all 21 Hawaiian native *Hedyotis* belong, suggested nomenclatural changes were necessary. Terrell *et al.*'s (2005) study of seed and fruit characters revealed that the Hawaiian species were distinct from Asian and Pacific species of *Hedyotis* subgenus *Hedyotis* and from North American specimens of tribe Hedyotideae, and the oldest available genus name, *Kadua*, was resurrected and applied to all 21 Hawaiian taxa. The new combination for *Hedyotis st.-johnii* is *Kadua st.-johnii*

(Terrell *et al.* 2005) and the species will be referred to as this throughout the remainder of this review.

The main threats to *Kadua st.-johnii* are predation and habitat degradation by feral goats (*Capra hircus*) (Factors A, C, and D), and trampling and grazing by feral cattle (*Bos taurus*) (Factors A and C). As a result of past goat activity, this species is now almost entirely restricted to sites inaccessible to goats. Competition from introduced invasive plant species such as *Pluchea carolinensis* (sourbrush), *Lantana camara* (lantana), *Erigeron karvinskianus* (daisy fleabane), *Leucaena leucocephala* (haole koa) and *Ageratina conyzoides* (billygoat weed), and *Chamaesyce hirta* (hairy spurge) is also a major threat to this species (Factor E) (USFWS 1991, 1995, 2003; Wood *et al.* 2001; K. Wood, pers. comm. 2008).

In addition to the threats listed above, species like *Kadua st.-johnii* 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, fire, droughts flooding and disease outbreaks (Factor E) (USFWS 1995; Wood *et al.* 2001; K. Wood, pers. comm. 2008). When considered on their own, the natural processes associated with being a single island endemic do not affect *K. st.-johnii* to such a degree that it is threatened or endangered with extinction in the foreseeable future, but these natural processes can exacerbate the threat from anthropogenic factors, such as habitat loss from or predation by introduced species (Factor E) (USFWS 1995).

To safeguard existing genetic material, propagation for genetic storage and reintroduction is occurring at the University of Hawaii's Lyon Arboretum Micropropagation Laboratory (2007), Center for Conservation Research and Training Seed Storage Facility (2007), and the National Tropical Botanical Garden (2007). *Kadua* spp. are easily germinated from seed or rooted from cuttings, but are very susceptible to insect attacks (Lilleeng-Rosenberger 2005). The National Tropical Botanical Garden (2007) reported nine plants in controlled propagation and an undetermined number of seeds in storage. There are also an undetermined number of cuttings in the National Tropical Botanical Garden nursery. Seeds for *K. st.-johnii* tested for storage at the U.S. Department of Agriculture National Center for Genetic Resources Preservation indicate the seeds are orthodox (seeds with natural dormancy allowing long-term storage with little damage to the DNA) and can be stored by drying or freezing. Seeds germinated in about six months (Yoshinaga 2001).

Stabilizing, downlisting, and delisting objectives are provided in the recovery plan for plants from the island of Kauai (USFWS 1995), based on whether the species is an annual, a short-lived perennial (fewer than ten years), or a long-lived perennial. *Kadua st.-johnii* is a short-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 the island of Kauai. Each of these populations

must be naturally reproducing and increasing in number, with a minimum of 50 mature individuals per population.

The stabilization goals for this species have not been met as there are fewer than 50 wild individuals and none of the threats have been managed (see Table 1). Therefore, *Kadua st.-johnii* meets the definition of endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:

- Continue collection of genetic resources for storage, future propagation and reintroducing into protected suitable habitat within historical range.
- Construct enclosure fences to protect individuals from the adverse impacts of feral pigs, and eradicate introduced invasive plant species within the enclosures.
- Enhance current natural populations to increase numbers of individuals.
- Survey geographical and historical range for a thorough current assessment of the species.
- Initiate planning and contribute to implementation of ecosystem level restoration and management to benefit this species.
- Assess genetic variability within extant and *ex situ* populations.
- Study *Kadua st.-johnii* populations with regard to population size and structure, geographical distribution, flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, limiting factors, and threats.
- Update the listed entity on 50 CFR 17 to match the currently recognized taxonomy.

References:

- Center for Conservation Research and Training Seed Storage Facility. 2007. Seed conservation lab database. Unpublished.
- Harold L. Lyon Arboretum Micropropagation Laboratory. 2007. Micropropagation database. University of Hawaii at Manoa. Unpublished.
- Lilleeng-Rosenberger, K.E. 2005. Growing Hawaii's native plants. Mutual Publishing, Honolulu, HI. 416 pages.

- National Tropical Botanical Garden. 2007. Report on controlled propagation of listed and candidate species, as designated under the U.S. Endangered Species Act. Unpublished.
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- Yoshinaga, A. 2001. Seed storage practices for native Hawaiian plants: An on-line manual. Center for Conservation Research and Training, University of Hawaii, Honolulu, Hawaii. Available online at

<http://www.hawaiiconservation.org/_library/documents/seed%20storage%20manual.pdf>. Downloaded 11 May 2008.

Personal communications:

Wood, Ken. Research Biologist, National Tropical Botanical Garden, e-mail communication to Bernice P. Bishop Museum, June 2008.

Imada, Clyde. Research Specialist, Bernice P. Bishop Museum, e-mail communication to Christian Torres-Santana (USFWS) on June 30, 2008.

Table 1. Status of *Kadua st.-johnii* from listing through 5-year review.

Date	No. wild individuals	No. outplanted	Stability Criteria identified in Recovery Plan	Stability Criteria Completed?
1991 (listing)	< 200	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
1995 (recovery plan)	< 200	0	All threats managed in all 3 populations	No
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	No
2003(critical habitat)	227 to 292	0	All threats managed in all 3 populations	No
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	No
2008 (5-year review)	< 50	0	All threats managed	No
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	No

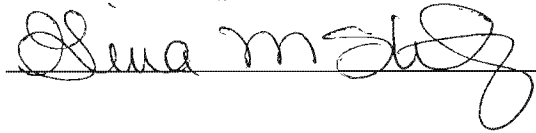
U.S. FISH AND WILDLIFE SERVICE
SIGNATURE PAGE for 5-YEAR REVIEW of *Hedyotis st-johnii*
(Na Pali beach hedyotis)

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

Acting Field Supervisor, Pacific Islands Fish and Wildlife Office



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