5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Hedyotis degeneri* (No common name)

Current Classification: Endangered

Federal Register Notice announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2010. Endangered and threatened wildlife and plants; initiation of 5-year status reviews of 69 species in Idaho, Washington, Hawaii, Guam, and the Commonwealth of the Northern Mariana Islands. Federal Register 75(67):17947-17950.

Lead Region/Field Office:

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

Name of Reviewer(s):

Chelsie Javar, Fish and Wildlife Biologist, PIFWO
Marie Bruegmann, Plant Recovery Coordinator, PIFWO
Jess Newton, Recovery Program Leader, 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 April 8, 2010. The review was based on a review of current, available information since the last 5-year review for *Hedyotis degeneri* (USFWS 2007). Bernice Pauahi Bishop Museum 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 Chelsie Javar, Fish and Wildlife Biologist, was reviewed by the Plant Recovery Coordinator. The document was then reviewed by the Recovery Program Leader 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).

Review Analysis:

Please refer to the previous 5-year review for *Hedyotis degeneri* published on August 2, 2007 (available at http://www.fws.gov/ecos/ajax/docs/five_year_review/doc1136.pdf) and the Recovery plan for Oahu plants (USFWS 1998), for a complete review of the species' status, threats, and management efforts. No new threats or 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. degeneri*

This short-lived perennial shrub is endangered and occurs on the island of Oahu (USFWS 1998). *Hedyotis degeneri* var. *coprosmifolis* has not been collected since the 1980s and

no current populations are known (USFWS 2002, 2007). The current status and trends for *Hedyotis degeneri* are provided in the tables below.

New taxonomic information:

Terrell *et al*. (2005) studied seed and fruit characters of Hawaiian members of the tribe Hedyotideae (Rubiaceae) previously recognized in the genus *Hedyotis*, and determined that species from Hawaii were distinct from Asian and Pacific species of *Hedyotis* and from North American species of Hedyotideae. The oldest available genus name for the 21 Hawaiian species, *Kadua* was resurrected (7 other species from the Pacific were also included in the genus). In addition, the two intraspecific taxa (*coprosmifolia, degeneri*), however, are treated at the subspecific level, not at the varietal level, as they were under the name *Hedyotis degeneri*. Therefore, this species will be referred to as *Kadua degeneri* (Fosberg) W. L. Wagner and Lorence, with subsp. *coprosmifolia* and subsp. *degeneri* for the remainder of this review. The results of the study also correlated with the taxonomic arrangement in the current Hawaiian flora. A phylogenetic study of the herbaceous tribe Spermacoceae (Rubiaceae) (Groeninckx *et al*. 2009) supports the resurrection of the genus *Kadua*. This change in taxonomy does not result in a change of the range of the taxon as it was listed.

New threats:

Climate change may also pose a threat to this species. 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.

New management actions:

- Ungulate exclosure:
    - In 2009, construction of the Manuwai population unit fence began (U.S. Army Garrison 2009). This fence will protect the Manuwai portion of the Alaiheihe to Manuwai population unit. As of 2010, the fence was still under construction (U.S. Army Garrison 2010).
    - The Kahanahaiki subunit I is fenced; subunit II is proposed for construction in 2013 (U.S. Army Garrison 2010).
- Ungulate control – As of 2010, subunit I of Kahanahaiki population unit was ungulate–free (U.S. Army Garrison 2010).
- Ecosystem-altering invasive plant species control – Weeds are controlled around individuals of *Kadua degeneri* var. *degeneri* at the Kahanahaiki to Pahole population unit (U.S. Army Garrison 2010).
- Captive propagation and genetic storage – In 2009, the Center for Conservation Research and Training Seed Storage Laboratory (2009) had 17,599 seeds in storage.

- Population viability monitoring:
    - The 2009 monitoring data showed a decline in the number of individuals of *Kadua degeneri* var. *degeneri* from 2008 in the Alaiheihe and Manuwai population unit and Central Makaleha and West branch of east Makaleha (U.S. Army Garrison 2009).
    - In 2010, seed collections for genetic storage continued from the Alaiheihe to Manuwai and the Central Makaleha and West branch of East Makaleha population unit (U.S. Army Garrison 2010).
    - In 2010, monitoring data showed a decline in the number of individuals at the Alaiheihe and Manuwai population unit (U.S. Army Garrison 2010). In the same year, monitoring at the Central Makaleha and West Branch of East Makaleha population unit showed no change in the population status. No monitoring was conducted at the Kahanahaiki to Pahole population unit in 2010 for *Kadua degeneri* var. *degeneri.*

Synthesis:

In 2010, there were a total of 230 mature individuals, 239 immature individuals, and 104 seedlings of *Kadua degeneri* var. *degeneri* (U.S. Army Garrison 2010). Of these, Kahanahaiki to Pahole had 186 mature, 204 immature, and 100 seedlings; Alaiheihe and Manuwai had 21 mature and 2 immature; and central Makaleha and West branch of East Makaleha population units had 23 mature, 33 immature, and 4 seedlings.

Stabilizing, downlisting, and delisting objectives are provided in the recovery plan for plants from the island of Oahu (USFWS 1998), based on whether the species is an annual, a short-lived perennial (fewer than 10 years), or a long-lived perennial. *Kadua degeneri* is a short-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 Oahu. Each of these populations must be naturally reproducing and increasing in number, with a minimum of 50 mature individuals per population.

The interim stabilization goals for this species have only been partially met, as currently only a single population contains more than 50 mature individuals at the Kahanahaiki to Pahole population unit (Table 1) and all threats are only being partially managed throughout all of the populations (Table 2). Therefore, *Kadua degeneri* meets the definition of endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:

- Captive propagation for genetic storage and reintroduction:
    - Continue to collect seeds from tagged individuals, keeping close track of the maternal source for use in *ex situ* propagation.

    - Continue to collect seeds from all existing populations and send to at least two or three different venues for propagation.
- Reintroduction / translocation implementation – Reintroduce the species back into its known historical range.
- Ungulate exclosures:
    - Continue to construct fenced exclosures around existing and reintroduced populations to provide protection from feral ungulates.
    - Monitor fenced exclosures for evidence of breaching by feral ungulates.
- Ungulate control – Continue to protect all populations against disturbances from feral ungulates.
- Ecosystem-altering invasive plant species control – Continue to control invasive introduced plant species around all populations.
- Surveys / inventories:
    - Conduct surveys to locate *Kadua degeneri* var. *coprosmifolia*. If found, genetic material should be collected and any remaining individuals should be protected via fencing and weeding to determine whether this taxon truly represents a genetically distinct variety.
    - Conduct thorough surveys of all suitable habitats where *Kadua degeneri* var. *degeneri* was historically seen.
- Fire protection – Develop and implement a fire management plan for all populations of *Kadua degeneri* var. *degeneri*.
- Population biology research – Study *Kadua degeneri* var. *degeneri* 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.
- Threats research – Assess the modeled effects of climate change on this species, and use to determine future landscape needed for the recovery of the species.
- Alliance and partnership development – Work with the U.S. Army, Hawaii Division of Forestry and Wildlife, and other land managers to initiate planning and contribute to implementation of ecosystem-level restoration and management to benefit this species.
- Federal Register updates – Update the listed entity on 50 CFR 17 to match the currently recognized taxonomy.

Table 1. Status of *Kadua degeneri* from listing through current 5-year review.

Date	No. wild indivs	No. outplanted	Stabilization Criteria identified in Recovery Plan	Stabilization Criteria Completed?
1991 (listing)	6	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
1998 (recovery plan)	32	0	All threats managed in all 3 populations	No
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	No
2003 (critical habitat)	60	0	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	No
2007 (5-yr review)	370	0	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	Partially
2012 (5-yr review)	230	0	All threats managed in all 3 populations	Partially (see Table 2)
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	Partially:

Table 2. Threats to *Kadua degeneri* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulates – Degradation of habitat	A, D	Ongoing	Partially: Kahanahaiki subunit I is fenced and ungulate-free; fence construction began at Manuwai population unit
Established ecosystem-altering invasive plant species	A	Ongoing	Partially: Weeds controlled at Kahanahaiki to Pahole population unit
Fire	E	Ongoing	No
Established invasive plant species competition	E	Ongoing	Partially: Weeds controlled at Kahanahaiki to Pahole population unit
Climate change	A, E	Increasing	No

References:

See previous 5-year review for a full list of references (USFWS 2007). Only references for new information are provided below.

Center for Conservation Research and Training Seed Storage Laboratory. 2009. Seed bank inventory. Honolulu, Hawaii. Microsoft Access database. Unpublished.

Groeninckx, I., S. Dessein, H. Ochoterena, C. Persson, T.J. Motley, J. Karehed, B. Bremer, S. Huysmans and E. Smets. 2009. Phylogeny of the herbaceous tribe Spermacoceae (Rubiaceae) based on plastid DNA data. Annals of the Missouri Botanical Garden 96:109-132.

Terrell, E.E., H.E. Robinson, W.L. Wagner and D.H. Lorence. 2005. Resurrection of genus Kadua for Hawaiian Hedyotidinae (Rubiaceae), with emphasis on seed and fruit characters and notes on South Pacific species. Systematic Botany 30(4):818-833.

U.S. Army Garrison. 2009. 2009 status report for the Makua and Oahu implementation plans. U.S. Army Garrison, Hawaii and Pacific Cooperative Park Studies Unit. Schofield Barracks, Hawaii. 711 pages. Available online at <http://www.botany.hawaii.edu/faculty/duffy/DPW.htm>.

U.S. Army Garrison. 2010. 2010 status report for the Makua and Oahu implementation plans. U.S. Army Garrison, Hawaii and Pacific Cooperative Park Studies Unit. Schofield Barracks, Hawaii. 730 pages. Available online at <http://manoa.hawaii.edu/hpicesu/dpw.htm>.

[USFWS] U.S. Fish and Wildlife Service. 1998. Recovery plan for the Oahu plants. U.S. Fish and Wildlife Service, Portland, Oregon. 207 pages + appendices. Available online at <http://www.fws.gov/pacificislands/recoveryplans.html>.

[USFWS] U.S. Fish and Wildlife Service. 2002. Endangered and threatened wildlife and plants; designations of critical habitat for plant species from the island of Oahu, Hawaii; proposed rule concerning designation of critical habitat. Federal Register 67(102):37108-37272.

[USFWS] U.S. Fish and Wildlife Service. 2007. *Hedyotis degeneri* (no common name) 5-year review summary and evaluation. U.S. Fish and Wildlife Service, Honolulu, Hawaii. 10 pages. Available online at <http://www.fws.gov/ecos/ajax/docs/five_year_review/doc1136.pdf>.

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U.S. FISH AND WILDLIFE SERVICE
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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

Appropriate Listing/Reclassification Priority Number, if applicable:_____

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for

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