

5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Kadua degeneri* (no common name)

Current Classification: Endangered

Federal Register Notice announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2017. Endangered and threatened wildlife and plants; initiation of 5-year status reviews for 138 species in Hawaii, Oregon, Washington, and California. Federal Register 82(75): 18665–18668, April 20, 2017.

Lead Region/Field Office:

Region 1/Pacific Islands Fish and Wildlife Office (PIFWO), Honolulu, Hawai'i

Name of Reviewer:

Cheryl Phillipson, Biologist, PIFWO

Lauren Weisenberger, Plant Recovery Coordinator, PIFWO

Megan Laut, Conservation & Restoration Team Manager, PIFWO

Methodology used to complete this 5-year review:

This review was conducted by staff of the Pacific Islands Fish and Wildlife Office (PIFWO) of the U.S. Fish and Wildlife Service (Service) beginning in October 2018. The review was based on a review of current, available information since the last 5-year review for *Kadua degeneri* (as *Hedyotis degeneri*) (USFWS 2012). The evaluation completed by Cheryl Phillipson, Biologist, was reviewed by Lauren Weisenberger, Plant Recovery Coordinator, and Megan Laut, Conservation and Restoration Team Manager.

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 reviews for *Kadua degeneri* (as *Hedyotis degeneri*) published in the Federal Register on August 2, 2007 and August 28, 2012 (available at https://ecos.fws.gov/docs/five_year_review/doc1136.pdf and https://ecos.fws.gov/docs/five_year_review/doc4284.pdf) for a complete review of the species' status, threats, and management efforts. We are not aware of any significant new information regarding the species' biological status since listing to warrant a change in the Federal listing status of *Kadua degeneri*.

This short-lived perennial branched, prostrate shrub in the Rubiaceae (coffee) family is endangered and endemic to O'ahu. The current status and trends for *Kadua degeneri* are provided in the tables below. There are two subspecies in this taxon. *Kadua degeneri* var. *coprosmifolia* has not been collected since the 1980s and no current populations are known. This review is of the subspecies *degeneri*.

New Status Information:

- Currently there are 136 mature, 141 immature, and 150 seedlings of *Kadua degeneri* subsp. *degeneri* in three population units and five scattered locations in the Wai‘anae mountains of O‘ahu. The large majority of individuals are found in one population (ANRP 2018).
- As discussed in the previous 5-year review, Terrell *et al.* (2005) determined that the Hawaiian species of *Hedyotis* were distinct from other Asian and Pacific species, and resurrected the name *Kadua*, treating both varieties of *Kadua degeneri* (var. *degeneri* and var. *coprosimifolia*) at the subspecific level. In our 2012 designation of critical habitat (77 FR 57648, September 18, 2012) we recognized and published this taxonomic change to *Kadua degeneri*.
- In 2012, 11 critical habitat units in two ecosystems (lowland mesic and dry cliff) were designated for *Kadua degeneri* in the Wai‘anae mountains of O‘ahu (7,312 ac, 2,960 ha) (77 FR 57648, September 18, 2012).

New Threats:

- Climate change loss or degradation of habitat—Climate change may pose a threat to this species. Fortini *et al.* (2013) conducted a landscape-based assessment of climate change vulnerability for native plants of Hawai‘i using high resolution climate change projections. Climate change vulnerability is defined as the relative inability of a species to display the possible responses necessary for persistence under climate change. The assessment by Fortini *et al.* (2013) concluded that *Kadua degeneri* is highly vulnerable to the impacts of climate change, with a vulnerability score of 0.815 (on a scale of 0 being not vulnerable to 1 being extremely vulnerable to climate change). Therefore, additional management actions may be needed to conserve this taxon into the future, such as locating key microsites that overlap with current and future climate envelopes for outplanting efforts.

New Management Actions:

- Ungulate monitoring and control—The Army Natural Resources Program-O‘ahu (ANRP) has removed ungulates from two population units, Kahanahaiki to Pahole, and Alaiheihe and Manuwai (ANRP 2018).
- Invasive plant monitoring and control—The ANRP controls nonnative plants in two population units, Kahanahāiki to Pahole, and Alaiheihe-Manuwai (ANRP 2018).
- Captive propagation for genetic storage and reintroduction—
 - In 2018, the ANRP reported that 143 plants have seeds stored in the seed bank, and 122 of those plants have adequate representation (50 or more seeds in storage) (ANRP 2018).
 - Lyon Arboretum Micropropagation Laboratory reports 36 explants in storage representing one individual from Manuwai (Lyon Arboretum 2018).
- Reintroduction—The ANRP reports reintroduction of 58 mature and 63 immature *Kadua degeneri* at Alaiheihe and Manuwai (ANRP 2018).

Synthesis:

Currently there are 136 mature and 141 immature individuals of *Kadua degeneri* subsp. *degeneri*, with 73 percent of individuals found in one population. A landscape-based assessment of climate change vulnerability for native plants of Hawai‘i using high resolution climate change projections was made by Fortini *et al.* (2013) and their analysis showed that *K. degeneri* is highly vulnerable to the effects of climate change. Ungulates and nonnative plants are controlled in two large management areas. More than 120 plants have been reintroduced.

Stabilizing (interim), downlisting, and delisting objectives were provided in the Recovery Plan for the O‘ahu Plants (USFWS 1998), and have been updated according to the draft revised recovery objective guidelines developed by the Hawai‘i and Pacific Plants Recovery Coordinating Committee (HPPRCC 2011). The HPPRCC identifies an additional initial objective, the Preventing Extinction Stage, in addition to the Interim Stabilization, Delisting, and Downlisting objectives. Furthermore, life history traits such as breeding system, population size fluctuation or decline, and reproduction type (sexual or vegetative), have been included in the calculation of goals for the number of populations and reproducing individuals for each stage. The goals for each stage remain grouped by life span defined as annual, short-lived perennial (fewer than 10 years), or long-lived perennial.

Kadua degeneri is a short-lived perennial branching, prostrate shrub. To prevent extinction, which is the first milestone in recovering the species, the taxon must be managed to control threats (*e.g.*, fenced) and have 50 individuals (or the total number of individuals if fewer than 50 exist) from each of three populations represented in *ex situ* (secured off-site, such as a nursery or seed bank) collections. In addition, a minimum of three populations should be documented on O‘ahu where they now occur or occurred historically and each of these populations must be naturally reproducing (*i.e.*, viable seeds, seedlings, saplings) and increasing in number, with a minimum of 50 mature, reproducing individuals per population.

The preventing extinction goals for this species have not been met. Only one population has more than 50 mature individuals (Kahanahāiki to Pahole) (Table 1). Genetic representation is nearly complete; however, not all threats are managed (Table 1, Table 2). Therefore, *Kadua degeneri* meets the definition of Endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:

Other than the new data on this taxon’s vulnerability to climate change, we are not aware of any new threats or significant new information regarding the species’ biological status since the last 5-year review in 2012. Thus, the following recommendations for future actions are reiterated for the 5-year review for 2019.

- Surveys, inventories, and monitoring—Continue surveys and monitoring for occurrences in known historical sites and in suitable habitat.

- Ungulate monitoring and control—Continue fencing and ungulate control at all known populations.
- Invasive plant monitoring and control—Continue to control established ecosystem-altering nonnative invasive plant species, and those that compete with *Kadua degeneri*.
- Fire monitoring and control—Implement fire management plans and coordinate fire response efforts.
- Climate change adaptation strategy—Assess the modeled effects of climate change on this species and use to determine future landscape needed for the recovery of the species.
- Rodent predation and herbivory—Implement rat control methods if necessary.
- Captive propagation for genetic storage and reintroduction—
 - Continue collection and propagation efforts for maintenance of genetic stock and for reintroduction.
 - If *Kadua degeneri* subsp. *coprosmifolia* is found, genetic material should be collected to determine if the taxon represents a distinct subspecies of *K. degeneri* or is more closely related to *K. cordata*.
- Reintroduction and translocation—Continue to augment or establish new populations within historical habitat to increase numbers of individuals and populations.
- Alliance and partnership development—Work with the U.S. Army and other land managers to initiate planning and contribute to implementation of ecosystem-level restoration and management to benefit this species.

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

Date	No. wild individuals	No. outplanted	Stabilization Criteria identified in Recovery Plan	Stabilization Criteria Completed?
1991 (listing)	6	0	All threats managed in all three populations	No
			Complete genetic storage	No
			Three populations with 50 mature individuals each	No
1998 (recovery plan)	32	0	All threats managed in all three populations	No
			Complete genetic storage	Partially
			Three populations with 50 mature individuals each	No

2003 (critical habitat)	60	0	All threats managed in all three populations	Partially
			Complete genetic storage	Partially
			Three populations with 50 mature individuals each	No
2007 (5-year review)	370	0	All threats managed in all three populations	Partially
			Complete genetic storage	Partially
			Three populations with 50 mature individuals each	Partially
2012 (5-year review)	230	0	All threats managed in all three populations	Partially
			Complete genetic storage	Partially
			Three populations with 50 mature individuals each	Partially
2012 (critical habitat)	280–370	0	All threats managed in all three populations	Partially
			Complete genetic storage	Partially
			Three populations with 50 mature individuals each	Partially
Date	No. wild individuals	No. outplanted	*Preventing Extinction Criteria identified by HPPRCC	*Preventing Extinction Criteria Completed?
2019 (5-year review)	277	>120	All threats managed in all three populations	Partially
			Complete genetic storage	Partially

			Reproduction (<i>i.e.</i> viable seeds, seedlings) at all three populations	Partially, at one population
			Three populations with 50 mature individuals each	Partially, one population >50 individuals

* The Preventing Extinction Stage was established in 2011. Prior to 2011, the Interim Stabilization Stage was the first stage towards recovery (now it is the second after Preventing Extinction).

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

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulate degradation and destruction of habitat	A	Ongoing	Partial, fencing and ungulate removal at two managed areas
Established ecosystem altering invasive plant species degradation of habitat	A	Ongoing	Partial, nonnative plant control at two managed areas
Fire destruction and degradation of habitat	A	Ongoing	Partial, management plan and coordinated fire response efforts
Climate change degradation or loss of habitat	A	Ongoing	None
Invertebrate predation and herbivory	C	Ongoing	None
Competition with established invasive plant species	E	Ongoing	None
Stochastic events and small populations	E	Ongoing	Partial, seed collection and propagation ongoing

References:

See previous 5-year reviews for a full list of references (USFWS 2007, 2012). Only references for new information are provided below.

[ANRP] Army Natural Resource Program-Oahu. 2018. 2018 status report for the Makua and Oahu implementation plans. 217 pp.

Fortini, L., J. Price, J. Jacobi, A. Vorsino, J. Burgett, K. Brinck, F. Amidon, S. Miller, S. Gon II, G. Koob, and E. Paxton. 2013. A landscape-based assessment of climate

- change vulnerability for all native Hawaiian plants. Technical report HCSU-044. Hawaii Cooperative Studies Unit, University of Hawaii at Hilo, Hawaii. 134 pp.
- [HPPRCC] Hawai'i and Pacific Plants Recovery Coordinating Committee. 2011. Revised recovery objective guidelines. 8 pp.
- Lyon Arboretum. 2018. Report on controlled propagation of listed and candidate species, as designated under the U.S. Endangered Species Act. Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawaii.
- [USFWS] U.S. Fish and Wildlife Service. 2012. *Hedyotis degeneri* 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI. https://ecos.fws.gov/docs/five_year_review/doc4284.pdf.
- [USFWS] 2012. Endangered and threatened wildlife and plants; Endangered status for 23 species on Oahu and designation of critical habitat for 124 species; final rule. Department of the Interior, Federal Register 77 (181): 57648–57862, September 18, 2012.
- [USFWS] 2017. Endangered and threatened wildlife and plants; initiation of 5-year status reviews for 138 species in Hawaii, Oregon, Washington, and California. Federal Register 82(75): 18665–18668, April 20, 2017.

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
- No Change in listing status

For Field Supervisor, Pacific Islands Fish and Wildlife Office

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