

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. 2022. Endangered and Threatened Wildlife and Plants; Initiation of 5-Year Status reviews for 167 Species in Oregon, Washington, Idaho, Montana, California, Hawaii, Guam, and the Northern Mariana Islands. Federal Register 87(90):28031–28034, May 10, 2022.

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, Recovery Program 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 2023. The review was based on a review of current, available information since the last 5-year review for *Kadua degeneri* (USFWS 2019). The evaluation by Cheryl Phillipson, Biologist, was reviewed by Lauren Weisenberger, Plant Recovery Coordinator, and Megan Laut, Recovery Program 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/ecp/species/1652>).

Review Analysis:

Please refer to the previous 5-year reviews for *Kadua degeneri* published in the Federal Register on August 2, 2007 (as *Hedyotis degeneri*), August 28, 2012 (as *Hedyotis degeneri*) and September 26, 2019 (available at https://ecos.fws.gov/docs/tess/species_nonpublish/1103.pdf, https://ecos.fws.gov/docs/tess/species_nonpublish/2108.pdf, and https://ecos.fws.gov/docs/tess/species_nonpublish/2872.pdf) for a complete review of the species' status, threats, management efforts, and references cited. 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 *K. degeneri*.

This short-lived perennial shrub in the Rubiaceae (coffee) family is endangered and endemic to O'ahu. There are two subspecies in this taxon. *Kadua degeneri* var.

coprosmafolia has not been collected since the 1980s and no current populations are known. The status and trends for *K. degeneri* var. *degeneri* are provided in the tables below.

New Status Information:

- In 2019, there were fewer than 300 individuals of *Kadua degeneri* along the Wai‘anae mountain summits of O‘ahu (USFWS 2019). Recent survey data documents a substantial decline with a total of 89 mature and 42 immature wild individuals in three wild populations: 72 mature and 32 immature individuals at Kahanahāiki to Pahole; 16 mature and 9 immature individuals at Alaiheihe; and 3 mature and 1 immature individuals at Makaleha (Army Natural Resources Program of O‘ahu [ANRPO] 2023a appendices p. 310; ANRPO 2023b; Plant Extinction Prevention Program [PEPP] 2019–2023). The largest population is at Kahanahāiki to Pahole (PEPP 2019–2023; ANRPO 2023a appendices, p. 310).
- Currently, approximately 163 founders from 3 populations are represented in seed collections, micropropagation, and in plant nurseries (ANRPO 2023a appendices p. 310; ANRPO 2023b; National Tropical Botanical Garden [NTBG] 2022; Lyon Arboretum 2022; Native Ecosystems Protection & Management [NEPM] 2020).

New Threats:

- None reported.

New Management Actions:

- Feral ungulate monitoring and control—ANRPO manages feral ungulates at Kahanahāiki to Pahole, Mākaha to ‘Ōhikilolo, Alaiheihe, Manuwai, and central Makaleha (ANRPO 2023a appendices, p. 354).
- Invasive nonnative plant monitoring and control—
 - ANRPO conducts nonnative plant control at Kahanahāiki to Pahole, Mākaha to ‘Ōhikilolo, Alaiheihe, Manuwai, and central Makaleha (ANRPO 2020, p. 51; ANRPO 2021, p. 48; ANRPO 2022, p. 57; ANRPO 2023a, p. 67, appendices, p. 354).
 - ANRPO controls nonnative invasive plants at Mākaha by removing them and replacing them with common native plants (ANRPO 2020, p. 89).
- Rodent monitoring and control—ANRPO conducts small vertebrate control at Mākaha to ‘Ōhikilolo (ANRPO 2023a, p. 354).
- Invertebrate monitoring and control—ANRPO conducts partial slug control at Mākaha to ‘Ōhikilolo (ANRPO 2022, p. 217, appendices p. 244; ANRPO 2023a appendices, p. 354). In 2023, slug control was initiated at Manuwai (ANRPO 2023a appendices, p. 152).
- Collection and propagation for genetic storage and reintroduction—
 - In 2021, the Lyon Arboretum Micropropagation Laboratory reported storage of 36 explants representing one founder at Manuwai (Lyon Arboretum 2022).
 - In 2023, ANRPO reported collection and storage of more than 80,000 seeds representing 163 founders at three populations (Manuwai and Alaiheihe, Makaleha, Kahanahāiki to Pahole) (ANRPO 2023b). Fifty-nine plants are

stored in the nursery representing 15 founders from populations at Manuwai and Makaleha (ANRPO 2023b).

- Seed storage viability testing was completed and the recollection interval has been changed from every 15 years to every 20 years (ANRPO 2021 appendices, p. 513).
- In 1992, the National Tropical Botanical Garden (NTBG) reported storage of 2,800 seeds from an unspecified source, their viability is unknown (NTBG 2022).
- The Native Ecosystems Protection & Management Program (NEPM) reported propagation of 31 plants representing one founder at Manuwai (NEPM 2020).
- Reintroduction and augmentation—ANRPO expanded an outplanting site at Mākaha in 2020 (ANRPO 2020, p. 108). Approximately 68 founders are represented at four reintroduction sites (ANRPO 2023b). Recruitment was observed at Manuwai in 2023 (ANRPO 2023a appendices, p. 172).

Table 1. Status and trends of *Kadua degeneri* from listing through current 5-year review. Table 1a shows progress according to Interim Stabilization Goals; Table 1b shows progress according to Preventing Extinction Goals.

Table 1a.

Date	No. wild individuals	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
2007 (5-year review)	370	0	All threats managed in all 3 populations	Partial
			Complete genetic storage	Partial
			3 populations with 50 mature individuals each	Partial
2012 (5-year review)	230	0	All threats managed in all 3 populations	Partial
			Complete genetic storage	Partial
			3 populations with 50 mature individuals each	Partial

Table 1b.

Date	No. wild individuals	No. outplanted	*Preventing Extinction Targets identified by HPPRCC	*Preventing Extinction Targets Completed?
2019 (5-year review)	277	>120	All threats managed in all 3 populations	Partial
			Complete genetic storage	Partial
			Reproduction (i.e., viable seeds, seedlings) at all 3 populations	Partial, recruitment at 1 population
			3 populations with 50 mature individuals each	Partial, 1 population >50 individuals
2024 (5-year review)	89 mature 42 immature	>675 total; 150 mature 133 immature remain	All threats managed in all 3 populations	Partial, all populations fenced with nonnative plant control, rodent control at Mākaha, slug control at Mākaha and Manuwai
			Complete genetic storage	Partial, 163 founders from 3 populations
			Natural reproduction at all 3 populations	Partial, recruitment observed at Manuwai
			3 populations with 50 mature individuals each	Partial, 1 population >50

* 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 stage after Preventing Extinction).

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

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulate destruction and degradation of habitat	A	Ongoing	Complete, all populations fenced
Established ecosystem altering invasive plant species destruction and degradation of habitat and competition	A, E	Ongoing	Complete, control at all populations
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	Partial, slug control at 2 populations
Small populations	E	Ongoing	Partial, seed collection, propagation, and translocation

Synthesis:

Currently, there are approximately 89 mature and 42 immature wild individuals of *Kadua degeneri* in three populations at Kahanahāiki to Pahole, Makaleha, and Manuwai and Alaiheie. Only one population totals more than 50 mature individuals. Feral ungulates and nonnative invasive plants are controlled by fencing of all areas. Invertebrates (slugs) are controlled at two populations. Approximately 163 founders from three populations are represented in seed collections and propagation. Approximately 675 individuals were reintroduced, with 150 mature and 133 immature individuals remaining. Seed viability testing indicated that the recollection period could be increased from 15 years to 20 years.

Stabilizing (interim), and downlisting and delisting criteria are provided in the Recovery Plan for the O‘ahu Plants (USFWS 1998) and preventing extinction targets have been added and criteria 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 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 that are well managed. In addition, a minimum of a total 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) with a minimum of 50 mature, reproducing individuals per population.

The preventing extinction goals for *Kadua degeneri* have not been met. The number of wild individuals continues to decline. Fencing provides protection from feral ungulates at all populations, but fence monitoring and nonnative plant control must continue (Table 1, Table 2). Genetic representation is complete for only one population, even with 167 founders from five populations represented in collections (Table 1). More than 675 individuals were reintroduced with fewer than one-third surviving. Invertebrate predation is addressed at only two populations. Wildfire is a threat for all occurrences. Therefore, *K. degeneri* meets the definition of Endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:

No significant new information regarding the species’ biological status has been reported since the last 5-year review in 2019. Thus, the following recommendations for future actions are updated or reiterated for the 5-year review for 2024.

- Surveys and monitoring—Continue to conduct surveys in suitable and historical habitat for additional populations and monitor known populations.
- Ungulate monitoring and control—Continue to fence and monitor all populations to provide protection against the negative impacts of feral ungulates.
- Nonnative invasive plant monitoring and control—Continue to control established ecosystem-altering nonnative invasive plant species, and those that compete with *Kadua degeneri*, at all populations.
- Fire monitoring and control—Implement fire management plans and coordinate wildfire response efforts.
- Climate change adaptation strategy—Assess the modeled effects of climate change on this species and use to determine future landscape needed for its recovery.
- Rodent predation and herbivory control—Implement effective control methods if necessary.
- Invertebrate predation and herbivory control—Determine effective control methods and implement at populations where necessary.
- Captive propagation for genetic storage and reintroduction—Continue collection and propagation efforts for maintenance of genetic stock and for reintroduction.
- Reintroduction and augmentation—Continue to augment and establish new populations within suitable and historical habitat that is being managed for known threats to this species.
- Build resiliency, redundancy, and representation—Increase species’ viability through habitat restoration, threat control, and reintroduction and translocation to reduce impacts of predation, climate change, and wildfires.

- Alliance and partnership development—Continue to work with ANRPO, the State’s Native Ecosystems Protection and Management division, and other land managers and partners to initiate planning and contribute to implementation of ecosystem-level restoration and management to benefit this species.

References:

- [ANRPO] Army Natural Resources Program of O‘ahu. 2020. 2020 Status report for the Mākua and O‘ahu Implementation Plans. Office of the Vice President for Innovation and Research, University of Hawaii. 214 pp. +appendices, 516 pp.
- [ANRPO] 2021. 2021 Status report for the Mākua and O‘ahu Implementation Plans. Office of the Vice President for Innovation and Research, University of Hawaii. 207 pp. + appendices, 623 pp.
- [ANRPO] 2022. 2022 Status report for the Mākua and O‘ahu Implementation Plans. Office of the Vice President for Innovation and Research, University of Hawai‘i. 228 pp. + appendices, 690 pp.
- [ANRPO] 2023a. 2023 Status report for the Mākua and O‘ahu Implementation Plans. Prepared by Army Natural Resources Program, O‘ahu, Office of the Vice President for Innovation and Research, University of Hawai‘i. 255 pp. + appendices, 534 pp.
- [ANRPO] 2023b. Report on controlled propagation of listed 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, Hawai‘i.
- [HPPRCC] Hawai‘i and Pacific Plants Recovery Coordinating Committee. 2011. Revised recovery objective guidelines. 8 pp.
- Lyon Arboretum. 2022. Report on controlled propagation of listed 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, Hawai‘i.
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- [NEPM] Natural Resources Protection & Management Program. 2020. Report on controlled propagation of listed 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, Hawai‘i.

- [PEPP] Plant Extinction Prevention Program. 2019–2023. Plant Extinction Prevention Program fiscal years 2019 to 2023 interim performance report (October 1, 2018-September 30, 2023). U.S. Fish and Wildlife Service CFDA Program \$15.657 Endangered Species Conservation—Recovery Implementation Funds, Cooperative Agreement: F18AC00502 (Final performance report), University of Hawai‘i at Mānoa, Pacific Cooperative Studies Unit. 105 pp.
- [PEPP] 2021. Plant Extinction Prevention Program fiscal year 2021 interim performance report (October 1, 2020-September 30, 2021), Cooperative Agreement F19AC00532 (Interim report), U.S. Fish and Wildlife Service CFDA Program #15.657 Endangered Species Conservation—Recovery Implementation Funds, University of Hawai‘i at Mānoa, Pacific Cooperative Studies Unit, Plant Extinction Prevention Program. 46 pp.
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https://ecos.fws.gov/docs/five_year_review/doc/2872.pdf.
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U.S. FISH AND WILDLIFE SERVICE
SIGNATURE PAGE for 5-YEAR REVIEW of *Kadua degeneri* (no common name)

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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