5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Kadua cookiana* (ʻāwiwi)

Current Classification: Endangered

Federal Register Notice announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2021a. Endangered and Threatened Wildlife and Plants; Initiation of 5-Year Status reviews for 77 Species in Oregon, Washington, Idaho, and Hawaii. Federal Register 86(120): 33726–33728, June 25, 2021.

Lead Region/Field Office:

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

Name of Reviewer:

Cheryl Phillipson, Biologist, PIFWO
Lauren Weisenberger, Plant Recovery Coordinator, PIFWO
Megan Laut, Recovery 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 2022. The review was based on a review of current, available information since the last 5-year review for *Kadua cookiana* (USFWS 2018). The evaluation by Cheryl Phillipson, Biologist, was reviewed by Lauren Weisenberger, Plant Recovery Coordinator, and Megan Laut, Recovery 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/ecp/species/4666*).

Review Analysis:

Please refer to the previous 5-year reviews for *Kadua cookiana* published in the Federal Register on August 27, 2010, and October 23, 2018 (available at *https://ecos.fws.gov/docs/tess/species_nonpublish/1604.pdf* and *https://ecos.fws.gov/docs/tess/species_nonpublish/2635.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. cookiana*.

This short-lived perennial shrub in the Rubiaceae (coffee) family is endangered and occurs on Kauaʻi. Populations previously reported on Molokaʻi and Oʻahu are determined to be *Kadua elatior*. This species has not been observed on the island of Hawaiʻi since the 1800s. The status and trends for *Kadua cookiana* are provided in the tables below.

New Status Information:

- Currently, there are two populations of *Kadua cookiana*, one of approximately 150 individuals at Waiahuakua and fewer than 50 individuals at Hanakoa (both including immature plants and seedlings) on the north coast of Kauaʻi (Perlman and Williams 2018; Williams 2023, pers. comm.). At Hanakoa there is more potential habitat; however, the plants occur out of reach along the edges of the waterfall and cliff area (Williams 2023, pers. comm.). Possibly a UAV could be used to better determine the extent of both populations.
- In 2022, taxonomic information was presented that determined those individuals occurring on Oʻahu and Molokaʻi are *Kadua elatior*. There is a collection from the 1800s from the island of Hawaiʻi, but no plants have been observed there since that time. This restricts the range of *K. cookiana* to Kauaʻi. This information changes the range but not the endangered status of the species (Wagner 2022, pers. comm.).
- Currently, there are fewer than 20 founders (wild plants) represented in *ex situ* storage and propagation.

New Threats:

- None reported.

New Management Actions:

- Monitoring and surveys—Individuals of *Kadua cookiana* occur along the edges and cliff areas of waterfalls and are monitored by the Kauai Plant Extinction Prevention Program (KPEPP) and the State. Numbers may be better determined by use of UAV (Williams 2023, pers. comm.).
- Collection and propagation for genetic storage and translocation—
    - In 2018, the National Tropical Botanical Garden (NTBG) reported collection and storage of 2,988 seeds from 10 plants in a living collection at the Lawai Garden sourced from the wild population of *K. cookiana* at Hanakoa and collection and storage of 3,211 seeds from eight plants in a living collection at the garden sourced from the wild population at Waiahuakua (NTBG 2022). In addition, three plants were propagated from these collections (NTBG 2022).
    - The Lyon Arboretum Seed Conservation Laboratory reported storage of 152 seeds representing three founders at Hanakoa and 409 seeds representing three founders at Waiahuakua collected in 2018, and over 100 seeds from three additional founders from Waiahuakua collected in 2016 (Lyon Arboretum 2022).

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

Date	No. wild individuals	No. outplanted	Stability Criteria identified in Recovery Plan	Stability Criteria Completed?
1994 (listing)	50–100	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
2010 (5-year review)	100–122	0	All threats managed in all 3 populations	No
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	No
Date	**No. wild individuals**	**No. outplanted**	***Preventing Extinction Criteria identified by HPPRCC**	***Preventing Extinction Criteria Completed?**
2018 (5-year review)	<200	0	All threats managed in all 3 populations	No
			Reproduction (i.e., viable seeds, seedlings) at all 3 populations	No
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	Partially, 1 population >50
2023 (5-year review)	<200	0	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			Natural reproduction at all 3 populations	No
			3 populations with 50 mature individuals each	Partially, 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 cookiana* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Degradation and destruction of habitat by feral ungulates	A	Ongoing	Partial, feral ungulate management at Hono o Na Pali NAR
Established ecosystem altering invasive plant species degradation of habitat	A	Ongoing	None
Landslides and erosion destruction and degradation of habitat	A	Ongoing	None
Climate change degradation or loss of habitat	A	Ongoing	None
Inadequacy of regulatory mechanisms–lack of adequate hunting regulations	E	Ongoing	Partial, feral ungulate management at Hono o Na Pali NAR
Reduced viability due to low numbers	E	Ongoing	Partial, living collections with seed storage ongoing

Synthesis:
Currently, there are estimated to be fewer than 200 wild individuals of *Kadua cookiana* in two populations on Kauaʻi. Threats including habitat degradation by feral ungulates, and impacts of nonnative invasive plants, landslides, and low numbers, are only partially addressed. Seed collection from individuals in living collections is ongoing; however, genetic representation is incomplete with fewer than 20 founders represented. No translocations or augmentations are conducted.

Stabilizing (interim), downlisting, and delisting objectives are provided in the Kauaʻi Islandwide Recovery Plan (USFWS 2021b) and have been updated according to the draft revised recovery objective guidelines developed by the Hawaiʻi 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 cookiana 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 Kaua‘i where they now occur or occurred historically. 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 this species have not been met. There are estimated to be fewer than 200 wild individuals with only one population of 50 mature, reproducing plants (Table 1). Genetic representation is incomplete (Table 1). Not all threats are being managed including feral ungulates, nonnative invasive plants, landslides, climate change, and the small number of individuals and populations (Table 2). Therefore, *Kadua cookiana* meets the definition of Endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:
Information regarding the taxonomic status of individuals occurring on islands other than Kaua‘i reveals that the range of *Kadua cookiana* is restricted to Kaua‘i. No other significant information regarding the species’ biological status has been reported since the last 5-year review in 2018. Thus, the following recommendations for future actions are added or reiterated for the 5-year review for 2023.

- Surveys and monitoring—Continue to survey for additional populations in areas of potentially suitable habitat and monitor known populations of *Kadua cookiana.*
- Ungulate monitoring and control—Construct and maintain strategic fencing to protect individuals from the negative impacts of feral ungulates.
- Invasive nonnative plant monitoring and control—Control established ecosystem-altering nonnative invasive plant species around all populations.
- Climate change adaptation strategy—Assess the modeled effects of climate change on this species to determine future landscape required for its recovery.
- Captive propagation for genetic storage and reintroduction—
    - Continue collection and propagation efforts for maintenance of genetic stock and for translocation.
    - Evaluate genetic resources currently in storage to determine the need to place additional material into long-term storage due to this species’ vulnerability to climate change.
- Translocation and augmentation—Augment current populations and translocate individuals into suitable habitat within historic range that is being managed for known threats to this species.
- Build resiliency, redundancy, and representation—Increase numbers of populations and individuals throughout historic range to reduce impacts of landslides and reduced viability.
- Alliance and partnership development—Continue to work with partners and other land managers in planning and implementation of ecosystem-level restoration and management to benefit this taxon.

References:

[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.

[NTBG] National Tropical Botanical Garden. 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.

Perlman, S. and A. Williams. 2018. Hawai‘i Rare Plant Restoration Group (HRPRG) Field Data Form *in* PEPP 2022: Plant Extinction Prevention Program, FY 2022 Annual Report (Oct 1, 2021-Sep 30, 2022), USFWS CFDA Program #15.657, Endangered Species Conservation-Recovery Implementation Funds, Coop Agreement F19AC00532 (Interim Report), December 29, 2022, UH Mānoa, PCSU, PEPP. 50 pp. BioPacifica database record for *Kadua cookiana*, Pacific Islands Fish and Wildlife Office.

[USFWS] U.S. Fish and Wildlife Service. 2010. *Kadua cookiana* 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI. *https://ecos.fws.gov/docs/tess/species_nonpublish/1604.pdf*.

[USFWS] 2018. *Kadua cookiana* 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI. *https://ecos.fws.gov/docs/tess/species_nonpublish/2635.pdf*.

[USFWS] 2021a. Endangered and Threatened wildlife and plants; initiation of 5-year status reviews for 77 Species in Oregon, Washington, Idaho, and Hawaii. Federal Register 86(120): 33726–33728, June 25, 2021.

[USFWS] 2021b. Kaua‘i Islandwide Recovery Plan. Portland, OR. 109 pp.

Wagner, W. 2022, pers. comm., Smithsonian Institution, Email regarding distribution of *Kadua cookiana*, 11 MAY 2022.

Williams, A. 2023, pers. comm. Kaua‘i Botanist, Division of Forestry and Wildlife, email regarding current status of *Kadua cookiana*. 12 MAY 2023.

U.S. FISH AND WILDLIFE SERVICE
SIGNATURE PAGE for 5-YEAR REVIEW of *Kadua cookiana* (ʻāwiwi)

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

For **Field Supervisor, Pacific Islands Fish and Wildlife Office**

MEGAN LAUT Digitally signed by MEGAN LAUT Date: 2023.08.29 11:19:53 -10'00'

_____ Date_____