

5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Kadua cookiana* (‘uiwi)

Current Classification: Endangered

Federal Register Notice announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2018. Endangered and threatened wildlife and plants; initiation of 5-year status reviews for 18 species in Hawaii, Oregon, Washington, Idaho, and Canada. Federal Register 83(14): 3014–3015, January 22, 2018.

Lead Region/Field Office:

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

Name of Reviewers:

Cheryl Phillipson, Biologist, PIFWO

Lauren Weisenberger, Plant Recovery Coordinator, PIFWO

Gregory Koob, 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 (USFWS) beginning in January 2018. The review was based on a review of current, available information since the last 5-year review for *Kadua cookiana* (USFWS 2010). The evaluation by Cheryl Phillipson, Biologist, was reviewed by Lauren Weisenberger, Plant Recovery Coordinator, and Gregory Koob, 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 review for *Hedyotis cookiana* published in the Federal Register on August 27, 2010 (available at https://ecos.fws.gov/docs/five_year_review/doc3294.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 cookiana*.

This short-lived perennial many-branched shrub in the Rubiaceae (coffee) family is endangered and occurs on Kaua‘i, with historical occurrences on O‘ahu, Moloka‘i, and Hawai‘i. The current status and trends for *Kadua cookiana* are provided in the tables below.

New Status Information:

- In 2011, the 5-year review reported two populations on Kaua‘i totaling 100 to 120 individuals. Currently, the two populations are in the same areas, with about 150 individuals at Waiahuakua and about 50 or fewer individuals at Hanakoa (Williams 2018, in litt.). This species has not been observed on O‘ahu, Moloka‘i, or Hawai‘i since the 1800s and is likely extirpated from these islands.
- In 2015, the Service published a technical correction for this and other plant and wildlife species, recognizing the taxonomic change from *Hedyotis cookiana* to *Kadua cookiana* (80 FR 35860, June 23, 2015). The taxonomic change does not affect the range or endangered status of this species.

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 cookiana* is highly vulnerable to the impacts of climate change, with a vulnerability score of 0.869 (on a scale of 0 being not vulnerable to 1 being extremely vulnerable to climate change). Therefore, additional management actions are needed to conserve this taxon into the future, such as locating key microsites that overlap with current and future climate envelopes for outplanting efforts.
- Lack of adequate hunting regulations—Both populations of *Kadua cookiana* occur within a State hunting area. Ungulate destruction and degradation of habitat, and predation by ungulates, are noted as threats to this species. One population is also within the Na Pali Coast State Wilderness Area, but there is no documented ungulate control and no fencing to prevent ungulate ingress (Division of State Parks 2018, in litt.). In addition, public hunting areas are not fenced and game mammals have unrestricted access to most areas across the landscape, regardless of underlying land use designation; therefore, any unfenced populations are at risk (DLNR 2010).

New Management Actions:

- Surveys and monitoring—The National Tropical Botanical Garden (NTBG) continues to conduct surveys of the known populations of this species (NTBG 2015a, 2015b). Staff from Hawai‘i’s DLNR-Division of Forestry and Wildlife monitors this species on Kaua‘i (Williams 2018, in litt.).
- Captive propagation for genetic storage and reintroduction—Conservation actions for this species is hindered by the difficulty of monitoring and outplanting or augmenting populations in areas that are relatively inaccessible.
 - The NTBG has planted individuals in the botanic gardens and continues to collect thousands of seeds from these plants from founders from both wild populations at Hanakoa (at least six founders) and Waiahuakua (at least three founders) for storage (NTBG 2017).

- The Lyon Arboretum Seed Conservation Laboratory has over 600 seeds in storage collected from seven founders at Waiahuakua in 2016 and 2018, and three founders from Hanakoa in 2018 (Lyon Arboretum 2018).
- The Plant Extinction Prevention Program (PEPP) monitors this species and has collected seeds from six individuals at both populations. Seeds were sent to NTBG (PEPP 2016). In addition, the Program has elevated the status of this species to “POP,” a potential PEPP species, as numbers of individuals are nearing the level of PEPP status (fewer than 50 individuals in the wild) and threat levels are high.

Synthesis:

Currently, there are about 200 or fewer wild individuals of *Kadua cookiana* on Kaua‘i at two locations. All individuals known from Oahu, Molokai, and Hawai‘i are believed to be extirpated from these islands. 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. cookiana* is highly vulnerable to the effects of climate change, in that there will be a smaller area of suitable habitat available for the species in the near future. Only a few wild individuals (ca 20) are represented in seed and living collections.

Stabilizing (interim), downlisting, and delisting objectives were provided in the Recovery Plan for the Kaua‘i Plant Cluster (USFWS 1995), 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 cookiana is a short-lived perennial shrub. To prevent extinction, which is the first step 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 Kaua‘i and at least one other island within historical range. 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 as there is only one population of at least 50 individuals, it is uncertain how many of those are reproducing, genetic representation is incomplete (Table 1), and all threats are not being sufficiently

managed throughout the range of the species (Table 2). Therefore, *Kadua cookiana* meets the definition of Endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:

We are not aware of any new threats or significant new information regarding the species' biological status since the last 5-year review in 2010. Thus, the following recommendations for future actions are reiterated for the 5-year review for 2018.

- Population viability and monitoring—Continue to survey known localities and suitable habitat areas on Kaua‘i to determine the current status of all populations of *Kadua cookiana*.
- Ungulate monitoring and control—Construct and maintain exclusion fences, or strategic fencing as appropriate, to protect *K. cookiana* from the impacts of feral ungulates.
- Invasive plant monitoring and control—Control established ecosystem-altering nonnative invasive plant species around all populations.
- Captive propagation for genetic storage and reintroduction—
 - Continue collection of genetic resources for storage, propagation, and reintroduction into protected suitable habitat within historical range.
 - 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.
 - Research potential problems resulting from lack of pollen viability.
- Reintroduction and translocation—Augment current populations and reintroduce individuals into suitable habitat within historic range that is being managed for known threats to this species.
- Climate change adaptation strategy—Assess the modeled effects of climate change on this species and use this information to determine future landscape needed for the recovery of the species.
- Alliance and partnership development—Work with Hawai‘i Division of Forestry and Wildlife and Hawai‘i State Parks to initiate planning and contribute to implement of ecosystem-level restoration and management to benefit this taxon.

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 three populations	No
			Complete genetic storage	No
			Three populations with 50 mature individuals each	No
1995 (recovery plan)	50–100	0	All threats managed in all three populations	No
			Complete genetic storage	No
			Three populations with 50 mature individuals each	No
2003 (critical habitat)	60–80	0	All threats managed in all three populations	No
			Complete genetic storage	No
			Three populations with 50 mature individuals each	No
2010 (5-year review)	100–122	0	All threats managed in all three populations	No
			Complete genetic storage	Partially
			Three 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 three populations	No
			Complete genetic storage	Partially
			Reproduction (<i>i.e.</i> viable seeds, seedlings) at all three populations	No
			Three populations with 50 mature individuals each	No, only one 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 after Preventing Extinction).

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

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulate degradation of habitat	A	Ongoing	None
Established ecosystem altering invasive plant species degradation of habitat	A	Ongoing	None
Landslides destruction or degradation of habitat	A	Ongoing	None
Climate change degradation or loss of habitat	A	Ongoing	None
Ungulate predation or herbivory	C	Ongoing	None
Lack of adequate hunting regulations	D	Ongoing	None
Stochastic events—Reduced viability due to low numbers	E	Ongoing	None

References:

See the previous 5-year review for a full list of references (USFWS 2010). Only references for new information are provided below.

[DLNR] Department of Land and Natural Resources. 2010. Hawai‘i administrative rules, title 13, subtitle 5, part 2, chapter 123, rules regulating game mammal hunting. 78 pp.

Division of State Parks. 2018, in litt. Napali Coast State Wilderness Park, <http://dlnr.Hawai'i.gov/dsp/parks/kauai/napali-coast-state-wilderness-park/>, accessed 20 APR 2018.

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. Hawai‘i Cooperative Studies Unit, University of Hawai‘i at Hilo, Hawai‘i. 134 pp.

[HPPRCC] Hawai‘i and Pacific Plants Recovery Coordinating Committee. 2011. Revised recovery objective guidelines. 8 pp.

Lyon Arboretum. 2018. Seed conservation laboratory database.

[NTBG] National Tropical Botanical Garden. 2015a. NTBG database herbarium specimen detail for *Kadua cookiana*. No number, 24 JUN 2015.

[NTBG] 2015b. NTBG database herbarium specimen detail for *Kadua cookiana*. 070659, 9 OCT 2015.

[NTBG] 2017. Controlled propagation report.

[PEPP] Plant Extinction Prevention Program. 2016. Plant Extinction Prevention Program FY 2016 annual report (Oct 1, 2015-Sep 30, 2016), US FWS CFDA Program #15.657; Endangered Species Conservation-Recovery Implementation Funds, Coop Agreement F14AC00174, December 24, 2016, UH Manoa, PCSU, PEPP. 237 pp.

[USFWS] U.S. Fish and Wildlife Service. 2010. *Hedyotis cookiana* 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI. https://ecos.fws.gov/docs/five_year_review/doc3294.pdf.

[USFWS] 2015. Endangered and threatened wildlife and plants; technical corrections for 54 wildlife and plant species on the list of endangered and threatened wildlife and plants. Federal Register 80 (12) FR 35860–35869, June 23, 2015.

[USFWS] 2018. Endangered and threatened wildlife and plants; initiation of 5-year status reviews for 18 species in Hawai'i, Oregon, Washington, Idaho, and Canada. Federal Register 83(14): 3014–3015, January 22, 2018.

Williams, A. 2018, in litt. Email regarding current status of *Kadua cookiana* on Kaua'i. 5 FEB 2018.

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

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