

## 5-YEAR REVIEW

Short Form Summary

**Species Reviewed:** *Kadua cordata* subsp. *remyi* (kopa)

**Current Classification:** Endangered

### **Federal Register Notice announcing initiation of this review:**

[USFWS] U.S. Fish and Wildlife Service. 2016. Endangered and threatened wildlife and plants; initiation of 5-year status reviews of 76 species in Hawaii, Oregon, Washington, Montana, and Idaho. Federal Register 81(29): 7571–7573.

### **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 August 2017. The review was based on a review of current, available information since the last 5-year review for *Hedyotis schlechtendahlia* var. *remyi* (USFWS 2014). 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](http://ecos.fws.gov/tess_public)).

### **Review Analysis:**

Please refer to the previous 5-year reviews for *Kadua cordata* subsp. *remyi* (as *Hedyotis schlechtendahlia* subsp. *remyi*) published in the Federal Register on January 18, 2008 and March 27, 2014 (available at [http://ecos.fws.gov/docs/five\\_year\\_review/doc1815.pdf](http://ecos.fws.gov/docs/five_year_review/doc1815.pdf) and [https://ecos.fws.gov/docs/five\\_year\\_review/doc3838.pdf](https://ecos.fws.gov/docs/five_year_review/doc3838.pdf)) for a complete review of the subspecies’ status, threats, and management efforts. We are not aware of any significant new information regarding the subspecies’ biological status since listing to warrant a change in the Federal listing status of *Kadua cordata* subsp. *remyi*.

This short-lived perennial few-branched subshrub in the Rubiaceae (coffee) family is endangered and endemic to Lāna‘i. The current status and trends for *Kadua cordata* subsp. *remyi* are provided in the tables below.

#### New Status Information:

- In the last 5-year review for *Kadua cordata* subsp. *remyi* in 2014, there were only two individuals. Currently, one individual, a seedling at Hulopo‘e, remains (PEPP 2016, 2018; Oppenheimer 2018, in litt.).
- In 2012, three critical habitat units were proposed for *Kadua cordata* subsp. *remyi* in two ecosystems (lowland mesic and lowland wet) on Lāna‘i (11,779 ac; 4,767 ha) (77 FR 34464, June 11, 2012). In the final rule the Service excluded critical habitat for this species on the island of Lāna‘i because, as demonstrated by the ongoing conservation activities by the private landowner, their commitment to develop the Lāna‘i Natural Resources Plan, and a memorandum of understanding with the Service, exclusion from critical habitat would provide greater long-term benefits to the species than designation of critical habitat (USFWS 2015; 81 FR 17790, March 30, 2016).

#### New Threats:

Climate change loss or degradation of habitat—Climate change may pose a threat to this subspecies. 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) was conducted at the species level and concluded that *Kadua cordata* is vulnerable to the impacts of climate change, with a vulnerability score of 0.287 (on a scale of 0 being not vulnerable to 1 being extremely vulnerable to climate change). Based on the range of subspecies *remyi*, it is uncertain if the vulnerability would increase if the analysis was completed separately for this taxon.

#### New Management Actions:

- Ungulate monitoring and control—The last known individual of *Kadua cordata* subsp. *remyi* will be provided protection from ungulates when all three increments of the Lāna‘ihale fenced enclosure are completed and skirting is repaired and maintained to prevent animal ingress, and when all ungulates (axis deer) are removed. Surveys to determine required fence materials and repairs are being conducted (Donoho 2016, in litt.; USFWS 2015).
- Invasive plant and predator monitoring and control—The Plant Extinction Prevention Program (PEPP) monitors *Kadua cordata* subsp. *remyi*.
- Captive propagation for genetic storage and reintroduction—
  - The Lyon Seed Conservation Laboratory reports 37 seeds collected in 2010 from one individual (Lyon Arboretum 2018).
    - The Olinda Rare Plant Facility (ORPF) has 10 potted plants grown from a collection at Hulopo‘e in 2013 (ORPF 2017).
    - PEPP collected seeds until 2011 (PEPP 2012).
- Stochastic events—Build resiliency and redundancy—PEPP reintroduced three individuals at Hulopo‘e in 2010; however, by 2015 all the individuals had died (PEPP 2015).

**Synthesis:**

Currently, only one individual of *Kadua cordata* subsp. *remyi* is known on Lāna‘i. 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. cordata* is 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. Seed collections occurred until 2011. There is some representation of at least one founder as propagules (seeds and potted plants) in storage. To date, outplantings are not successful.

Stabilizing (interim), downlisting, and delisting objectives were provided in the Addendum to the Recovery Plan for Multi-island Plants (USFWS 2002), 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 cordata* subsp. *remyi* is a short-lived perennial subshrub. To prevent extinction, which is the first step in recovering the subspecies, 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 Lāna‘i. 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 are no populations of 50 reproducing individuals, genetic representation is incomplete (the seedling is small and immature and collections cannot be made; Table 1), and all threats are not being sufficiently managed throughout the range of the species (Table 2). Therefore, *Kadua cordata* subsp. *remyi* 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 2014. Thus, the following recommendations for future actions are reiterated for the 5-year review for 2018.

- Surveys and inventories—Continue to survey for additional populations of *Kadua cordata* subsp. *remyi* in areas of potentially suitable habitat and at historic locations.

- Ungulate monitoring and control—Maintain fencing and remove ungulates from fenced area to prevent browsing by axis deer.
- Invasive plant monitoring and control—
  - Control established ecosystem-altering nonnative invasive plant species around all populations.
  - Control invasive nonnative species that compete with the species around all populations.
- Fire monitoring and control—Develop and implement a fire management plan for all populations.
- Predator and herbivore monitoring and control—Identify unknown invertebrate damaging wild plants and determine control method if necessary.
- Captive propagation for genetic storage and reintroduction—Continue collection and propagation efforts for maintenance of genetic stock and reintroduction.
- Reintroduction and translocation—Continue to reintroduce individuals into suitable habitat within historic range that is being managed for known threats to this species.
- Population viability monitoring and analysis—Continue to monitor wild and reintroduced individuals.
- Climate change adaptation strategy—Research the suitability of habitat for reintroducing this species in the future due to the impacts of climate change.
- Alliance and partnership development—Continue to contribute to implementation of ecosystem-level restoration and management to benefit this taxon.

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

Date	No. wild individuals	No. outplanted	Stability Criteria identified in Recovery Plan	Stability Criteria Completed?
1999 (listing)	6	0	All threats managed in all three populations	No
			Complete genetic storage	No
			Three populations with 50 mature individuals each	No
2002 (recovery plan)	13	0	All threats managed in all three populations	No
			Complete genetic storage	Partially

			Three populations with 50 mature individuals each	No
2003 (critical habitat)	8	0	All threats managed in all three populations	No
			Complete genetic storage	Partially
			Three populations with 50 mature individuals each	Partially
2008 (5-year review)	0	175	All threats managed in all three populations	No
			Complete genetic storage	Yes
			Three populations with 50 mature individuals each	No
2014 (5-year review)	2	3	All threats managed in all three populations	No
			Complete genetic storage	Partially
			Three populations with 50 mature individuals each	No
2016 (critical habitat)	2	3	All threats managed in all three populations	No
			Complete genetic storage	Partially
			Three populations with 50 mature individuals each	No
<b>Date</b>	<b>No. wild individuals</b>	<b>No. outplanted</b>	<b>*Preventing Extinction Criteria identified by HPPRCC</b>	<b>*Preventing Extinction Criteria Completed?</b>
2018 (5-year review)	1	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

\* 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 cordata* subsp. *remyi* and ongoing conservation efforts.**

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulate degradation of habitat	A	Ongoing	Partial, fencing and ungulate removal
Established ecosystem altering invasive plant species degradation of habitat	A	Ongoing	Partial, monitoring and nonnative plant removal
Drought and erosion destruction or degradation of habitat	A	Ongoing	None
Fire destruction and degradation of habitat	A	Ongoing	None
Climate change degradation or loss of habitat	A	Ongoing	None
Ungulate predation or herbivory	C	Ongoing	Partial, fencing and ungulate removal
Invertebrate predation or herbivory	C	Ongoing	None
Stochastic events—Small population size	E	Ongoing	Partial, seed collection and small scale reintroduction

## References:

See previous 5-year reviews for a full list of references (USFWS 2008, 2014). Only references for new information are provided below.

- Donoho, M. 2016, in litt. 2015 annual report to the US Fish & Wildlife Service per the requirements of a Memorandum of Understanding dated January 26, 2016 between USFWS & Pūlama Lāna‘i. 6 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. Hawai‘i Cooperative Studies Unit, University of Hawai‘i at Hilo, Hawai‘i. 134 pp.
- [HPPRC] Hawai‘i and Pacific Plants Recovery Coordinating Committee. 2011. Revised recovery objective guidelines. 8 pp.
- Lyon Arboretum. 2018. Seed conservation laboratory database.
- [ORPF] Olinda Rare Plant Facility. 2017. Controlled propagation report.
- Oppenheimer, H. 2018, in litt. GIS data and population information for *Kadua cordata* subsp. *remyi*.
- [PEPP] Plant Extinction Prevention Program. 2015. PEPP annual report fiscal year 2015 (July 1, 2014-June 30, 2015). 179 pp.
- [PEPP] 2016. 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. 235 pp.
- [PEPP] 2018. PEPP report for April. Excel table.
- [USFWS] U.S. Fish and Wildlife Service. 2014. U.S. Fish and Wildlife Service. *Hedyotis schlechtendahlia* var. *remyi* 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI.  
[https://ecos.fws.gov/docs/five\\_year\\_review/doc3838.pdf](https://ecos.fws.gov/docs/five_year_review/doc3838.pdf).
- [USFWS] 2015. Memorandum of understanding between Lanai Resorts, LLC, Castle & Cooke Properties, Inc., and U.S. Department of the Interior, Fish and Wildlife Service. 36 pp.
- [USFWS] 2016. Endangered and threatened wildlife and plants; initiation of 5-year status reviews of 76 species in Hawai‘i, Oregon, Washington, Montana, and Idaho. Federal Register 81(29): 7571–7573, February 12, 2016.

[USFWS] 2016. Endangered and threatened wildlife and plants; designation and nondesignation of critical habitat on Molokai, Lanai, Maui, and Kahoolawe for 135 species; final rule. Federal Register 81 (61): 17790–18110, March 30, 2016.

**U.S. FISH AND WILDLIFE SERVICE**  
SIGNATURE PAGE for 5-YEAR REVIEW of *Kadua cordata* subsp. *remyi* (kopa)

**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**