5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Kadua laxiflora* (pilo)

Current Classification: Endangered

Federal Register Notice announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2021. 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, Hawai‘i

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 laxiflora* (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/4667*).

Review Analysis:

Please refer to the previous 5-year reviews for *Kadua laxiflora* (previously known as *Hedyotis mannii*) published in the Federal Register on August 2, 2011, and October 23, 2018 (available at *https://ecos.fws.gov/docs/tess/species_nonpublish/1755.pdf* and *https://ecos.fws.gov/docs/tess/species_nonpublish/2637.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. laxiflora*.

This short-lived perennial shrub in the Rubiaceae (coffee) family is endangered and occurs on Mauna Kahālāwai (west Maui) and historically on Lāna‘i and Moloka‘i. The status and trends for *Kadua laxiflora* are provided in the tables below.

New Status Information:

- On Mauna Kahālāwai, *Kadua laxiflora* was last observed at Honokōhau (9 individuals) in 2018 and at ʻĪao in 2020 (16 individuals) (Maui Plant Extinction Prevention Program [Maui PEPP] 2018, 2020). Seedlings have been observed at both locations. A landslide occurred at Honokōhau, removing some or all of the population (Maui PEPP 2018). Wild plants on Lānaʻi are extirpated (PEPP 2018). There are five translocated populations on Mauna Kahālāwai and one translocated population on Lānaʻi (Maui PEPP 2018, 2021, 2022).
- Currently, there are 16 founders (wild plants) from Honokōhau and 17 founders from ʻĪao on Maui and 3 founders from one population on Lānaʻi represented in *ex situ* storage and propagation.

New Threats:

- None reported.

New Management Actions:

- Monitoring and surveys—Maui PEPP and Pūlama Lānaʻi monitor the wild and translocated populations (Maui PEPP 2018-2022; Pūlama Lānaʻi 2019, 2021).
- Ungulate monitoring and control—All sites with wild and translocated plants on Lānaʻi are fenced (Pūlama Lānaʻi 2021).
- Invasive nonnative plant monitoring and control—
  - Pūlama Lānaʻi conducts invasive nonnative plant control at the translocation sites at Lānaʻihale (Pūlama Lānaʻi 2021).
  - Maui PEPP conducts invasive nonnative plant control at the Honokōhau, ʻĪao, Pōhākea, and Ukumehame populations on Mauna Kahālāwai and at the Lānaʻihale populations on Lānaʻi (Maui PEPP 2018-2020).
- Rodent control—Pūlama Lānaʻi conducts rat control at the translocation sites at Lānaʻihale (Pūlama Lānaʻi 2021).
- Collection and propagation for genetic storage and translocation—
  - From 2019 to 2023, the Olinda Rare Plant Facility (ORPF) reported propagation of 175 plants representing four founders at Honokōhau, four founders at ʻĪao, and one founder at Lānaʻihale (ORPF 2019, 2020, 2023).
  - In 2022, the Lyon Arboretum Micropropagation Laboratory reported storage of 72 explants representing one founder at Honokōhau (Lyon Arboretum 2022). The Lyon Arboretum Seed Conservation Laboratory reported storage of 7,464 seeds representing second generation plants sourced from one founder at Lānaʻihale, over 25,000 seeds representing 17 founders from Honokōhau received from 2013 to 2018, and over 50,000 seeds representing 16 founders at ʻĪao Valley received from 2016 to 2020 (Lyon Arboretum 2022).
  - In 2021, Pūlama Lānaʻi reported germination of fourth-generation plants from seeds grown in flats at the nursery (Pūlama Lānaʻi 2021).
  - From 2017 to 2020, Maui PEPP collected seeds for storage at Lyon Arboretum from one founder at Honokōhau and from 17 founders at ʻĪao (Maui PEPP 2017-2020).
- Reintroductions, augmentations, translocation—

- In 2021, Pūlama Lānaʻi reported that all third-generation plants propagated in the nursery were translocated (Maui PEPP 2021). Monitoring of the translocated population at Lānaʻihale found that two of the four *K. laxiflora* remained in 2020 (Pūlama Lānaʻi 2021).
- In 2018 and 2020, Maui PEPP translocated *K. laxiflora* on Mauna Kahālāwai at Honokōhau (15), ʻĪao Valley (7), and Hanaʻula Spring Trail (5); and in 2018 on Lānaʻi at Lānaʻihale (19) (PEPP 2018). In 2022, Maui PEPP translocated an additional 11 individuals at Hanaʻula Spring Trail (PEPP 2022). In 2023, three mature individuals remained at Ukumehame from a previous translocation (Maui PEPP 2023).

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

Date	No. wild individuals	No. outplanted	Stability Criteria identified in Recovery Plan	Stability Criteria Completed?
1992 (listing)	2 (Molokaʻi) 9 (Lānaʻi)	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
2011 (5-year review)	3 (Lānaʻi) 6 (Maui)	18	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)	0 (Molokaʻi) 0 (Lānaʻi) ca 30 (Maui)	0	All threats managed in all 3 populations	No
			Reproduction (i.e., viable seeds, seedlings, saplings) at all 3 populations	No
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	No
2023 (5-year review)	0 (Molokaʻi) 0 (Lānaʻi) <20 (Maui)	Planted 47 Maui; 23 Lānaʻi; remain 15 Maui, 4 Lānaʻi	All threats managed in all 3 populations	Partial
			Complete genetic storage	Partial
			Natural reproduction at all 3 populations	Yes
			3 populations with 50 mature individuals each	Partial

* 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 laxiflora* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Degradation and destruction of habitat by feral ungulates	A	Ongoing	Partial, exclosures at 1 wild and 1 translocated population on Maui; 1 translocated population on Lānaʻi
Established ecosystem altering invasive plant species degradation of habitat	A	Ongoing	Partial, nonnative plant control within exclosures
Landslides and flooding destruction and degradation of habitat	A	Ongoing	None
Fire destruction and degradation of habitat	A	Ongoing	None
Climate change degradation or loss of habitat including hurricanes	A	Ongoing	None
Predation and herbivory by feral ungulates	C	Ongoing	Partial, exclosures at 1 wild and 1 translocated population on Maui; 1 translocated population on Lānaʻi
Predation and herbivory by invertebrates	C	Ongoing	None
Reduced viability due to low numbers	E	Ongoing	Partial, seed collection, propagation and translocation ongoing

Synthesis:
Currently there are fewer than 20 wild (Maui only) and fewer than 20 translocated individuals of *Kadua laxiflora* remaining on Mauna Kahālāwai and Lānaʻi. Individuals are provided protection by fencing and nonnative plant control. Seed collections, propagation, and translocations are ongoing; however, translocations have low survival rates.

Stabilizing (interim), downlisting, and delisting objectives are provided in the Recovery Plan for the Molokaʻi Plant Cluster (U.S. Fish and Wildlife Service 1996) 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 laxiflora 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 Lānaʻi 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 this species have not been met as there are no populations of at least 50 mature individuals (Table 1). Genetic representation is nearly complete (Table 1); however, all threats including landslides, fire, predation by nonnative invertebrates, and climate change are not sufficiently managed throughout the range of the species (Table 2). Translocations have low success rates. Therefore, *Kadua laxiflora* 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 2018. Thus, the following recommendations for future actions are updated or reiterated for the 5-year review for 2023.

- Surveys and inventories—Continue to survey for additional populations of *Kadua laxiflora* in areas of potentially suitable habitat on Mauna Kahālāwai, Lānaʻi, and Molokaʻi.
- Ungulate monitoring and control—Continue to construct and maintain exclosures, or strategic fencing as appropriate, to protect *K. laxiflora* from the negative impacts of feral ungulates.
- Invasive nonnative plant monitoring and control—Continue control of established ecosystem-altering nonnative invasive plant species, and those that compete with *K. laxiflora*, at all populations.
- Flooding monitoring and control—Monitor populations affected by flooding.
- Fire prevention and control—Develop and implement fire management plans for all populations on Mauna Kahālāwai and Lānaʻi.
- Climate change adaptation strategy—Assess the modeled effects of climate change on this species and use this information to determine future landscape needed for recovery of the species.
- Predator and herbivore monitoring and control—
    - Protect all occurrences against browsing by feral ungulates.

    - Identify unknown invertebrate damaging wild individuals and develop and implement effective control methods if necessary.
    - Implement effective control methods for rats at all populations.
- Captive propagation for genetic storage and reintroduction—Continue collection and propagation efforts for maintenance of genetic stock and for translocation.
- Translocation and augmentation—Continue to translocate individuals into suitable habitat within historic range that is being managed for known threats to this species.
- Build resiliency, redundancy, and representation—Continue translocation of individuals into suitable habitat that is being managed for known threats to this species to reduce impacts of flooding, fire, and predation by invertebrates.
- 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.

[Maui PEPP] Maui Plant Extinction Prevention Program. 2017-2023. Maui Nui plant species monitoring reports, 2017-2023. Excel data tables.

[ORPF] Olinda Rare Plant Facility. 2019. 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.

[ORPF] 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.

[ORPF] 2023. 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. 2018. Plant Extinction Prevention Program, fiscal year 2018 interim performance report (October 1, 2017-September 30, 2018) cooperative agreement F18AC00502, US Fish and Wildlife Service CFDA Program #15.657, Endangered species conservation—recovery implementation

funds, University of Hawaii at Manoa, Pacific Cooperative Studies Unit, Plant Extinction Prevention Program. 49 pp.

[PEPP] 2022. Plant Extinction Prevention Program fiscal year 2022 interim performance report (October 1, 2021-September 30, 2022), 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. 50 pp.

Pūlama Lāna‘i. 2019. Consolidated annual report for 2016, 2017, 2018 to the US Fish & Wildlife Service as required by the Memorandum of Understanding dated January 26, 2015, between USFWS & Pūlama Lāna‘i, 8 pp.

Pūlama Lāna‘i. 2021. Threatened and Endangered species report for Division of Forestry and Wildlife. Tab 2, population site monitoring, Tab 3, nursery accessions, Tab 4, individual plants and collections. Excel data table, 4 tabs.

[USFWS] U.S. Fish and Wildlife Service. Recovery Plan for the Molokai Plant Cluster. Portland. 143 pp.

[USFWS] 2011. *Hedyotis mannii* 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI. *https://ecos.fws.gov/docs/tess/species_nonpublish/1755.pdf*.

[USFWS] 2018. *Kadua laxiflora* 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI. *https://ecos.fws.gov/docs/tess/species_nonpublish/2637.pdf*.

[USFWS] 2021. 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.

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SIGNATURE PAGE for 5-YEAR REVIEW of *Kadua laxiflora* (pilo)

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**

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