

5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Euphorbia remyi* var. *kauaiensis* (‘akoko)

Current Classification: Endangered

Federal Register Notice announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2020. Endangered and Threatened Wildlife and Plants; Initiation of 5-Year Status reviews for 129 Species in Oregon, Washington, Idaho, Hawaii, Montana, California, and Nevada. Federal Register 85(48): 14240–14243, March 11, 2020.

Lead Region/Field Office:

Interior Region 12/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, 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 (Service or USFWS) beginning in October 2021. The review was based on a review of current, available information since the last 5-year review for *Euphorbia remyi* var. *kauaiensis* (USFWS 2017). The evaluation by Cheryl Phillipson, Biologist, was reviewed by Lauren Weisenberger, Plant Recovery Coordinator, and Megan Laut, 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 (<https://ecos.fws.gov/ecp/species/2643>).

Review Analysis:

Please refer to the previous 5-year review for *Euphorbia remyi* var. *kauaiensis* published in the Federal Register on September 13, 2017 (available at https://ecos.fws.gov/docs/tess/species_nonpublish/2442.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 *E. remyi* var. *kauaiensis*.

This short-lived perennial shrub in the Euphorbiaceae (spurge) family is listed as endangered and is known from the island of Kaua‘i. The status and trends for *Euphorbia remyi* var. *kauaiensis* are provided in the tables below.

New Status Information:

- In 2020, there were four subpopulations of *Euphorbia remyi* var. *kauaiensis* totaling an estimated 2,000 individuals on Kaua‘i (Lorence et al. 2020). Most of the individuals were in Wainiha Preserve, with 30 at the upper Wailua River (Blue Hole), 50 to 100 at Lumaha‘i, and an unknown number at ‘Ili‘ili‘ula.
- Another variety, *Euphorbia remyi* var. *hanaleiensis*, was believed to be extinct when an unusual *Euphorbia* specimen was found in 2014 (Wood and Walsh 2022, pp. 29–31). An error in the original description of this variety by Koutnik (in Wagner et al. 1999, p. 614) caused the delay in reporting of this discovery until now. After examination of the original holotype, the surveyors realized the colony of 100 individuals consisted of *E. remyi* var. *hanaleiensis*. The status of this variety will continue to be assessed.

New Threats:

- None reported.

New Management Actions:

- Collection and captive propagation—The Lyon Arboretum Micropropagation Laboratory reported propagation of 14 explants representing one founder at the upper Wailua river (Lyon Arboretum 2022).

Table 1. Status and trends of *Euphorbia remyi* var. *kauaiensis* from listing through current 5-year review.

Date	No. wild individuals	No. outplanted	*Preventing Extinction Criteria identified by HPPRCC	*Preventing Extinction Criteria Completed?
2010 (5-year review)	920–1,000	0	All threats managed in all 3 populations	Partially
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
2017 (5-year review)	225–325	0	All threats managed in all 3 populations	Partially, Wainiha Preserve enclosure
			Complete genetic storage	No

			Reproduction (i.e., viable seeds, seedlings) at all 3 populations	Unknown
			3 populations with 50 mature individuals each	No
2022 (5-year review)	ca 2,000	0	All threats managed in all 3 populations	Partially, Wainiha Preserve enclosure
			Complete genetic storage	Partially, 1 founder represented
			Natural reproduction at all 3 populations	Unknown
			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 *Euphorbia remyi* var. *kauaiensis* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Degradation and destruction of habitat and herbivory by feral ungulates	A, C	Ongoing	Partial, Wainiha Preserve enclosure
Established ecosystem altering invasive plant species degradation of habitat and competition	A, E	Ongoing	Partial, Wainiha Preserve enclosure
Landslides and erosion destruction or degradation of habitat	A	Ongoing	None
Climate change degradation and destruction of habitat, including hurricanes	A	Ongoing	None
Predation and herbivory by rodents	C	Ongoing	None
Inadequacy of existing regulatory mechanisms—lack of adequate hunting and biosecurity regulations	D	Ongoing	None

Synthesis:

Currently, *Euphorbia remyi* var. *kauaiensis* occurs at Wainiha Preserve, Lumaha‘i, upper Wailua river (Blue Hole), and ‘Ili‘ili‘ula on Kaua‘i. These populations are estimated to total 2,000 individuals based on available habitat. There are 14 explants in storage representing one founder from the upper Wailua river. The population at Wainiha Preserve is fenced, with some ungulate and nonnative plant control.

Stabilizing (interim), downlisting, and delisting objectives are provided in the Kaua‘i Islandwide Recovery Plan (USFWS 2021) 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.

Euphorbia remyi var. *kauaiensis* 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 this species now occurs 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 *Euphorbia remyi* var. *kauaiensis* have not been met. Although there are estimated to be 2,000 wild individuals, most occur in one population, with three other small and widely separated populations (Table 1). Successful recruitment is not reported and only one founder is represented in a collection (Table 1). In addition, not all threats are being addressed (Table 2). Therefore, *E. remyi* var. *kauaiensis* meets the definition of Endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:

No new threats and no significant new information regarding the species’ biological status have been reported since the last 5-year review in 2017. Thus, the following recommendations for future actions are reiterated or updated for the 5-year review for 2022.

- Surveys and inventories—Continue to survey suitable habitat in current and historical range for additional populations of *Euphorbia remyi* var. *kauaiensis* and monitor known occurrences.

- Ungulate monitoring and control—Continue to construct enclosures to prevent disturbance and browsing by feral ungulates.
- Nonnative invasive plant monitoring and control—Continue to control established ecosystem-altering nonnative invasive plant species and those that compete with *E. remyi* var. *kauaiensis* at all populations.
- Predator and herbivore monitoring and control—Implement effective control methods for rats.
- Climate change adaptation strategy—Research suitability of habitat for viability of species, including where to conduct translocations in the future due to impacts of climate change.
- Captive propagation for genetic storage and reintroduction—Collect seeds and propagative materials for storage and for maintenance of genetic stock.
- Reintroduction and augmentation—Augment wild populations and establish new populations within protected and managed suitable habitat.
- Build resiliency and redundancy—Increase numbers of individuals and populations through historical range to reduce impacts of landslides and hurricanes.
- Population biology research—Study *E. remyi* var. *kauaiensis* populations to determine viable population size and structure, geographical distribution, flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, limiting factors, and threats.
- 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 species.

References:

- [HPPRCC] Hawai‘i and Pacific Plants Recovery Coordinating Committee. 2011. Revised recovery objective guidelines. 8 pp.
- Koutnik, D.L. 1999. *Chamaesyce* S.F. Gray, spurge, native species. *In* Manual of the Flowering Plants of Hawai‘i, Wagner, W.L., D R. Herbst, and S.H. Sohmer (eds.), University of Hawai‘i Press, Bishop Museum Press. Pp. 602–617.
- Lorence, D.H., B. Nyberg, and K. Wood. 2020. *Euphorbia remyi* var. *kauaiensis*. The IUCN Red List of Threatened Species 2020: e.T44148A97884587. <https://dx.doi.org/10.2305/IUCN.UK.2020-2.RLTS.T44148A97884587.en>.
- 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.
- [USFWS] 2017. *Euphorbia remyi* var. *kauaiensis* 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI. https://ecos.fws.gov/docs/tess/species_nonpublish/2442.pdf.

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[USFWS] 2021. Kaua‘i Islandwide Recovery Plan. U.S. Fish and Wildlife Service, Portland, OR. 65 pp. + appendices.

Wood, K.R. and S.K. Walsh. 2022. Notes on the Hawaiian flora: Kaua‘i rediscoveries and range extensions. Records of the Hawaii Biological Survey for 2021. N.L. Evenhuis (ed.), Bishop Museum Occasional Papers 142: 27–34.

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SIGNATURE PAGE for 5-YEAR REVIEW of *Euphorbia remyi* var. *kauaiensis* ('akoko)

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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