

5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Melicope quadrangularis* (alani)

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 *Melicope quadrangularis* (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 (http://ecos.fws.gov/tess_public).

Review Analysis:

Please refer to the previous 5-year reviews for *Melicope quadrangularis* published in the Federal Register on August 27, 2010, and September 16, 2017 (available at http://ecos.fws.gov/docs/tess/species_nonpublish/1608.pdf and http://ecos.fws.gov/docs/tess/species_nonpublish/2477.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 *M. quadrangularis*.

This long-lived perennial tree in the Rutaceae (rue or citrus) family is listed as endangered and is known from the island of Kaua‘i. The status and trends for *Melicope quadrangularis* are provided in the tables below.

New Status Information:

- Currently, there are three subpopulations of *Melicope quadrangularis* totaling 27 individuals on Kaua‘i (Wood et al. 2020).

New Threats:

- None reported.

New Management Actions:

- Surveys and monitoring—The National Tropical Botanical Garden (NTBG) monitors and surveys for populations of *Melicope quadrangularis* on Kaua‘i (Wood et al. 2020; NTBG 2018, 2020).
- Captive propagation for genetic storage and reintroduction—One plant is in the NTBG nursery as a result from a 2014 collection at Waiahi (NTBG 2021).

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

Date	No. wild individuals	No. outplanted	Stability Criteria identified by HPPRCC	Stability Criteria Completed?
1994 (listing)	13	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 25 mature individuals each	No
1995 (recovery plan)	13	0	All threats managed in all 3 populations	No
			Complete genetic storage	Partially
			3 populations with 25 mature individuals each	No
2003 (critical habitat)	0	0	All threats managed in all 3 populations	No
			Complete genetic storage	Partially
			3 populations with 25 mature individuals each	No
2010 (5-year review)	0	0	All threats managed in all 3 populations	No

			Complete genetic storage	Partially
			3 populations with 25 mature individuals each	No
Date	No. wild individuals	No. outplanted	*Preventing Extinction Criteria identified by HPPRCC	*Preventing Extinction Criteria Completed?
2017 (5-year review)	14	0	All threats managed in all 3 populations	Partially, 1 subpopulation within enclosure
			Complete genetic storage	No
			Reproduction (i.e., viable seeds, seedlings) at all 3 populations	Unknown
			3 populations with 25 mature individuals each	No
2022 (5-year review)	27	0	All threats managed in all 3 populations	Partially, 1 subpopulation within enclosure
			Complete genetic storage	Partial, one founder
			Natural reproduction at all 3 populations	Unknown
			3 populations with 25 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 stage after Preventing Extinction).

Table 2. Threats to *Melicope quadrangularis* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Degradation and destruction of habitat by feral ungulates	A	Ongoing	Partial, 1 subpopulation in enclosure
Established ecosystem altering invasive plant species degradation of habitat and competition	A, E	Ongoing	Partial, 1 subpopulation in enclosure
Landslide and flooding destruction or degradation of habitat	A	Ongoing	None
Climate change degradation and destruction of habitat, including hurricanes	A	Ongoing	None
Rodent predation and herbivory	C	Ongoing	None
Invertebrate predation and herbivory	C	Ongoing	None
Reduced viability due to low numbers	E	Ongoing	None

Synthesis:

Currently, there are 27 wild individuals of *Melicope quadrangularis* on Kaua‘i. One subpopulation is within a managed enclosure. Only one founder is represented in cultivation.

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.

Melicope quadrangularis is a long-lived perennial tree. 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 25 mature, reproducing individuals per population.

The preventing extinction goals for *Melicope quadrangularis* have not been met. There are only 27 known individuals and only one has been represented *ex situ* (Table 1). Only one subpopulation is provided protection by an ungulate exclosure (Table 1, Table 2). This species is additionally susceptible to rodent and invertebrate predation and herbivory, nonnative plant competition, climate change, landslides, and hurricanes, as well as reduced viability due to small total population size (Table 2). Therefore, *M. quadrangularis* 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 monitoring—Continue to survey for populations of *Melicope quadrangularis* in areas of potentially suitable habitat and monitor known populations to determine their current status.
- Ungulate monitoring and control—Continue to construct and maintain exclosures to protect all occurrences from habitat disturbance by feral ungulates.
- Nonnative invasive plant monitoring and control—Control established ecosystem-altering nonnative invasive plant species and those that compete with *M. quadrangularis* at all populations.
- Predator and herbivore monitoring and control—
 - Implement effective control measures for rats at all populations.
 - Determine level of threat from slug herbivory and any additional recovery actions needed.
- 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—Begin collection of seeds and propagules for maintenance of genetic stock.
- Build resiliency and redundancy — Increase species’ viability through habitat restoration, threat control, and reintroduction and translocation into suitable habitat that is being managed for known threats to this species to reduce impacts of climate change, landslides, flooding, and reduced viability due to low numbers of individuals.
- 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.
- [NTBG] National Tropical Botanical Garden. 2018. NTBG database herbarium record detail for *Melicope quadrangularis*, PTBG 1000068296, 080044, 15 NOV 2018.
- [NTBG] 2020. NTBG database herbarium record detail for *Melicope quadrangularis*, PTBG 1000082017 and 10000082011, 080044 and 082877, 30 JAN 2020.
- [NTBG]. 2021. 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] U.S. Fish and Wildlife Service. 2010. *Melicope quadrangularis* 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI. https://ecos.fws.gov/docs/tess/species_nonpublish/1608.pdf.
- [USFWS] 2017. *Melicope quadrangularis* 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI. https://ecos.fws.gov/docs/tess/species_nonpublish/2477.pdf.
- [USFWS] 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.
- [USFWS] 2021. Kaua'i Islandwide Recovery Plan. U.S. Fish and Wildlife Service, Portland, OR. 65 pp. + appendices.
- Wood, K., B. Nyberg, and U. Nagendra. 2020. *Melicope quadrangularis*. The IUCN Red List of Threatened Species 2020: e.T33559A83803234. <https://dx.doi.org/10.2305/IUCN.UK.2020-2.RLTS.T33559A83803234.en>.

U.S. FISH AND WILDLIFE SERVICE
SIGNATURE PAGE for 5-YEAR REVIEW of *Melicope quadrangularis* (alani)

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

_____ Date_____