5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Melicope haupuensis* (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 haupuensis* (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/2236*).

Review Analysis:

Please refer to the previous 5-year reviews for *Melicope haupuensis* published in the Federal Register on July 21, 2009, and September 16, 2017 (available at *http://ecos.fws.gov/docs/tess/species_nonpublish/1385.pdf* and *http://ecos.fws.gov/docs/tess/species_nonpublish/2473.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. haupuensis*.

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 haupuensis* are provided in the tables below.

New Status Information:

- There are 53 wild individuals of *Melicope haupuensis*, half of which (26) occur at one location on Kauaʻi (Heintzman et al. 2020). Surveys of the area of an historic occurrence at Mt. Hāʻupu were conducted but no plants were found (Wood 2020, p. 15).

New Threats:

- None reported.

New Management Actions:

- Surveys and monitoring—The Plant Extinction Prevention Program (PEPP) and the National Tropical Botanical Garden (NTBG) monitor and survey for populations of *Melicope haupuensis* on Kauaʻi (PEPP 2017, 2018, 2020, 2021).
- Collection and propagation—
  - In 2016 and 2017, PEPP reported production of airlayers for propagation representing seven founders from Honopū and seed collections from five founders at Awaʻawapuhi (PEPP 2016, 2017). In addition, leaf samples were taken from five founders at Honopū for genetic studies.
  - In 2019, the Kōkeʻe Mid-Elevation Nursery (KMEN) reported propagation of two plants representing one founder for reintroduction (KMEN 2019).
  - In 2020, the Lyon Arboretum Seed Conservation Laboratory reported storage of 29 seeds representing one founder from Awaʻawapuhi and storage of 14 seeds representing three founders from Honopū (Lyon Arboretum 2022).
- Reintroduction and augmentation—Between 2017 and 2018, PEPP reintroduced 21 individuals into an exclosure (PEPP 2018; Kishida and Arnold 2018; Perlman and Alevizos 2018; Perlman and O'Sullivan 2017).

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

Date	No. wild individuals	No. outplanted	Stability Criteria identified by Recovery Plan	Stability Criteria Completed?
1994 (listing)	2	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
1995 (recovery plan)	2	0	All threats managed in all 3 populations	No
			Complete genetic storage	Partially

			3 populations with 50 mature individuals each	No
2003 (critical habitat)	13		All threats managed in all 3 populations	No
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	No
2009 (5-year review)	30		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?**
2017 (5-year review)	ca 40	1	All threats managed in all 3 populations	No
			Complete genetic storage	Partially
			Reproduction (i.e., viable seeds, seedlings) at all 3 populations	Unknown
			3 populations with 50 mature individuals each	No
2022 (5-year review)	53	21	All threats managed in all 3 populations	Partially, 1 reintroduced population in exclosure
			Complete genetic storage	Partially, 12 founders from 2 populations represented
			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 haupuensis* 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, 1 reintroduced population in exclosure
Established ecosystem altering invasive plant species degradation of habitat and competition	A, E	Ongoing	Partial, exclosure is managed
Landslide and flooding destruction or degradation of habitat	A	Ongoing	None
Fire destruction and 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	Partial, some control implemented
Reduced viability due to low numbers	E	Ongoing	Partial, collection, propagation, and reintroduction

Synthesis:
Currently, there are approximately 53 wild individuals of *Melicope haupuensis* primarily at one location on Kauaʻi. Twelve founders from two populations are represented in seed collections and in propagation efforts, including air–layering, with 21 individuals reintroduced to a managed exclosure.

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

Melicope haupuensis 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 haupuensis* have not been met. The wild individuals are mostly in one location, with other individuals in widely separated areas (Table 1). There are small collections of seeds and propagules representing 12 founders in two populations (Table 1). Twenty-one individuals were reintroduced into an exclosure (Table 1, Table 2). The wild populations are susceptible to other threats including ungulate, rodent and invertebrate herbivory and predation, nonnative plant competition and habitat degradation, and landslides (Table 2). Therefore, *M. haupuensis* 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 haupuensis* 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 and herbivory by feral ungulates.
- Nonnative invasive plant monitoring and control—Control established ecosystem-altering nonnative invasive plant species and those that compete with *M. haupuensis* at all populations.
- Fire monitoring and control—Develop and implement fire management plans for all wild and reintroduced populations.
- 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.
- Predator and herbivore monitoring and control—
    - Implement effective control measures for rats at all populations.

    - Determine level of threat of predation and herbivory by invertebrates and any additional recovery actions required.
- Captive propagation for genetic storage and reintroduction—Continue collection and propagation efforts for maintenance of genetic stock.
- Reintroduction and augmentation—Continue to reintroduce individuals into protected suitable habitat within historic range that is being managed for known threats to this species to build resiliency and redundancy and reduce impacts of landslides and hurricanes, as well as reduced viability due to low numbers.
- Population biology and genetic research—
    - Study *M. haupuensis* 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.
    - Assess genetic variability of the extant 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.

Heintzman, S., B. Nyberg, and K. Wood. 2020. *Melicope haupuensis*. The IUCN Red List of Threatened Species 2020: e.T33666A83802613. *https://dx.doi.org/10.2305/IUCN.UK.2020-2.RLTS.T33666A83802613.en*.

Kishida, W. and L. Arnold 2018. Hawai‘i Rare Plant Restoration Group (HRPRG) Field Data Form *in* PEPP 2019: Plant Extinction Prevention Program, FY 2019 Annual Report (Oct 1, 2018-Sep 30, 2019), USFWS CFDA Program #15.657, Endangered Species Conservation-Recovery Implementation Funds, Coop Agreement F18AC00502, December 26, 2019, UH Mānoa, PCSU, PEPP. 192 pp. + appendices. BioPacifica database record for *Melicope haupuensis*, Pacific Islands Fish and Wildlife Office.

[KMEN] Kōke‘e Mid-Elevation Nursery. 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.

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.

Perlman, S. and C. Alevizos. 2018. Hawai‘i Rare Plant Restoration Group (HRPRG) Field Data Form *in* PEPP 2019: Plant Extinction Prevention Program, FY 2019 Annual Report (Oct 1, 2018-Sep 30, 2019), USFWS CFDA Program #15.657, Endangered Species Conservation-Recovery Implementation Funds, Coop Agreement F18AC00502, December 26, 2019, UH Mānoa, PCSU, PEPP. 192 pp. + appendices. BioPacifica database record for *Melicope haupuensis*, Pacific Islands Fish and Wildlife Office.

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[PEPP] Plant Extinction Prevention Program 2017. Plant Extinction Prevention Program FY 2017 annual report (Oct 1, 2016-Sep 30, 2017), Coop Agreement: F14A00174, U.S. Fish and Wildlife Service CFDA Program #15.657, Endangered Species Conservation-Recovery Implementation Funds. 235 pp.

[PEPP] 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] 2020. Plant Extinction Prevention Program, fiscal year 2020 interim performance report (October 1, 2019-September 30, 2020) cooperative agreement F18AC00502 (interim report), F19AC00532 (interim report), 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. 70 pp.

[PEPP] Plant Extinction Prevention Program. 2021. Fiscal year 2021 interim performance report (October 1, 2020-September 30, 2021) cooperative agreements F18AC00502 and F19AC00532, 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.

[USFWS] U.S. Fish and Wildlife Service. 2009. *Melicope haupuensis* 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI. *https://ecos.fws.gov/docs/tess/species_nonpublish/1385.pdf.*

[USFWS] 2017. *Melicope haupuensis* 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI. *https://ecos.fws.gov/docs/tess/species_nonpublish/2473.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. Kauaʻi Islandwide Recovery Plan. U.S. Fish and Wildlife Service, Portland, OR. 65 pp. + appendices.

Wood, K. 2020. Appendix 1, Hāʻupu survey, 20 pp., *In* DeMotta, M., 2020, USFWS Partners Program, Mt. Hāʻupu Conservation Project, Service Award #F18AC00511, Interim Performance and Financial Report, Oct 1, 2019-Sept 30, 2020. 17 pp.

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SIGNATURE PAGE for 5-YEAR REVIEW of *Melicope haupuensis* (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
_X____ No Change in listing status

For **Field Supervisor, Pacific Islands Fish and Wildlife Office**

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