5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Melicope mucronulata* (alani)

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, Acting 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 *Melicope mucronulata* (USFWS 2018). The evaluation by Cheryl Phillipson, Biologist, was reviewed by Lauren Weisenberger, Plant Recovery Coordinator, and Acting 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/706*).

Review Analysis:

Please refer to the previous 5-year reviews for *Melicope mucronulata* published in the Federal Register on January 18, 2008, March 31, 2014, and October 23, 2018 (available at *https://ecos.fws.gov/docs/tess/species_nonpublish/1187.pdf*, *https://ecos.fws.gov/docs/tess/species_nonpublish/2198.pdf* and *https://ecos.fws.gov/docs/tess/species_nonpublish/2648.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. mucronulata*.

This long-lived perennial tree in the Rutaceae (rue) family is endangered and occurs on Moloka‘i and has not been observed on east Maui since 1983. The status and trends for *M. mucronulata* are provided in the tables below.

New Status Information:

- Currently, on Molokaʻi, there is one wild individual of *Melicope mucronulata* at Kūpāʻia Gulch, and one of the two individuals at ʻŌnini Gulch died. In 2020, two more individuals were discovered at lower ʻŌnini Gulch (Coelho 2020; Coelho and Purdy 2019; Bakutis et al. 2020; PEPP 2020, p. 30). By 2023, and additional wild plant died, leaving two individuals at ʻŌnini Gulch and one individual at Kūpāʻia Gulch (Molokaʻi Plant Extinction Prevention Program [MoPEPP] 2023).
- Currently, there are two founders (wild plants) represented in *ex situ* storage and propagation, one from each population at Kūpāʻia Gulch and ʻŌnini Gulch.

New Threats:

- None reported.

New Management Actions:

- Monitoring and surveys—The Molokaʻi Plant Extinction Prevention Program [MoPEPP] monitors the wild and translocated individuals of *Melicope mucronulata* on Molokaʻi (Coelho 2020; Coelho and Purdy 2019; Bakutis et al. 2020).
- Ungulate monitoring and control—Fencing at ʻŌnini Gulch is monitored and repaired as needed (PEPP 2018, p. 30; PEPP 2020, p. 7; PEPP 2021, p. 7).
- Captive propagation for genetic storage and translocation—
    - In 2020, MoPEPP collected nine fruits from translocated plants at ʻŌnini Gulch (Coelho et al. 2020).
    - In 2022, the Lyon Arboretum Micropropagation laboratory reported storage of 342 explants representing one founder at Kūpāʻia Gulch and 216 explants representing one founder at ʻŌnini Gulch (Lyon Arboretum 2022). In 2009, the Lyon Arboretum Seed Conservation laboratory reported storage of 56 seeds representing the same founder from Kūpāʻia Gulch and storage of 137 seeds representing the same founder from ʻŌnini Gulch (Lyon Arboretum 2022).
    - Between 2015 and 2020, the Olinda Rare Plant Facility (ORPF) reported propagation and storage of 54 propagules representing one founder at ʻŌnini Gulch and 14 propagules representing one founder at Kūpāʻia Gulch (ORPF 2023).
- Translocation and augmentation—In 2018, 10 individuals were translocated to a fenced area at ʻŌnini Gulch representing one founder each from Kūpāʻia and ʻŌnini gulches (Coelho and Pali 2018; Pali and Coelho 2018). A separate report in 2018 indicated 17 plants were translocated (PEPP 2018, p. 30). This population is maturing and producing seeds (PEPP 2019, p. 18).

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

Date	No. wild individuals	No. outplanted	Stability Criteria identified in Recovery Plan	Stability Criteria Completed?
1992 (listing)	5	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 25 mature individuals each	No
2008 5-year review	4	0	All threats managed in all 3 populations	No
			Complete genetic storage	Partially
			3 populations with 25 mature individuals each	No
2014 (5-year review)	3	0	All threats managed in all 3 populations	Partially, fenced at Auwahi
			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?**
2018 (5-year review)	4	4	All threats managed in all 3 populations	Partially, 1 exclosure
			Reproduction (i.e., viable seeds, seedlings, saplings) at all 3 populations	No
			Complete genetic storage	Partially

			3 populations with 25 mature individuals each	No
2023 (5-year review)	3	10–17	All threats managed in all 3 populations	Partially, 1 exclosure
			Complete genetic storage	Partially, 2 founders represented
			Natural reproduction at all 3 populations	No
			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 mucronulata* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Degradation and destruction of habitat by feral ungulates	A	Ongoing	Partial, one population fenced
Established ecosystem altering invasive plant species degradation of habitat	A	Ongoing	Partial, nonnative plant control in fenced area
Fire destruction and degradation	A	Ongoing	None
Climate change degradation or loss of habitat	A	Ongoing	None
Predation and herbivory by feral ungulates	C	Ongoing	Partial, one population fenced
Predation and herbivory by rodents	C	Ongoing	None
Predation and herbivory by invertebrates	C	Ongoing	Partial, treatments with insecticide

Reduced viability due to low numbers	E	Ongoing	Partial, collection, propagation, and translocation

Synthesis:
Currently, there are three wild individuals of *Melicope mucronulata* on Moloka‘i. Two founders are represented in collections, propagation, and translocation. One wild and augmented population of 10 to 17 individuals is within an exclosure with some invasive nonnative plant control.

Stabilizing (interim), downlisting, and delisting objectives are provided in the Recovery Plan for the Maui Plant Cluster (Hawaii) (U.S. Fish and Wildlife Service 1997) 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 mucronulata 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 Moloka‘i and Maui where they now occur or occurred historically and each of these populations must be naturally reproducing (i.e., viable seeds, seedlings, saplings) with a minimum of 25 mature, reproducing individuals per population.

The preventing extinction goals for this species have not been met as there are no populations of at least 25 mature individuals, and only two of four founders are represented in collections (Table 1). Threats, including drought and invertebrate predation or herbivory, are not sufficiently managed throughout the range of the species (Table 1, Table 2). Therefore, *Melicope mucronulata* 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 added or reiterated for the 5-year review for 2023.

- Surveys and inventories—Continue to survey for individuals of *Melicope mucronulata* in areas of potentially suitable habitat.

- Ungulate monitoring and control—Continue to construct and maintain exclosures to protect *M. mucronulata* from the negative impacts of feral ungulates.
- Invasive nonnative plant monitoring and control—Continue to control established ecosystem-altering nonnative invasive plant species, and those that compete with *M. mucronulata*, at all populations.
- Fire monitoring and control—Develop and implement a fire management plan for all populations.
- Climate change adaptation strategy—Assess the modeled effects of climate change on this species and determine future landscape needed for its recovery.
- Invertebrate monitoring and control—Continue to test effective control methods for invertebrate pests.
- Captive propagation for genetic storage and reintroduction—
    - Continue collection of genetic resources for storage, propagation, and translocation into protected suitable habitat within historical range.
    - Evaluate genetic resources and determine the need to place additional material into long-term storage due to this species' vulnerability to climate change.
    - Determine effective alternate methods of propagation (air-layering, micropropagation, grafting, cuttings) since seeds are not abundantly produced.
- Translocation and augmentation—Continue to augment the current populations and translocate individuals into suitable habitat within historic range that is being managed for known threats to this species.
- Build resiliency, redundancy, and representation—Increase numbers of populations and individuals throughout historic range to reduce impacts of drought, invertebrate and rodent predation, and low numbers.
- Alliance and partnership development—Initiate work with partners and other land managers in planning and implementation of ecosystem-level restoration and management to benefit this taxon.

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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**

LAUREN WEISENBERGER Digitally signed by LAUREN WEISENBERGER Date: 2023.08.23 16:16:13 -10'00'

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