5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Melicope reflexa* (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 reflexa* (USFWS 2019). 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/2942*).

Review Analysis:

Please refer to the previous 5-year reviews for *Melicope reflexa* published in the Federal Register on August 2, 2011, and September 27, 2019 (available at *https://ecos.fws.gov/docs/tess/species_nonpublish/1736.pdf* and *https://ecos.fws.gov/docs/tess/species_nonpublish/2883.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. reflexa*.

This long-lived perennial tree or sprawling shrub in the Rutaceae (rue) family is endangered and occurs on Moloka‘i. The status and trends for *M. reflexa* are provided in the tables below.

New Status Information:

- In 2015, there were at least 50 wild individuals along the Kalua‘aha ridge with the total population estimated to be more than 100 individuals (Bakutis et al. 2015). When the population was visited in 2020, plants were observed scattered along the same ridgeline both inside and outside the fenced area (Bakutis et al. 2020). At least five individuals were observed in the Pu‘u‘ōhelo area in 2009; however, their current status is unknown.
- Currently, there are five founders (wild plants) from the population at Kalua‘aha ridge represented in *ex situ* storage and propagation.

New Threats:

- None reported.

New Management Actions:

- Surveys and monitoring—The Moloka‘i Plant Extinction Prevention Program (MoPEPP) monitors the population of *Melicope reflexa* along Kalua‘aha ridge (Bakutis et al. 2015; Bakutis et al. 2020).
- Ungulate monitoring and control—The fence at Kalua‘aha ridge has not been completed and habitat destruction and degradation by feral pigs was observed (Bakutis et al. 2020; PEPP 2020).
- Collection and propagation for genetic storage and translocation—
  - In 2020, MoPEPP collected seeds from three founders and cuttings from five founders (Bakutis et al. 2020).

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

Date	No. wild individuals	No. outplanted	Stability Criteria identified in Recovery Plan	Stability Criteria Completed?
1992 (listing)	<1,000	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 25 mature individuals each	No
2011 (5-year review)	6	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 25 mature individuals each	No

Date	No. wild individuals	No. outplanted	*Preventing Extinction Criteria identified by HPPRCC	*Preventing Extinction Criteria Completed?
2019 (5-year review)	70–100	0	All threats managed in all 3 populations	No
			Reproduction (i.e., viable seeds, seedlings, saplings) at all 3 populations	No
			Complete genetic storage	No
			3 populations with 25 mature individuals each	No
2023 (5-year review)	50–100+	0	All threats managed in all 3 populations	Partially, fence under construction
			Complete genetic storage	Partially
			Natural reproduction at all 3 populations	No
			3 populations with 25 mature individuals each	Partially, 1 population >25

* 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 reflexa* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Degradation and destruction of habitat by feral ungulates	A	Ongoing	Partial, fence under construction
Established ecosystem altering invasive plant species degradation of habitat	A	Ongoing	None

Climate change degradation or loss of habitat	A	Ongoing	None
Predation and herbivory by ungulates	C	Ongoing	Partial, fence under construction
Predation and herbivory by rodents	C	Ongoing	None
Predation and herbivory by invertebrates	C	Ongoing	None
Reduced viability due to low numbers	E	Ongoing	Partial, collection of seeds and cuttings

Synthesis:
Currently, there are 50 to more than 100 wild individuals of *Melicope reflexa* on Moloka‘i. A fence is under construction to protect the largest population from feral ungulates. Approximately three to five founders from one population are represented in collections. Currently, there is no augmentation or translocation of individuals. No recruitment has been reported.

Stabilizing (interim), downlisting, and delisting objectives are provided in the Recovery Plan for the Molokai Plant Cluster (Hawaii) (U.S. Fish and Wildlife Service 1996) 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 reflexa is a long-lived perennial tree or sprawling 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 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 is only one population of at least 25 mature individuals, and only three to five founders are represented in collections (Table 1). Threats, including feral ungulates, and rodent and

invertebrate predation or herbivory, are not sufficiently managed throughout the range of the species (Table 1, Table 2). Therefore, *Melicope reflexa* 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 reflexa* in current and historical range for a thorough assessment of the species' status.
- Ungulate monitoring and control—Continue to construct and maintain exclosures to protect *M. reflexa* from the negative impacts of feral ungulates.
- Invasive nonnative plant monitoring and control—Control established ecosystem-altering nonnative invasive plant species, and those that compete with *M. reflexa*, at all populations.
- Climate change adaptation strategy—Assess the modeled effects of climate change on this species and determine future landscape needed for its recovery.
- Rodent monitoring and control—Implement effective control measures for predation and herbivory by rodents at all populations.
- Invertebrate monitoring and control—Develop and implement effective control methods for the black twig borer.
- Captive propagation for genetic storage and reintroduction—Continue collection of genetic resources for storage, propagation, and translocation into protected suitable habitat within historical range.
- Translocation and augmentation—Begin population augmentation and translocation of individuals into suitable habitat within historic range that is being managed for known threats to this species.
- Genetic research—Conduct studies of the genetic relationships to clarify the *M. volcanica/M. reflexa/M. pseudoanisata* species complex.
- Build resiliency, redundancy, and representation—Increase numbers of populations and individuals throughout historic range to reduce impacts of ungulate and rodent and invertebrate predation, and low numbers.
- 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:

Bakutis, A., K. Coelho, and P. Pali. 2015. Hawai‘i Rare Plant Restoration Group (HRPRG) Field Data Form *in* PEPP 2022: Plant Extinction Prevention Program, FY 2022 Annual Report (Oct 1, 2021-Sep 30, 2022), USFWS CFDA Program #15.657, Endangered Species Conservation-Recovery Implementation Funds, Coop Agreement F19AC00532 (Interim Report), December 29, 2022, UH Mānoa, PCSU, PEPP. 50 pp. BioPacifica database record for *Melicope reflexa*, Pacific Islands Fish and Wildlife Office.

Bakutis, A., K. Coelho, and K. Purdy. 2020. Hawai‘i Rare Plant Restoration Group (HRPRG) Field Data Form *in* PEPP 2022: Plant Extinction Prevention Program, FY 2022 Annual Report (Oct 1, 2021-Sep 30, 2022), USFWS CFDA Program #15.657, Endangered Species Conservation-Recovery Implementation Funds, Coop Agreement F19AC00532 (Interim Report), December 29, 2022, UH Mānoa, PCSU, PEPP. 50 pp. BioPacifica database record for *Melicope reflexa*, Pacific Islands Fish and Wildlife Office.

[HPPRCC] Hawai‘i and Pacific Plants Recovery Coordinating Committee. 2011. Revised recovery objective guidelines. 8 pp.

[PEPP] Plant Extinction Prevention Program. 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), 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. 70 pp.

[USFWS] U.S. Fish and Wildlife Service. 1996. Recovery plan for the Molokai plant cluster (Hawaii). Portland. 143 pp.

[USFWS] 2011. *Melicope reflexa* 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI. *https://ecos.fws.gov/docs/tess/species_nonpublish/1736.pdf.*

[USFWS] 2019. *Melicope reflexa* 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI. *https://ecos.fws.gov/docs/tess/species_nonpublish/2883.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 *Melicope reflexa* (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**

LAUREN WEISENBERGER Digitally signed by LAUREN WEISENBERGER Date: 2023.08.23 16:22:32 -10'00'

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