

5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Melicope munroi* (alani)

Current Classification: Endangered

Federal Register Notice announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2016. Endangered and threatened wildlife and plants; initiation of 5-year status reviews of 76 species in Hawaii, Oregon, Washington, Montana, and Idaho. Federal Register 81(29): 7571–7573.

Lead Region/Field Office:

Region 1/Pacific Islands Fish and Wildlife Office (PIFWO), Honolulu, Hawai‘i

Name of Reviewers:

Cheryl Phillipson, Biologist, PIFWO

Lauren Weisenberger, Plant Recovery Coordinator, PIFWO

Gregory Koob, 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 (USFWS) beginning in August 2017. The review was based on a review of current, available information since the last 5-year review for *Melicope munroi* (USFWS 2012). The evaluation by Cheryl Phillipson, Biologist, was reviewed by Lauren Weisenberger, Plant Recovery Coordinator, and Gregory Koob, 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 review for *Melicope munroi* published in the Federal Register on August 28, 2012 (available at https://ecos.fws.gov/docs/five_year_review/doc4075.pdf) for a complete review of the species’ status, threats, and management efforts. 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. munroi*.

This long-lived perennial sprawling shrub in the Rutaceae (rue) family is endangered and known from Lāna‘i and Moloka‘i. The current status and trends for *Melicope munroi* are provided in the tables below.

New Status Information:

- Currently there are a few dozen individuals scattered across Lāna‘i hale on Lāna‘i (Oppenheimer 2018, in litt.). There are no individuals known on Moloka‘i; however, not all historical habitat has been searched (Bakutis 2018, in litt.).
- In 2012, three critical habitat units were proposed in two ecosystems (montane wet and wet cliff) on Lāna‘i for *Melicope munroi* (1,209 ac, 490 ha) (77 FR 34464, June 11, 2012). In the final rule the Service excluded critical habitat for this species on the island of Lāna‘i because, as demonstrated by the ongoing conservation activities by the private landowner, their commitment to develop the Lāna‘i Natural Resources Plan, and a memorandum of understanding with the Service, exclusion from critical habitat would provide greater long-term benefits to the species than designation of critical habitat (USFWS 2015; 81 FR 17790, March 30, 2016). In 2016, one critical habitat unit in the lowland mesic ecosystem was designated for *M. munroi* on Moloka‘i (8,770 ac; 3,549 ha).

New Threats:

- Drought loss or degradation of habitat—Drought is noted as a threat to the population of *Melicope munroi* on Lāna‘i (Oppenheimer 2018, in litt.). Over the last 100 years, the Hawaiian Islands have experienced an annual decline in precipitation of over 9 percent, increasing to as much as 15 percent within the last 20 years (US-NSTC 2008; Chu and Chen 2005; Diaz 2005). Drought affects plants directly by desiccation. The increase in drought frequency and intensity leads to a self-perpetuating cycle of increase in cover of nonnative plants, increase in the number of fires, and an increase of erosion (US-GCRP 2009; Warren 2011). Recent episodes of drought have also driven deer farther into urban and forested areas in search of food, increasing their negative impacts to native vegetation from herbivory and trampling (Waring 1996, in litt; Nishibayashi 2001, in litt.).
- Climate change loss or degradation of habitat—We previously reported that climate change may pose a threat to this species, anticipating an analysis by 2013. The assessment conducted by Fortini *et al.* (2013) concluded that *Melicope munroi* is highly vulnerable to the impacts of climate change, with a vulnerability score of 0.777 (on a scale of 0 being not vulnerable to 1 being extremely vulnerable to climate change). Therefore, additional management actions are needed to conserve this taxon into the future, such as locating key microsites that overlap with current and future climate envelopes for outplanting efforts.

New Management Actions:

- Surveys and inventories—The Plant Extinction Prevention Program (PEPP) monitors individuals of *Melicope munroi* on Lāna‘i (PEPP 2016). Because the numbers of individuals of this species is declining, PEPP is considering elevating its status to a “POP,” a potential PEP species (those species with 50 or fewer wild individuals).
- Captive propagation for genetic storage and reintroduction—In 2017, Lyon Arboretum reported four containers of propagules of *M. munroi* in storage.

- Habitat and natural process management and restoration—Pūlama Lāna‘i provides conservation benefits to plant and animal species on Lāna‘i, as demonstrated by the ongoing conservation efforts on the island, the commitment to develop the Lāna‘i Natural Resources Plan (LNRP), and a memorandum of understanding (MOU) with the Service (USFWS 2015). Currently, Pūlama Lāna‘i has surveyed and inspected the Lāna‘i hale fence (where *M. munroi* occurs) to determine repair needs and vegetation maintenance needs, and has removed 17 axis deer and eight mouflon sheep from within the fenced area (Donoho 2016, in litt.).

Synthesis:

Currently, there is one population of several dozen scattered individuals of *Melicope munroi* on the summit area of Lāna‘i. No plants are currently known on Moloka‘i. A landscape-based assessment of climate change vulnerability for native plants of Hawai‘i using high resolution climate change projections was made by Fortini *et al.* (2013) and their analysis showed that *M. munroi* is highly vulnerable to the effects of climate change, in that there will be a smaller area of suitable habitat available for the species in the near future. The population on Lāna‘i may be provided some protection by partial fencing and ongoing ungulate control and nonnative plant control at Lāna‘ihale. Seed collection is ongoing.

Stabilizing (interim), downlisting, and delisting objectives were provided in the Addendum to the Recovery Plan for the Multi-island Plants (USFWS 2002), 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 munroi is a long-lived perennial sprawling shrub. To prevent extinction, which is the first step 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. In addition, a minimum of three populations should be documented on Lāna‘i and Moloka‘i. Each of these populations must be naturally reproducing (*i.e.*, viable seeds, seedlings, saplings) and increasing in number, 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 individuals, genetic representation is incomplete (Table 1), and all threats are not being sufficiently managed throughout the range of the species (Table

2). Therefore, *Melicope munroi* meets the definition of Endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:

Drought is reported to be a threat to this species; however, we are not aware of any significant new information regarding the species' biological status since the last 5-year review in 2012. Thus, the following recommendations for future actions are added or reiterated for 5-year review for 2018.

- Surveys and inventories—Continue to survey for additional populations of *Melicope munroi* in areas of potentially suitable habitat on Lāna‘i and Moloka‘i. Regularly monitor known populations.
- Ungulate monitoring and control—Complete the Lanaihale summit fencing project and remove all feral ungulates from the fenced area to protect *M. munroi* from the impacts of feral ungulates.
- Invasive plant monitoring and control—
 - Control established ecosystem-altering nonnative invasive plant species around all populations.
 - Control invasive nonnative species that compete with the species around all populations, especially focusing on *Clidemia hirta* (Koster’s curse), and *Hedychium gardnerianum* (kāhili ginger), *Leptospermum scoparium* (Australian tea tree), *Morella faya* (firetree), *Psidium cattleianum* (strawberry guava), and *Tibouchina herbacea* (glorybush)
- Predator and herbivore 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 reintroduction into protected suitable habitat within historical range.
 - Explore alternate methods of propagation (e.g., cuttings, air-layering, and tissue culture).
- Reintroduction and translocation—Begin reintroduction of individuals into suitable habitat within historic range that is being managed for known threats to this species.
- Climate change adaptation strategy—Assess the modeled effects of climate change on this species to determine future landscape needed for recovery of the species.
- Alliance and partnership development—Continue to work with land managers to initiate planning and contribute to implementation of ecosystem-level restoration and management to benefit this taxon.

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

Date	No. wild individuals	No. outplanted	Stability Criteria identified in Recovery Plan	Stability Criteria Completed?
1999 (listing)	300–500	0	All threats managed in all three populations	No
			Complete genetic storage	No
			Three populations with 25 mature individuals each	No
2002 (recovery plan)	300–800	0	All threats managed in all three populations	No
			Complete genetic storage	No
			Three populations with 25 mature individuals each	No
2003 (critical habitat)	0 (Moloka‘i) ca 35 (Lāna‘i)	0	All threats managed in all three populations	No
			Complete genetic storage	No
			Three populations with 25 mature individuals each	No
2012 (5-year review)	300–800	0	All threats managed in all three populations	Partially, some fenced areas
			Complete genetic storage	No
			Three populations with 25 mature individuals each	Partially
2016 (critical habitat)	0 (Moloka‘i) < 40 (Lāna‘i)	0	All threats managed in all three populations	Partially, some fenced areas
			Complete genetic storage	No

			Three 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)	0 (Moloka‘i) several dozen (Lāna‘i)	0	All threats managed in all three populations	Partially, some fenced areas
			Complete genetic storage	Partial
			Reproduction (<i>i.e.</i> viable seeds, seedlings) at all three populations	No
			Three 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 after Preventing Extinction).

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

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulate degradation of habitat	A	Ongoing	Partial, some fenced areas
Established ecosystem altering invasive plant species degradation of habitat	A	Ongoing	Partial, some fenced areas
Drought loss or destruction of habitat	A	Ongoing	None
Climate change degradation or loss of habitat	A	Ongoing	None
Invertebrate predation or herbivory	C	Ongoing	None
Stochastic events—Reduced viability due to small number of individuals	E	Ongoing	None

References:

See the previous 5-year review for a full list of references (USFWS 2012). Only references for new information are provided below.

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- Donoho, M. 2016, in litt., 2015 annual report to the US Fish & Wildlife Service per the requirements of a Memorandum of Understanding dated January 26, 2016 between USFWS & Pūlama Lāna‘i. 5 pp.
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- Lyon Arboretum. 2017. Micropropagation and seed conservation laboratory databases.
- Nishibayashi, E. 2001, in litt., The wild, wide-ranging herds also are blamed in 36 road collisions, article in Honolulu Star-Bulletin, G.T. Kubota, 28 AUG 2001.
- Oppenheimer, H. 2018, in litt. Population information for Maui Nui plant species. Excel table.
- [PEPP] Plant Extinction Prevention Program. 2016. Plant Extinction Prevention Program FY 2016 Annual Report (Oct 1, 2015-Sep 30, 2016), US FWS CFDA Program #15.657; Endangered Species Conservation-Recovery Implementation Funds, Coop Agreement F14AC00174, December 24, 2016, UH Manoa, PCSU, PEPP. 237 pp.
- [US-GCRP] US GCRP Advisory Committee. 2009. Global climate change impacts in the United States. Karl, T.R., J.M. Melilo, and T.C. Peterson (eds.), Cambridge University Press. 189 pp.

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- [USFWS] 2012. Endangered and threatened wildlife and plants; listing 38 species on Molokai, Lanai, and Maui as Endangered and designating critical habitat on Molokai, Lanai, Maui, and Kahoolawe for 135 species; proposed rule. Department of the Interior, Federal Register 77 (112): 34464–34775, June 11, 2012.
- [USFWS] 2015. Memorandum of understanding between Lanai Resorts, LLC, Castle & Cooke Properties, Inc., and U.S. Department of the Interior, Fish and Wildlife Service. 36 pp.
- [USFWS] 2016. Endangered and threatened wildlife and plants; initiation of 5-year status reviews of 76 species in Hawai‘i, Oregon, Washington, Montana, and Idaho. Federal Register 81(29): 7571–7573, February 12, 2016.
- [USFWS] 2016. Endangered and threatened wildlife and plants; designation and nondesignation of critical habitat on Molokai, Lanai, Maui, and Kahoolawe for 135 species; final rule. Federal Register 81 (61): 17790–18110, March 30, 2016.
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U.S. FISH AND WILDLIFE SERVICE
SIGNATURE PAGE for 5-YEAR REVIEW of *Melicope munroi* (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

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