

Melicope munroi
(Alani)

**5-Year Review
Summary and Evaluation**

**U.S. Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office
Honolulu, Hawaii**

5-YEAR REVIEW

Species reviewed: *Melicope munroi* (Alani)

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5-YEAR REVIEW
***Melicope munroi* (Alani)**

1.0 GENERAL INFORMATION

1.1 Reviewers

Lead Regional Office:

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Lead Field Office:

Pacific Islands Fish and Wildlife Office, Loyal Mehrhoff, Field Supervisor, (808)
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Cooperating Field Office(s):

N/A

Cooperating Regional Office(s):

N/A

1.2 Methodology used to complete the review:

This review was conducted by staff of the Pacific Islands Fish and Wildlife Office of the U.S. Fish and Wildlife Service (USFWS), beginning on April 8, 2010. The review was based on the designation of critical habitat for *Melicope munroi* and the addendum to the recovery plan for the multi-island plants (USFWS 2003, 2002), as well as a review of current, available information. The Bernice Pauahi Bishop Museum provided an initial draft of portions of the review and recommendations for conservation actions needed prior to the next five-year review. The evaluation of Samuel Aruch, biological consultant, was reviewed by a recovery biologist and the Plant Recovery Coordinator. The document was then reviewed by the Recovery Program Leader and the Assistant Field Supervisor for Endangered Species before submission to the Field Supervisor for approval.

1.3 Background:

1.3.1 Federal Register (FR) Notice citation announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2010. Endangered and threatened wildlife and plants; 5-year review status of 69 species in Idaho, Washington, Hawaii, Guam, and the Commonwealth of the Northern Mariana Islands. Federal Register 75(67):17947-17950.

1.3.2 Listing history

Original Listing

FR notice: USFWS. 1999. Endangered and threatened wildlife and plants; final endangered status for 10 plant taxa from Maui Nui, Hawaii; final rule. Federal Register 64(171):48307-48324.

Date listed: September 3, 1999

Entity listed: Species

Classification: Endangered

Revised Listing, if applicable

FR notice: N/A

Date listed: N/A

Entity listed: N/A

Classification: N/A

1.3.3 Associated rulemakings:

USFWS. 2003a. Endangered and threatened wildlife and plants; final designation of critical habitat for three plant species from the island of Lanai, Hawaii; final rule. Federal Register 68(6):1220-1274.

USFWS. 2003b. Endangered and threatened wildlife and plants; final designations and nondesignations of critical habitat for 42 plant species from the island of Molokai, Hawaii; final rule. Federal Register 68(52):12982-13141.

The proposed critical habitat designation for 28 plant species, including *Melicope munroi*, was deferred because of a preexisting cooperative agreement with Castle and Cooke Resorts, LLC to manage the lands in proposed unit Lanai D, as well as adjacent lands, for the conservation benefit of the 28 listed species. Because large portions of proposed unit D were already being managed under the Lanai Forest and Watershed Partnership by Castle and Cooke on a voluntary basis in cooperation with USFWS and the State of Hawaii to achieve important conservation goals. It was decided that the benefits of excluding unit Lanai D from critical habitat designation outweighed the costs (USFWS 2003a).

Critical habitat was not proposed for *Melicope munroi* on the island of Molokai because the species no longer occurs on that island and essential habitat for the conservation of the species was not identifiable (USFWS 2003b).

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. Federal Register 77(112):34464-34775.

Critical habitat is currently being proposed for *Melicope munroi* (USFWS 2012).

1.3.4 Review History:

Species status review [FY 2011 Recovery Data Call (August 2011)]:
Undetermined

Recovery achieved:

1 (0-25%) (FY 2007 Recovery Data Call)

1.3.5 Species' Recovery Priority Number at start of this 5-year review:

5

1.3.6 Current Recovery Plan or Outline

Name of plan or outline: USFWS. 2002. Addendum to the recovery plan for the Multi-Island plants. U.S. Fish and Wildlife Service, Portland, Oregon. vii + 125 pages. Available online at

<<http://www.fws.gov/pacificislands/recoveryplans.html>>.

Date issued: December 10, 2002

Dates of previous revisions, if applicable: N/A

2.0 REVIEW ANALYSIS

2.1 Application of the 1996 Distinct Population Segment (DPS) policy

2.1.1 Is the species under review a vertebrate?

Yes
 No

2.1.2 Is the species under review listed as a DPS?

Yes
 No

2.1.3 Was the DPS listed prior to 1996?

Yes
 No

2.1.3.1 Prior to this 5-year review, was the DPS classification reviewed to ensure it meets the 1996 policy standards?

Yes
 No

2.1.3.2 Does the DPS listing meet the discreteness and significance elements of the 1996 DPS policy?

Yes
 No

2.1.4 Is there relevant new information for this species regarding the application of the DPS policy?

Yes

No

2.2 Recovery Criteria

2.2.1 Does the species have a final, approved recovery plan containing objective, measurable criteria?

Yes

No

2.2.2 Adequacy of recovery criteria.

2.2.2.1 Do the recovery criteria reflect the best available and most up-to date information on the biology of the species and its habitat?

Yes

No

2.2.2.2 Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria?

Yes

No

2.2.3 List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information:

A synthesis of the threats (Listing Factors A, B, C, D, and E) affecting this species is presented in Section 2.3.2 and Table 2.

Stabilizing, downlisting, and delisting objectives are provided in the addendum to the recovery plan for the multi-island plants (USFWS 2002), based on whether the species is an annual, a short-lived perennial (fewer than ten years), or a long-lived perennial. *Melicope munroi* is a long-lived perennial, and to be considered stabilized, which is the first step in recovering the species, the taxon must be managed to control threats (*e.g.*, fenced) and be represented in an *ex situ* (off-site) collection. In addition, a minimum of three populations should be documented on islands where they now occur or occurred historically. For the species to be considered stable, each of these populations must be naturally reproducing and increasing in number, with a minimum of 25 mature individuals per population.

This recovery objective has been partially met.

For downlisting, a total of five to seven populations of *Melicope munroi* should be documented on islands where they now occur or occurred historically. Each of

these populations must be naturally reproducing, stable or increasing in number, and secure from threats, with a minimum of 100 mature individuals per population. Each population should persist at this level for a minimum of five consecutive years before downlisting is considered.

This recovery objective has not been met.

For delisting, a total of eight to ten populations of *Melicope munroi* should be documented on islands where they now occur or occurred historically. Each of these populations must be naturally reproducing, stable or increasing in number, and secure from threats, with 100 mature individuals per population. Each population should persist at this level for a minimum of five consecutive years before delisting is considered.

This recovery objective has not been met.

2.3 Updated Information and Current Species Status

2.3.1 Biology and Habitat

2.3.1.1 New information on the species' biology and life history:

Little is known about the life history of *Melicope munroi*. Its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors remain unknown (USFWS 2002, 2003a, 2003b). Hank Oppenheimer (Plant Extinction Prevention Program, pers. comm. 2010) noted that he has never observed seedlings or saplings in the wild, nor has he ever found fruit capsules, and wondered whether the flowers were being eaten by Lepidoptera, as happens with some other species of *Melicope*.

2.3.1.2 Abundance, population trends (e.g. increasing, decreasing, stable), demographic features (e.g., age structure, sex ratio, family size, birth rate, age at mortality, mortality rate, etc.), or demographic trends:

At the time the species was federally listed in 1999, *Melicope munroi* was known from only a single widely scattered population of about 300 to 500 individuals on Lanai on the Lanaihale summit ridge (USFWS 1999). The numbers were soon thereafter revised to two populations totaling an estimated 300 to 800 individuals on privately owned land on the Lanaihale summit, the head of Hauola Gulch, and Waialala Gulch (USFWS 2002). *Melicope munroi* was last collected on Molokai in 1910 by J.F. Rock, and it is now assumed to be extinct there (USFWS 2003b).

In the proposed designation of critical habitat for Lanai, the census estimate was drastically reduced to two populations totaling about 35 individuals (USFWS 2003a).

In 2006, a population of about 100 individuals was reported by Ken Wood from the headwaters of Hauola Gulch, just northwest of Haalelepaakai summit (National Tropical Botanical Garden 2010).

The latest census estimate for *Melicope munroi* is 300 to 800 individuals within a single population (USFWS 2010). Ken Wood (National Tropical Botanical Garden, pers. comm. 2010) believes there could easily be more than 300 individuals; he has observed individuals of *M. munroi* from Kunoa, Hauola, and Lopa Gulches, and in the drainage emptying into Waiopae Gulch, south of Kahinahina Ridge. Hank Oppenheimer (pers. comm. 2010) agrees that existing individuals could be considered as a single large population, but does not agree that there are as many as 800 individuals of *M. munroi*.

2.3.1.3 Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.):

No new information.

2.3.1.4 Taxonomic classification or changes in nomenclature:

Melicope munroi is a long-lived, sprawling perennial shrub in the citrus family (Rutaceae). It was originally described in 1944 by Harold St. John in the nearly endemic Hawaiian genus *Pelea* (except for two species from the Marquesas Islands) as *P. munroi*, based on a collection by George Munro in 1915 from Lanaihale, Lanai (St. John 1944; Wagner *et al.* 1999). The genus *Pelea* has since been submerged into the Pacific genus *Melicope*, creating the combination *M. munroi* (Wagner *et al.* 1999; USFWS 1999, 2002). Wagner *et al.* (1999) attributed the species only to Lanai, although a specimen collected by Joseph Rock in 1910 above Kamalo on Molokai was determined as *M. munroi* (Hawaii Biodiversity and Mapping Program 2010) in 1989 by Warren Wagner (Bishop Museum 2011). That specimen remains the only documentation of *M. munroi* on Molokai, and it is now assumed to be extinct there (USFWS 2003b).

2.3.1.5 Spatial distribution, trends in spatial distribution (e.g. increasingly fragmented, increased numbers of corridors, etc.), or historic range (e.g. corrections to the historical range, change in distribution of the species' within its historic range, etc.):

No new information.

2.3.1.6 Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem):

Melicope munroi is typically found on slopes in lowland wet shrublands at 701 to 1,032 meters (2,299 to 3,385 feet) elevation. Associated native plant taxa include *Diplopterygium pinnatum* (uluhe lau nui), *Dicranopteris linearis* (uluhe), *Metrosideros polymorpha* (ohia), *Cheirodendron trigynum* (olapa), *Coprosma* spp. (pilo), *Broussaisia arguta* (kanawao), other *Melicope* spp., *Kadua* spp., *Wikstroemia bicornuta* (akia), and *Machaerina angustifolia* (uki) (USFWS 1999, 2002, 2003a; H. Oppenheimer, pers. comm. 2010).

The habitat at Hauola Gulch is a riparian, mostly open-canopied *Metrosideros* forest with 80 percent groundcover of the matted ferns *Diplopterygium* and *Dicranopteris*; *Melicope munroi* was present as an emergent, diffusely branched shrub up to 3-meters (10-feet) tall in the fern understory. Associated native understory trees and shrubs include *Pittosporum confertiflorum* (hoawa), *Scaevola chamissoniana* (naupaka kuahiwi), *Pipturus albidus* (mamaki), *Clermontia arborescens* (oha wai nui), *C. grandiflora* (oha wai), *Freycinetia arborea* (ieie), *Cyrtandra grayana* (haiwale), *Dubautia laxa* (naenae pua melemele), and *D. plantaginea* (naenae) (National Tropical Botanical Garden 2010). Nothing is known of the preferred habitats or native plants associated with *Melicope munroi* on Molokai (USFWS 2003b).

2.3.1.7 Other:

No new information.

2.3.2 Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)

2.3.2.1 Present or threatened destruction, modification or curtailment of its habitat or range:

Threats:

- Ungulate degradation of habitat – Axis deer (*Axis axis*) (USFWS 1999, 2002, 2003a)
- Established ecosystem-altering invasive plant species degradation of habitat
 - *Clidemia hirta* (Koster's curse) (K. Wood, pers. comm. 2010; H. Oppenheimer, pers. comm. 2010)
 - *Morella faya* (firetree) (K. Wood, pers. comm. 2010; H.

Oppenheimer, pers. comm. 2010)

- *Psidium cattleianum* (strawberry guava) (USFWS 1999, 2002, 2003a)

Current conservation efforts:

- Ungulate exclosure – Castle and Cooke is constructing approximately 35 kilometers (22 miles) of fencing around the Lanaihale summit to control feral axis deer. The fence will be completed in three increments. The first increment is completed and the second increment is well under construction (H. Oppenheimer, pers. comm. 2010).

2.3.2.2 Overutilization for commercial, recreational, scientific, or educational purposes:

None reported.

2.3.2.3 Disease or predation:

Threats:

- Ungulate predation or herbivory – Axis deer (USFWS 1999, 2002, 2003a)
- Black twig borer – (*Xylosandrus compactus*), which burrows into the twigs of host plants to lay eggs, at the same time introducing pathogens. Symptoms include branch dieback, and in extreme infestations, tree death. There is a wide array of host plants in Hawaii, including both economic crops and native forest trees (Tenbrink and Hara 2007; USFWS 2010)

2.3.2.4 Inadequacy of existing regulatory mechanisms:

Threats:

- Lack of adequate hunting regulation in areas with ungulates – The lack of adequate ungulate control and the existence of established hunting programs in areas where *Melicope munroi* occurs continue to threaten this species.

2.3.2.5 Other natural or manmade factors affecting its continued existence:

Threats:

- Ungulate trampling – Axis deer (USFWS 1999, 2002, 2003a)
- Established invasive plant species competition:

- *Cinnamomum burmannii* (Padang cassia) (K. Wood, pers. comm. 2010; H. Oppenheimer, pers. comm. 2010)
- *Leptospermum scoparium* (New Zealand tea) (USFWS 1999, 2002, 2003a)
- *Pluchea carolinensis* (sourbush) (K. Wood, pers. comm. 2010; H. Oppenheimer, pers. comm. 2010)
- *Tibouchina herbacea* (K. Wood, pers. comm. 2010; H. Oppenheimer, pers. comm. 2010)
- Climate change may pose a threat to this species. However, current climate change analyses in the Pacific Islands lack sufficient spatial resolution to make predictions on impacts to this species. The Pacific Islands Climate Change Cooperative (PICCC) has currently funded climate modeling that will help resolve these spatial limitations. We anticipate high spatial resolution climate outputs by 2013.

Current conservation efforts:

There are no reports of controlled propagation of this species, nor any genetic seed storage, by the Center for Conservation Research and Training Seed Storage Laboratory (2011), Harold L. Lyon Arboretum (2011), or National Tropical Botanical Garden (2011).

2.4 Synthesis

The interim stabilization goals for this species have been partially met. The latest census estimate for *Melicope munroi* is 300 to 800 individuals within a single population on Lanai (Table 1). However, there is no material of this species in *ex situ* collections and all threats are not being managed (Table 2). Therefore, *Melicope munroi* meets the definition of endangered as it remains in danger of extinction throughout its range.

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

Date	No. wild individuals	No. outplanted	Stabilization Criteria identified in Recovery Plan	Stabilization Criteria Completed?
1999 (listing)	300-500	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 25 mature individuals each	No
2002 (recovery plan)	300-800	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 25 mature individuals each	No
2003 (critical habitat)	35	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 25 mature individuals each	No
2012 (5-year review)	300-800	0	All threats managed in all 3 populations	Partially (See Table 2)
			Complete genetic storage	No
			3 populations with 25 mature individuals each	Partially

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

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulates – Degradation of habitat, herbivory, trampling	A, C, D, E	Ongoing	Partially: Ungulate exclosure constructed at Lanaihale summit; fencing not complete
Established ecosystem-altering invasive plant species degradation of habitat	A	Ongoing	No
Black twig borer	C	Ongoing	No
Established invasive plant species competition	E	Ongoing	No
Climate change	A, E	Increasing	No

3.0 RESULTS

3.1 Recommended Classification:

Downlist to Threatened

Uplist to Endangered

Delist

Extinction

Recovery

Original data for classification in error

No change is needed

3.2 New Recovery Priority Number:

Brief Rationale:

3.3 Listing and Reclassification Priority Number:

Reclassification (from Threatened to Endangered) Priority Number: _____

Reclassification (from Endangered to Threatened) Priority Number: _____

Delisting (regardless of current classification) Priority Number: _____

Brief Rationale:

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

- Captive propagation for genetic storage and reintroduction:
 - Collect cuttings or seed from tagged individuals, keeping close track of the maternal source for use in *ex situ* propagation.
 - Collect seeds from all existing populations and send to at least two or three different venues for propagation and storage.
 - Explore alternate methods of propagation (e.g., cuttings, air-layering, and tissue culture).
- Reintroduction / translocation protocol development – Maximize the genetic variation among individuals at each reintroduction site, based on microsatellite data and detailed information from crossing records.
- Reintroduction / translocation site identification – While surveying for new populations or reintroduced populations, determine which sites are least invaded by invasive introduced plant species and which appear to have the highest likelihood of maintaining new reintroductions.
- Ungulate exclosures – Complete the Lanaihale summit fencing project to protect populations of *M. munroi*.
- Ungulate control – Once the fencing at Lanaihale is completed, control ungulates within the fenced exclosure.
- Ecosystem-altering invasive plant species control – Control invasive introduced plant species around all populations.
- Surveys / inventories – Continue to search for *Melicope munroi* in habitats where it has historically been found on Lanai and Molokai, as well as in other potentially suitable habitats.
- Threats research – Develop and implement effective control methods for black twig borer. Methods to control black twig borer should be developed and implemented if possible.
- Threat monitoring and control – Monitor newly established reintroduced and wild populations for evidence of plant disease and insect predation. If threats are found implement effective control methods.
- Alliance and partnership development – Work with Castle and Cooke and other land managers to initiate planning and contribute to implementation of ecosystem-level restoration and management to benefit this species.
- Threats research – Assess the modeled effects of climate change on this species, and use to determine future landscape needed for the recovery of the species.

5.0 REFERENCES

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critical habitat on Molokai, Lanai, Maui and Kahoolawe for 135 species. Federal Register 77(112):34464-34775.

Wagner, W.L., D.R. Herbst, and S.H. Sohmer. 1999. Manual of the flowering plants of Hawaii, revised edition. University of Hawaii and Bishop Museum Press, Honolulu, Hawaii. 1,918 pages.

Personal communications:

Oppenheimer, Hank. 2010. Maui Nui Coordinator, Plant Extinction Prevention Program, Lahaina, Hawaii. E-mail to Clyde Imada, Bernice Pauahi Bishop Museum, dated October and December 2010. Subject: *Melicope munroi*.

Wood, Ken. 2010. Research Biologist, National Tropical Botanical Garden, Kalaheo, Hawaii. E-mail to Clyde Imada, Bernice Pauahi Bishop Museum, dated December 1, 2010. Subject: *Neraudia sericea*.

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U.S. FISH AND WILDLIFE SERVICE
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

Appropriate Listing/Reclassification Priority Number, if applicable: _____

Review Conducted By:

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Date 8/28/2012