

Melicope pallida
(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 pallida* (alani)

TABLE OF CONTENTS

1.0	GENERAL INFORMATION	1
1.1	Reviewers.....	1
1.2	Methodology used to complete the review:.....	1
1.3	Background:	1
2.0	REVIEW ANALYSIS.....	3
2.1	Application of the 1996 Distinct Population Segment (DPS) policy	3
2.2	Recovery Criteria.....	4
2.3	Updated Information and Current Species Status	5
2.4	Synthesis.....	8
3.0	RESULTS	12
3.3	Recommended Classification:.....	12
3.3	Listing and Reclassification Priority Number:	12
4.0	RECOMMENDATIONS FOR FUTURE ACTIONS.....	13
5.0	REFERENCES.....	13
	Signature Page.....	15

5-YEAR REVIEW
***Melicope pallida* / alani**

1.0 GENERAL INFORMATION

1.1 Reviewers

Lead Regional Office:

Region 1, Endangered Species Program, Division of Recovery, Jesse D'Elia, (503) 231-2071

Lead Field Office:

Pacific Islands Fish and Wildlife Office, Loyal Mehrhoff, Field Supervisor, (808) 794-9400

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 29, 2008. The review was based on the final critical habitat designation for *Melicope pallida* and other species from the islands of Oahu and Kauai (USFWS 2003a,b), as well as a review of current, available information. The National Tropical Botanical Garden 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 the Plant Recovery Coordinator. The document was then reviewed by the Assistant Field Supervisor for Endangered Species and Acting Deputy Field Supervisor 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. 2008. Endangered and threatened wildlife and plants; initiation of 5-year status reviews of 70 species in Idaho, Montana, Oregon, Washington, and the Pacific Islands. Federal Register 73(83):23264-23266.

1.3.2 Listing history

Original Listing

FR notice: USFWS. 1994. Endangered and threatened wildlife and plants; determination of endangered or threatened status for 24 plants from the island of Kauai, Hawaii; final rule. Federal Register 59(38):9304-9329.

Date listed: February 25, 1994

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 or nondesignation of critical habitat for 95 plant species from the islands of Kauai and Niihau, Hawaii; final rule. Federal Register 68(39):9116-9479.

USFWS. 2003b. Endangered and threatened wildlife and plants; final designation or nondesignation of critical habitat for 101 plant species from the island of Oahu, Hawaii; final rule. Federal Register 68(116):35949-35998.

Critical habitat was designated for *Melicope pallida* in 2 units totaling 453 hectares (1,118 acres) on the island of Kauai (USFWS 2003a).

These designations includes habitat on state lands (USFWS 2003a).

Critical habitat was designated for *Melicope pallida* in 5 units totaling 1,321 hectares (3,265 acres) on the island of Oahu (USFWS 2003b).

These designations includes habitat on state, private, and federal lands (USFWS 2003b).

1.3.4 Review History:

Species status review [FY 2009 Recovery Data Call (September 2009)]:
Improving

Recovery achieved:

1 (0-25%) (FY 2007 Recovery Data Call – this was the last year this was reported)

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. Recovery plan for the Kauai plant cluster. U.S. Fish and Wildlife Service, Portland, Oregon. 270 pages.

Date issued: September 20, 1995.

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 (Factors A, C, D, and E) affecting this species is presented in section 2.4. Factor B (overutilization for commercial, recreational, scientific, or educational purposes) is not known to be a threat to this species.

Stabilizing, downlisting, and delisting objectives are provided in the recovery plan for the Kauai plant cluster (USFWS 1995), based on whether the species is an annual, a short-lived perennial (fewer than 10 years), or a long-lived perennial. *Melicope pallida* 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, weeding, etc.) 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. 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 met, there are three populations with greater than 25 mature individuals.

For downlisting, a total of five to seven populations of *Melicope pallida* 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 pallida* 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 300 mature individuals per population for short-lived perennials. 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

In addition to the status summary table below, information on the species' status and threats was included in the final critical habitat rule referenced above in section 1.3.3 ("Associated Rulemakings") and in section 2.4 ("Synthesis") below, which also includes any new information about the status and threats of the species.

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

Date	No. wild individuals	No. outplanted	Downlisting Criteria identified in Recovery Plan	Downlisting Criteria Completed?
1994 (listing)	<100	0	All threats managed in all 5-7 populations	No
			Complete genetic storage	No
			3 populations with 300 mature individuals each	No
			Naturally reproducing, stable, and increasing in number	Unknown
			Stable for five consecutive years	Unknown
1995 (recovery plan)	156	0	All threats managed in all 5-7 populations	No
			Complete genetic storage	Partially
			3 populations with 300 mature individuals each	No
			Naturally reproducing, stable, and increasing in number	Unknown
			Stable for five consecutive years	Unknown
2003 (critical habitat)	182	0	All threats managed in all 5-7 populations	No
			Complete genetic storage	Partially
			3 populations with 300 mature individuals each	No
2008 (5-year review)	217-296	0	All threats managed in all 5-7 populations	No
			Complete genetic	Partially

Date	No. wild individuals	No. outplanted	Downlisting Criteria identified in Recovery Plan	Downlisting Criteria Completed?
			storage	
			3 populations with 300 mature individuals each	No
			Naturally reproducing, stable, and increasing in number	Unknown
			Stable for five consecutive years	Unknown

2.3.1 Biology and Habitat

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

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:

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

2.3.1.4 Taxonomic classification or changes in nomenclature:

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.):

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

2.3.1.7 Other:

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:

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

2.3.2.3 Disease or predation:

2.3.2.4 Inadequacy of existing regulatory mechanisms:

2.3.2.5 Other natural or manmade factors affecting its continued existence:

2.4 Synthesis

Melicope pallida was historically known from the Waianae Mountains of Oahu from the base of Mount Kaala and near Palikea, within The Nature Conservancy of Hawaii's Honouliuli Preserve, and along the western rim of Kalalau Valley on Kauai (USFWS 1995). No living individuals of *M. pallida* have been observed on Oahu since 1970 nor has another collection been made on Kauai since 1952 (Bishop Museum Herbarium 2000). Lorence and Flynn (1995) published the rediscovery of *M. pallida* on Kauai and reported it to be widespread within several Na Pali Coast valleys (Wood 2008). In 1995, USFWS estimated there were 158 individuals at several locations on Kauai (USFWS 1995).

Currently, *Melicope pallida* is restricted to 7 valleys on northwestern Kauai with an estimated total of 217 to 296 individuals. Locations include Awaawapuhi Valley (50 to 60 individuals); Hanakapiai Valley (6 individuals); Honopu Valley (50 to 60 individuals); Honopu Ridge above Awaawapuhi Valley (5 individuals); Kalalau Valley (about 100 to 150 individuals); Koaie Canyon (five to ten individuals); Pohakuao (5 to 10 individuals); and Waiahuakua Valley (5 individuals) (Tangalin 2008; Wood 2008).

In Awaawapuhi Valley, about 50 individuals of *Melicope pallida* are known in an area from 866 to 1,050 meters (2,840 to 3,100 feet) elevation. In Hanakapiai, *M. pallida* occurs on the western side of the valley, on cliffs below Pohakea, at 457 meters (1,550 feet) elevation. In Honopu, it occurs from 853 meters (2,800 feet) at Honopu Rim, from 975 to 1,067 meters (3,200 to 3,500 feet) elevation on the Honopu Trail, to 1,274 meters (4,180 feet) elevation in upper Honopu (Wood 2008).

In Kalalau Valley, *Melicope pallida* grows along exposed ridges on the edge of cliff habitat on the northern side of the valley, east of Keanapuka Falls; on

north-facing mesic cliffs and slopes between the Puu o Kila and Kalalau lookouts, at 914 to 990 meters (3,000 to 3,248 feet) elevation; on the back walls of the valley below Pihea; on the slopes of the Kalahu region, down the dividing ridge between Honopu and Kalalau, on cliffs on the Kalalau side, about 200 to 300 meters (656 to 984 feet) east of the Navy plane crash debris site at 762 meters (2,500 feet) elevation; and on Alealau cliffs above Kaaalahina (Wood 2008).

In Koaie Canyon, *Melicope pallida* grows along stream sides from 805 to 859 meters (2,641 to 2,818 feet) elevation. In Pohakuao's hanging valley between Kalalau and Hanakoa, *M. pallida* grows at 400 to 500 meters (1,312 to 1,640 feet) elevation. In the Waiahuakua Valley, in the Hono o Na Pali Natural Area Reserve, *M. pallida* grows in the back of the valley by the main waterfall, on cliffs west of the main falls, at 457 meters (1,500 feet) elevation. In 1994, a single tree of *M. pallida* was seen in the upper Limahuli Valley, on the northeastern side of the ridge above Limahuli waterfall at 607 meters (1,991 feet) elevation, but has not been relocated since (Wood 2008).

The plant community associated with *Melicope pallida* in Awaawapuhi is *Metrosideros polymorpha* – *Acacia koa* mesic forest with *Alphitonia ponderosa* (kauila), *Alyxia stellata* (maile), *Antidesma platyphyllum* (hame), *Carex wahuensis* (no common name [NCN]), *Dianella sandwicensis* (uki uki), *Coprosma waimeae* (olena), *Dicranopteris linearis* (uluhe), *Dodonaea viscosa* (aali), *Doodia kunthiana* (okupukupu), *Kadua affinis* (manono), *Leptecophylla tameiameiae* (pukiawe), *Melicope anisata* (mokihana), *Melicope barbiger* (alani), *Myrsine alyxifolia* (kolea), *Pouteria sandwicensis* (alaa), *Pritchardia minor* (loulu), *Psychotria greenwelliae* (kopiko), *P. mariniana* (kopiko), *Scaevola procera* (naupaka kuahiwi), and *Tetraplasandra waimeae* (ohe kikoola) (National Tropical Botanical Garden 2006; Wood 2008).

The habitat in Hanakapiai Valley where *Melicope pallida* occurs is *Diospyros sandwicensis* (lama) mesic forest and cliff shrubland with associated species including *Chamaesyce celastroides* (akoko), *Alphitonia ponderosa*, *Alyxia stellata*, *Artemisia australis* (ahinahina), *Bidens* spp. (kookoolau), *Bobea elatior* (ahakea lau nui), *Eragrostis variabilis* (kawelu), *Hibiscus kokio* subsp. *saintjohnianus* (Kokia ula), *Kadua affinis* (manono), *Leptecophylla tameiameiae*, *Metrosideros polymorpha* (ohia), *Pittosporum napaliensis* (hoawa), *Pritchardia napaliensis* (loulu), *Psychotria* spp. (kopiko), *Psydrax odorata* (alahee), *Pteralyxia kauaiensis* (kaulu), *Rauvolfia sandwicensis* (hao), *Syzygium sandwicensis* (ohia ha), *Tetraplasandra* sp. (ohe), and *Wilkesia gymnoxiphium* (iliau) (National Tropical Botanical Garden 2006; Wood 2008).

The Honopu sites have *Acacia koa* – *Metrosideros polymorpha* montane mesic forest habitat and *Metrosideros polymorpha* – *Dicranopteris linearis* montane mesic forest

habitat with *Alphitonia* sp., *Artemisia* sp., *Bohea brevipes* (akahea lau nui), *Boehmeria grandis* (akolea), *Carex* spp. (NCN), *Chamaesyce atrococca* (akoko), *Cocculus triloba* (huehue), *Coprosma waimeae*, *Cryptocarya* sp., *Dianella sandwicensis*, *Dodonaea viscosa*, *Kadua affinis*, *K. flynnii* (NCN), *K. knudsenii* (NCN), *Lepidium serra* (anaunau), *Leptecophylla tameiameia*, *Lobelia yuccoides* (panaunau), *Lysimachia kalalauensis* (NCN), *Melicope anisata*, *M. barbiger*, *Myrsine alyxifolia*, *Nestegis sandwicensis* (olopua), *Nototrichium divaricatum* (kului), *Pleomele aurea* (hala pepe), *Pouteria sandwicensis*, *Pritchardia minor*, *Psychotria mariniana*, *Tetraplasandra waimeae*, and *Wilkesia gymnoxiphium* (National Tropical Botanical Garden 2006; Wood 2008).

In Koaie Canyon, in *Metrosideros polymorpha* – *Dicranopteris linearis* transitional mesic to wet forest along stream walls in the back of the canyon *Melicope pallida* grows with other associated species, including *Alyxia stellata*, *Boehmeria grandis*, *Carex* spp., *Claoxylon sandwicensis* (laukea), *Coprosma* spp., *Cyrtandra* spp. (haiwale), *Dodonaea viscosa*, *Dubautia* spp. (naenaena), *Elaeocarpus bifidus* (kalia), *Embelia pacifica* (kolioe), *Freycinetia arborea* (ie ie), *Lepidium serra* (anaunau), *Machaerina angustifolia* (uki), *Nestegis sandwicensis*, *Perrottetia sandwicensis* (olomea), *Pipturus* spp. (mamake), *Pleomele aurea*, *Pouteria sandwicensis*, *Psychotria* spp., and *Syzygium sandwicense* (National Tropical Botanical Garden 2006; Tangalin 2008; Wood 2008).

On diverse mesic cliff and wet *Metrosideros polymorpha* – *Cheirodendron* sp. (olapa) montane forest communities on the northern side of Kalalau Valley, east of Keanapuka Falls, and on the ridge below and west of Pihea, *Melicope pallida* grows with various combinations of associated species including *Acacia koa*, *Artemisia australis*, *Astelia argyrocoma*, *Bidens sandwicensis*, *Bohea* sp., *Boehmeria grandis*, *Broussaisia arguta* (kanawao), *Carex meyenii*, *Chamaesyce celastroides* var. *hanapepensis*, *C. eleanoriae* (akoko), *C. remyi* (akoko), *Cheirodendron* spp., *Dicranopteris linearis* (uluhe), *Diospyros sandwicensis*, *Diplazium sandwichianum* (hoio), *Dubautia* spp., *Eragrostis variabilis*, *Eurya sandwicensis* (anini), *Festuca* sp. nov. (fescue), *Freycinetia arborea*, *Gunnera kauaiensis* (ape ape), *Hibiscadelphus woodii* (hau kuahiwi), *Hillebrandia sandwicensis* (aka aka awa), *Ilex anomala* (aiea), *Kadua flynnii*, *Labordia waialealae* (kamakahala lau lii), *Lysimachia glutinosa* (NCN), *L. kalalauensis* (NCN), *Melicope peduncularis* (alani), *Myrsine lessertiana* (kolea lau nui), *M. linearifolia* (kolea), *Neraudia kauaiensis* (NCN), *Nototrichium divaricatum*, *Panicum lineale* (NCN), *Perrottetia*, *Pipturus kauaiensis*, *Poa mannii* (NCN), *Pouteria sandwicensis*, *Psychotria greenwelliae*, *P. mariniana*, *Santalum freycinetianum* var. *pyrularium* (iliahi), *Syzygium sandwicensis*, *Touchardia latifolia* (olona), and *Wilkesia gymnoxiphium* (National Tropical Botanical Garden 2006; Wood 2008).

The *Metrosideros polymorpha* – *Diospyros sandwicensis* lowland forest and cliff plant communities at Pohakuao include associated species *Charpentiera densiflora* (papala), *Exocarpos luteolus* (heau), *Festuca* sp. nov., *Flueggea neowawraea* (mehamehame),

Pteralyxia kauaiensis, *Kadua flynnii*, *Kokia kauaiensis* (kokio), *Neraudia sandwicensis*, *Nototrichium divaricatum*, and *Santalum freycinetianum* var. *pyrularium* (iliahi). In Waiahuakua Valley, *Melicope pallida* grows in *Diospyros sandwicensis* mesic to *Diospyros sandwicensis* – *Metrosideros polymorpha* lowland mesic forest with *Artemisia australis*, *Bidens forbesii* (kookoolau), *Chamaesyce* spp., *Cibotium nealiae* (hapuu), *Elaeocarpus bifidus*, *Freycinetia arborea*, *Santalum freycinetianum* var. *pyrularium* (iliahi), *Pipturus* spp., *Pisonia* sp., *Psychotria* spp., and *Rauvolfia sandwicensis* (National Tropical Botanical Garden 2006; Wood 2008).

Invasive introduced plant species that threaten *Melicope pallida* by competing for resources and modifying the habitat include *Ageratum conyzoides* (spreading mist flower), *Blechnum appendiculatum* (NCN), *Bryophyllum pinnatum* (airplant), *Erigeron karvinskianus* (daisy fleabane), *Hedychium gardnerianum* (kahili ginger), *Lantana camara* (lantana), *Psidium guajava* (common guava), *Rubus argutus* (blackberry), *Sphaeropteris cooperi* (Australian tree fern), and *Verbena littoralis* (vervain) (Factor E) (National Tropical Botanical Garden 2006; Tangalin 2008; Wood 2008).

Feral ungulates, including pigs (*Sus scrofa*), feral goats (*Capra hircus*), and mule deer (*Odocoileus hemionus*), modify the habitat and damage plants (Factors A, C, and D) (National Tropical Botanical Garden 2006). Pig sign and goats were observed in the Honopu area in 2008 (Tangalin 2008). Other threats include landslides (Factor E); hurricanes (Factor E); and human disruption (Factor E) (National Tropical Botanical Garden 2006).

Herbivory by rats (*Rattus* spp.) and flower damage by introduced nectar-robbing passerine birds have both been reported (Factor C) (National Tropical Botanical Garden 2006; Wood 2008).

Climate change may also pose a threat to *Melicope pallida* (Factors A and E). However, current climate change models do not allow us to predict specifically what those effects, and their extent, would be for this species.

A risk of extinction from stochastic natural events is present, as Kauai has had several hurricanes in the last few decades (Factor E). Warmer temperatures as a result of global warming could modify the climate at the elevations where this species presently grows (Factor E) (LaPointe 2005; U.S. Environmental Protection Agency 1998). The loss of reproductive vigor as the result of limited numbers of existing individuals is another concern as numbers of individuals decline and the populations become more isolated (Factor E).

Melicope species in general appear to be difficult to germinate, with many having undeveloped embryos. In the field they are observed to have only a few good seeds. Many capsules are empty or have only minute, undeveloped seeds

(Tangalin 2008). There has been very little success propagating *Melicope pallida* or other *Melicope* species (M. Tapati, National Tropical Botanical Garden, pers. comm. 2008; C. Walters, National Center for Genetic Resource Preservation, pers. comm. 2008). The National Tropical Botanical Garden has 112 seeds of *Melicope pallida* and 10 other types of propagules in storage (National Tropical Botanical Garden 2009).

Melicope pallida remains in most of the areas where it was found when listed, at actually higher numbers. This is attributable to more thorough surveys, and not to population growth. Seedlings have not been reported, and there seem to be barriers to reproduction and/or regeneration, including low seed viability. Pollination has not been studied, but could be a factor. Threats to the species and its habitats are worse than twenty years ago.

The downlisting goals for this species have not been met (see Table 1), as no population has more than 100 mature individuals and all threats are not being managed. Therefore, *Melicope pallida* meets the definition of endangered as it remains in danger of extinction throughout its range.

3.0 RESULTS

3.3 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

- Fence to exclude ungulates from wild populations.
- Weed around existing plants to remove competition from introduced invasive species, and hopefully increase the possibility of *in situ* regeneration.
- Collect seed from all populations for genetic storage, research, and propagation.
- Determine barriers to seed viability.
- Research methods of germination and propagation.
- Work with Hawaii Division of Forestry and Wildlife and Hawaii State Parks to initiate planning and contribute to implementation of ecosystem-level restoration and management to benefit this species.

5.0 REFERENCES

- Bishop Museum Herbarium. 2000. *Melicope* vouchers. Bishop Museum, Honolulu, Hawaii. 44 pages. Unpublished.
- LaPointe, D., T. Benning and C. Atkinson. 2005. Avian malaria, climate change, and native birds of Hawaii. Pages 317-321 in T. Lovejoy (editor), *Climate change and biodiversity*. Yale University Press, New Haven, Connecticut. 440 pages.
- Lorence, D.H., and T. Flynn. 1995. Contributions to the flora of Hawaii. III. New additions, range extensions, and rediscoveries of flowering plants. *Bishop Museum Occasional Papers, Records of the Hawaii Biological Survey* 41:1-80.
- National Tropical Botanical Garden. 2006. Living collections database. National Tropical Botanical Garden, Kalaheo, Hawaii. Unpublished.
- National Tropical Botanical Garden. 2009. Report on controlled propagation of listed and candidate species, as designated under the U.S. Endangered Species Act. National Tropical Botanical Garden, Kalaheo, Hawaii. Unpublished.
- Tangalin, N. 2008. *Melicope pallida*. National Tropical Botanical Garden, Kalaheo, Hawaii. 2 pages. Unpublished.
- U.S. Environmental Protection Agency, Office of Policy. 1998. *Climate change and Hawaii*. Available online at

<[http://yosemite.epa.gov/oar/GlobalWarming.nsf/UniqueKeyLookup/SHSU5BUNQM/\\$File/hi_impct.pdf](http://yosemite.epa.gov/oar/GlobalWarming.nsf/UniqueKeyLookup/SHSU5BUNQM/$File/hi_impct.pdf)>. Accessed 25 November 2008.

[USFWS] U.S. Fish and Wildlife Service. 1994. Endangered and threatened wildlife and plants; determination of endangered or threatened status for 24 plants from the island of Kauai, Hawaii; final rule. Federal Register 59(38):9304-9329.

[USFWS] U.S. Fish and Wildlife Service. 1995. Recovery plan for the Kauai plant cluster. U.S. Fish and Wildlife Service, Portland, Oregon. 270 pages.

[USFWS] U.S. Fish and Wildlife Service. 2003a. Endangered and threatened wildlife and plants; final designation or nondesignation of critical habitat for 95 plant species from the islands of Kauai and Niihau, Hawaii; final rule. Federal Register 68(39):9116-9479.

[USFWS] U.S. Fish and Wildlife Service. 2003b. Endangered and threatened wildlife and plants; final designation or nondesignation of critical habitat for 101 plant species from the island of Oahu, Hawaii; final rule. Federal Register 68(116):35949-35998.

Wood, K.R. 2008. Notes on *Melicope pallida* (Hillebr.) T.G. Hartley & B.C. Stone (Rutaceae). National Tropical Botanical Garden, Kalaheo, Hawaii. 5 pages. Unpublished.

Personal Communications

Clark, Margaret. 2008. Seed Bank Manager, National Tropical Botanical Garden, Kalaheo, Hawaii. *Melicope pallida*: note to the record, dated November 28, 2008.

Tapati, M. 2008. Micropropagation Laboratory Manager, National Tropical Botanical Garden, Kalaheo, Hawaii. E-mail to Margaret Clark, National Tropical Botanical Garden, dated November 26, 2008. Subject: *Melicopes*.

Walters, Christina. 2008. Lead Scientist, National Center for Genetic Resource Preservation, Fort Collins, Colorado. E-mail to Margaret Clark, National Tropical Botanical Garden, dated November 29, 2008. Subject: *Melicopes*.

Signature Page
U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of *Melicope pallida* (alani)

Current Classification: _____ E _____

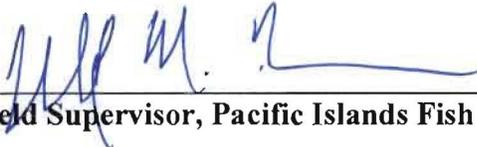
Recommendation resulting from the 5-Year Review:

- Downlist to Threatened
- Uplist to Endangered
- Delist
- No change needed

Appropriate Listing/Reclassification Priority Number, if applicable: _____

Review Conducted By:

Marie Bruegmann, Plant Recovery Coordinator
Marilet A. Zablan, Assistant Field Supervisor for Endangered Species
Jeff Newman, Acting Deputy Field Supervisor

Approved  Date **AUG 27 2010**
Acting Field Supervisor, Pacific Islands Fish and Wildlife Office