

Diellia pallida
(No Common Name)

**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: *Diellia pallida* (no common name)

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5-YEAR REVIEW
***Diellia pallida* (no common name)**

1.0 GENERAL INFORMATION

1.1 Reviewers

Lead Regional Office:

Region 1, Jesse D'Elia, Chief, Division of Recovery, (503) 231-2071.

Lead Field Office:

Pacific Islands Fish and Wildlife Office, Gina Shultz, Assistant Field Supervisor for Endangered Species, (808) 792-9400.

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 (PIFWO) of the U.S. Fish and Wildlife Service (USFWS) between June 2006 and June 2007. The National Tropical Botanical Garden provided most of the updated information on the current status of *Diellia pallida*. They also provided recommendations for conservation actions that may be needed prior to the next five-year review. The evaluation of the lead PIFWO biologist was reviewed by the Plant Recovery Coordinator. These comments were incorporated into the draft five-year review. The document was then reviewed by the Recovery Program Leader and the Assistant Field Supervisor for Endangered Species before final approval.

1.3 Background:

1.3.1 FR Notice citation announcing initiation of this review:

1.3.2 Listing history

Original Listing

FR notice: USFWS. 1994. Final listing, endangered and threatened wildlife and plants; determination of endangered or threatened status for 24 plants from the island of Kauai, HI. 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. 2003. Endangered and threatened wildlife and plants; final designation or nondesignation of critical habitat for 95 plant species from the islands of Kauai and Niihau, HI; final rule. Federal Register 68(39):9215-9264.

Critical habitat was designated for *Diellia pallida* in two units totaling 656 hectares (1,621 acres) on Kauai.

1.3.4 Review History:

Species status review [FY 2007 Recovery Data Call (September 2006)]:
Declining

Recovery achieved:

1 (0-25%) (FY 2006 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: Recovery plan for the Kaua'i plant cluster. 1995. U.S. Fish and Wildlife Service, Portland OR. 227 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?

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 threats 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. In order for *Diellia pallida*, as a short-lived perennial, to be considered stable, the existing population must be managed to control threats (e.g., fenced), and be represented in an *ex situ* (off-site) collection. Additionally, a minimum total of three populations should be documented on Kauai, each population must be naturally reproducing and increasing in number with a minimum of 50 mature individuals per population (USFWS 1995).

This recovery objective has not been met.

For downlisting, a total of five to seven populations of *Diellia pallida* should be documented on Kauai. Each of these populations must be naturally reproducing, stable or increasing in number, and secure from threats, with a minimum of 300 mature individuals per population. Each population should persist at this level for a minimum of five consecutive years before downlisting is considered (USFWS 1995).

This recovery objective has not been met.

For delisting, a total of eight to ten populations should be documented on Kauai. Each of the populations must be naturally reproducing, stable or increasing in number, and secure from threats, with a minimum of 300 mature individuals per population. Each population should persist at this level for a minimum of five consecutive years (USFWS 1995).

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 I.C.5 ("Associated Rulemakings") and in section II.D ("Synthesis") below, which also includes any new information about the status and threats of the species.

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

Date	No. wild inds	No. outplanted	Stability Criteria	Stability Criteria Completed?
1994 – listing	Less than 10	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals	No

Date	No. wild inds	No. outplanted	Stability Criteria	Stability Criteria Completed?
			each	
1995 – recovery plan	23	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
2003 – critical habitat	43-48	0	All threats managed in all 3 populations	No
			Complete genetic storage	Unknown
			3 populations with 50 mature individuals each	No
2007 – 5-yr review	12	0	All threats managed in all 3 populations	Only one threat was managed in 1 pop
			Complete genetic storage	Unknown
			3 populations with 50 mature individuals each	No

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. 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

Diellia pallida is known historically from Halemanu on Kauai (Hillebrand 1888). The species had not been seen since 1949 until a collection was made in 1988 in Puu Ka Pele Forest Reserve (USFWS 1994). Since then, several other populations were discovered, but from seven populations known in 1947 to 1949 (Wagner 1952), only three populations currently remain, totaling 12 mature individuals (USFWS 1994; Agurauja 2005). Individuals in the western Mahanaloa population show very high mortality of gametophyte and sporeling stages (National Tropical Botanical Garden 2006).

Recent observations of natural populations of *Diellia pallida* (Agurauja 2005) showed that transformation from sporeling stage into premature stage may take place within 6 to 12 months depending on microhabitat and local weather conditions. The observations showed that if protected and in favorable microhabitat conditions, this species may reach maturity within five years. Delayed stage transformation up to five years, probably caused by unfavorable microsite conditions, has also been observed in *D. pallida*. Estimates based on observations of natural populations and experiments show that about one percent of the population could live more than 35 years, with average lifespan for mature plants of 23.2 years. However, the overall life span of individuals under current conditions in the wild is only 2.6 years, mainly due to high sporeling mortality (Agurauja *et al.* 2005).

The proportion of spore-producing mature individuals varies between years. Reverting of reproductive mature plants to vegetative phase of only one or two short vegetative fronds was observed for *D. pallida* when stressed or senescent (Agurajuja 2005). In some cases, it was clearly a result of aging, but currently seems to be more common as an expression of the stress condition related to erosion (the rhizomes eroded or washed out and hardly attached to the soil), drought, or changed moisture conditions of the substrate. Although the ferns with spore-producing fronds could be found all year around, maximum spore release is still seasonal, following the wet season (May through June).

The population ecology research conducted by Agurajuja (2005) fell into climate transition periods of extremely dry (1999 to 2002) to extremely wet (2003 to 2004) and finally normal weather patterns (2005 and onwards). The regeneration of *Diellia* populations during this period suggests that they may follow the so-called “window of opportunity” (Jelinski and Cheliak 1992) model, where recruitment is a rare event, possible only in particularly favorable years. Successful mating, as well as persistence of established individuals, may therefore be low in dry years, due to the lack of moisture. Although the area of spore dispersal may be greater than the area in which sporophytes are recorded (Page 1979), the small number of spore-producing individuals also limits establishment of new individuals and new populations.

Diellia pallida is a species of the Kauai Diverse Lowland Mesic Forest and Mixed Mountain Mesic Forest communities. *Diellia pallida* is currently restricted to a spatially-fragmented habitat type on the steep sides of gulches. Plants occur on northern slopes at elevations between 600 and 750 meters (1,970 and 2,460 feet), on slopes varying from gentle to steep (30 to 75 degrees). *Diellia pallida* is terrestrial. Although germination on rocks has been observed, no mature individuals have been found growing on rocks. This species grows on bare granular soil with dry to mesophytic leaf litter with a pH of 6.9 to 7.9, where soil moisture content is halved from February to June. Ground cover in current habitat is very sparse (one to 25 percent). However, *D. pallida* prefers the shade of canopy and under story shrubs, with coverage usually 70 to 90 percent (National Tropical Botanical Gardens 2006).

The main threats to the species, ungulate disturbance (predation and habitat degradation) (Factors A, C and D) and invasive introduced plant species (Factor E) continue to occur and the low number of individuals left in the wild makes the species vulnerable to stochastic events, such as hurricanes and landslides (Factor E) (National Tropical Botanical Garden 2006). The species is also threatened by erosion and fire (Factor E) (USFWS 1994 and 1995).

Diellia pallida is being propagated for restoration and genetics storage at National Tropical Botanical Garden is also propagating plants for outplanting. The material

in storage at Lyon Arboretum did not survive (Harold L. Lyon Arboretum Micropropagation Laboratory 2006).

Some invasive introduced plant species control on *Diellia pallida* locations was done simultaneously with research studies of population ecology 2002 to 2005 (Aguraiuja 2005). Weeding out *Kalanchoe pinnata* (air plant) around mature individuals of *Diella pallida* in Kuia has increased the area for sporeling establishment (National Tropical Botanical Garden 2006).

The stabilization and recovery goals for this species have not been met, because only 12 mature individuals are known and the threats are not all being managed. Therefore, *Diellia palida* meets the definition of endangered as it remains in danger of extinction throughout its range.

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: N/A

Brief Rationale:

3.3 Listing and Reclassification Priority Number: N/A

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

- Continue spore collection for genetic storage.
- Fence individual plants outside of proposed or already fenced areas for short-term protection from ungulates.

- Control introduced invasive plant species around remaining plants: in Kuia, *Kalanchoe pinnata*, *Adiantum hispidulum* (rough maidenhair fern), *Blechnum appendiculatum* (no common name (NCN)); in the eastern part of Mahanaloa Valley, *Kalanchoe pinnata*, *Adiantum hispidulum* (rough maidenhair fern), *Blechnum appendiculatum* (NCN), *Oplismenus hirtellus* (basketgrass); in the western part of Mahanaloa Valley *Kalanchoe pinnata*, *Adiantum hispidulum* (rough maidenhair fern), *Blechnum appendiculatum* (NCN).
- Survey for populations in known historical sites and suitable habitat.
- Augment populations as plants become available in nurseries.
- Reintroduce individuals into suitable habitat within historical range that is being managed for the known threats to this species.
- Continue monitoring of population condition and additional research on the breeding system both in experimental and natural conditions.
- Genetic research to determine genetic composition of remaining population and whether to mix sources for reintroduced populations.

5.0 REFERENCES

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Signature Page
U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of *Diellia pallida*

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:

Marilet A. Zablan, Recovery Program Leader, Acting Assistant Field Supervisor for Endangered Species, June 24, 2007
Marie Bruegmann, Plant Recovery Coordinator, March 23, May 24, and June 29, 2007
Annie P. Marshall, Fish and Wildlife Service Biologist, February 7, 2007

Approve Patricia L. [Signature] Date 1/15/05
Lead Field Supervisor, Fish and Wildlife Service