

Hedyotis coriacea
(Kio`ele)

**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: *Hedyotis coriacea* (Kio`ele)

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5-YEAR REVIEW
***Hedyotis coriacea* (Kio`ele)**

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 September 2007. The National Tropical Botanical Garden, subcontracted by Hawaii Biodiversity and Mapping Program, provided most of the updated information on the current status of *Hedyotis coriacea*. They also provided recommendations for conservation actions that may be needed prior to the next five-year review. The evaluation of the Plant Recovery Coordinator was 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:

USFWS. 2006. Endangered and threatened wildlife and plants; initiation of 5-year reviews of 70 species in Idaho, Oregon, Washington, Hawaii, and Guam. Federal Register 71(69):18345-18348.

1.3.2 Listing history

Original Listing

FR notice: USFWS. 1992. Endangered and threatened wildlife and plants; determination of endangered status for 15 plants from the island of Maui, HI. Federal Register 57(95):20772-20788.

Date listed: May 15, 1992
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] U.S. Fish and Wildlife Service. 2003a. Endangered and threatened wildlife and plants: final designation or nondesignation of critical habitat for 60 Plant Species from the Islands of Maui and Kahoolawe, HI; Final Rule. Federal Register 68(93):25934-26165.

[USFWS] U.S. Fish and Wildlife Service. 2003b. Endangered and threatened wildlife and plants: final designation or nondesignation of critical habitat for 60 Plant Species from the Islands of Maui and Kahoolawe, HI; Final Rule. Federal Register 68(93):25934-26165.

USFWS. 2003c. Endangered and threatened wildlife and plants: final designation or nondesignation of critical habitat for 101 plant species from the island of Hawaii, Hawaii: final rule. Federal Register 68(116):35949-36406.

Critical habitat was designated for *Hedyotis coriacea* in six units totaling 349 hectares (862 acres) on the island of Oahu and 244 hectares (602 acres) on the island of Maui (USFWS 2003b and c). This designation includes habitat on state and private lands. Critical habitat was not designated on U.S. Army land on the island of Hawaii land because active management of the area by the landowner outweighed any additional benefits from including that area as critical habitat (USFWS 2003c).

1.3.4 Review History:

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

Recovery achieved:

1 (0-25%) (FY 2006 Recovery Data Call)

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

2

1.3.6 Current Recovery Plan or Outline

Name of plan or outline: USFWS. 1997. Recovery plan for the Maui plant cluster. U.S. Fish and Wildlife Service, Portland, OR. 130 pp. + appendices.

Date issued: July 29, 1997.

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 a threat to this species.

Stabilizing, downlisting, and delisting objectives are provided in the recovery plan for Oahu plants (USFWS 1997), based on whether the species is an annual, a short-lived perennial (fewer than ten years), or a long-lived perennial. *Hedyotis coriacea* is a short-lived perennial, and to be considered stable, 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 Maui and, if possible, at least one other island where they now occur or occurred historically. Each of these populations must be naturally reproducing and increasing in number, with a minimum of 50 mature individuals per population.

This recovery objective has not been met.

For downlisting, a total of five to seven populations of *Hedyotis coriacea* should be documented on Maui and, if possible, at least one other island 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 300 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 *Hedyotis coriacea* should be documented on Maui and, if possible, at least one other island 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") above and in section 2.4 ("Synthesis") below, which also includes any new information about the status and threats of the species.

Status of *Hedyotis coriacea* from listing through 5-year review.

Date	No. wild inds	No. outplanted	Stability Criteria	Stability Criteria Completed?
1992 – listing	3	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
1998 – recovery plan	<20	0	All threats managed in all 3 populations	No
			Complete genetic storage	Partial
			3 populations with 50 mature individuals each	No
2003 – critical habitat	150	160	All threats managed in all 3 populations	Partial
			Complete genetic storage	Partial
			3 populations with 50 mature individuals each	No
2007 – 5-yr review	156	85	All threats managed	Partial
			Complete genetic storage	Partial
			3 populations with 50 mature individuals each	Partial

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

Polynesian species previously assigned to the genus *Hedyotis* were transferred to *Kadua* in 2005, with no change in the distribution of the species (Terrell *et al.* 2005). Therefore, this species will be referred to as *Kadua coriacea* throughout the remainder of this review. *Kadua coriacea* was historically found on Oahu, Maui, and

the island of Hawaii. At the time of listing, *K. coriacea* was known from one individual on West Maui and two individuals on the island of Hawaii. Nine natural populations of *Kadua coriacea* currently occur at the U.S. Army's Pohakuloa Training Area on the island of Hawaii, totaling 149 mature and six immature plants. In 2005, the first seedling of *Kadua coriacea* in the wild was recorded since the species was discovered at the U.S. Army's Pohakuloa Training Area in the early 1990s. The increase in the number of plants is a result of increased survey efforts rather than natural recruitment. In addition, 75 individuals survive from reintroduction efforts in six different areas both in and outside the U.S. Army's Pohakuloa Training Area (U.S. Army Pohakuloa Training Area 2006). Only one individual was known from Lihau Natural Area Reserve on Maui, but is likely dead following a fire in 2007. Although the immediate area did not burn, the heat was apparently intense enough to cause all the leaves of the *K. coriacea* to turn brown and dry. They were still attached to the stems, and the plant was watered in July, so there is a slight possibility it may recover. The plant will be surveyed in the fall, when rains may revive it (H. Oppenheimer, Maui Nui Plant Extinction Prevention Program, pers. comm. 2007).

The habitats in which *Kadua coriacea* is found are sparse *Metrosideros* (ohia lehua) woodland, open *Metrosideros* woodland with sparse shrub understory, open *Metrosideros* woodland with dense shrub understory and in *Dodonaea viscosa* (aalii) shrubland with native species *Bidens menziesii* (kookoolau), *Carex meyenii* (no common name (NCN)), *Eragrostis variabilis* (kawelu), *Heteropogon contortus* (pili grass), *Doryopteris decipiens* (kumuniu), *Gouania hillebrandii* (NCN), *Cyperus* sp., *Melanthera lamarum* (nehe), *Myoporum sandwicense*, (naio), *Osteomeles actinophylla* (ulei), *Santalum ellipticum* (iliahialoe, coast sandalwood), *Senna gaudichaudii* (kolomona), *Sida fallax* (ilima), and *Waltheria indica* (uhaloa, kanakaloha) (Wood 2001).

Threats to *Kadua coriacea* include habitat degradation and predation by feral ungulates, including mouflon (*Ovis musimon*), goats (*Capra hircus*) and pigs (*Sus scrofa*) (Factors A, C, and D); fire (Factor E); the introduced invasive plant species *Leucaena leucocephala* (koa haole), *Melinis repens* (Natal grass) and *Opuntia ficus-indica* (panini); susceptibility to scale insects at outplanting sites where there is also a high ant infestation (Factor E); a lack of natural recruitment which may be due to a loss of an insect pollinator(s) (Factor E (Shaw 1997; U.S. Army Pohakuloa Training Area 2006; Wood 2001)).

In addition to all of the other threats, species like *Kadua coriacea* that are endemic to small portions of a single island are inherently more vulnerable to extinction than widespread species because of the higher risks posed to a few populations and individuals by random demographic fluctuations and localized catastrophes such as hurricanes and disease outbreaks (Factor E). When considered on their own, the natural processes associated with being a single island endemic do not affect *K. coriacea* to such a degree that it is threatened or endangered with extinction in the foreseeable future, but these natural processes can exacerbate the threat from

anthropogenic factors, such as habitat loss for human development or predation by alien species (Factor E) (USFWS 1997).

Thousands of seeds are in long-term genetic storage (Center for Conservation and Research Training Seed Storage Laboratory 2007; Harold L. Lyon Arboretum Micropropagation Laboratory 2007; U.S. Army Pohakuloa Training Area 2006). Although germination is not problematic, seedling mortality remains high and may be a normal life history trait for this species. Seedling growth is very slow, requiring at least 12 months from seeding to outplanting. Between 2003 and 2006, 196 individuals have been outplanted in six locations. Of the 186 planted between 2003 and 2005, 75 (40 percent) survived through 2006. *Kadua coriacea* has been adaptable to a wide variety of substrates at other sites, including a lava rock at Kipuka Oweowe, silt loam at Koaia Tree Sanctuary, and sandy loam at Puu Waawaa Cone Unit (U.S. Army Pohakuloa Training Area 2006). Temporary emergency exclosures have been placed around the immediate vicinity of the populations with the U.S. Army Pohakuloa Training Area (USFWS 2003a).

The stabilization and recovery goals for this species have not been met, as only one population has numbers at interim stability, and not all of the threats are being managed in any of populations. Therefore, *Kadua coriacea* 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:

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:

- Construct large-scale fences around all naturally occurring and reintroduced individuals to control feral ungulates.
- Continue seed collection for *ex situ* genetic storage and reintroduction.
- Control introduced invasive plant species around wild and outplanted plants.
- Survey suitable habitat with current and historical locations for additional individuals
- Investigate techniques to improve natural recruitment.
- Study *Kadua coriacea* populations with regard to population size and structure, geographical distribution, flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, limiting factors, and threats.
- Update the listed entity on 50 CFR 17 to match the currently recognized taxonomy.

5.0 REFERENCES:

- Center for Conservation and Research Training Seed Storage Laboratory. 2007. Database Unpublished.
- Harold L. Lyon Arboretum Micropropagation Laboratory. 2007. Database. Unpublished.
- Terrell, E.E., H.E. Robinson, W.L. Wagner and D.H. Lorence. 2005. Resurrection of the genus *Kadua* for Hawaiian Hedyotidanae (Rubiaceae) with emphasis on seed and fruit characters and notes on South Pacific species. *Systematic Botany* 30(4):818-833.
- Shaw, Robert B. 1997. Rare plants of Pohakuloa Training Area, Hawaii. Center for Ecological Management of Military Lands, Department of Forest Sciences, Colorado State University, Fort Collins, Colorado 80523-1470. Available online at https://www.denix.osd.mil/denix/Public/ES_Programs/Conservation/Legacy/HawaiiPlants/hiplant.html
- U.S. Army Pohakuloa Training Area. 2006. 2006 Update for Genetic Safety Net Species Found at Pohakuloa Training. Unpublished.
- [USFWS] U.S. Fish and Wildlife Service. 2003a. Endangered and threatened wildlife and plants: final designation or nondesignation of critical habitat for 101 plant species from the island of Hawaii, Hawaii: final rule. *Federal Register* 68(116):35949-36406.

[USFWS] U.S. Fish and Wildlife Service. 2003b. Endangered and threatened wildlife and plants: final designation or nondesignation of critical habitat for 60 Plant Species from the Islands of Maui and Kahoolawe, HI; Final Rule. Federal Register 68(93):25934-26165.

[USFWS] U.S. Fish and Wildlife Service. 2003c. Endangered and threatened wildlife and plants; final designations or nondesignations of critical habitat for 101 plant species from the island of Oahu, Hawaii; final rule. Federal Register 68(116):35950-35993.

[USFWS] U.S. Fish and Wildlife Service. 1997. Recovery plan for the Maui plant cluster. U.S. Fish and Wildlife Service, Portland, OR. 130 pp. + appendices.

[USFWS] U.S. Fish and Wildlife Service. 1992. Endangered and threatened wildlife and plants; determination of endangered status for 15 plants from the island of Maui, HI. Federal Register 57(95):20772-20788.

Wood, K.R. 2001. Biogeography Data. National Tropical Botanical Garden, Lawai, Kauai. Unpublished.

Personal Communications:

Oppenheimer, Hank. 2007. Maui Nui Plant Extinction Prevention Coordinator. E-mail to Marie Bruegmann, USFWS, July 19, 2007.

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of *Hedyotis coriacea* (kio`ele)

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 and Acting Assistant Field Supervisor for Endangered Species, October 30, 2007

Marie Bruegmann, Plant Recovery Coordinator, August 31 and September 4, 2007

Approve  Date 1/18/08
Lead Field Supervisor, Fish and Wildlife Service