

Hedyotis mannii
(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: *Hedyotis mannii* / no common name

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5-YEAR REVIEW
***Hedyotis mannii* (no common name)**

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) 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 of the U.S. Fish and Wildlife Service (USFWS), beginning on March 16, 2009. The review was based on final critical habitat designations for *Hedyotis mannii* and other species from the islands of Lanai, Molokai, and Maui (USFWS 2003a, 2003b, 2003c) 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 Recovery Program Lead and the Assistant Field Supervisor for Endangered Species before submission to the Deputy 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. 2009. Endangered and threatened wildlife and plants; initiation of 5-year reviews of 103 species in Hawaii. Federal Register 74(49):11130-11133.

1.3.2 Listing history

Original Listing

FR notice: USFWS. 1992. Endangered and threatened wildlife and plants; determination of threatened or endangered status for 16 plants from the island of Molokai, Hawaii; final rule. Federal Register 57(196):46325-46340.

Date listed: October 8, 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. 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.

USFWS. 2003c. Endangered and threatened wildlife and plants; designation of critical habitat for 60 plant species from the islands of Maui and Kahoolawe, Hawaii; final rule. Federal Register 68(93):25934-26165.

Critical habitat was not designated for *Hedyotis mannii* on the island of Lanai (USFWS 2003a) or the island of Molokai (USFWS 2003b). Critical habitat was designated for *Hedyotis mannii* in a single unit totaling 2,234 hectares (5,521 acres) on the island of Maui. This designation includes habitat on State and private lands (USFWS 2003c).

1.3.4 Review History:

Species status review [FY 2010 Recovery Data Call (September 2010)]: Improving

Recovery achieved:

1 (0-25%) (FY 2007 Recovery Data Call – most recent year 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: Recovery plan for the Molokai plant cluster

Date issued: September 26, 1996

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, C, D, and E) affecting this species is presented in section 2.3.2 and Table 2. Listing 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 Molokai plant cluster recovery plan (USFWS 1996), based on whether the species is an annual, a short-lived perennial (fewer than 10 years), or a long-lived perennial. *Hedyotis mannii* is a short-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 Molokai, 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.

There is no confirmed population of more than 50 mature individuals and all threats have not been managed. This recovery objective has not been met.

For downlisting, a total of five to seven populations of *Hedyotis mannii* should be documented on Molokai and 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 mannii* should be documented on Molokai and 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

2.3.1 Biology and Habitat

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

No new information.

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:

When the Molokai recovery plan was written, *Hedyotis mannii* was known from Molokai, Lanai, and West Maui, with a total of 50 to 65 individuals (USFWS 1996). After not being seen for 50 years, this species was rediscovered in 1987 by Steve Perlman on private land in Kawela Gulch on East Molokai. In 1991, an additional nine individuals were discovered on the island of Lanai in two populations, at Hauola Gulch and Waiialala (Kunoa) Gulch.

Hedyotis mannii was rediscovered in 1987 on the west side of east Kawela Gulch, Molokai, at 1,052 meters (3,450 feet) elevation (Perlman 2009). Subsequently, there were as many as five individuals there, but the population declined to only one or two individuals and in 2008, Perlman reported that all individuals were dead. They formerly grew near a stream, and were probably destroyed by a flood (S. Perlman, National Tropical Botanical Garden, pers. comm. 2009).

Two populations on Lanai are now known, at Hauola Gulch and Kunoa Gulch. Ten individuals were seen in 1994 at Kehewai Ridge at 884 to 1,006 meters (2,900 to 3,300 feet) elevation, but they have not been sighted since (Wood 2009). In the early 1990s, eight to ten individuals of *Hedyotis mannii* were seen at Hauola Gulch, and eight individuals were seen in flower at 1,006 meters (3,300 feet) elevation in 1997. In 2004, only two to three individuals were noted in Hauola Gulch, that was still the case at the last observation at the end of 2008 (Perlman 2009; Wood 2009). Two individuals were also seen at East Kunoa Gulch in 1990 at about 811 meters (2,660 feet) elevation (Perlman 2009), and a single individual was seen there in 1997 at 771 meters (2,530 feet) elevation (Wood 2009).

On West Maui, a population in Kauaula Valley at 914 to 1,128 meters (3,000 to 3,700 feet) elevation had a few individuals when visited in 1993 and 1997 (Perlman 2009; Wood 2009). In 2009, two individuals were seen there at 869 meters (2,850 feet) elevation by Ken Wood and Hank Oppenheimer of the Plant Extinction Prevention Program. Later in 2009, Oppenheimer revisited Kauaula Valley with staff from the West Maui Mountains Watershed Partnership and found four individuals on a cliff, two of which were reproductive (H. Oppenheimer, pers. comm. 2009). A previous population of *Hedyotis mannii* located across the stream was not relocated during this survey and is presumed extirpated (Wood 2009). A population of three individuals, observed in Mananole Gulch in Waihee Valley in 1994, hasn't been relocated despite several attempts by Hank Oppenheimer, the last relocation attempt occurred with Steve Perlman in early 2009 (H. Oppenheimer, pers. comm. 2009).

Currently, there are three individuals in two populations on Lanai and six individuals in a single population on Maui.

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:

The Hawaiian and other Polynesian species formerly included in the genus *Hedyotis* are currently placed in the genus *Kadua*. Terrell and others also changed the specific name by using the earliest available name associated with *Kadua*, in this case resulting in the name change from *H. mannii* to *K. laxiflora* (Terrell *et al.* 2005). Therefore, this species will be referred to as *Kadua laxiflora* for the remainder of this review.

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.):

See above section 2.3.1.2.

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

The historical habitat in East Kawela on Molokai is *Metrosideros polymorpha* (ohia) – *Dicranopteris linearis* (uluhe) mesic forest with *Clermontia pallida* (haha), *Cyanea mannii* (haha), *Cyrtandra macrocalyx* (haiwale), *Dodonaea viscosa* (aalii), *Leptecophylla tameiameia* (pukiawe), *Lobelia dunbariae* (no common name [NCN]), *Lysimachia remyi* (NCN), *Pipturus albidus* (mamake), *Pittosporum glabrum* (hoawa), *Pouteria sandwicensis* (alaa), *Psychotria* sp. (kopiko), *Scaevola chamissoniana* (naupaka kuahiwi), *Urera glabra* (opuhe), *Viola chamissoniana* subsp. *tracheliifolia* (pamakani), *Wikstroemia oahuensis* (akia), and *Xylosma hawaiiense* (ae) (Perlman 2009).

On Lanai, the habitat at Hauola Gulch is *Metrosideros polymorpha* – *Dicranopteris linearis* wet riparian and mesic forest with *Broussaisia arguta* (kanawao), *Cheirodendron*

trigynum (olapa), *Clermontia grandiflora* (oha wai), *Cyanea macrostegia* subsp. *gibsonii* (haha), *Cyrtandra grayana*, *C. grayi* (keokeo haiwale), *Diplopterygium pinnatum* (uluhe lau nui), *Freycinetia arborea* (ie ie), *Leptecophylla tameiameia*, *Lobelia hypoleuca* (kuhiaikamoowahie), *Perrottetia sandwicensis* (olomea), *Pipturus albidus*, *Pittosporum confertiflorum* (hoawa), *Pneumatopteris sandwicensis* (hoio kula), *Sadleria cyatheoides* (amau), *S. pallida* (amau ii), *Scaevola chamissoniana*, *Selaginella* sp., and *Wikstroemia oahuensis* (Perlman 2009; Wood 2009). The habitat at East Kunoa Gulch is the same with additional associated native species including *Ilex anomala* (kawau), *Pritchardia lanaiensis* (loulu), and *Viola lanaiensis* (NCN) (Perlman 2009; Wood 2009).

On West Maui at the back of Kauaula Valley, the habitat is seeping wet vertical basalt cliffs with *Bidens* sp. (kookoolau), *Clermontia micrantha* (oha wai), *Lysimachia* sp., *Machaerina* sp. (uki), *Pteris lydgatei* (cliff brake), and *Tetramolopium capillare* (pamakani), surrounded by *Metrosideros polymorpha* – *Dicranopteris linearis* montane wet forest with *Boehmeria grandis* (akolea), *Broussaisia arguta*, *Cheirodendron* sp., *Coprosma* sp. (pilo), *Cyanea scabra* (haha), *Cyrtandra* spp. (keokeo haiwale), *Diplazium* sp. (hoio), *Dubautia* sp. (naena), *Gunnera* sp. (ape ape), *Kadua* spp., *Pipturus* sp., and *Touchardia latifolia* (Wood 2009).

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 that modify habitat include feral pigs (*Sus scrofa*), goats (*Capra hircus*), floods, and invasive introduced plants such as *Buddleia asiatica* (dogtail), *Lantana camara* (lantana), and *Melinis minutiflora* (molasses grass) (Perlman 2009).

Threats on Lanai include feral axis deer (*Axis axis*) and mouflon sheep (*Ovis musimon*), fire, and introduced invasive plant species such as *Morella faya* (fire tree), *Pluchea carolinensis*

(sourbush), *Psidium cattleianum* (strawberry guava), *Rubus rosifolius* (thimbleberry), and *Tibouchina herbacea* (glorybush) (Perlman 2009; Wood 2009).

Threats on West Maui are invasive introduced plants such as *Ageratina adenophora* (sticky snakeroot), *Buddleia asiatica*, *Clidemia hirta* (Koster's curse), *Erigeron karvinskianus* (daisy fleabane), *Rubus rosifolius*, and *Tibouchina herbacea*, as well as damage from landslides (Wood 2009).

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

Not a threat.

2.3.2.3 Disease or predation:

Rats (*Rattus* spp.) and slugs (various species) are herbivores of *Kadua laxiflora* (Perlman 2009). Certain unidentified insects apparently are seed predators, and have destroyed the seeds before they could be collected. No method has yet been developed to protect the flowers or fruits to prevent insect predation (H. Oppenheimer, pers. comm. 2009).

2.3.2.4 Inadequacy of existing regulatory mechanisms:

No new information.

2.3.2.5 Other natural or manmade factors affecting its continued existence:

Threats from introduced invasive plant species discussed in section 2.3.2.1 above, are also a threat to *Kadua laxiflora* because they compete with the species for water, light, and nutrients.

Climate change may also 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 has currently funded climate modeling that will help resolve these spatial limitations. We anticipate high spatial resolution climate outputs by 2013.

In addition to all of the other threats, species like *Kadua laxiflora* that are endemic to very small portions of a few islands 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, landslides, flooding, and disease outbreaks. The extent of these natural processes on this taxon with very low numbers is exacerbated by anthropogenic threats, such as habitat loss for human development or predation by introduced species (USFWS 1996).

On West Maui, Hank Oppenheimer, was able to collect seeds, which were sent to the Center for Conservation and Research Training Seed Laboratory. The Seed Laboratory currently has 938 seeds in storage from the population on Lanai (Center for Conservation and Research Training Seed Laboratory 2010). Seeds were collected in 2004 from Hauola Gulch on Lanai, which are now stored at the National Tropical Botanical Garden. Some of these seeds will be sent to the National Center for Genetic Resource Preservation in Ft. Collins, Colorado for long-term storage. Two plants are growing in the National Tropical Botanical Garden nursery, and some cuttings of these plants were transferred to the Olinda Rare Plant Facility on Maui, where they are apparently producing seed (H. Oppenheimer, pers. comm. 2009).

In 2009, one million dollars in funds from the federal Department of Interior's Cooperative Endangered Species Conservation Fund was granted for use on Molokai, to help acquire a perpetual conservation easement over 248 hectares (614 acres) of strategic watershed on the eastern end of the island. The property has several federally listed threatened or endangered species as well as critical habitat in and around the proposed easement area. Among federally listed species that will benefit from this protection are *Cyanea mannii* (haha), *Canavalia molokaiensis* (awikiwiki), *Hibiscus arnottianus* ssp. *immaculatus* (kokio keokeo), *Brighamia rockii* (puaala), *Cyanea dunbariae* (haha), *Gardenia brighamii* (nanu), *Pritchardia munroi* (loulu), and *Phylostegia hispida* (USFWS 2009; C. Rowland, USFWS, pers. comm. 2010). *Kadua laxiflora* is also found in this area and may benefit from this action.

2.4 Synthesis

Stabilizing, downlisting, and delisting objectives are provided in the recovery plan for the Molokai plant cluster (USFWS 1996), based on whether the species is an annual, a short-lived perennial (fewer than ten years), or a long-lived perennial. *Hedyotis mannii* is a short-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 50 mature individuals per population.

The interim stabilization goals for this species have not been met as there is no confirmed population of more than 50 mature individuals (Table 1) and all threats have not been managed (Table 2). Therefore, *Kadua laxiflora* meets the definition of endangered as it remains in danger of extinction throughout its range.

Table 1. Status of *Kadua laxiflora* from listing through 5-year review.

Date	No. wild indivs	No. outplanted	Stability Criteria identified in Recovery Plan	Stability Criteria Completed?
1992 (listing)	11	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
1996 (recovery plan)	50-65	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
2003 (critical habitat)	55-60	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
2010 (5-year review)	9	18	All threats managed in all 3 populations	No (Table 2)
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	No: Lanai 3 individuals in two populations, Maui one population of 6 individuals

Table 2. Threats to *Kadua laxiflora*.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulates – habitat modification	A, D	Ongoing	No
Landslides	A, E	Ongoing	No
Rats – herbivory	C	Ongoing	No
Slugs – seed predation	C	Ongoing	No
Invasive introduced plants	A, E	Ongoing	No
Climate change	A, E	Increasing	No
Small population size	E	Ongoing	Seed collection not enough at this point for reintroductions; no protected sites are available

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

- Survey areas where *Kadua laxiflora* has been reported to determine the current status of the species.
- Monitor known populations and collect any available seed for genetic storage and reintroduction.
- Fence existing populations to protect them from negative impacts of ungulates.
- Control invasive introduced species around known populations.
- Develop and implement methods to control rats and slugs.
- Propagate to augment the existing populations.
- Establish additional populations within protected suitable habitat.
- Update the listed entity on 50 CFR 17 to match the currently recognized taxonomy.
- Work with Hawaii Division of Forestry and Wildlife and other land managers to initiate planning and contribute to implementation of ecosystem-level restoration and management to benefit this species.
- 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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the island of Molokai, Hawaii; final rule. Federal Register 57(196):46325-46340.

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Personal Communications:

Oppenheimer, Hank L. 2009. Maui Nui coordinator, Plant Extinction Prevention Program, Lahaina, Hawaii. E-mail to Margret Clark, National Tropical Botanical Garden, dated December 7, 2009. Subject: *Kadua laxiflora*.

Perlman Steve. 2009. Field Botanist, National Tropical Botanical Garden, Kalaheo, Hawaii. Personal communication to Margret Clark, National Tropical Botanical Garden, dated December 29, 2009. Subject: *Kadua laxiflora*.

Rowland, Craig. 2010. Conservation Partnerships Program Coordinator, Pacific Islands Fish and Wildlife Office, U.S. Fish and Wildlife Service, Honolulu, Hawaii. E-mail to Marie Bruegmann, U.S Fish and Wildlife Service, dated April 16, 2010. Subject: Additional information on status of Molokai easement.

Signature Page
U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of *Hedyotis mannii* (no common name)

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

Review Conducted By:

Chelsie Javar, Fish and Wildlife Biologist
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Field Supervisor, Pacific Islands Fish and Wildlife Office


AC/NO

Date 5/2/11