

*Clermontia drepanomorpha*  
(Oha wai)

**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: *Clermontia drepanomorpha* (Oha wai)

## TABLE OF CONTENTS

<b>1.0</b>	<b>GENERAL INFORMATION</b> .....	<b>3</b>
1.1	Reviewers.....	3
1.2	Methodology used to complete the review:.....	3
1.3	Background:.....	3
<b>2.0</b>	<b>REVIEW ANALYSIS</b> .....	<b>5</b>
2.1	Application of the 1996 Distinct Population Segment (DPS) policy.....	5
2.2	Recovery Criteria.....	5
2.3	Updated Information and Current Species Status .....	7
2.4	Synthesis.....	12
<b>3.0</b>	<b>RESULTS</b> .....	<b>14</b>
3.1	Recommended Classification:.....	14
3.2	New Recovery Priority Number:.....	14
3.3	Listing and Reclassification Priority Number: .....	14
<b>4.0</b>	<b>RECOMMENDATIONS FOR FUTURE ACTIONS</b> .....	<b>15</b>
<b>5.0</b>	<b>REFERENCES</b> .....	<b>16</b>
	Signature Page.....	19

**5-YEAR REVIEW**  
***Clermontia drepanomorpha* (Oha wai)**

**1.0 GENERAL INFORMATION**

**1.1 Reviewers**

**Lead Regional Office:**

Region 1, Endangered Species Program, Division of Recovery, Jesse D'Elia,  
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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 *Clermontia drepanomorpha* and the Addendum to the recovery plan for the Big Island plant cluster (USFWS 2003, 1998), 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. 1996. Endangered and threatened wildlife and plants; determination of endangered or threatened status for thirteen plant species from the island of Hawaii, State of Hawaii; final rule. Federal Register 61(198):53137-53153.

**Date listed:** October 10, 1996

**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 and nondesignation of critical habitat for 46 plant species from the island of Hawaii, Hawaii; final rule. Federal Register 68(127):39624-39761.

Critical habitat was designated for *Clermontia drepanomorpha* in a single unit totaling 1,906 hectares (4,709 acres) on State lands on Hawaii Island (USFWS 2003).

### 1.3.4 Review History:

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

Declining

#### **Recovery achieved:**

1 (0-25%) (FY 2007 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. 1998. Big Island II: Addendum to the recovery plan for the Big Island plant cluster. U.S. Fish and Wildlife Service, Portland, Oregon. 80 pages + appendices.

**Date issued:** May 11, 1998

**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 Big Island plant cluster (USFWS 1998), based on whether the species is an annual, a short-lived perennial (fewer than ten years), or a long-lived perennial. *Clermontia drepanomorpha* 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 the Big Island (Hawaii Island). 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.

This recovery objective has not been met.

For downlisting, a total of five to seven populations of *Clermontia drepanomorpha* should be documented on the island of Hawaii. 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 *Clermontia drepanomorpha* should be documented on the island of Hawaii. 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:

*Clermontia drepanomorpha* is a terrestrial or epiphytic, short-lived woody species (Wagner *et al.* 1999; Lammers 1991; USFWS 1996, 1998, 2002). The species has purplish-black flowers and orange fruits (Lammers 1991). It is unusual in the genus by its possession of a declinate (curved downward) peduncle (the stalk of a solitary flower or of an inflorescence), which is three to five times longer than the upturned pedicels (a thin, membranous or skin covering) (Lammers 1991, 1995). The only other species with these features is *C. pyrularia*, which is placed in Section *Clermontioideae* Series *Clermontioideae*, suggesting the features arose in parallel (Lammers 1995).

The flowering period for *Clermontia drepanomorpha* is nearly year-round with favorable conditions, with specimens known in flower from all months except February through April, June, and November; in contrast, fruiting specimens are present only from July through December (Bishop Museum 2011; National Tropical Botanical Garden 2011).

*Clermontia drepanomorpha* hybridizes with *C. kohalae* (Lammers 1991), the products of which have been described as *C. leptoclada* (Lammers 1991). Individuals of hybrid origin flower in July, August, and November, although the fruiting period is unknown (Bishop Museum 2011; National Tropical Botanical Garden 2011).

According to unpublished experimental data (Baskin *et al.* no date-a), seed germination of *Clermontia drepanomorpha* commences 42 days after planting and can continue up to 260 days after planting. Furthermore, the species has a type of seed dormancy referred to as “physiological dormancy” (Baskin *et al.* no date-b), wherein the embryo lacks sufficient “push power” to overcome the mechanical constraint of the seed coats. Dormancy in seeds with “physiological dormancy” can be broken by various means, but after the seed becomes non-dormant the embryo has adequate push power to break through constraining layers (Baskin *et al.* no date-b).

**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:**

*Clermontia drepanomorpha* was known from four populations in the Kohala Mountains through the late 1980s (Wagner *et al.* 1999; USFWS 1996), but other populations were discovered later (USFWS 2010a).

In 1995, Steve Perlman saw 50 to 100 individuals of *Clermontia drepanomorpha* (Perlman 14830 [National Tropical Botanical Garden 2011]), including seedlings and juveniles, at the Kawainui Stream site; he also recorded about 10 individuals with immature fruits from Kawaiiki Stream in August (Perlman 14833 [National Tropical Botanical Garden 2011]). Since several other collections were made by Perlman in 1995, the number of individuals was relatively healthy at that time (National Tropical Botanical Garden 2011).

At the time of its listing, *Clermontia drepanomorpha* was known from five populations totaling approximately 200 individuals on State lands (USFWS 1996). At the time the recovery plan was published (USFWS 1998), *C. drepanomorpha* was known from six populations totaling approximately 237 to 293 individuals. When critical habitat was proposed, *C. drepanomorpha* was known from a single population comprising approximately 200 individuals (USFWS 2002, USFWS 2003).

In 2008, Hawaii Department of Land and Natural Resources (2008) reported that approximately 6 to 12 individuals had been observed in May of that year along the Kohala Ditch Trail.

In 2008, there were approximately 300 individuals located within several populations in the Kohala area (USFWS 2010b). In April 2010, only a single population containing an unknown number of individuals of *Clermontia drepanomorpha* was reportedly known from the Laupahoehoe Natural Area Reserve, although approximately 31 populations had been documented between 1989 and 2010 in Kohala (USFWS 2010a). As of March 2011, Nick Agorastos (Natural Area Specialist of the Hawaii Division of Forestry of Wildlife, pers. comm. 2011) stated that *C. drepanomorpha* is still documented from Kohala, however he could not report the exact number of individuals observed but noted that the species is declining.

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

The chromosome number of *Clermontia drepanomorpha* has been reported as  $2n = 28$  (Wagner *et al.* 1999) and as  $n = 14$  by Lammers (1991).

#### **2.3.1.4 Taxonomic classification or changes in nomenclature:**

*Clermontia drepanomorpha*, a member of the bellflower family (Campanulaceae), was described by Joseph Rock (1913) from collections made in the Kohala Mountains in the early 1900s (USFWS 1996, 1998). The species has no known synonyms (Wagner *et al.* 1999; Lammers 1991), although hybrids between it and another species have been named (see below) (Lammers 1991).

Lammers (1991) revised the genus *Clermontia* and treated *Clermontia drepanomorpha*, much as he (the author of the treatment) had in Wagner *et al.* (1999). Lammers (1995) studied the taxonomy and speciation patterns in *Clermontia* and included *Clermontia drepanomorpha* in Section *Clermontia*, Series *Kakeanae*. Based on cladistic studies, *C. drepanomorpha* was stated to be most closely related to *C. montis-loa* and *C. kohalae* (Lammers 1995).

#### **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):**

*Clermontia drepanomorpha* grows in montane bogs in montane wet forests (Lammers 1991) between approximately 915 and 1,640 meters (3,002 and 5,381 feet) elevation. However, elevational estimates vary by source (e.g., Wagner *et al.* 1999 and Lammers 1991; USFWS 2002, 2003). At the time critical habitat was designated (USFWS 2003), the given range was between 1,106 and 1,676 meters [3,627 and 5,495 feet] elevation, which was based on the only known extant population at the time.

The montane wet forests typically are dominated by *Metrosideros polymorpha* (ohia), *Cheirodendron trigynum* (olapa), and *Cibotium glaucum* (hapuu) (Lammers 1991, 1995; USFWS 1996, 1998). No details of soil types have been recorded by the Hawaii Biodiversity and Mapping Program (2010).

Native plant species associated with *Clermontia drepanomorpha* include *Carex alligata* (no common name), *Melicope clusiifolia* (alani), *Leptecophylla tameiameiae* (pukiawe), *Astelia menziesiana* (painiu), *Rubus hawaiiensis* (akala), *Cyanea pilosa* (haha), *Sphagnum* moss

(unidentified to species), and species of *Coprosma* (pilo) (USFWS 1996, 2003; National Tropical Botanical Garden 2011).

#### **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:
  - Disturbance by feral pigs (*Sus scrofa*) (USFWS 1996, 2003; Hawaii Biodiversity and Mapping Program 2010; National Tropical Botanical Garden 2011)
  - Habitat degradation by cattle (*Bos taurus*) (N. Agorastos, pers. comm. 2011)
- Established ecosystem-altering invasive plant species degradation of habitat (USFWS 1996, 2003; Hawaii Biodiversity and Mapping Program 2010; National Tropical Botanical Garden 2011)
  - *Hedychium gardnerianum* (kahili ginger)
  - *Rubus rosifolius* (thimbleberry)
  - *Tibouchina herbacea* (cane ti, cane tibouchina, glorybush)

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

##### **Threats:**

- Collecting – Over-collection by collectors and researchers (N. Agorastos, pers. comm. 2011)

#### **2.3.2.3 Disease or predation:**

##### **Threats:**

- Rodent predation or herbivory – Girdling of stems by rats (*Rattus* sp.) (USFWS 1996, 2003; Hawaii Biodiversity and Mapping Program 2010)
- Slugs – Unidentified species (USFWS 1996, 2003; Hawaii

#### **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 *Clermontia drepanomorpha* occurs continue to threaten this species.

#### **2.3.2.5 Other natural or manmade factors affecting its continued existence:**

##### **Threats:**

- Hiking and trail maintenance – Ditch improvements (USFWS 1996, 2003; Hawaii Biodiversity and Mapping Program 2010)
- Established invasive plant species competition (USFWS 1996, 2003; Hawaii Biodiversity and Mapping Program 2010)
  - *Axonopus fissifolius* (common carpetgrass)
  - *Juncus* spp. (no common name)
  - *Polygonum punctatum* (dotted smartweed)
  - *Setaria palmifolia* (palmgrass)
- Low numbers – increased likelihood of stochastic extinction due to changes in demography, the environment, genetics, or other factors (USFWS 1996, 2003; Hawaii Biodiversity and Mapping Program 2010)
- Drought (N. Agorastos, pers. comm. 2011)
- 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:**

- Captive propagation for genetic storage and reintroduction – In 2009, the Plant Extinction Prevention Program (2009) reported less than 100 individuals of *Clermontia drepanomorpha* as being in cultivation *ex situ*, although no details were provided about where the individuals were located. A year later, in a report by the Plant

Extinction Prevention Program (2010), the only comment about *C. drepanomorpha* was that more information was needed, and no estimate was given for the number of individuals *ex situ*.

- Reintroduction / translocation implementation – *Clermontia drepanomorpha* was reintroduced in the Waimanu Bog in the Kohala Mountains, which occurs on State-owned land (USFWS 2002).

## 2.4 Synthesis

The interim stabilization goals for this species have not been met, as there is approximately 300 individuals of *Clermontia drepanomorpha* in Kohala however, it is unknown if any population contains more than 50 individuals (Table 1). In addition, all threats are not being managed (Table 2). Therefore, *Clermontia drepanomorpha* meets the definition of endangered as it remains in danger of extinction throughout its range.

**Table 1. Status of *Clermontia drepanomorpha* from listing through 5-year review.**

Date	No. wild individuals	No. outplanted	Stabilization Criteria identified in Recovery Plan	Stabilization Criteria Completed?
1996 (listing)	200	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
1998 (recovery plan)	237-292	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
2003 (critical habitat)	200	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
2012 (5-year review)	~300	Unknown	All threats managed in all 3 populations	Partially (see Table 2)
			Complete genetic	Partially

			storage	
			3 populations with 50 mature individuals each	Unknown

**Table 2. Threats to *Clermontia drepanomorpha* and ongoing conservation efforts.**

<b>Threat</b>	<b>Listing factor</b>	<b>Current Status</b>	<b>Conservation/ Management Efforts</b>
Ungulates – Degradation of habitat	A, D	Ongoing	No
Established ecosystem-altering invasive plant species degradation of habitat	A	Ongoing	No
Collecting	B	Ongoing	No
Rodent predation or herbivory – Rats	C	Ongoing	No
Slugs	C	Ongoing	No
Hiking and trail maintenance	E	Ongoing	No
Established invasive plant species competition	E	Ongoing	No
Drought	E	Ongoing	No
Low numbers	E	Ongoing	Partially: Captive propagation for genetic storage and reintroduction, reintroduction / translocation implementation, and monitoring
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.
  - Continue to collect seeds from all existing populations and send to at least two or three different venues for propagation and storage.
- Reintroduction / translocation implementation – Continue to reintroduce the species back into its known historical range.
- 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 exclosure – Construct ungulate-proof fenced exclosures around each population and monitor the fences for any signs of breaching.
- Ungulate control – Protect all populations against disturbances from feral ungulates.
- Ecosystem-altering invasive plant species control – Control invasive introduced plant species around all populations.
- Predator / herbivore control – Implement effective control methods for rodents.
- Threats research – Develop and implement control methods for slugs.
- 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.
- Site / area / habitat protection – Develop and implement effective measures to reduce the impact of collecting, drought, and hiking and trail maintenance.
- Surveys / inventories:
  - The historical range of the species should be resurveyed intensively, preferably in July, which coincides with the greatest number of historical records of the species being in flower.
  - Determine if previously unknown populations exist and whether the species has reappeared at localities where it formerly was believed to have been extirpated.

- Population biology research – Study the reproductive biology of the species in the field to determine which (presumably) bird species pollinate the plant, and what species likely are involved with fruit dispersal.
- Genetic research:
  - Tag and sample at least 50 individuals in the single extant population and carry out genetic studies using microsatellites or other appropriate genetic markers to determine the genetic variation within the population.
  - Based on the results of microsatellite (or other appropriate genetic markers), consult with a population geneticist to devise a crossing plan that will maximize the amount of genetic variation in the progeny.
- Alliance and partnership development – 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.
- 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.

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**Signature Page**  
**U.S. FISH AND WILDLIFE SERVICE**  
**5-YEAR REVIEW of *Clermontia drepanomorpha* (Oha wai)**

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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*for*

Jess Newton

Date 8/28/2012