

*Cyrtandra tintinnabula*  
(Haiwale)

**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: *Cyrtandra tintinnabula* (Haiwale)

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**5-YEAR REVIEW**  
***Cyrtandra tintinnabula* (Ha‘iwale)**

**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 *Cyrtandra tintinnabula* and the Big Island plant cluster recovery plan (USFWS 2003, 1996), 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. 1994. Endangered and threatened wildlife and plants; determination of endangered or threatened status for 21 plants from the island of Hawaii, State of Hawaii. Federal Register 59(43):10305-10325.

**Date listed:** March 4, 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 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 *Cyanea tintinnabula* in two units totaling 2,700 hectares (6,672 acres) on Hawaii Island on State lands (USFWS 2003).

### 1.3.4 Review History:

Species status review [FY 2011 Recovery Data Call (August 2011)]:  
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:

8

### 1.3.6 Current Recovery Plan or Outline

**Name of plan or outline:** USFWS. 1996. Recovery plan for the Big Island plant cluster. U.S. Fish and Wildlife Service, Portland, Oregon. 202 pages + appendices. Available online at  
<<http://www.fws.gov/pacificislands/recoveryplans.html>>.

**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, 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 recovery plan for the Big Island 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. *Cyrtandra tintinnabula* 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 *Cyrtandra tintinnabula* 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 *Cyrtandra tintinnabula* 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:

*Cyrtandra tintinnabula* is a short-lived perennial species (USFWS 1996). *Cyrtandra tintinnabula* has been observed flowering in July and August, and fruiting in December (USFWS 1996). Stems of *C. tintinnabula* break easily (USFWS 1996), and are thus highly susceptible to damage by the activities of feral pigs (*Sus scrofa*). Nothing is known about what pollinates the flowers or disperses the seed for this species. *Cyrtandra tintinnabula* may hybridize with *C. giffardii*, a single specimen of which St. John (1987) named as *C. trite* (Bishop Museum 2011).

### 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:

At the time *Cyrtandra tintinnabula* was listed, it was known from three populations with a total of 18 individuals on State lands (USFWS 1994). When the recovery plan was released, the three populations consisted of a total of 18 known individuals (USFWS 1996).

At the time critical habitat was proposed, the species was known from about 25 individuals scattered throughout 6 populations (USFWS 2002). The next year the number of populations was modified to four populations (USFWS 2003). There were 18 individuals located within the Laupahoehoe Natural Area Reserve,

Between 2003 and 2008, several collecting trips to Laupahoehoe Natural Area Reserve were made by researchers from National Tropical Botanical Garden (2011), although the specimen labels do not contain complete data in some cases, to know with certainty if the multiple collections of *Cyrtandra tintinnabula* were made from the same location. What is notable, however, is an evident decrease in the number of specimens from the general area between 2003 and 2008, if comments on the herbarium labels are accurate. For example, *Perlman 18321* (National Tropical Botanical Garden 2011) noted “100+ plants” from a collection made in January of 2003. In contrast, a collection made in April of 2008 (*Perlman 20954*) indicated only “10+ plants”.

Reports from the Plant Extinction Prevention Program present a similar story regarding population declines for much of the decade between 2000 and 2009, except that (see below) the overall population seemed to rebound in 2009. The Plant Extinction Prevention Program (2007)

reported seven individuals of *Cyrtandra tintinnabula* seen at Laupahoehoe Natural Area Reserve on November 21, 2007, but only a single individual at the same site in early January 2008. This site had previously contained 50 to 100 individuals as recently as 2002 or 2003 (Plant Extinction Prevention Program 2007; National Tropical Botanical Garden 2011). At a site on Blair Road, five individuals were seen on February 20, 2008 (Plant Extinction Prevention Program 2007), an area from which the species evidently had not been seen previously. At Kilau Stream, located in the Laupahoehoe area, contained approximately 75 to 100 individuals on February 21, 2008, in an area that had contained “hundreds” of individuals from earlier surveys (Plant Extinction Prevention Program 2007; National Tropical Botanical Garden 2011). A single individual was recorded from Wailuku River, where it had not been recorded previously (Plant Extinction Prevention Program 2007). A total of three individuals were found at Wailuku River, where the species also had not been recorded previously (Plant Extinction Prevention Program 2007). Populations of *C. tintinnabula* were surveyed and monitored during fiscal year 2008 by the Plant Extinction Prevention Program (2008), where additional introduced plant species were first reported as threats to this species. The number of individuals increased, with over 150 individuals from Laupahoehoe Natural Area Reserve observed in February 2009 (Plant Extinction Prevention Program 2009). A year later, the Plant Extinction Prevention Program (2010) reported three populations, but did not indicate the number of individuals. However, USFWS (2010) reported approximately 25 individuals at 1,402 meters (4,600 feet) elevation from the Hakalau Forest Unit within the Middle Maulua Unit of Hakalau Forest National Wildlife Refuge.

Jeffrey and Horiuchi (2008) reported, presumably sometime not long before 2005, that two populations comprising a total of 7 individuals were known from the Middle Maulua unit of Hakalau National Wildlife Refuge, and that 12 additional individuals were discovered in 2005.

In 2009, the Plant Extinction Prevention Program (2009) reported a total of three populations containing more than 150 individuals.

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

Smith *et al.* (1996) used randomly amplified polymorphic DNA markers to investigate hybridization among *Cyrtandra* species in Hawaii, and were able to confirm the hybrid origin of all species in Hawaii that were considered to be of hybrid origin. However, the study did not include *C. tintinnabula*.



Cronk *et al.* (2005) studied the evolutionary history of Pacific species of *Cyrtandra* and determined that the Pacific species are monophyletic, strongly suggesting a single origin of the genus from Asia into the Pacific region. Fourteen of the approximately 53 species of *Cyrtandra* in Hawaii were included in the study, although *C. tintinnabula* was not included. The Hawaiian species were shown to be monophyletic, suggesting a single arrival to Hawaii, but the Hawaiian species were not the most recently evolved clade within the genus (Cronk *et al.* 2005).

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

*Cyrtandra tintinnabula* is a perennial shrub from the African violet family (Gesneriaceae) (Wagner *et al.* 1999). The species was originally described by Rock (1919) from a specimen he collected in 1909 on Mauna Kea on the island of Hawaii (USFWS 1996). There are no known taxonomic synonyms for the species (Wagner *et al.* 1999). The historical range of the species is limited to the island of Hawaii on the northern slopes of Mauna Kea. Historical collections, now evidently extirpated, were known from Hamakua at Paauhau, Makahanaloa at Puu Kauku, and North Hilo at Honomu (USFWS 1996). These sites represent the easternmost and westernmost historical occurrences (USFWS 1996). At the time of listing, the species was still known from Honohina in North Hilo, and West Kilau Stream and Kilau Stream in Laupahoehoe, located on State and private lands (USFWS 1994, 1996).

#### **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):**

*Cyrtandra tintinnabula* grows in dense lowland wet forests or gulches dominated by *Metrosideros polymorpha* (ohia), *Acacia koa* (koa), and/or members of the fern genus *Cibotium* (hapuu) (USFWS 1994, 1996). The elevation range is between 390 to 1,443 meters (1,280 to 4,690 feet) (USFWS 2002). The only soil group that is recorded for known sites of *C. tintinnabula* is typic hydrandepts (Hawaii Biodiversity Mapping Program 2010). Native plant species found growing in association with *C. tintinnabula* include other species of *Cyrtandra* and of *Kadua*, *Vaccinium calycinum* (ohelo), *Rubus hawaiiensis* (akala), and *Dryopteris wallichiana* (laukahi; Wallich's tall fern) (USFWS 2002).

### **2.3.1.7 Other:**

No new information.

## **2.3.2 Five-Factor Analysis (threats, conservation measures, and 2.3.2.1 Present or threatened destruction, modification or curtailment of its habitat or range:**

### **Threats:**

- Ungulate degradation of habitat (USFWS 1994, 1996)
  - Feral pigs (*Sus scrofa*)
  - Goats (*Capra hircus*)
- Established ecosystem-altering invasive plant species degradation of habitat (Plant Extinction Prevention Program 2008, 2009; Bishop Museum 2011; National Tropical Botanical Garden 2011)
  - *Angiopteris evecta* (mule's-foot fern)
  - *Clidemia hirta* (Koster's curse)
  - *Cyathea cooperi* (Australian tree fern)
  - *Psidium cattleianum* (strawberry guava)

### **Current conservation efforts:**

- Ungulate exclosure – In 2009, a fenced exclosure approximately 68.6 by 22.9 meters (225 by 75 feet), was constructed in Laupahoehoe Natural Area Reserve to protect *Cyrtandra tintinnabula* along with four other rare plant species (Plant Extinction Prevention Program 2009).

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

Not a threat.

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

None reported.

### **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 *Cyrtandra tintinnabula* occurs continue to threaten this species.

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

##### **Threats:**

- Ungulate trampling (USFWS 1994, 1996)
  - Feral pigs (*Sus scrofa*)
  - Goats (*Capra hircus*)
- Low numbers – increased likelihood of stochastic extinction due to changes in demography, the environment, genetics, or other factors (USFWS 1994, 1996; Plant Extinction Prevention Program 2009)
- Loss of mutualists – Due to native habitat loss, it is possible that the native pollinator(s) are now scarce or absent (USFWS 1996).
- 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:
  - The National Tropical Botanical Garden propagated this species, although details are unknown (USFWS 1996).
  - Rick Warshauer took a cutting from an individual in the field that was tentatively identified as *Cyrtandra tintinnabula* (M. Bruegmann, USFWS, pers. comm. 1998) which was given to the Volcano Rare Plant Facility, but it is unknown if the cutting(s) survived.
  - In 1999, a cutting was taken from the Hakalau National Wildlife Refuge (Jeffrey and Horiuchi 2008) but survived only a few months in the greenhouse. In 2002, two additional cuttings were collected from Hakalau; in 2008 one of the cuttings was thriving and flowered in 2007 (Jeffrey and Horiuchi 2008).
  - In 2000, seed was sown from several fruits in the Hakalau National Wildlife Refuge greenhouse but none of the seedlings

survived; the possible cause of mortality was cooler temperatures at the higher altitude of the greenhouse compared to the source of the seeds (Jeffrey and Horiuchi 2008).

- In 2009 and 2010, the Volcano Rare Plant Facility (2009, 2010) reported five individuals of *C. tintinnabula* in controlled population from Laupahoehoe. In 2011, there were two individuals of *C. tintinnabula* in controlled population from Laupahoehoe (The Volcano Rare Plant Facility 2011).

## 2.4 Synthesis

The interim stabilization goals for this species have not been met. As of 2009, there were three populations containing more than 150 wild individuals at Laupahoehoe Natural Area Reserve, Middle Maulua Unit of Hakalau Forest National Wildlife Refuge, and Wailuku River on Hawaii Island (Plant Extinction Prevention Program 2009). Thus, there is only a single population containing more than 50 wild mature individuals of *Cyrtandra tintinnabula* at Laupahoehoe Natural Reserve (Table 1). In addition, all threats are not being managed (Table 2). Therefore, *C. tintinnabula* meets the definition of endangered as it remains in danger of extinction throughout its range.

**Table 1. Status of *Cyrtandra tintinnabula* from listing through 5-year review.**

<b>Date</b>	<b>No. wild individuals</b>	<b>No. outplanted</b>	<b>Stabilization Criteria identified in Recovery Plan</b>	<b>Stabilization Criteria Completed?</b>
1994 (listing)	18	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
1996 (recovery plan)	18	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
2003 (critical habitat)	25	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)	>150	0	All threats managed in all 3 populations	Partially (see table 2)
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	Partially

**Table 2. Threats to *Cyrtandra tintinnabula* and ongoing conservation efforts.**

<b>Threat</b>	<b>Listing factor</b>	<b>Current Status</b>	<b>Conservation/ Management Efforts</b>
Ungulates – Degradation of habitat, trampling	A, D, E	Ongoing	Partially: Ungulate exclosure at Laupahoehoe Natural Area Reserve
Established ecosystem-altering invasive plant species degradation of habitat	A	Ongoing	No
Low numbers	E	Ongoing	Partially: Captive propagation for genetic storage and reintroduction
Loss of mutualists	E	Ongoing	No
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 – Continue to collect cuttings or seed from the remaining populations for adequate genetic storage.

- Captive propagation protocol development – Implement research needed for the propagation of the species, especially at Hakalau Forest National Wildlife Refuges greenhouse.
- Reintroduction / translocation site identification – Identify suitable habitat within the historical range of the species for reintroductions.
- Reintroduction / translocation implementation – Reintroduce the species back into its known historical range.
- Ecosystem-altering invasive plant species control – Control invasive introduced plant species around all populations.
- Ungulate exclosures – Continue to 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.
- Surveys / inventories – Resurvey the historical range of the species to search for additional populations or individuals.
- Population viability monitoring – Monitor each population at least twice yearly for evidence of disease or mortality.
- Population biology research – Carry out field studies to determine the pollinators associated with the 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.
- Alliance and partnership development – Work with the Hawaii Division of Forestry and Wildlife, and other land managers to continue implementation of ecosystem-level restoration and management to benefit this species.

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**Signature Page**  
**U.S. FISH AND WILDLIFE SERVICE**  
**5-YEAR REVIEW of *Cyrtandra tintinnabula* (Haiwale)**

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
- X       No Change in listing status

**Appropriate Listing/Reclassification Priority Number, if applicable:**           

**Review Conducted By:**

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Marie Bruegmann, Plant Recovery Coordinator  
Jess Newton, Endangered Species Recovery Program Leader  
Assistant Field Supervisor for Endangered Species

**Field Supervisor, Pacific Islands Fish and Wildlife Office**

*for*

          *Jess Newton*          

Date   8/28/2012