

Cyrtandra dentata
(Haiwale)

**5-Year Review
Summary and Evaluation**

**U.S. Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office
Honolulu, Hawaii**

5-YEAR REVIEW

***Cyrtandra dentata* (Ha 'iwale)**

I. GENERAL INFORMATION

A. Methodology used to complete the review:

This review was conducted by staff of the Pacific Islands Fish and Wildlife Office (PIFWO) of the Fish and Wildlife Service between July 2005 and June 2006. The Hawaii Biodiversity and Mapping Program was contracted to provide updated information on the current status of *Cyrtandra dentata*. They also provided recommendations for future actions that may be needed prior to the next 5-year review. The evaluation of the lead PIFWO biologist was reviewed by the Plant Recovery Coordinator, whose comments were incorporated into the draft 5-year Review. The draft 5-year Review was then reviewed by the Recovery Program Leader and the Assistant Field Supervisor for Endangered Species before PIFWO submission to the Regional Office.

B. Reviewers

Lead Region: Region 1

Lead Field Office: Pacific Islands Fish and Wildlife Office

C. Background

1. FR Notice citation announcing initiation of this review:

U.S. Fish and Wildlife Service. July 6, 2005. Endangered and Threatened Wildlife and Plants; Initiation of 5-year Reviews (of 33 species in Region 1). 70 FR 38972-38975.

2. Species status:

Improving (FY 2006 Recovery Data Call)

3. Recovery achieved:

1, meaning 0 - 25 percent of the identified recovery objectives for *Cyrtandra dentata* have been achieved (FY 2006 Recovery Data Call)

4. Listing history

Original Listing

FR notice: U.S. Fish and Wildlife Service. 1996. Endangered and threatened wildlife and plants; determination of endangered status for twenty-five plant species from the island of Oahu, HI. *Federal Register* 61(198): 53089-53108.

Date listed: October 10, 1996

Entity listed: Species

Classification: Endangered

Revised Listing, if applicable
N/A

5. Associated actions:

Critical habitat was designated for *Cyrtandra dentata* in one unit totaling 758 acres (307 hectares) on Oahu (U.S. Fish and Wildlife Service. 2003. Endangered and threatened wildlife and plants; final designations or nondesignations of critical habitat for 101 plant species from the island of Oahu, Hawaii. *Federal Register* 68(116): 35950-36406).

6. Review History: Just the original listing, designation of critical habitat, and recovery plan development actions.

7. Species' Recovery Priority Number at start of review: 8, meaning a species with a moderate degree of threat and a high recovery potential.

8. Recovery Plan or Outline

Name of plan: Recovery Plan for the Oahu Plants. 1998. U.S. Fish and Wildlife Service, Portland, Oregon. 207 pp. plus appendices.

Date issued: August 10, 1998

Dates of previous revisions: N/A

Some of the actions outlined in the Recovery Plan have been initiated but not completed (*e.g.*, control nonnative plants within fenced enclosures). Some recovery actions will require long-term commitments (*e.g.*, maintenance of enclosure fences; weed and rat control) or may only be necessary intermittently (*e.g.*, provide protection against fire).

II. REVIEW ANALYSIS

A. Application of the 1996 Distinct Population Segment (DPS) Policy

This Policy does not apply to plant species.

B. Recovery Criteria

1. Does the species have a final, approved recovery plan?

Yes

No

2. Does the recovery plan contain recovery (i.e., downlisting or delisting) criteria?

Yes

No

3. **Adequacy of recovery criteria.**
- a. **Do the recovery criteria reflect the best available (i.e., most up-to-date) information on the biology of the species and its habitat?**
 Yes
 No
- b. **Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria (and there is no new information to consider regarding existing or new threats)?**
 Yes
 No
4. **List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information. For threats-related recovery criteria, please note which of the 5 listing factors* are addressed by that criterion. If any of the 5-listing factors are not relevant to this species, please note that here.**

The threats (Factors A, C, and E) affecting this species are discussed in detail in section II.D. Factors B and D are not considered a threat to this species.

Stabilizing, downlisting, and delisting objectives are provided in the Recovery Plan for Oahu Plants (Service 1998), based on whether the species is an annual, a short-lived perennial (fewer than 10 years), or a long-lived perennial. *Cyrtandra dentata* is a short-lived perennial, and to be considered stable, this species must be managed to control threats (e.g., fenced) (Factors A, C, and E) and be represented in an *ex situ* collection. In addition, a minimum of three populations should be documented on the island of Oahu where the species now occurs 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 *Cyrtandra dentata* should be documented on the island of Oahu where it now occurs or occurred historically. Each of these populations must be naturally reproducing, stable or increasing in number, and secure from threats (Factors A, C, and E), with a minimum of 300 mature individuals per population. Each population should persist at this level for a minimum of 5 consecutive years before downlisting is considered.

This recovery objective has not been met.

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- A) Present or threatened destruction, modification or curtailment of its habitat or range;
 - B) Overutilization for commercial, recreational, scientific, or educational purposes;
 - C) Disease or predation;
 - D) Inadequacy of existing regulatory mechanisms;
 - E) Other natural or manmade factors affecting its continued existence.

For delisting, a total of 8 to 10 populations should be documented on the island of Oahu where it now occurs or occurred historically. Each of these populations must be naturally reproducing, stable or increasing in number, and secure from threats (Factors A, C, and E), with 300 mature individuals per population for short-lived perennials. Each population should persist at this level for a minimum of 5 consecutive years before delisting is considered.

This recovery objective has not been met.

C. Synthesis

Historically, *Cyrtandra dentata* was known from six populations in the Waianae mountains and three populations in the Koolau mountains of Oahu (61 FR 53089). In the Waianae mountains the species was documented in the northern and southern portions of the mountain range, however, the record from the southern Waianae mountains may be based on a misidentified specimen (Makua Implementation Team 2003). At the time of listing, *C. dentata* was found only in the Waianae mountains in Pahole and Ekahanui Gulches, and in Kapuna Valley, in 3 populations totaling fewer than 50 individuals (61 FR 53089). In the Koolau mountains, *C. dentata* was known from three populations in Kaiwikoele, Kawaiiki, and Opaepala drainages (Hawaii Heritage Program 2005). In 1998, when the recovery plan was published, this species was known from 4 populations with approximately 50 individuals in the Kahanahaiki population and 20 more individuals at Ekahanui and Pahole gulches, and in Kapuna Valley (Service 1998). Currently, this species is known from the adjoining drainages of Kahanahaiki, Pahole, Kapuna, Keawapilau, and West Makaleha in the Waianae mountains, with individuals found in the Koolau mountains in the Kawaiiki and Opaepala drainages, within the Army's Kawailoa Training Area. In 2003, the estimated number of individuals for this species was about 470 (Makua Implementation Team 2003). Currently, the total number of individuals is approximately 1,640 from both the Waianae and Koolau mountains (U.S. Army 2006; J. Lau, Hawaii Biodiversity and Mapping Program, pers. comm. 2006). However, this increase in numbers does not reflect recorded changes in population sizes of the species, but rather is the result of the discovery of new plants and updated information on the species' populations (U.S. Army 2006; J. Lau, pers. comm. 2006). No outplantings of *C. dentata* are planned as this species' natural recruitment is high once the threats of habitat degradation and predation by feral pigs are controlled (U.S. Army 2005).

Habitat degradation by feral pigs (*Sus scrofa*) is considered one of the major threats to *Cyrtandra dentata* (Factor A) (Service 2003a, U.S. Army 2005). As early as 1778, European explorers introduced livestock, which became feral, increased in number and range, and caused significant changes to the natural environment of Hawaii. The pig is originally native to Europe, northern Africa, Asia Minor, and Asia. European pigs became feral and invaded forested areas, especially wet and mesic forests and dry areas at high elevations. Feral pigs are currently present on Oahu and inhabit rain forests and grasslands. While rooting in the ground in search of the invertebrates and plant material they eat, feral pigs disturb and destroy vegetative cover, trample plants and seedlings, and threaten forest regeneration by damaging seeds and seedlings. They

disturb soil and cause erosion, especially on slopes. Alien plant seeds are dispersed on their hooves and coats as well as through their digestive tracts, and the disturbed soil is fertilized by their feces, helping these plants to establish. Feral pigs are a major vector in the spread of many introduced plant species (Smith 1985; Stone 1985; Medeiros *et al.* 1986; Scott *et al.* 1986; Tomich 1986; Cuddihy and Stone 1990; Wagner *et al.* 1999). The state of Hawaii's Division of Forestry and Wildlife fenced the Pahole Gulch portion of *C. dentata*'s range in 1996 (Hawaii Division of Forestry and Wildlife 1996), and this fenced unit has been ungulate free since 1998. Under the terms of the 1999 U.S. Fish and Wildlife Service's 2003 Biological Opinion for Routine Military Training on Oahu, and the subsequent 2003 Makua Implementation Plan, the Army began fencing individuals of this species (Makua Implementation Team 2003). The *C. dentata* individuals in Kahanahaiki Valley are contained within an enclosure constructed in 1996. The Army is planning to fence the *C. dentata* found in Kapuna and Keawapilau Gulches in 2008-2009 (U.S. Army 2005). The Army's goal is 100 percent exclusion of feral pigs within these fenced areas (Makua Implementation Team 2003).

Fire is considered a threat as *Cyrtandra dentata* occurs in mesic forests which often become very dry in the summer months and this species is not considered fire tolerant (Factors A and E) (Service 1998, 1999, 2003a; 61 FR 53089, 68 FR 35950). One potential cause of fire is from military training activities in Makua Military Reservation. The Army has addressed the threat of fire from their training actions by developing and implementing a fire management plan to minimize the number of ignitions in the reservation, to respond rapidly to any ignitions, and to maintain fire breaks to help contain any ignitions away from the endangered species locations (U.S. Army 2003). Fire is less of a threat to *C. dentata* in the Koolau mountains since the forest habitat is wetter than that in the Waianae mountains (Makua Implementation Team 2003).

Competition with and habitat degradation by invasive alien plant species is a major threat to *Cyrtandra dentata* (Factors A and C). At the time of listing the primary nonnative plants impacting *C. dentata* were *Clidemia hirta* (Koster's curse) and *Psidium cattleianum* (strawberry guava) (61 FR 53089). Currently, the nonnative plant species impacting *C. dentata* include *Aleurites moluccana* (kukui), *Ageratina adenophora* (Maui pamakani), *Buddleia asiatica* (dog tail), *Christella parasitica*, *Clidemia hirta* (Koster's curse), *Psidium cattleianum* (strawberry guava), *Rubus rosifolius* (thimbleberry), and *Schinus terebinthifolius* (Christmas berry) (61 FR 53089). The Army has initiated control of the invasive nonnative plant species at the Kahanahaiki population and at the Pahole to West Makaleha population (U.S. Army 2005).

Feral pigs not only degrade the habitat of *Cyrtandra dentata*, but also cause harm to the plants by feeding on them, trampling them, or uprooting them in search of invertebrate food (Factor C) (Makua Implementation Team 2003). Conservation measures such as fencing have been initiated to reduce the threat of predation by feral pigs.

Predation by rats was identified as a potential threat at the time *Cyrtandra dentata* was listed in 1996 (Factor C) (61FR 53093). Rats are known to eat the fruit and strip the bark of some native plants, especially those with fleshy stems and fruits (Cuddihy and Stone 1990; Tomich 1986). *Cyrtandra dentata* produces its fruit over an extended period, producing a prolonged food supply which could support rodent populations (Makua Implementation Team 2003; Service 1998). The Army conducts rat control at *C. dentata* enclosures (U.S. Army 2005).

Slug predation may impact *Cyrtandra dentata*, but research is needed to determine the extent of the impact on this species (Factor C) (U.S. Army 2005).

In addition to all of the other threats, species like *Cyrtandra dentata* that are endemic to single small 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 and disease outbreaks (Factor E). The Army is addressing the threat to this species from the small number of populations and the small population sizes through genetic storage and propagation for eventual reintroduction of individuals in a portion of the species' range in the Waianae and Koolau mountains. Propagation for genetic storage is occurring in the Army's baseyard and at the University of Hawaii's Lyon Arboretum Micropropagation and Seed Storage Laboratories. The Army and Lyon Arboretum are working together to store genetic material long-term against stochastic events (U.S. Army 2005). The goal for genetic storage of *C. dentata* is to collect up to 50 seeds each from up to 50 individuals from each population (Makua Implementation Team 2003). This goal has been partially met (U.S. Army 2005). The northern Waianae individuals of *Cyrtandra dentata* in West Makaleha Valley, and in the gulches of Pahole, Kapuna, and Keawapilau are treated as a single population for management by the Army. Populations in Kahanahaiki Valley in the northern Waianae mountains, and the populations in Kawaiiiki and Opaepala Gulches in the Koolau mountains will be monitored by the Army. The target goals for each population are 50 mature, reproducing individuals (U.S. Army 2005). Three factors stand out that still put *Cyrtandra dentata* at imminent risk of extinction (Table 1): 1) only one large population exists, in a very small range (1-mile x 2-mile area), providing no resilience for to short and long term environmental changes; 2) the one large population (95 percent of the species), occurs in an area at some fire risk from military training; and 3) the long-term sustainability of the populations are not well known with only two years of demography data. Therefore, this species does not warrant downlisting at this time.

The goals for genetic storage of *Cyrtandra dentata* have been partially met. The goals for stabilization, downlisting, and recovery for this species have not been met and, therefore, *C. dentata* meets the definition of endangered as it remains in danger of extinction throughout all of its range.

III. RESULTS

A. Recommended Classification:

- Yes, downlist to Threatened
- Yes, uplist to Endangered
- Yes, delist
- No, no change is needed

B. New Recovery Priority Number NA

IV. RECOMMENDATIONS FOR FUTURE ACTIONS

- Search for additional populations of *Cyrtandra dentata*, particularly in the species' historical range in the Koolau mountains, which has seldom been explored by botanists (Makua Implementation Team 2003).
- Study *Cyrtandra dentata* 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 to the species.
- Manage all known populations of *Cyrtandra dentata*.

Table 1. Current status of *Cyrtandra dentata*

Population	No. mature individuals	No. immature individuals	No. seedlings	Reasonably good regeneration? *	Ungulate control?	Weed control?	Rat control?	Slug control?
Pahole to Kapuna to West Makaleha	686	574	348	Yes	Pahole and Kahanaha iki portions are fenced	Ongoing for Kahahai ki, control for other species in area benefits Pahole part of this population	Partial	No
Kawaiiki	19	35	43	Yes	No	No	No	No
Opaeula	35	47	43	Yes	No	No	No	No
TOTAL NUMBERS	740	656	284					

V. REFERENCES

Cuddihy, L.W. and C.P. Stone. 1990. Alteration of native Hawaiian vegetation: Effects of humans, their activities and introductions. Coop. Natl. Park Resources Studies Unit, University of Hawaii, Honolulu. 138 pp.

- Hawaii Division of Forestry and Wildlife. 1996. Statewide Endangered Plant Program, Surveys and Inventories - Monitoring and Germplasm Collection Statewide. January 1996 Revision. Prepared for the U.S. Fish and Wildlife Service for section 6 funding.
- Hawaii Heritage Program. 2005. Database. Unpublished.
- Makua Implementation Team. 2003. Implementation Plan for the Makua Military Reservation, Island of Oahu. Prepared for U.S. Army Garrison, Hawaii, May 2003.
- Medeiros, A.C. *et al.* 1986. Status of native flowering plant species on the south slope of Haleakala, East Maui, Hawaii. Coop. Natl. Park Resources Studies Unit, University of Hawaii, Honolulu. 230 pp.
- Scott, J.M. *et al.* 1986. Forest bird communities of the Hawaiian Islands: Their dynamics, ecology, and conservation. *Studies in Avian Biology* 9: 1-429.
- Smith, C.W. 1985. Impact of alien plants on Hawaii's native biota. *In* Hawaii's Terrestrial Ecosystems: Preservation and Management, Stone, C.P. and J.M. Scott, eds., Coop. Natl. Park Resources Studies Unit, University of Hawaii, Honolulu. pp. 180-250.
- Stone, C.P. 1985. Alien animals in Hawaii's native ecosystems: Toward controlling the adverse effects of introduced vertebrates. *In* Hawaii's Terrestrial Ecosystems: Preservation and Management, Stone, C.P. and J.M. Scott, eds., Coop. Natl. Park Resources Studies Unit, University of Hawaii, Honolulu. pp.251-297.
- Tomich, P.Q. 1986. Mammals in Hawaii: a Synopsis and Notational Bibliography. Bishop Museum Press, Honolulu. 375 pp.
- U.S. Army Garrison, Hawaii. 2003. Integrated Wildland Fire Management Plan, Oahu & Pohakuloa Training Areas, 25th Infantry Division (Light) and United States Army, Hawaii. 213 pp. + appendices
- U.S. Army Garrison, Hawaii. 2005. 2005 Status Report, Makua Implementation Plan, Island of Oahu. Directorate of Public Works, Environmental Division. 334 pp.
- U.S. Army Garrison, Hawaii. 2006. Rare plant database, Mar. 23, 2006. Unpublished.
- U.S. Fish and Wildlife Service. 1996. Endangered and Threatened Wildlife and Plants; Determination of Endangered Status for Twenty-five Plant Species from the Island of Oahu, HI. *Federal Register* 61(198): 53089-53108.
- U.S. Fish and Wildlife Service. 1998. Recovery Plan for Oahu Plants. U.S. Fish and Wildlife Service, Portland, Oregon. 207 pp., + appendices.
- U.S. Fish and Wildlife Service. 1999. Biological Opinion of the U.S. Fish and Wildlife Service

for Routine Military Training at Makua Military Reservation. Honolulu, Hawaii. 41 pp.
+ attachments.

U.S. Fish and Wildlife Service. 2003a. Biological Opinion of the U.S. Fish and Wildlife Service for Routine Military Training and Transformation of the 2nd Brigade 25th Infantry Division (Light), U.S. Army Installations, Island of Oahu. October 23, 2003. 356 pp.

U.S. Fish and Wildlife Service. 2003b. Endangered and Threatened Wildlife and Plants; Final Designations or Nondesignations of Critical Habitat for 101 Plant Species from the Island of Oahu, Hawaii. Federal Register 68(116): 35950-36406.

Wagner, W.L. *et al.* 1999. Manual of the Flowering Plants of Hawaii, Second Edition. University of Hawaii Press and Bishop Museum Press, Honolulu. 1,918 pp.

EXPERTS CONSULTED

Lau, Joel. 2006. Hawaii Biodiversity and Mapping Program. Personal communication.

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

Current Classification Endangered

Recommendation resulting from the 5-Year Review

- Downlist to Threatened
- Uplist to Endangered
- Delist
- No change is needed

Appropriate Listing/Reclassification Priority Number N/A

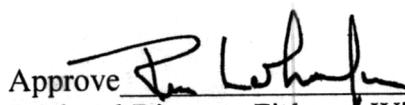
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Date JUL - 3 2007

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Date Aug 2 2007

Regional Director, Fish and Wildlife Service