Chamaesyce herbstii
(Akoko)

5-Year Review
Summary and Evaluation

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

5-YEAR REVIEW
Chamaesyce herbstii (Akoko)

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 and threats to *Chamaesyce herbstii*. 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:

Stable (FY 2006 Recovery Data Call)

3. Recovery achieved:

1, meaning 0 - 25 percent of the identified recovery objectives for *Chamaesyce herbstii* 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, Hawaii. *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 *Chamaesyce herbstii* in three units totaling 1,228 acres (497 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): 35949-36406).

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.*, construct exclosures to protect populations from feral pigs; control nonnative plants within fenced exclosures). Some recovery actions will require long-term commitments (*e.g.*, maintenance of exclosure fences; weed 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?
__X__ *Yes*
____ *No*

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

   __X__ *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)?**

   __X__ *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 and E) affecting this species are discussed in detail in section II.D. Factors B, C, 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. *Chamaesyce herbstii* 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 *Chamaesyce herbstii* 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.

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) Inadqequacy of existing regulatory mechanisms;
E) Other natural or manmade factors affecting its continued existence.

For delisting, a total of 8 to 10 populations of *Chamaesyce herbstii* 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 delisting is considered.

This recovery objective has not been met.

C. Synthesis

Historically, *Chamaesyce herbstii* was found in both the northern and southern ends of the Waianae mountains on the island of Oahu. It was extant in the drainages of Pahole, Kapuna, Makaleha, and in South Ekahanui Gulch. The last known plants in South Ekahanui Gulch died in 2001 (Makua Implementation Team 2003). *Chamaesyce herbstii* was last recorded in Makaleha Valley by Steve Perlman in 1987, when he observed 10 to12 individuals. Perlman searched the site again in 2001 and could not locate any individuals (Makua Implementation Team 2003). In 2003 it was estimated that there was a total of approximately 170 plants in the northern Waianae mountains in the adjoining gulches of Pahole and Kapuna (Makua Implementation Team 2003). This species has undergone a dramatic decline in numbers in the last 5 years (T. Takahama, Natural Area Reserve System, pers. comm. 2005). By 2005, the total number of plants had declined to an estimated 56 individuals (U.S. Army 2006). Currently, there are no extant individuals in the southern end of the Waianae mountains, and a decrease in range of individuals in the northern Waianae mountains. The Army has outplanted into the area between Kapuna and Pahole Gulches, and currently there are two mature individuals outplanted in Kapuna Gulch, and 18 immature plants outplanted in Pahole Gulch (U.S. Army 2006). The total number of individuals in the remaining Kapuna to Pahole Gulch population are therefore approximately 58 mature and 18 immature individuals.

Habitat degradation and predation by feral pigs (*Sus scrofa*) are considered major threats to *Chamaesyce herbstii* (Factors A and C) (61 FR 53089; 68 FR 35950). 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. Past and present activities of introduced alien mammals are the primary factor altering and degrading vegetation and habitats on Oahu. The pig is originally native to Europe, northern Africa, Asia Minor, and Asia. European pigs, introduced to Hawaii by Captain James Cook in 1778, 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 both rain forest and grassland. 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. Pigs are a primary vector in the spread of many introduced plant species (Smith 1985; Stone 1985; Scott *et al.* 1986; Tomich

1986; Cuddihy and Stone 1990; Wagner *et al.* 1999; Service 2001 and 2004; U.S. Army 2003; 61 FR 53089). The Hawaii Division of Forestry and Wildlife fenced the Pahole Gulch portion of the species' range in 1996 and this fenced unit has been ungulate free since 1998 (Hawaii Division of Forestry and Wildlife 1996). Between 2001 and 2005, populations at South Ekahanui Gulch and Makaleha Valley were extirpated. All of the Kapuna Gulch individuals of *C. herbstii* will be included within a fenced unit planned for construction by the U.S. Army Environmental Division in 2007 for this gulch and the adjacent Keawapilau Gulch (U.S. Army 2005). The Army's goal is 100 percent exclusion of feral pigs within these fenced areas (Makua Implementation Team 2003).

Habitat degradation from and competition with invasive alien plant species is a major threat to *Chamaesyce herbstii* (Factors A and E). At the time of listing in 1996 the primary nonnative plants impacting *C. herbstii* were *Grevillea robusta* (silk oak), *Passiflora suberosa* (huehue haole), *Psidium cattleianum* (strawberry guava), and *Schinus terebinthifolius* (Christmas berry) (61 FR 53089). Currently, the invasive alien plant species with the greatest impact on *C. herbstii* include *Ageratina adenophora* (Maui pamakani), *Buddleia asiatica* (dog tail), *Clidemia hirta* (Koster's curse), *Psidium cattleianum* (strawberry guava), *Psidium guajava* (common guava), *Rubus rosifolius* (thimbleberry), and *Schinus terebinthifolius* (Christmas berry). The Army has started controlling invasive alien species in Pahole Gulch (U.S. Army 2005).

Fire is considered a potential threat, as *Chamaesyce herbstii* 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) (Service1998, 2004; 61 FR 53089). Two potential causes of fire are arson and military training activities in Makua Military Reservation. The Army has addressed the threat of fire from their actions by developing and implementing a wildland 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).

In addition to all of the other threats, species like *Chamaesyce herbstii* that are endemic to a small portion of a single island are inherently more vulnerable to extinction than widespread species because of the higher risks posed to a few populations and individuals by random demographic fluctuations and localized catastrophes such as hurricanes and disease outbreaks (Factor E).

Under the terms of the U.S. Fish and Wildlife Service's Biological Opinions for Routine Military Training at Makua Military Reservation (1999, 2001, and 2004) and the subsequent 2003 Makua Implementation Plan, the Army began addressing the threat from the small numbers and sizes of populations of *C. herbstii* through genetic storage and propagation for eventual reintroduction of individuals in the species' recorded range (Service 2001, Makua Implementation Team 2003). In addition to reintroduction already occurring between Kapuna and Pahole Gulches, Army management plans also include reintroduction of *C. herbstii* in Makaha Valley and West Makaleha Valley (U.S. Army 2005). A population unit at South Ekahanui Gulch has been fenced by the Army with additional fencing at this site planned in 2008. The Army conducts weed control at all fenced areas (Makua Implementation Team 2003). Because *C. herbstii* is known from two widely separated areas in the northern and southern portions of the Waianae

mountains, it is possible that there is some level of genetic distinctiveness between the two stocks. The precautionary approach is to refrain from introducing northern Waianae stock to the southern Waianae area until it is fairly certain that the southern population is completely extirpated (Makua Implementation Team 2003). The goal for genetic storage of *C. herbstii* is to collect up to 50 seeds each from up to 50 individuals from each population (Makua Implementation Team 2003). The target goals for numbers in each population are 25 mature, reproducing individuals (Makua Implementation Team 2003).

The Army's Environmental Division has propagated *Chamaesyce herbstii* from seeds and cuttings with the cooperation of the University of Hawaii's Lyon Arboretum (Service 1998, 2005). *Chamaesyce herbstii* has been outplanted at two sites in the Pahole Natural Area Reserve managed by the State (U.S. Army 2005). Other propagation activities are taking place at the National Tropical Botanical Garden, the state of Hawaii's Division of Forestry and Wildlife's Pahole Rare Plant Facility, and at Audubon Society's Waimea Valley Park. These organizations and agencies are working together to store genetic material long-term against stochastic events and to supply the Army with plants for reintroductions (Service 2005).

The stabilization, downlisting, and recovery goals for this species have not been met and, therefore, *Chamaesyce herbstii* 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**
__X__ **No, no change is needed**

B. New Recovery Priority Number N/A

IV. RECOMMENDATIONS FOR FUTURE ACTIONS

- Efforts should continue to be made to fence and protect populations of the remaining individuals of *Chamaesyce herbstii.*

- Collection and propagation for complete genetic representation of the remaining individuals of *Chamaesyce herbstii* should be conducted.

- Study the known population of *Chamaesyce herbstii* 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.

- Reintroduce populations of *Chamaesyce herbstii* within its historical range.

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EXPERTS CONSULTED

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of *Chamaesyce herbstii* (Akoko)

Current Classification ___Endangered__

Recommendation resulting from the 5-Year Review

Downlist to Threatened
Uplist to Endangered
____ Delist
_X_ No change is needed

Appropriate Listing/Reclassification Priority Number _N/A_

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