

*Chamaesyce skottsbergii* var. *kalaeloana*  
(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 skottsbergii* var. *kalaeloana* (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 of *Chamaesyce skottsbergii* var. *kalaeloana*. 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:**

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 *Chamaesyce skottsbergii* var. *kalaeloana* have been achieved (FY 2006 Recovery Data Call)

**4. Listing history**

Original Listing

FR notice: U.S. Fish and Wildlife Service. 1982. Endangered and threatened wildlife and plants; determination that *Euphorbia skottsbergii* var. *kalaeloana* (Ewa Plains Akoko) is an endangered species. *Federal Register* 47(164): 36846-36849.

Date listed: August 24, 1982

Entity listed: Variety

Classification: Endangered

Revised Listing, if applicable

N/A

5. **Associated actions:** N/A

6. **Review History:**

November 6, 1991 (56 FR 56882) – review of all species listed before 1991

7. **Species' Recovery Priority Number at start of review:** 6, meaning a subspecies with a high degree of threat and a low recovery potential.

8. **Recovery Plan or Outline**

Name of plan: N/A

Date issued: N/A

Dates of previous revisions: N/A

A recovery plan has been drafted for this species but has not been finalized.

## 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

### C. Updated Information and Current Species Status

1. **Improved Analyses --** *Has application of improved analytic methods resulted in relevant new information?*

Yes  
 No

2. **Biology and Habitat:**

a. **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:**

On Oahu, *Chamaesyce skottsbergii* var. *kalaeloana* was recorded only on the Ewa Plains, extending from Kalaeloa (Barbers Point) to Puuloa (Pearl Harbor). In a botanical survey for *C. skottsbergii* var. *kalaeloana* conducted in 1978 and 1979 (Char and Balakrishnan 1979), there

were 2,450 individuals at the western end of the Ewa Plains in the area of the present day Kalaeloa Barbers Point Harbor, and 1,300 individuals in the West Beach Resort area. These subpopulations are no longer extant due to the enlargement of the harbor, construction of harbor facilities, and development of the West Beach Resort (Whistler 1993; J. Kwon, U.S. Fish and Wildlife Service, pers. comm. 2006). Another 518 plants were found in the 1978-1979 survey in 2 areas on the Naval Air Station, Barbers Point (NASBP). In 1979, 18 of these plants were recorded at the northwest corner of the Air Station (Char and Balakrishnan 1979). In a 1993 survey of this area only seven plants were found (Whistler 1993), with four additional plants recorded in another part of this area in 1994. In a 1998 survey for *C. skottsbergii* var. *kalaeloana*, only one plant was located in the northwestern corner of the Air Station (Whistler 1998). The remaining 500 plants found in the 1978-1979 botanical survey were located on the eastern portion of the Air Station (Char and Balakrishnan 1979). In 1983 the number of plants in that area was estimated to be 5,000, with the highest concentration of the population at the Northern Trap and Skeet Range (NTSR) site (HBMP 2006). A few plants have also been found at scattered locations away from the NTSR site (Whistler 1998; J. Kwon, pers. comm. 2006). A cleanup of the NTSR was conducted in 2004 to remove soil contaminated with arsenic and lead deposited when the range was in use (Guinther 2006). A survey was conducted in March and April 2003 of the 23-acre NTSR site prior to the cleanup, and a total of 858 *C. skottsbergii* var. *kalaeloana* plants were located; with 391 individuals found in 8 concentrations distributed over a total of 0.4 acres of the 23-acre parcel, and the remaining 467 individuals distributed outside of those concentrations (Whistler 2003).

During the 1978-1979 botanical survey, two small subpopulations were observed in the Campbell Industrial Park between the air station and the harbor/resort area. One subpopulation at the Standard Oil refinery consisted of 100 individuals. In August 1979, this area was bulldozed, destroying most of the plants (Char and Balakrishnan 1979). Only a single individual remained there in 1984 (HBMP 2006). The second subpopulation observed in Campbell Industrial Park on the 1978-1979 survey was found west of the air station's western boundary, with a total of 20 individuals (Char and Balakrishnan 1979). This subpopulation was comprised of an unknown number of individuals in 1993 (HBMP 2006). As of October 2005, 316 individuals were outplanted at the Building 1527 site, and 302 individuals were outplanted at the Kalaeloa site (Koebele 2005). In March of 2006, there was a total of 1,354 natural and outplanted individuals, with 894 at the NTSR site (including Building 1527), and 451 at the Kalaeloa site (Guinther 2006).

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

Genetic studies were conducted in 2002 and 2005 on the extant populations of *Chamaesyce skottsbergii* from Oahu and Molokai in order to assess the level of genetic distinctiveness between them (Morden 2002; Morden and Gregoritz 2006). *Chamaesyce skottsbergii* var. *skottsbergii* from Oahu was found to be genetically distinct from the Molokai populations of var. *skottsbergii* and var. *vaccinioides*, and the extent of this genetic differentiation supports the recognition of all three populations as distinct varieties. It was found that the Molokai population is more closely related to var. *vaccinioides* than to var. *skottsbergii* on Oahu, and thus should be recognized by the previously used variety name, *Chamaesyce skottsbergii* var. *audens*.

The level of genetic differentiation between the Oahu population and the two varieties on Molokai may warrant the recognition of the Oahu population as a separate species, although further research is needed before recognition at the species level is considered (Morden 2002; Morden and Gregoritz 2006). Genetic variation within each of the three studied populations was found to be higher than in any other populations of native Hawaiian plant taxa that have been similarly studied. The Oahu population of *Chamaesyce skottsbergii* var. *kalaeloana* is evidently not genetically depauperate, and its endangered status apparently is a consequence of factors other than anything intrinsic to the population itself (Morden and Gregoritz 2006).

**c. Taxonomic classification or changes in nomenclature:**

The Oahu populations of *Chamaesyce skottsbergii* var. *kalaeloana* were federally listed as endangered under the name *Euphorbia skottsbergii* var. *kalaeloana* in 1982. In a taxonomic revision of the native Hawaiian taxa of the genus *Chamaesyce* published in 1990 (Koutnik 1990) two varieties within the species *Chamaesyce skottsbergii* were recognized: var. *skottsbergii* and var. *vaccinioides*. Variety *skottsbergii* was considered to include *Euphorbia skottsbergii* var. *kalaeloana* along with populations of the species from northwestern Molokai. Variety *vaccinioides* included plants from central Molokai, Kahoolawe, and the southern side of East Maui. Currently, DNA sequence analysis indicates that *Chamaesyce skottsbergii* populations on Oahu and Molokai are genetically distinct, and the extent of this differentiation supports the recognition of these populations as distinct varieties. The Molokai population is more closely related to var. *vaccinioides*, and should be recognized by the previously used variety name, *C. skottsbergii* var. *audens* and the Oahu variety should be recognized as *C. skottsbergii* var. *kalaeloana* (Morden and Gregoritz 2006)

**d. 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.):**

Historically, *Chamaesyce skottsbergii* var. *kalaeloana* was known only from the Ewa Plains of Oahu, in the vicinity of Barbers Point. The precise natural range of this taxon was unknown, but probably did not go beyond the coralline plains of the Ewa area (47 FR 36846). A site near the oil refinery at Barbers Point Harbor contained approximately 100 individuals, but was bulldozed in 1979. Plants on the west beach side of Barbers Point Harbor were cleared during a quarrying operation in 1980. In 1980 the estimates of *C. skottsbergii* var. *kalaeloana* around Barbers Point Harbor were 500 to 1,000 individuals, a drop from the original estimate of 2,450 individuals in 1979. Currently, there are 3 populations of *C. skottsbergii* var. *kalaeloana* totaling approximately 1,345 adult individuals at the NTSR (including Building 1527) and the Kalaeloa sites. (Guinther 2006).

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

*Chamaesyce skottsbergii* var. *kalaeloana* is found in coastal dry shrublands with calcareous substrate or thin soil pockets in the coralline rubble, restricted to the Ewa Plains on the island of

Oahu (Morden 2002). Associated native species are *Erythrina sandwicensis* (wiliwili), *Myoporum sandwicense* var. *stellatum* (naio), *Santalum ellipticum* (iliahialoe), *Sida fallax* (ilima), and *Sicyos pachycarpus* (kupala). All of these habitats are highly degraded. (Guinther 2006).

**3. Five Factor Analysis (threats, conservation measures and regulatory mechanisms)**

**a. Present or threatened destruction, modification or curtailment of its habitat or range:**

The decline of *Chamaesyce skottsbergii* var. *kalaeloana* on Oahu can largely be attributed to loss of its habitat due to Polynesian settlement, agriculture, the establishment of a rock quarry, and the construction of roads, housing, an industrial complex, a deep-draft harbor, a resort development, and military bases (47 FR 36846).

*Chamaesyce skottsbergii* var. *kalaeloana* is currently threatened by soil remediation actions taken by the US. Navy at the former Naval Air Station at Barbers Point (NASBP). Due to the NASBP base closure in 2003, the U.S. Navy removed hazardous substances from the property prior to its transfer of ownership. Under the terms of the U.S. Fish and Wildlife Service's 2002 Biological Opinion and the 2003 reinitiation of consultation regarding potential impacts to *C. skottsbergii* var. *kalaeloana* (akoko) from the proposed soil removal action for decontamination of the Northern Trap and Skeet Range (NTSR), soil in the areas containing the larger numbers of *C. skottsbergii* var. *kalaeloana* plants was hand-cleaned of arsenic and lead contamination in order to minimize the impact of the cleanup (Service 2002, 2003). Outside of these larger concentrations the contaminated soil was removed down to the coral bedrock by the use of bulldozers (Service 2003; Guinther 2006).

Habitat degradation and competition from invasive nonnative plant species are a significant threat to *Chamaesyce skottsbergii* var. *kalaeloana*. The primary nonnative plant species impacting *C. skottsbergii* var. *kalaeloana* include *Prosopis pallida* (kiawe), which often forms closed-canopied forests; *Pluchea x fosbergii* (marsh fleabane), *Asystasia gangetica* (Chinese violet), *Cenchrus ciliaris* (buffel grass), and *Leucana leucocephala* (koa haole) (AECOS 1981). Another fast-growing native vine, *Sicyos pachycarpus* (kupala), can sometimes overgrow *C. skottsbergii* var. *kalaeloana*, but these plants are removed when they appear to pose a threat (Guinther 2006). A set of goals and actions to prevent reduction in the numbers of *C. skottsbergii* var. *kalaeloana* remaining were outlined in the Service's 2002 Biological Opinion, and the U.S. Navy has hired a contractor to implement management actions for *C. skottsbergii* var. *kalaeloana*, which include nonnative plant control.

Fire is a threat to *Chamaesyce skottsbergii* var. *kalaeloana*. This species occurs in one of the driest areas of Oahu, and the ongoing residential and industrial development of the Ewa Plains increases the threat of fire (Service 2002). Two bordering roads provide fire truck access to the site. Water tanks and an irrigation system were set up at the Building 1527 site. A rain catchment system feeds water into the tanks. A high pressure water system was installed at both

the NTSR and Building 1527 sites from a U.S. Navy hydrant. A similar system, but with smaller tanks, was built at the Kalaeloa site. Measures have been taken to reduce the fuel load at *C. skottsbergii* var. *kalaeloana* population sites.

**b. Overutilization for commercial, recreational, scientific, or educational purposes:**

A few incidences of trespass have been noted of vehicles being driven in the Building 5127 area, one of which tamped down a soil and boulder berm, reducing its effectiveness as a barrier to other off-road vehicles (AECOS 2006).

**c. Disease or predation:**

*Chamaesyce skottsbergii* var. *kalaeloana* is threatened by the native parasitic vine *Cassytha filiformis* (kāunaoa pehu), which is locally common on the Ewa Plains (AECOS 1981).

Potentially damaging insects have been observed on *Chamaesyce skottsbergii* var. *kalaeloana*, including an unidentified borer, the croton moth caterpillar (*Aechaea janata*), and the spiraling white fly (*Aleurodicus dispersus*) (AECOS 1981).

**d. Inadequacy of existing regulatory mechanisms:**

N/A

**e. Other natural or manmade factors affecting its continued existence:**

In addition to all of the other threats, species like *Chamaesyce skottsbergii* var. *kalaeloana* 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. *Chamaesyce skottsbergii* var. *kalaeloana* is also threatened by the small number of populations and the small population sizes.

Historically, several attempts were made to remove and transplant *Chamaesyce skottsbergii* var. *kalaeloana* plants threatened by the harbor expansion and resort development. Two of the attempted transplantings were conducted on NASBP. In the first attempt, 218 plants were moved to a site in the southwestern corner of NASBP in 1979. Two years later, only two of the plants were still alive (AECOS 1981). In 1980 a second transplanting of 742 plants was conducted in the northwestern portion of NASBP. When the second group was surveyed 7 months after transplantation, only 172 living individuals of the original 742 were found, and 3 months later only 143 plants were still extant (AECOS 1981). In the 1998 survey of NASBP for *Chamaesyce skottsbergii*, only two individuals were found at this transplantation site (Whistler 1998).

Due to the NASBP base closure in 2003, the U.S. Navy removed hazardous substances from the property prior to its transfer of ownership. The U.S. Navy and the Service agreed upon a conservation/work plan in response to the effects that cleanup actions may have on the last

sizeable population of *Chamaesyce skottsbergii* var. *kalaeloana* on Oahu. The goals of the project are as follows (Service and U.S. Navy 2003):

- No net loss in the number of adult *Chamaesyce skottsbergii* var. *kalaeloana* plants as a result of the cleanup action.

Reestablish a viable seedbank of *Chamaesyce skottsbergii* var. *kalaeloana* at each site where outplanting will occur.

- Establish an *ex situ* collection of *Chamaesyce skottsbergii* var. *kalaeloana* seeds that represent the genetic diversity of the existing, pre-cleanup, NTSR population.
- Maintain an average of 300 or more adult, self-sustaining and reproducing individuals of *Chamaesyce skottsbergii* var. *kalaeloana* at each of 2 sites (a total of 600 such plants) over the 5-year period. One of the two sites will be established in the former NTSR (which includes Building 1527), the other at the Service's Kalaeloa Wildlife Refuge. At the end of the 5-year period, the 300 or more plants at each of the 2 sites will be self-reproducing (i.e., reproducing without supplemental care).

Maintain or establish a minimum total of 100 adult, self-sustaining and reproducing *Chamaesyce skottsbergii* var. *kalaeloana* plants within the 8 "islets" in the cleanup area.

- Seeds and seedling collection follow strict protocols outlined in the work plan. Genetic materials will be stored at Lyon Arboretum (Service and U.S. Navy 2003). Currently, there are 894 adult plants at the NTSR site (including Building 1527), and 451 adult plants at the Kalaeloa site (Guinther 2006).

#### D. Synthesis

In 1982, at the time *Chamaesyce skottsbergii* var. *kalaeloana* was listed, there were 2 populations on Oahu, one totaling 2,450 individuals at the western end of the Ewa Plains in the area of the present day Kalaeloa Barbers Point Harbor, and the second totaling 1,300 individuals in the West Beach Resort area. In 1998, this species was reduced to 518 known individuals in the same areas. Currently, there are 1,345 known wild and outplanted individuals in the NTSR and Kalaeloa, due to recovery efforts including population augmentations.

At the time of listing the major threats to *Chamaesyce skottsbergii* var. *kalaeloana* were habitat destruction by development and land modification, competition from nonnative plants, and risk of extinction and reduced reproductive vigor due to the small number of extant individuals (Factors A and E). In 2002, there were additional threats to this species including increased numbers of nonnative plants (Factors A and E), the use of off-road vehicles (Factor B), the presence of a parasitic vine (Factor C), potentially damaging insects (Factor C), and soil remediation efforts by the Navy (Factor E). Currently, *C. skottsbergii* var. *kalaeloana* is threatened by damaging insects (Factor C), fire (Factors A and E), competition with and habitat



degradation by nonnative plants (Factors A and E), the use of off-road vehicles (Factor B), and the small number of populations and the small population sizes (Factor E).

Under the terms of the 2002 U.S. Fish and Wildlife Service's Biological Opinion regarding potential impacts to *C. skottsbergii* var. *kalaeloana* (akoko) from the proposed soil removal action for decontamination of the Northern Trap and Skeet Range (NTSR), and the subsequent 2003 reinitiation, the Navy began propagating and outplanting individuals of this species (Service 2002, 2003; Koebele 2005). As of 2006, the Navy has outplanted and augmented the *C. skottsbergii* var. *kalaeloana* populations, which currently total 1,345 natural and outplanted adult individuals. Seed collection for genetic storage and propagation for reintroduction is underway (Guinther 2006). This is year 4 of the 5-year project.

*Chamaesyce skottsbergii* var. *kalaeloana* 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 N/A

### IV. RECOMMENDATIONS FOR FUTURE ACTIONS

- Ensure long-term monitoring of in situ and outplanted subpopulations of Oahu *Chamaesyce skottsbergii* var. *kalaeloana*.
- Determine whether any plants or propagules remain of the subpopulations of *Chamaesyce skottsbergii* var. *kalaeloana* from the Kalaeloia Barbers Point Harbor and West Beach Resort areas. This plant material may be *in situ*, at outplanting sites, or in nurseries or botanic gardens. Conduct genetic studies on any remaining plant material in order to assess its genetic value with respect to the conservation of *C. skottsbergii* var. *kalaeloana*.
- Study Oahu *C. skottsbergii* var. *kalaeloana* subpopulations with regard to population size and structure, geographical distribution, flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, limiting factors, and threats.

- Increase the number of suitable and available outplanting sites for *C. skottsbergii* var. *kalaeloana*.

## V. REFERENCES

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

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

Review Conducted By

Gina Shultz, Assistant Field Supervisor for Endangered Species  
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Cheryl Phillipson, Fish and Wildlife Biologist

Approve  Date JUL - 3 2007  
Field Supervisor, Fish and Wildlife Service

Approve  Date Aug 2 2007  
Regional Director, Fish and Wildlife Service