# *Argyroxiphium kauense*
# (Mauna Loa (= Ka`u) silversword)

## 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:** *Argyroxiphium kauense* (Mauna Loa (= Ka`u) silversword)

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# 5-YEAR REVIEW
# *Argyroxiphium kauense*/Mauna Loa (= Ka`u) silversword

## 1.0 GENERAL INFORMATION

### 1.1 Reviewers

**Lead Regional Office**:
Region 1, Endangered Species Program, Division of Recovery, Jesse D'Elia, (503) 231-2071

**Lead Field Office**:
Pacific Islands Fish and Wildlife Office, Gina Shultz, Deputy Field Supervisor, (808) 792-9400

**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 (PIFWO) of the U.S. Fish and Wildlife Service (USFWS) beginning on March 8, 2007. Bernice P. The Bishop Museum provided most of the updated information on the current status of *Argyroxiphium kauense* and also provided recommendations for conservation actions needed prior to the next five-year review. The evaluation of the status of the species was prepared by the lead PIFWO biologist and reviewed by the Plant Recovery Coordinator. The document was then reviewed by the Recovery Program Leader and acting Assistant Field Supervisor for Endangered Species, and Deputy Field Supervisor, 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. 2007. Endangered and threatened wildlife and plants; initiation of 5-year reviews of 71 species in Oregon, Hawaii, Commonwealth of the Northern Mariana Islands, and Territory of Guam. Federal Register 72(45):10547-10550.

### 1.3.2 Listing history

Original Listing
**FR notice:** USFWS. 1993. Endangered and threatened wildlife and plants; determination of endangered status for *Argyroxiphium kauense* (Ka`u silversword); final rule. Federal Register 58(65):18029-18033.
**Date listed:** April 7, 1993
**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, HI; final rule. Federal Register 68(127):39624-39761.

Critical habitat was designated for *Argyroxiphium kauense* in four units totaling 14,431 hectares (35,657 acres) on the island of Hawaii. This designation includes habitat on State, Federal and private lands (USFWS 2003).

### 1.3.4 Review History:

Species status review [FY 2008 Recovery Data Call (September 2008)]: Improving

**Recovery achieved:**
2 (25-50%) (FY 2008 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**: Recovery plan for the Ka`u Silversword, A*rgyroxiphium kauense*. 1995. U.S. Fish and Wildlife Service, Portland, OR. 62 + pages.
**Date issued**: November 21, 1995
**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***
__X__ ***No***

**2.1.2 Is the species under review listed as a DPS?**

____ ***Yes***
__X_ ***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***
__X_ ***No***

### 2.2 Recovery Criteria

**2.2.1 Does the species have a final, approved recovery plan containing objective, measurable criteria?**

__X_ ***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?**

__X_ ***Yes***
____ ***No***

**2.2.2.2 Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria?**

__X_ ***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 (Factors A, B, C, D, and E) affecting this species is presented in section 2.4.

Downlisting of *Argyroxiphium kauense* can be considered when there are a total of at least ten large and widespread populations, each consisting of at least 2,000 individuals. Population structure should be indicative of an expanding population, and consistent regeneration should be occurring. Populations should be genetically diverse and all threats must be controlled. These criteria should be revised periodically as more information becomes available.

This recovery objective has not been met.

Delisting criteria were not identified in this recovery plan.

## 2.3 Updated Information and Current Species Status

In addition to the status summary table below, information on the species' status and threats was included in the proposed (USFWS 2002) and final critical habitat designation rules (USFWS 2003) referenced above in section 1.3.3 ("Associated Rulemakings") and in section 2.4 ("Synthesis") below, which also includes any new information about the status and threats of the species.

**Table 1. Status of *Argyroxiphium kauense* from listing through 5-year review**.

| Date | No. wild individuals | No. outplanted | Downlisting Criteria identified in Recovery Plan | Downlisting Criteria Completed? |
|---|---|---|---|---|
| 1993 (listing) | ~ 540 | 18 | 10 large, widespread populations, each consisting of 2,000 individuals. | No |
| | | | Population structure expanding and consistent regeneration occurring | No |
| | | | Population genetically diverse | No |
| | | | All threats controlled | No |
| 1995 (recovery plan) | < 600 | 1 | 10 large, widespread populations, each consisting of 2,000 individuals | No |
| | | | Population structure expanding and consistent regeneration occurring | No |
| | | | Population genetically diverse | No |
| | | | All threats controlled | Partially |
| 2003 (critical habitat) | 1,830 | 1,000 | 10 large, widespread populations, each consisting of 2,000 individuals | No |
| | | | Population structure expanding and consistent regeneration occurring | No |
| | | | Population genetically diverse | No |
| | | | All threats controlled | Partially |
| 2008 (5-year review) | ~ 1,000 | 24,000+ | 10 large, widespread populations, each consisting of 2,000 individuals | No |
| | | | Population structure expanding and consistent regeneration occurring | No |
| | | | Population genetically diverse | Yes |
| | | | All threats controlled | Partially |

**2.3.1 Biology and Habitat** [see note in section 2.3]

**2.3.1.1 New information on the species' biology and life history**:

**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**:

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

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

**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.)**:

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

**2.3.1.7 Other**:

**2.3.2 Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)** [also see note in section 2.3]

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

**2.3.2.2 Overutilization for commercial, recreational, scientific, or educational purposes:**
No new information.

**2.3.2.3 Disease or predation:**

**2.3.2.4 Inadequacy of existing regulatory mechanisms:**
No new information.

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

## 2.4 Synthesis

At the time of Federal listing, *Argyroxiphium kauense* consisted of two wild populations: Powerline Road in Upper Waiakea Forest Reserve and Ke a Pohina on

Kahuku Ranch, with an estimated total of 540 individuals (USFWS 1993). As of 2007, *A. kauense* is found in three geographically separated wild populations consisting of about 1,000 individuals scattered across the species' former range on Mauna Loa, island of Hawaii. The three populations exhibit differential adaptation to the habitats in which they are found: Kahuku (approximately 700 individuals in mesic to wet forest), Kapapala (approximately 20 individuals in mesic shrubland and open forest) and Waiakea (approximately 150 individuals in montane bog) (Perry 2007). No recruitment has been observed in the remnant Kapapala population, but some recruitment has been observed at the remnant Kahuku and Waiakea populations (R. Robichaux, Hawaiian Silversword Foundation, pers. comm. 2007, 2008a). Approximately 24,000 seedlings have been reintroduced into fenced exclosures within the historical range of the species (Perry 2007; R. Robichaux, pers. comm. 2008a). However, the life trait of this monocarpic (only flowering once before dying) species suggests it can take 10 to 50 years to first flower (Carr 1985; Carlquist *et al*. 2003). Only a handful of the reintroduced seedlings have produced flowers, but none have yet to produce seedlings (R. Robichaux, pers. comm. 2007, 2008a).

Genetic variation within and among the three remnant populations was measured using microsatellite markers (Friar *et al*. 2001; Friar and Robichaux 2003). Significant genetic variation was found within all the populations, along with significant genetic differentiation among the populations reflecting observed ecological and morphological differences. Inbreeding depression was determined not to pose a risk as long as seeds used for the founding new populations are broadly sampled from each source population. Because the genetic differences between the three extant populations may have adaptive value, outbreeding depression is possible, and the mixing of source populations should be avoided. A lack of evidence for significant inbreeding indicate that despite a severe decline in number and size, the extant populations have not undergone multiple generations during the period of small population size. However, the population belonging to Waiakea Forest Reserve can be considered a separate evolutionary unit, with distinctive qualitative traits and growing in a very different habitat (R. Robichaux, pers. comm. 2008a). Experts on this species suggest the Waiakea population be recognized as a different species, pending the outcome of more detailed analysis (including DNA sequencing) (R. Robichaux, pers. comm. 2008b). No taxonomic changes have yet been published to reflect this change.

Seeds can be stored at 4 degrees Celsius (39 degrees Fahrenheit) in a refrigerator, and do not decline in viability for at least two to three years (Moriyasu and Robichaux 2003). Viability of fresh seeds is variable across the different maternal lines and ranges from less than one percent to more than 55 percent.

The major threat for *Argyroxiphium kauense* when not protected by fencing is habitat destruction caused by feral cattle (*Bos taurus*), goats (*Capra hircus*), mouflon sheep (*Ovis musimon*) and pigs (*Sus scrofa*) (Factors A and D), which destroy habitat and prevent seedling establishment (Factor C). Grazing of individuals not protected by exclosure fencing prevents the plants from reaching maturity (Factor C), causing

them to resprout with multiple stems, which greatly reduces vigor and seed viability (Factor E) (USFWS 1993, 1996, 2002). The invasive plant species *Axonopus fissifolius* (carpet grass) is a threat in some of the Waiakea outplanting sites (Factor E) (R. Robichaux, pers. comm. 2008). Illegal collecting for scientific, horticultural or other purposes threatens the populations, as well as possible excessive visitation (Factor B). For instance, in 2007, seven reintroduced plants were uprooted in the Mauna Loa strip area and four plants were stolen (USFWS 2008).

The establishment of multiple exclosures is helping to prevent loss of plants from ungulates. The establishment of multiple populations in a wide geographic range within historical habitat is protecting the species against catastrophic loss due to environmental events such as lava flows, as this species occurs in a volcanically active area (Perry 2007; R. Robichaux, pers. comm. 2007).

*Argyroxiphium kauense,* has been successfully outplanted within two fenced units within the Mauna Loa Special Ecological Area of Hawaii Volcanoes National Park, and both fenced units contain suitable sites for continued reintroduction of silverswords, as well as other endangered, rare, and depleted native plants documented from the Hawaii Volcano National Park (Belfield and Pratt 2002). Outplanting efforts since 1996 have expanded the number of populations to four, with approximately 24,000 seedlings surviving in Kahuku Ranch in Hawaii Volcanoes National Park, Kapapala Forest Reserve, Mauna Loa Strip area of Hawaii Volcanoes National Park, and Upper Waiakea Forest Reserve (USFWS 2002; Perry 2007; R. Robichaux, pers. comm. 2007, 2008a) from over 200 maternal lines.

To safeguard existing genetic material, propagation for genetic storage and reintroduction is occurring at the Volcano Rare Plant Facility (2007) and National Tropical Botanical Garden (2007). Genetic resources in storage include 5,090 seeds at the National Tropical Botanical Garden. The Volcano Rare Plant Facility has 470 accessions from four Kahuku individuals, 18 accessions from 18 Waiakea individuals, and 487 accessions from 13 Kapapala individuals.

The downlisting goals for this species have not been meet (see table 1), as only a handful of the approximately 24,000 reintroduced plants have flowered and none have reproduced. Therefore, *Argyroxiphium kauense* meets the definition of endangered as it remains in danger of extinction throughout its range.

## 3.0 RESULTS

### 3.3 Recommended Classification:

**____ Downlist to Threatened**
**____ Uplist to Endangered**
**____ Delist**
____ *Extinction*
____ *Recovery*
____ *Original data for classification in error*

__X__ **No change is needed**

**3.2 New Recovery Priority Number:** N/A

**Brief Rationale:**

**3.3 Listing and Reclassification Priority Number:** N/A

**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

- Continue maintenance of exclosure fencing. Establish new and expand existing exclosures within historical range.

- Continue reintroduction of new maternal lines into existing exclosures, and new exclosures as available, as additional wild individuals flower.

- Continue to work with the Tri-Mountain Alliance and Hawaii Volcanoes National Park to implement ecosystem-level restoration and management to benefit this species on Mauna Loa.

- Assess the pollination and natural recruitment of wild and reintroduced plants.

## 5.0 REFERENCES

Belfield, T.R., and L.W. Pratt. 2002. Rare plants of the Mauna Loa Special Ecological Area, Hawaii Volcanoes National Park. Pacific Cooperative Studies Unit Technical Report 130. University of Hawaii at Manoa, Department of Botany, Honolulu, Hawaii. 61 pages.

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Moriyasu, P., and R. Robichaux. 2003. Propagation for endangered Mauna Loa Silversword. Native Plants 4(1):39-41.

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[USFWS] U.S. Fish and Wildlife Service. 1996. Recovery plan for the Ka`u silversword, *Argyroxiphium kauense*. U.S. Fish and Wildlife Service, Portland, OR. 62 + pages.

[USFWS] U.S. Fish and Wildlife Service. 2002. Endangered and threatened wildlife and plants; designation of critical habitat for plant species from the island of Hawaii, HI; proposed rule. Federal Register 6(102):36968-37106.

[USFWS] U.S. Fish and Wildlife Service. 2003. Endangered and threatened wildlife and plants; final designation and nondesignation of critical habitat for 46 plant species from the island of Hawaii, HI; final rule. Federal Register 68(127):39624-39761.

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**Personal communications**

Robichaux, Robert, H. 2007. Hawaii Silversword Foundation. Email communication to Marie Bruegmann (USFWS), dated January 15, 2007. Subject: Silversword progress in 2006.

Robichaux, Robert, H. 2008a. Hawaii Silversword Foundation. Email communication to Marie Bruegmann (USFWS), dated April 7, 2008. Subject: Silversword progress in 2007.

Robichaux, Robert, H. 2008b. Hawaii Silversword Foundation. Email communication to Steve Bergfeld (Hawaii Division of Forestry and Wildlife), dated May 20, 2008. Subject: Waiakea swords.

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**U.S. FISH AND WILDLIFE SERVICE**
**5-YEAR REVIEW of *Argyroxiphium kauense***

**Current Classification:** E

**Recommendation resulting from the 5-Year Review:**

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
__X__ No change needed

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

**Review Conducted By:**
Christian Torres-Santana, Student Trainee Biologist
Marie Bruegmann, Plant Recovery Coordinator
Marilet A. Zablan, Recovery Program Leader and acting Assistant Field Supervisor for Endangered Species
Gina Shultz, Deputy Field Supervisor

Approved _____ Date 21 July 2009
**Acting Field Supervisor, Pacific Islands Fish and Wildlife Office**