

5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Argyroxiphium kauense* (Mauna Loa (Ka‘u) silversword)

Current Classification: Endangered

Federal Register Notice announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2013. Endangered and threatened wildlife and plants; Initiation of 5-year status reviews of 44 species in Oregon, Hawaii, Guam, and the Northern Mariana Islands. Federal Register 78(24):8185-8187.

Lead Region/Field Office:

Region 1/Pacific Islands Fish and Wildlife Office (PIFWO), Honolulu, Hawaii

Name of Reviewer(s):

Chelsie Javar-Salas, Plant Biologist, PIFWO

Marie Bruegmann, Plant Recovery Coordinator, PIFWO

Kristi Young, Programmatic Deputy Field Supervisor, PIFWO

Methodology used to complete this 5-year 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 March 4, 2013. The review was based on a review of current, available information since the last 5-year review for *Argyroxiphium kauense* (USFWS 2009). The evaluation by Chelsie Javar-Salas, Plant Biologist, was reviewed by the Plant Recovery Coordinator. It was subsequently reviewed and approved by the Programmatic Deputy Field Supervisor.

Background:

For information regarding the species listing history and other facts, please refer to the Fish and Wildlife Service's Environmental Conservation On-line System (ECOS) database for threatened and endangered species (http://ecos.fws.gov/tess_public).

Review Analysis:

Please refer to the previous 5-year review for *Argyroxiphium kauense* published on July 21, 2009 (available at http://www.fws.gov/docs/five_year_review/doc2454.pdf) for a complete review of the species' status, threats, and management efforts. No significant new information regarding the species' biological status has come to light since listing to warrant a change in the Federal listing status of *A. kauense*.

This long-lived perennial and member of the aster family (Asteraceae) is a primarily monocarpic (flowering and fruiting only once and then dying, usually after several years) giant rosette plant is endangered. Historically, *Argyroxiphium kauense* occurred from the southwest rift to the northeast slope of Mauna Loa on Hawaii Island (USFWS 1996). The species is currently extant in three wild populations in Hawaii Volcanoes National Park Kahuku Unit and State owned land in the Upper Waiakea and Kapapala Forest Reserves (USFWS 2009). The status and trends for *A. kauense* are provided in the tables below.

New status information:

Argyroxiphium kauense remains to be found in three geographically separated wild populations consisting of about 626 individuals scattered across the species' former range on Mauna Loa. The three populations exhibit differential adaptation to the habitats in which they are found: Kahuku (approximately 420 individuals in mesic forest habitat), Kapapala (approximately 6 individuals in mesic shrubland and open forest habitat), and Waiakea (approximately 200 individuals in bog habitat) (R. Robichaux, Hawaiian Silversword Foundation, pers. comm. 2015).

The multi-year outplanted total for *A. kauense* are 9,818 seedlings from the Waiakea source population (in four sites), 9,268 seedlings from the Kahuku source population (in three sites), and 15,978 seedlings from the Kapapala source population (in three sites) (Robichaux 2012). The total number of *A. kauense* outplanted across three populations is 35,064 individuals.

Overall, the number of wild individuals has decreased from the approximately 1,000 individuals reported in the previous 5-year review to around 626 individuals in 2015. However, the number of outplanted individuals has increased from the approximately 24,000 individuals reported in the previous 5-year review to more than 35,000 individuals in 2015.

New threats:

- Climate change destruction or degradation of habitat – Fortini *et al.* (2013) conducted a landscape-based assessment of climate change vulnerability for native plants of Hawaii using high resolution climate change projections. Climate change vulnerability is defined as the relative inability of a species to display the possible responses necessary for persistence under climate change. The assessment by Fortini *et al.* (2013) concluded that *Argyroxiphium kauense* is minimally vulnerable to the impacts of climate change.

New management actions:

- Ungulate monitoring and control
 - In 2009, constructed an approximately 10 acre (600 feet by 600 feet) fenced enclosure and a 5 acre addition to the existing enclosure were constructed at the Upper Waiakea Forest Reserve (Plant Extinction Prevention Program [PEPP] 2009).
 - The ungulate fence at Puu Makaala Natural Area Reserve is inspected at a minimum of four times per year (State of Hawaii Department of Land and Natural Resources [DLNR] 2013, 2014a).
 - The fence at Kapapala was inspected and in good condition as of October 2013 (PEPP 2014).
- Population viability monitoring and analysis
 - In 2012, 2013, and 2014, the wild and outplanted populations in Hawaii Volcanoes National Park Kahuku Unit were monitored (Robichaux 2014a). Survivorship in the main outplanted population is high (greater than 75 percent),

- with large numbers of more than 5,500 surviving plants now reaching moderate to large sizes of rosette diameter (Robichaux 2014a). Thirty-two plants flowered in the wild population at Kahuku in 2014, with none flowering in 2012 or 2013. Similarly, more than 60 plants flowered in the main outplanted population in 2014, which is the first year in which flowering has occurred in the population.
- The wild and outplanted populations at Kapapala Forest Reserve were monitored in 2012, 2013, and 2014 (Robichaux 2014a). Survivorship of the outplanted population was low at less than 15 percent. PEPP (2014) monitored the population in 2013 and indicated that half of the outplanted individuals appeared to be doing well; however, the other half appeared to be stunted.
 - The outplanted population at Hawaii Volcanoes National Park on Mauna Loa was monitored in 2012, 2013, and 2014 (Robichaux 2014a). A significant number of plants at this outplanted site have grown to very large sizes with 16 plants flowering in 2012, none in 2013, and 20 plants in 2014. The 16 plants that flowered in 2012 were originally outplanted in 2000 and 2001 with genetic source material obtained from the Kapapala population (Hawaii Volcanoes National Park 2013).
 - In the summer of 2012, more than 50 seedlings were discovered in the vicinity of plants that had flowered in previous years (Hawaii Volcanoes National Park 2013). This recruitment event combined with the vigorous growth of individuals in specific microsites has given managers important information for future restoration actions at the Mauna Loa location.
 - The wild population at the Upper Waiakea Forest Reserve was monitored in 2012, 2013, and 2014 (Robichaux 2014a). Sixteen plants flowered in the remnant population in 2012, with none flowering in 2013 or 2014.
 - Based on annual monitoring of the outplanted populations at Puu Makaala Natural Area Reserve, survivorship is high at more than 70 percent, with large numbers of the surviving plants now being moderate to large in rosette diameter (Robichaux 2014a).
 - In 2014, the Upper Waiakea Forest Reserve was monitored for flowering in (DLNR 2014b).
 - Captive propagation for genetic storage and reintroduction
 - The Volcano Rare Plant Facility (2013) had 172 individuals in their nursery and more than 1 million seeds in genetic storage. At Kulani, 1,216 individuals were outplanted in 2013 representing the Waiakea population.
 - There are 140 individuals of *A. kauense* growing at the Volcano Rare Plant Facility (2014). Twenty-nine individuals were outplanted and more than 2 million seeds are in genetic storage.
 - The National Tropical Botanical Garden (2014) has more than 4,000 seeds from two accessions in storage.
 - In 2013, propagules were collected from 16 founders of *A. kauense*; no location information was provided (DLNR 2013b).
 - Reintroduction / translocation
 - Flowering individuals in the wild population at Kahuku were cross-pollinated in 2014. Between 300,000 to 400,000 achenes were then collected, mixed, and dispersed at prime sites within the wild enclosure (Robichaux 2014a). In 2014,

- another 300,000 to 400,000 achenes were dispersed at prime sites in the main outplanted enclosure, together with 50,000 to 100,000 achenes from the 18 plants that had flowered in the wild population in 2010 (Robichaux 2014a). At Kahuku, for the large number of plants flowering in the outplanted population in 2014 the achenes were allowed to disperse naturally within the population; no manipulation was conducted (Robichaux 2014a). The achene-sowing in 2014 supplemented the achene-sowing that was completed in December 2012, when 30,000 to 50,000 achenes were sown from the 2010 flowering plants at prime sites in the remnant enclosure (Robichaux 2014a). Another 100,000 to 200,000 achenes were sown at prime sites in the main outplanted enclosure. Significant numbers of new seedlings have already established from the achene sowing in 2012; no numbers were provided (Robichaux 2014a).
- At the outplanted population in Hawaii Volcanoes National Park approximately 600,000 to 800,000 achenes were collected, mixed, and dispersed from the flowering plants in 2012 and 2014 (Robichaux 2014a). More than 200 seedlings germinated as a result of achene sowing in late 2012 (Robichaux 2014b). In 2014, 21 large individuals of *A. kauense* were outplanted (Robichaux 2014b).
 - In 2012 and 2013, approximately 200,000 to 300,000 achenes were collected, mixed, and dispersed in the recently expanded remnant population enclosure in the Upper Waiakea Forest Reserve (Robichaux 2014a). New seedlings have already established from the achene sowing, however; no numbers were provided (Robichaux 2014a).
 - Up to 100,000 to 200,000 achenes were dispersed in the main outplanted population in Puu Makaala Natural Area Reserve in 2013 (Robichaux 2014a). New seedlings have already established from the achene sowing, however; no numbers were provided (Robichaux 2014a).
 - Between October 2012 and October 2013, 1,792 seedlings were outplanted at two sites in the Puu Makaala Natural Area Reserve (Robichaux 2014a).
 - More than 1,000 achenes of *A. kauense* were direct seeded into one protected bog in the Upper Waiakea Forest Reserve within 25 microsites (DLNR 2014b). This seed represented 16 wild founders from the Upper Forest Reserve. Previous years' direct seeding efforts have resulted in successful germination.
 - The Hawaii Volcanoes National Park (2014) outplanted 29 individuals at Kapapala. All plants were propagated at the Volcano Rare Plant Facility.

Synthesis:

Downlisting objectives are provided in the recovery plan for the Ka‘u Silversword, *Argyroxiphium kauense* (USFWS 1995). Downlisting of *A. 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.

The downlisting criteria for this species have not been met, as natural recruitment has been recorded at only a single outplanted site and accounts for only a single population experiencing regeneration out of the 10 populations needed to meet the downlisting goals

for this species. Similarly, only two outplanted populations have flowered for the first time in 2012 and 2014. This resulted in more than 90 flowering plants out of the approximately 35,000 outplanted individuals (Table 1). It is too early to tell if this flowering event resulted in the natural recruitment. In addition, all threats are not being sufficiently managed throughout all of the populations (Table 2). Therefore, *Argyroxiphium kauense* meets the definition of endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:

- Captive propagation for genetic storage and reintroduction – Continue collection of genetic resources for storage, propagation, and reintroduction into protected suitable habitat within historical range.
- Reintroduction / translocation – Augment current natural populations to increase numbers of individuals.
- Ungulate monitoring and control – Maintain existing exclosures and monitor for potential incursions.
- Invasive plant monitoring and control – Continue control and maintenance of invasive plants within fenced exclosures.
- Population viability monitoring and analysis – Continue monitoring wild and outplanted individuals for a thorough current assessment of the species' status.
- Climate change adaptation strategy – Research the suitability of habitat for reintroducing this species in the future due to the impacts of climate change.
- Alliance and partnership development – Initiate planning and contribute to implementation of ecosystem-level restoration and management to benefit this taxon.

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

Date	No. wild indivs	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
2009 (5-yr 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
2015 (5-yr review)	~626	35,000+	10 large, widespread populations, each consisting of 2,000 individuals	Partially
			Population structure expanding and consistent regeneration occurring	No
			Population genetically diverse	Yes
			All threats controlled	Partially

Table 2. Threats to *Argyroxiphium kauense* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulates – degradation of habitat and herbivory	A, C, D, E	Ongoing	Partially, the wild and outplanted populations are fenced
Invasive introduced plants	A, E	Ongoing	None
Lava flows	A	Ongoing	None
Illegal collection	B	Ongoing	None
Invertebrate herbivory	C	Ongoing	None
Drought	E	Ongoing	None
Climate change	A, E	Increasing	None

References:

See previous 5-year review for a full list of references (USFWS 2009). Only references for new information are provided below.

Fortini, L., J. Price, J. Jacobi, A. Vorsino, J. Burgett, K. Brinck, F. Amidon, S. Miller, S. Gon II, G. Koob, and E. Paxton. 2013. A landscape-based assessment of climate change vulnerability for all native Hawaiian plants. Technical report HCSU-044. Hawaii Cooperative Studies Unit, University of Hawaii at Hilo, Hawaii. 141 pages.

Hawaii Volcanoes National Park. 2013. Annual permit report on threatened and endangered plants. Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawaii.

Hawaii Volcanoes National Park. 2014. Report on controlled propagation of listed and candidate species, as designated under the U.S. Endangered Species Act. Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawaii.

National Tropical Botanical Garden. 2014. Report on controlled propagation of listed and candidate species, as designated under the U.S. Endangered Species Act. Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawaii.

[PEPP] Plant Extinction Prevention Program. 2009. Plant Extinction Prevention Program annual report, fiscal year 2012 (July 1, 2008-June 30, 2009). Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawaii.

[PEPP] Plant Extinction Prevention Program. 2014. Plant Extinction Prevention Program annual report, fiscal year 2014 (July 1, 2013-June 30, 2014). Unpublished report

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

Robichaux, Rob. 2012. Hawaiian silversword foundation mid-year summary, April 24, 2012, grant agreement #12200BG007. Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawaii.

Robichaux, Rob. 2014a. Hawaiian silversword foundation final report, grant agreement #12200BG007, 29 August 2011 to 31 October 2014. Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawaii.

Robichaux, Rob. 2014b. Hawaiian silversword foundation mid-year summary, April 15, 2014, grant agreement #12200BG007. Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawaii.

[DLNR] State of Hawaii Department of Land and Natural Resources. 2013a. Department of Land and Natural Resources, Division of Forestry and Wildlife, Section 6 final report for plant habitat management, Natural Area Reserves, Hawaii. July 1, 2012 – June 30, 2013. Unpublished.

[DLNR] State of Hawaii Department of Land and Natural Resources. 2013b. Department of Land and Natural Resources, Division of Forestry and Wildlife, Section 6 final report for plant restoration and enhancement, threatened, endangered, candidate, and species of concern outplanting, Hawaii. July 1, 2012 – June 30, 2013. Unpublished.

[DLNR] State of Hawaii Department of Land and Natural Resources. 2014a. Department of Land and Natural Resources, Division of Forestry and Wildlife, Section 6 final report for plant habitat management, Natural Area Reserves, Hawaii. July 1, 2013 – December 30, 2013. Unpublished.

[DLNR] State of Hawaii Department of Land and Natural Resources. 2014b. Department of Land and Natural Resources, Division of Forestry and Wildlife, Section 6 interim report for plant restoration and enhancement, threatened, endangered, candidate, and species of concern outplanting, Hawaii. July 1, 2013 – June 30, 2014. Unpublished.

[USFWS] U.S. Fish and Wildlife Service. 1995. Recovery plan for the Ka‘u Silversword, *Argyroxiphium kauense*. U.S. Fish and Wildlife Service, Portland, Oregon. 62 + pages.

[USFWS] U.S. Fish and Wildlife Service. 2009. *Argyroxiphium kauense* 5-year review summary and evaluation. Pacific Islands Fish and Wildlife Office, Honolulu, Hawaii. 14 pages.

Volcano Rare Plant Facility. 2013. Report on controlled propagation of listed and candidate species, as designated under the U.S. Endangered Species Act. Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawaii.

Volcano Rare Plant Facility. 2014. Report on controlled propagation of listed and candidate species, as designated under the U.S. Endangered Species Act. Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawaii.

Personal communications

Robichaux, Rob. 2015. President, Hawaiian Silversword Foundation. E-mail to Chelsie Javar-Salas, , Pacific Islands Fish and Wildlife Office, dated June 22, 2015. Subject: status of remnant population of *A. kauense*.

U.S. FISH AND WILDLIFE SERVICE
SIGNATURE PAGE for 5-YEAR REVIEW of *Argyroxiphium kauense* (Mauna Loa
(Ka'u) silversword)

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
- No Change in listing status

Appropriate Listing/Reclassification Priority Number, if applicable: _____

for Programmatic Deputy Field Supervisor, Pacific Islands Fish and Wildlife Office

Maria M. Bluegman

Date *2015-07-23*