

5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Argyroxiphium sandwicense* ssp. *macrocephalum* (‘āhinahina)

Current Classification: Threatened

Federal Register Notice announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2021. Endangered and Threatened Wildlife and Plants; Initiation of 5-Year Status reviews for 77 Species in Oregon, Washington, Idaho, and Hawaii. Federal Register 86(120):33726–33728, June 25, 2021.

Lead Region/Field Office:

Region 1/Pacific Islands Fish and Wildlife Office (PIFWO), Honolulu, Hawai‘i

Name of Reviewer:

Cheryl Phillipson, Biologist, PIFWO

Lauren Weisenberger, Plant Recovery Coordinator, Acting Recovery Team Manager, PIFWO

Methodology used to complete this 5-year review:

This review was conducted by staff of the Pacific Islands Fish and Wildlife Office (PIFWO) of the U.S. Fish and Wildlife Service (Service) beginning in October 2021. The review was based on a review of current, available information since the last 5-year review for *Argyroxiphium sandwicense* ssp. *macrocephalum* (USFWS 2018). The evaluation by Cheryl Phillipson, Biologist, was reviewed by Lauren Weisenberger, Plant Recovery Coordinator, and Acting Recovery Team Manager.

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/ecp/species/387>).

Review Analysis:

Please refer to the previous 5-year reviews for *Argyroxiphium sandwicense* ssp. *macrocephalum* published in the Federal Register on August 2, 2011, and October 23, 2018 (available at https://ecos.fws.gov/docs/tess/species_nonpublish/1746.pdf and https://ecos.fws.gov/docs/tess/species_nonpublish/2610.pdf) for a complete review of the species’ status, threats, management efforts, and references cited. We are not aware of any significant new information regarding the species’ biological status since listing to warrant a change in the Federal listing status of *A. sandwicense* ssp. *macrocephalum*.

This long-lived monocarpic rosette herb in the Asteraceae (sunflower) family is threatened and endemic to Maui. The current status and trends for *Argyroxiphium sandwicense* ssp. *macrocephalum* are provided in the tables below.

New Status Information:

In 2011, there was considered to be one population of *Argyroxiphium sandwicense* ssp. *macrocephalum* totaling fewer than 50,000 individuals extending over 4,000 ac (1,600 ha) at Haleakalā on Maui. In 2013, data trends from study plots indicated the estimate of 50,000 or more plants was no longer justified. An estimate of the total population size in 2013 was approximately 30,000 to 40,000 individuals in 7 to 31 subpopulations (Krushelnycky et al. 2013; Krushelnycky et al. 2020, p. 2; Keir and Caraway 2020). Currently, based on mapping data, there are an estimated 20 subpopulations (most from 10 to 200 individuals each), one of which is translocated at more than 2,000 individuals (Haleakalā National Park [HALE NP] 2021). The 2023 survey has recently been completed, but results are still being analyzed. However, data suggest that the new total population size has continued to decline, especially at lower elevation subpopulations, and is more likely to contain 25,000-35,000 total individuals (Mallinson 2023, pers. comm.).

New Threats:

- None reported.

New Management Actions:

- Monitoring and surveys—All known individuals occur within protected areas managed and monitored by HALE NP and the Hawai'i State Division of Forestry and Wildlife (Keir and Caraway 2020).
- Collection and propagation for genetic storage and reintroduction—In 2018, HALE NP reported collection and storage of 1,900 seeds representing six founders (HALE NP 2018, p. 4). In 2019, more than 51,000 seeds were collected from 22 founders in the Crater subpopulation, 300 seeds were collected from 8 founders at the Silversword Forest along Sliding Sands trail, and 40 seeds were collected from 1 founder at Silversword Loop (HALE NP 2019). In 2020, HALE NP collected more than 300,000 seeds from 43 plants along Sliding Sands trail for propagation or storage (HALE NP 2020, pp. 11–15). In 2022, HALE NP reported propagation of 39 plants representing five founders (HALE NP 2022).
- Translocation and Augmentation—HALE NP reported that more than 4,500 seedlings were translocated to the Haleakalā summit area and crater since 2016 (Gates 2021, pers. comm.). Specifically, in 2018, 810 juvenile plants were translocated to Haleakalā summit, and 198 juvenile plants were translocated to State land along Skyline Trail (HALE NP 2018, p. 7). In 2020, HALE NP reported translocation of 438 plants to Haleakalā summit, 169 plants to Kalahaku, 9 plants to the Visitor Center planter box, and 270 plants to the State enclosure (HALE NP 2020, pp. 16–18). In 2021, 2,309 plants were translocated to Haleakalā summit (HALE NP 2021, p. 23). In 2021–2022, HALE NP translocated 510 individuals to Haleakalā Crater (HALE NP 2022).
- Population research—In 2020, a study of *Argyroxiphium sandwicense* ssp. *macrocephalum* showed that outplant survival was positively associated with site elevation: lower elevation plants are more susceptible to drought. In addition, the genotypic ecotype was found to have less of a role to play in survival

(Krushelnycky et al. 2020, p. 1). Seedling size and initial available water in test plantings were observed to have a strong influence on longevity, with larger seedlings dying more quickly than smaller plants (Krushelnycky et al. 2020, p. 11). Plants propagated on a regime of low water levels survived at higher rates, presumably because of greater investment in below-ground tissues and more effective water use and management (Krushelnycky et al. 2020, p. 18). Plants growing at lower elevations were found to have a reduction in flowering plant size with a reduction of fecundity by 41 percent, and a loss of plants reaching maturity, leading to a higher probability of extinction (Fortini et al. 2022, pp. 8, 11). Plants growing at higher elevations were cold-limited more than water-limited, with a calculated extinction rate of 0 percent (Fortini et al. 2022, p. 13). These studies concluded that future management should focus on more restrictive water regimes in propagation of plants and outplanting in climatically suitable habitat including areas outside of the species' current range (Krushelnycky et al. 2020, pp. 1, 19; Fortini et al. 2022, p. 14).

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

Date	No. wild individuals	No. outplanted	Stability Criteria identified in Recovery Plan	Stability Criteria Completed?
1982 (listing)	ca 50,000	0	All threats managed in 1 population	No
			Complete genetic storage	No
			1 population with 50,000 mature individuals	No
2011 (5-year review)	ca 50,000	16,279	All threats managed in 1 population	No
			Complete genetic storage	Partially
			1 population with 50,000 mature individuals	Yes
Date	No. wild individuals	No. outplanted	Interim Criteria identified by HPPRCC	Interim Criteria Completed?
2018 (5-year review)	<50,000	1,057	All threats managed in all 3 populations	No

			Reproduction (i.e., viable seeds, seedlings) at all 3 populations	No
			Complete genetic storage	Partially, >300 founders represented in collections
			3 populations with 1,000 mature individuals each	No, only 1 extended population
2023 (5-year review)	25,000-35,000	>6,000–7,000	All threats managed in all 3 populations	Partially
			Complete genetic storage	Complete
			Natural reproduction at all 3 populations	Partially, at higher elevations
			3 populations with 1,000 mature individuals each	Partially

* The Preventing Extinction Stage was established in 2011. Prior to 2011, the Interim Stabilization Stage was the first stage towards recovery (now it is the second stage after Preventing Extinction).

Table 2. Threats to *Argyroxiphium sandwicense* ssp. *macrocephalum* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Degradation and destruction of habitat by feral ungulates	A	Ongoing	Partial, HALE NP and State fencing
Established ecosystem altering invasive plant species degradation of habitat	A	Ongoing	Partial, nonnative plant control within HALE NP
Degradation and destruction of habitat by landslides and flooding	A	Ongoing	None

Drought destruction and degradation of habitat and mortality	A, E	Ongoing	Partial, research on effects of drought
Climate change degradation or loss of habitat	A	Ongoing	Partial, research on demographic responses to climate drivers on population trends
Predation and herbivory by feral ungulates	C	Ongoing	Partial, ungulate control and fencing monitored
Predation and herbivory by rodents	C	Ongoing	Partial, control within HALE NP
Predation of pollinators by ants	C	Ongoing	Partial, testing effective control methods
Lack of adequate hunting regulations	D	Ongoing	Partial, for plants within exclosures
Lack of adequate biosecurity legislation	D	Ongoing	None
Reduced viability due to loss of pollinators	E	Ongoing	Partial, propagation, seed storage, augmentation and translocation efforts are ongoing

Synthesis:

Studies confirm a decline of individuals especially at lower elevations. Preliminary census data from 2023 suggests there are approximately 25,000 to 35,000 wild individuals of *Argyroxiphium sandwicense* ssp. *macrocephalum*. The populations are provided protection by fencing and ungulate and nonnative plant control. Seed collections, propagation, and augmentation and translocation are ongoing. New propagative materials were collected from at least 80 founders, adding to the 300 founders already represented and reported previously.

Stabilizing (interim), downlisting, and delisting objectives are provided in the Recovery Plan for the Maui Plant Cluster (USFWS 1997) and have been updated according to the draft revised recovery objective guidelines developed by the Hawai‘i and Pacific Plants Recovery Coordinating Committee (HPPRCC 2011). The HPPRCC identifies an additional initial objective, the Preventing Extinction Stage, in addition to the Interim Stabilization, Delisting, and Downlisting objectives. Furthermore, life history traits such as breeding system, population size fluctuation or decline, and reproduction type (sexual or vegetative), have been included in the calculation of goals for the number of populations and reproducing individuals for each stage. The goals for each stage remain grouped by life span defined as annual, short-lived perennial (fewer than 10 years), or long-lived perennial.

Argyroxiphium sandwicense ssp. *macrocephalum* is a long-lived monocarpic rosette herb, and an obligate outcrosser. For interim stabilization, which is the second step in recovering the species, the taxon must be managed to control threats (e.g., fenced) and have 50 individuals (or the total number of individuals if fewer than 50 exist) from each of three populations adequately represented in *ex situ* (secured off-site, such as a nursery or seed bank) collections that are well managed. In addition, a minimum of a total of three populations of 1,000 mature individuals each should be documented on Maui where the species now occurs or occurred historically and each of these populations must demonstrate regeneration of seedlings and documented regeneration within each of the target populations.

The interim goals for *Argyroxiphium sandwicense* ssp. *macrocephalum* have not been met. There is one translocated population of greater than 1,000 individuals; however, it is uncertain how many individuals survive to maturity and recruit successfully. It is currently uncertain how many wild individuals are maturing on an annual basis. Populations at lower elevations are declining in number (Table 1). Genetic storage represents more than 380 founders (Table 1); however, not all threats are being managed (Table 2). Therefore, *A. sandwicense* ssp. *macrocephalum* meets the definition of Threatened as it is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Recommendations for Future Actions:

No significant new information regarding the species' biological status has been reported since the last 5-year review in 2018. Thus, the following recommendations for future actions are updated or reiterated for the 5-year review for 2023.

- Ungulate monitoring and control—Continue to maintain large-scale fenced enclosures and construct additional enclosures within suitable habitat outside of HALE NP to protect individuals from the negative impacts of habitat destruction and trampling and browsing by ungulates.
- Invasive nonnative plant monitoring and control—Continue control of established ecosystem-altering nonnative invasive plant species.
- Climate change adaptation strategy—Continue to research suitability of habitat for viability of species, including new sites within suitable habitat for translocations in the future due to the impacts of climate change.
- Predator monitoring and control—
 - Continue to study pollinators and impacts to them by the nonnative Argentine ant.
 - Determine which pollinators are most critical to successful seed set for the long-term survival of the species.
 - If necessary, implement effective methods to control predation by rodents at all populations.
- Captive propagation for genetic storage and reintroduction—
 - Continue collection and propagation efforts for maintenance of genetic stock and for translocation.

- Continue to conduct research on outcrossing methodology and maintain adequate representation of these individuals.
- Reintroduction and translocation—Continue to reintroduce individuals into suitable habitat within and outside of historic range that is being managed for known threats to this subspecies.
- Build resiliency, redundancy, and representation—
 - Increase the species' viability through habitat restoration and threat control.
 - Continue to augment wild populations and translocate individuals into suitable habitat that is being managed for known threats to this species to reduce impacts of poor recruitment, drought, and lack of biosecurity legislation.
- Population biology research—Continue to study population dynamics and implement adaptive management based on results of these studies for recovery of the subspecies.
- Alliance and partnership development—Continue to work with partners and other land managers in planning and implementation of ecosystem-level restoration and management to benefit this species.

References:

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[HALE NP] 2019. Report on controlled propagation of listed 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, Hawai‘i.

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U.S. FISH AND WILDLIFE SERVICE
SIGNATURE PAGE for 5-YEAR REVIEW of *Argyroxiphium sandwicense* ssp.
macrocephalum ('āhinahina)

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
- X No Change in listing status

For Field Supervisor, Pacific Islands Fish and Wildlife Office

Date _____