

5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Hesperomannia arbuscula* (no common name)

Current Classification: Endangered

Federal Register Notice announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2022. Endangered and Threatened Wildlife and Plants; Initiation of 5-Year Status reviews for 167 Species in Oregon, Washington, Idaho, Montana, California, Hawaii, Guam, and the Northern Mariana Islands. Federal Register 87(90):28031–28034, May 10, 2022.

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, PIFWO

Megan Laut, Recovery Program 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 2023. The review was based on a review of current, available information since the last 5-year review for *Hesperomannia arbuscula* (USFWS 2020). The evaluation by Cheryl Phillipson, Biologist, was reviewed by Lauren Weisenberger, Plant Recovery Coordinator, and Megan Laut, Recovery Program 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/5297>).

Review Analysis:

Please refer to the previous 5-year reviews for *Hesperomannia arbuscula* published in the Federal Register on April 7, 2009, August 15, 2013, and September 29, 2020 (available at https://ecos.fws.gov/docs/tess/species_nonpublish/1407.pdf, https://ecos.fws.gov/docs/tess/species_nonpublish/2076.pdf, and https://ecos.fws.gov/docs/tess/species_nonpublish/3152.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 *H. arbuscula*; however, the taxonomic change should be addressed in the *Federal Register*.

This long-lived perennial shrubby tree in the Asteraceae (sunflower) family is endangered and is known from the islands of O'ahu and Maui; however, occurrences on

west Maui are now recognized as *Hesperomannia arborescens*, and those in the Wai‘anae mountains of O‘ahu are recognized as *H. oahuensis* (Morden and Ching Harbin 2013). These populations will be included in this report as they were previously identified as *H. arbuscula*. The current status and trends for *H. arbuscula* are provided in the tables below.

New Status Information:

- In 2020, there were three mature and one immature wild individuals at Mākaha, O‘ahu (Army Natural Resources Program of O‘ahu [ANRPO] 2020 appendices, p. 309). Currently, only two mature and one immature individuals remain (ANRPO 2023a appendices, p. 308). There are reintroduced plants at Keawapilau (Pahole NAR), north Hale‘au‘au, Puali‘i, and Mākaha (ANRPO 2023b). On Maui, there have been 10 individuals observed at two locations in Waihe‘e over the last 5 years. There may be an additional 14 individuals in Waihe‘e, as well as 21 individuals in ‘Īao, however these have not been visited in 10 or more years (PEPP 2023).
- Four founders from three populations (Mākaha, Hale‘au‘au, and Wai‘anae Kai) on O‘ahu are represented in seed collections and nursery plants (ANRPO 2023b). Seven founders from three populations of *Hesperomannia arborescens* on west Maui (Wai‘ehu, Waihe‘e, and ‘Īao) are represented in propagation (Olinda Rare Plant Facility [ORPF] 2019, 2020, 2023).

New Threats:

- Drought may be a new threat to this species, as the number of individuals decreases in the summer months (ANRPO 2024, p. 5). Over the last 100 years, the Hawaiian Islands have experienced an annual decline in precipitation of over 9 percent, increasing to as much as 15 percent within the last 20 years (US-NSTC 2008, p. 61; Chu and Chen 2005, pp. 4812–4813; Diaz et al. 2005, 4 pp.). Drought affects plants directly by desiccation. The increase in drought frequency and intensity leads to a self-perpetuating cycle of increase in cover of nonnative plants, increase in the number of fires, and an increase of erosion (US-GCRP 2009, pp. 18, 24; Warren 2011).

New Management Actions:

- Feral ungulate monitoring and control—Ungulate control is reported at Hale‘au‘au, Keawapilau (Pahole NAR), Mākaha, Puali‘i, Wai‘anae Kai (ANRPO 2020 appendices, p. 407; ANRPO 2021 appendices, p. 390). Feral pig pressure on fences must be monitored (ANRPO 2022, p. 309). Beginning in 2022, ungulate control was discontinued for occurrences at Wai‘anae Kai (ANRPO 2022 appendices, p. 504; ANRPO 2023a appendices, p. 352).
- Nonnative invasive plant monitoring and control—ANRPO controls nonnative invasive plants at Keawapilau and in 2021 control efforts were focused at Puali‘i (ANRPO 2020 appendices, p. 74; ANRPO 2021, p. 52; ANRPO 2023a, p. 70). Nonnative plant removal efforts were established at Mākaha in 2023 (ANRPO 2023a appendices, p. 352).
- Predation and herbivory—

- In 2020, ANRPO reported establishment of grids of rodent traps at populations at Kapuna, Keawapilau, Mākaha, Puali‘i, and Hale‘au‘au (ANRPO 2020, p. 197, appendices pp. 47, 77–79, 178, 407; ANRPO 2021, p. 208, appendices p. 390; ANRPO 2022 appendices, p. 504; ANRPO 2023a, p. 208, appendices p. 352). In 2022, caches of fruit left by rats were discovered (ANRPO 2022, p. 97). Game cameras were set up and revealed that rats were taking flower nectar, and chewing and removing fruit (ANRPO 2022, p. 97). Additional traps were set along with rodenticide treatment, and treatments will continue with adjustment of timing for the flowering cycle of the plants (ANRPO 2022, pp. 97, 207).
- ANRPO conducts slug control at Mākaha (ANRPO 2021 appendices, p. 390; ANRPO 2022, pp. 217, appendices p. 504; ANRPO 2023a, p. 244; ANRPO 2023a appendices, p. 352). Due to the rarity of recruitment, slug control must be considered though direct evidence of slug herbivory is lacking (ANRPO 2022, p. 320).
- Collection and propagation for genetic storage and reintroduction—
 - In 2022, ANRPO collected 452 filled seed from a flowering event (>50 per tree) at a reintroduction site at Puali‘i that reflected open pollination (ANRPO 2022, p. 97). In 2023, more than 80 individuals were propagated and in storage at the greenhouse for future reintroduction efforts at Puali‘i, Mākaha, and Hale‘au‘au (ANRPO 2023a, p. 116; ANRPO 2023b).
 - From 2014 to 2016, the Olinda Rare Plant Facility (ORPF) reported propagation of eight individuals representing seven founders from three populations of *Hesperomannia arborescens* on west Maui (Wai‘ehu, Waihe‘e, and ‘Īao) (ORPF 2019, 2020). In 2023, ORPF reported propagation of an additional two individuals representing one founder at Honokōhau and two individuals representing an additional founder at ‘Īao (ORPF 2023).
 - The Native Ecosystems Protection & Management (NEPM) nursery reported propagation and storage of 10 plants representing two founders of *Hesperomannia arborescens* at Waihe‘e on west Maui (NEPM 2020).
- Reintroduction and augmentation—
 - Beginning in 2010, ANRPO established four reintroduction sites and outplanted a total of 274 individuals (ANRPO 2024, p. 4). Currently, ANRPO also reports 14 mature and 40 immature reintroduced at Mākaha, with 8 mature and 40 immature remaining; 65 mature reintroduced at Keawapilau with two mature remaining; 84 mature reintroduced at Puali‘i with 28 mature and 14 immature remaining; and 15 immature reintroduced at west Hale‘au‘au with 9 immature remaining (see Table 1a for summary). Recruitment of 14 seedlings at two reintroduction sites (Mākaha and Puali‘i) was recently observed; however, in 2024 ANRPO reported that none survived to maturity (ANRPO 2023a, p. 111; ANRPO 2024, p. 5). Overall survivorship of outplantings at Pahole NAR has been in steady decline and in 2023 the last plant died; an alternate site will be chosen (ANRPO 2023a, p. 115).
- Seed viability research—
 - Pollinator observations—In 2020, ANRPO reported that staff made multiple observations of the native honeycreeper, O‘ahu ‘amakihī (*Chlorodrepanis*

flava), visiting *H. oahuensis* flowers (ANRPO 2020, p. 108). Collection data of viable seeds from open-pollinated flowers indicates that the reintroduced plants at Puali‘i are being pollinated by birds (ANRPO 2020, p. 108). Recent large flowering events with corresponding numbers of viable seeds suggests that reintroductions of larger numbers of individuals may be better for attracting avian pollinators, along with bird song playback (ANRPO 2020, p. 108). In 2021, plants at Puali‘i were monitored weekly for pollinator visitation, and apapane (*Himatione sanguinea*) and ‘amakihi were observed, so ANRPO set up wildlife cameras and an automated call playback system to conduct further studies (ANRPO 2021, p. 96). In 2022, game cameras revealed that native and nonnative birds (‘amakihi, apapane, O‘ahu ‘elepaio (*Chasiempis ibidis*), red-vented bulbul (*Pycnonotus cafer*), and red-whiskered bulbul (*P. jocosus*) were interacting with buds and flowers. In 2024, birds and mice were detected by field cameras coming into direct contact with flowers (ANRPO 2024, p. 4). This data can be useful for selecting suitable reintroduction sites where these pollinators may be present.

- ANRPO conducts hand pollinations opportunistically, depending on flowering events (ANRPO 2024, p. 4).

Table 1. Status and trends of *Hesperomannia arbuscula* from listing through current 5-year review. Table 1a shows progress according to Interim Stabilization Goals; Table 1b shows progress according to Preventing Extinction Goals.

Table 1a.

Date	No. wild individuals	No. Outplanted	Stabilization Criteria identified in Recovery Plan	Stabilization Criteria Completed?
1991 (listing)	ca 50 (O‘ahu and Maui combined)	0	All threats managed in all 3 populations	Unknown
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
2009 (5-year review)	13 (O‘ahu) 3 (Maui)	0	All threats managed in all 3 populations	Partial
			Complete genetic storage	Partial
			3 populations with 50 mature individuals each	No

2013 (5-year review)	7 (O‘ahu <i>H. arbuscula</i>) 54 (Maui <i>H. arborescens</i>)	159 (O‘ahu <i>H. arbuscula</i>)	All threats managed in all 3 populations	Partial
			Complete genetic storage	Partial
			3 populations with 50 mature individuals each	No

Table 1b.

Date	No. wild individuals	No. outplanted	*Preventing Extinction Targets identified by HPPRCC	*Preventing Extinction Targets Completed?
2020 (5-year review)	4 (O‘ahu) 7 (Maui)	134 (252 outplanted O‘ahu)	All threats managed in all 3 populations	Partial
			Complete genetic storage	Partial
			Reproduction (i.e., viable seeds, seedlings, saplings) at all 3 populations	Partial
			3 populations with 50 mature individuals each	No
2024 (5-year review)	2 mature, 1 immature (O‘ahu <i>H. oahuensis</i>) 10 (Maui <i>H. arborescens</i>)	218 outplanted; 31 mature 29 immature survive (O‘ahu); 0 (Maui)	All threats managed in all 3 populations	Partial, ungulate, nonnative plant, rat, and slug control at some locations

			Complete genetic storage	Partial, 4 founders represented (O‘ahu); 7 founders represented (Maui)
			Natural reproduction at all 3 populations	Partial, recruitment observed at 2 O‘ahu reintroductions & on Maui
			3 populations with 50 mature individuals each	No

* 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 *Hesperomannia arbuscula* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Degradation and destruction of habitat and herbivory by feral ungulates	A, C	Ongoing	Partial, ungulate control at 4 O‘ahu populations
Established ecosystem altering invasive plant species degradation of habitat and competition	A, E	Ongoing	Partial, control at 3 populations
Fire destruction and degradation of habitat	A	Ongoing	Partial, fire management plan for Army training area on O‘ahu
Climate change degradation or loss of habitat	A	Ongoing	None
Collection impacts	B	Unknown	Partial, exclosures may provide protection on O‘ahu
Predation and herbivory by rodents	C	Ongoing	Partial, traps and rodenticide use at 5 populations
Predation and herbivory by slugs	C	Potential	Partial, control at 1 population

Lack of adequate hunting regulations	D	Ongoing	Partial, exclosures may provide protection on O‘ahu
Reduced viability due to low numbers, low pollen viability, and seedling mortality	E	Ongoing	Partial, seed storage, hand pollination, propagation, and translocation efforts; pollination research

Synthesis:

Currently, there are two mature and one immature wild individuals of *Hesperomannia oahuensis* on O‘ahu and ten wild individuals of *H. arborescens* on Maui. Ungulate control is ongoing at Hale‘au‘au, Keawapilau (Pahole NAR), Mākaha, and Puali‘i, on O‘ahu. There is some nonnative invasive plant control at Keawapilau, Puali‘i, and Mākaha. Drought is mentioned as a new threat to this species. Fruit caches made by rats were observed and rodent control was established at Kapuna, Keawapilau, Mākaha, Puali‘i, and Hale‘au‘au. Four founders from three populations on O‘ahu are represented in seed collections and nursery plants. Recruitment was recently observed at the reintroduction sites at Mākaha and Puali‘i; however, none reached maturity. Pollination studies including native bird observations are ongoing and may aid in site selection and establishment of future reintroductions.

Stabilizing (interim), and downlisting and delisting criteria are provided in the Recovery Plan for the O‘ahu Plants (USFWS 1998) and preventing extinction targets have been added and criteria 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.

Hesperomannia arbuscula, now recognized as *H. oahuensis* on O‘ahu and as *H. arborescens* on west Maui, is a long-lived self-incompatible perennial shrubby tree. To prevent extinction, which is the first milestone 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 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 should be documented on the islands where they now occur or occurred historically and each of these populations must be naturally reproducing (i.e., viable seeds, seedlings, saplings) with a minimum of 50 mature, reproducing individuals per population.

The preventing extinction goals for this species have not been met. The number of wild individuals continues to decline. There are no populations totaling at least 50 mature

individuals; however, some recruitment was recently observed at two reintroduction sites but did not reach maturity (Table 1). Predation and herbivory by rats and slugs are not managed at all populations. Some founders are only represented at reintroduction sites and not genetic storage. Only three subpopulations have management of nonnative invasive plants (Table 2). Drought is an additional threat. Therefore, *Hesperomannia arbuscula* (now *H. oahuensis* on O‘ahu and *H. arborescens* on Maui) meets the definition of Endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:

Drought and predation and herbivory by slugs are new threats. No significant new information regarding the species’ biological status has been reported since the last 5-year review in 2020. Thus, the following recommendations for future actions are updated or reiterated for the 5-year review for 2024.

- Surveys and monitoring—Continue to monitor extant wild and translocated populations, and survey suitable habitat for future translocation sites.
- Ungulate monitoring and control—Continue to construct and maintain exclosures to provide protection from the negative impacts of habitat degradation and browsing by feral ungulates.
- Nonnative invasive plant monitoring and control—Continue to control established ecosystem-altering nonnative invasive plant species, and those that compete with *Hesperomannia* species at all populations.
- Fire monitoring and control—
 - Continue to implement fire management plans for all populations.
 - Establish populations in areas where damage or destruction by wildfire is less likely.
- Climate change adaptation strategy—Assess the modeled effects of climate change on this species and use to determine future landscape needed for its recovery.
- Predator and herbivore monitoring and control—Implement effective methods to control rats and slugs at all populations.
- Captive propagation for genetic storage and reintroduction—
 - Continue collection and propagation efforts for maintenance of genetic stock and for reintroduction.
 - Develop a managed breeding program to generate more fruit/viable seeds and increase genetic diversity of populations on O‘ahu.
 - Continue hand pollination efforts to produce viable seeds.
 - Continue pollinator studies to aid in selection of reintroduction sites.
 - Consider other methods of propagation including air-layering and grafting to increase numbers for seed production and genetic representation.
- Reintroduction and augmentation—Continue to establish new populations and augment existing populations of *H. arbuscula* (*H. oahuensis*) in suitable habitat within historical range that is being managed for known threats to this species.
- Build resiliency, redundancy, and representation—Increase species’ viability through habitat restoration, threat control, and reintroduction and translocation to

- reduce impacts of drought, predation and herbivory, climate change, lack of adequate hunting regulations, and loss of viability.
- Alliance and partnership development—Continue to work with ANRPO, NEPM, and other land managers and partners to initiate planning and contribute to implementation of ecosystem-level restoration and management to benefit this species.
 - *Federal Register* updates—Update 50 CFR 17 to reflect the revised taxonomy.

References:

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U.S. FISH AND WILDLIFE SERVICE

SIGNATURE PAGE for 5-YEAR REVIEW of *Hesperomannia arbuscula* (no common name)

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

For Field Supervisor, Pacific Islands Fish and Wildlife Office

Date _____