

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. 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.

Lead Region/Field Office:

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

Name of Reviewer(s):

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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 (USFWS) beginning on March 8, 2007. The review was based on the final critical habitat designation for *Herperomannia arbuscula* and other species from the islands of Oahu and Maui (USFWS 2003a, b), as well as a review of current, available information. The Bernice P. Bishop Museum provided an initial draft of portions of the 5-year review and they 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 our 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 before submission to the Field Supervisor for approval.

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).

Application of the 1996 Distinct Population Segment (DPS) Policy:

This Policy does not apply to plants.

Review Analysis:

Please refer to the final critical habitat designation for *Hesperomannia arbuscula* published in the Federal Register on May 14 and June 17 of 2003 (USFWS 2003a, b) for a complete review of the species' status (including biology and habitat), threats, and management efforts. No new threats and no significant new information regarding the species biological status have come to light since listing to warrant a change in the Federal listing status of *H. arbuscula*.

When *Hesperomannia arbuscula* was listed in 1991, about 50 individuals within two populations were known to occur on Oahu and a single population on Maui (USFWS 1991). Further botanical survey increased the known number of populations on Oahu to six, comprised of 90 to 92 individuals (USFWS 2003b) and eight populations totaling 37 individuals on Maui (USFWS 2003a). However, both populations are steadily declining in numbers (Plant Extinction Prevention Program 2007a, b, 2008). Currently, *H. arbuscula* occurs as 13 individuals (11 mature and two immature) in three populations in the Waianae Mountains on Oahu (U.S. Army 2007; Plant Extinction Prevention Program 2008; Weisenberger 2008). While it was once known from three populations in Honouliuli Preserve (South Kaluaa Gulch, Kaaikukai Gulch, and North Palawai Gulch), the species is now found only in North Palawai, where it has declined from four mature individuals in 2006 to only two mature and one immature individual in 2007, and to one mature individual in 2008 (Plant Extinction Prevention Program 2008). A single individual in Kapuna Gulch died in 2007 despite efforts to save it (U.S. Army 2007). The population in Makaha Valley has declined from 20 mature individuals in 2005 to 14 mature individuals and one seedling in 2007, and down to eight mature individuals and one immature individual in 2008 (U.S. Army 2007; Plant Extinction Prevention Program 2008). The population in Waianae Kai consists of two mature and one immature individual (Plant Extinction Prevention Program 2007a, 2008). Three mature individuals remain in Iao Valley, West Maui (Plant Extinction Prevention Program 2007b); however, the taxonomic identity of the Maui population is in question (see taxonomic discussion below) (Ching Harbin 2003; USFWS 2007a). The species has very little to no regeneration or recruitment in the wild (Ching Harbin 2003).

Hesperomannia arbuscula seedlings are very slow growing (The Nature Conservancy 2006). While air layers may be used to propagate the species, they are not always successful, and are potentially damaging to the parent tree. Mature plants live for about 10 to 15 years, but can die quickly of unknown causes. Life history information suggests that the species flowers and fruits in the spring to early summer.

Pollen fertility of *Hesperomannia arbuscula* is low, averaging 44.6 percent viability across all individuals with one individual as low as 14 percent (Ching Harbin 2003). Pollen has been collected from flowering individuals in the Makaha, Palawai, and Waianae Kai populations, and used to cross-pollinate individuals between populations (Plant Extinction Prevention Program 2007a; Weisenberger 2008). Germination using cross-pollinated seed varies depending on the timing of the pollen collection and application, with an average germination of 55.6 percent. Seeds that were completely filled had high percentage of germination and it was possible to transfer them from the

germination media to pots within a controlled environment (U.S. Army 2007). The cross-pollination technique yielded over 100 seedlings of this species, a taxon that has been very difficult to propagate in the past (Plant Extinction Prevention Program 2008).

Individuals collected from Honokohau and Waihee, on Maui, have nearly glabrous (hairless) leaves that are narrower compared to the wider, tomentose (hairy) leaves of *H. arbuscula* in the Waianae Mountains. Furthermore, West Maui populations are found in wet forest (as are the *H. arborescens* populations on Oahu and Molokai) in contrast to the mesic habitat of *H. arbuscula* plants in the Waianae Mountains on Oahu. Rapid random amplification of polymorphic DNA (RAPDs) analysis also suggested that the Oahu populations are genetically distinct from the Maui population. These factors support treatment of the West Maui plants as taxonomically distinct from *H. arbuscula* on Oahu - - as a separate species -- although this has not been officially published in a taxonomic treatment (Ching Harbin 2003; S. Ching, Natural Resources Implementation Plan Project Manager, U.S. Army Environmental, pers. comm. 2008).

Despite a low degree of fitness, Oahu populations of *Hesperomannia arbuscula* exhibited the highest frequency of polymorphic loci and estimated heterozygosity at the population and species level. They also had the highest number of unique loci in comparison to other species in the genus. High genetic differentiation within the populations and low differentiation between populations species suggest that extant populations are experiencing genetic drift, which could be due to initial founder events of the different populations or through reproduction under prolonged genetic isolation (Ching Harbin 2003).

The West Maui individuals are currently identified as *H. arbuscula* by Wager *et al.* (1999). All previous taxonomic treatments had separated Maui individuals from the individuals found in the Waianae Mountains of Oahu either by species, subspecies, or variety (Degener 1938; Carlquist 1957; St. John 1978, 1983). While Ching Harbin (2003) indicated in her studies that *Hesperomannia arbuscula* populations in the Waianae Mountains are genetically distinct and should be considered as a separate species (namely *Hesperomannia oahuensis*), no formal publication or taxonomic name change has been published. The historical range of *H. arbuscula* is restricted to the Waianae Mountains, Oahu under the Ching Harbin (2003) treatment of the genus. The loss of populations within the Waianae Mountains is further reducing the geographic range of the species.

The major threat to *Hesperomannia arbuscula* remains habitat degradation by feral pigs (*Sus scrofa*) (Factor A and D) (USFWS 1991, 1995, 1998, 2003a, b, 2007 2008; U.S. Army 2007; Plant Extinction Prevention Program 2007a, b, 2008). Pig damage to the habitat and seedlings has occurred in unfenced areas (The Nature Conservancy 2006). Another major threat is the competition from introduced invasive plant species (Factor E) such as *Schinus terebinthifolius* (Christmas berry), *Paspalum conjugatum* (Hilo grass), *Oplismenus hirtellus* (basket grass), *Melinis minutiflora* (molasses grass), *Passiflora suberosa* (corky passion vine) *Clidemia hirta* (Koste's curse), *Lantana camara* (lantana), *Rubus argutus* (Florida prickly blackberry) and *Psidium cattleianum* (strawberry guava) (USFWS 1991, 1998, 1995, 2003a, b, 2007a, b; The Nature Conservancy 2006). Reduced reproductive vigor due to the small number of remaining occurrences and

individuals (Factor E), low pollen viability (Factor E), poor seedling survivorship (Factor E), and trampling and collection by humans (Factor B) are considered threats for this species (USFWS 1991, 1995, 1998, 2003a, b, 2007, 2008; Ching Harbin 2003; Plant Extinction Prevention Program 2007; U.S. Army 2007). Flowers from mature individuals have been stolen in the past (Plant Extinction Prevention Program 2007a), probably for lei (flower garland) making.

New threats identified for this species include predation by rats (*Rattus* spp.) and slugs that affect the survival of seedlings (Factor C) (The Nature Conservancy 2006; USFWS 2007; U.S. Army 2007), persistent droughts (Factor E) (Ching Harbin 2003; Plant Extinction Prevention Program 2008), and unidentified insect damage in most seeds (Factor C) (Lilleeng-Rosenberger 2005).

In addition to all of the other threats, *Hesperomannia arbuscula* is now considered to be restricted to a single island, if the Ching Harbin (2003) treatment is followed, and is 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, landslides and disease outbreaks (Factor E). When considered on their own, the natural processes associated with being a single island endemic do not affect *H. arbuscula* to such a degree that it is threatened or endangered with extinction in the foreseeable future, but these natural processes can exacerbate the threat from anthropogenic factors, such as habitat loss or predation by introduced species (Factor E) (USFWS 1995, 1998).

The populations in Palawai, Waianae and Makaha are fenced and protected from feral ungulates. One population (Palawai) is partially weeded and partial rat control is ongoing during periods of reproduction in all three populations (U.S. Army 2007).

Hesperomannia arbuscula is poorly represented in *ex situ* collections. The Pahole Rare Plant Facility has one air layered plant from the Waianae Kai population and the U.S. Army has 16 individuals in their nursery (U.S. Army 2008). The National Tropical Botanical Garden (2008) reports having 75 seeds in storage, but viability remains doubtful.

Stabilizing, downlisting, and delisting objectives are provided in the recovery plan for plants from the island of Oahu (USFWS 1998), based on whether the species is an annual, a short-lived perennial (fewer than ten years), or a long-lived perennial. *Hesperomannia arbuscula* is a long-lived perennial, and to be considered stabilized, which is the first step in recovering the species, the taxon must be managed to control threats (*e.g.*, fenced) and be represented in an *ex situ* (off-site) collection. In addition, a minimum of three populations should be documented on the island of Oahu and, if possible, at least one other island where they now occur or occurred historically. For the species to be considered stable, each of these populations must be naturally reproducing and increasing in number, with a minimum of 25 mature individuals per population.

The stabilization goals for this species have not been met, as only 13 individuals remain in the wild (see Table 1). Therefore, *Hesperomannia arbuscula* meets the definition of endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:

- Continue hand-pollination to produce viable seeds and augment genetic diversity among populations.
- Continue collection of genetic material for storage, especially to develop a managed breeding population to generate more seeds for controlled propagation and future population augmentation.
- Consider other methods of propagation to increase numbers in genetic storage, such as grafting onto other *Hesperomannia* stock.
- Determine and implement adequate rat and slug control methods.
- Establish new populations within historical range or suitable habitat where threats have been controlled.
- Enhance current natural populations with appropriate genetic individuals where threats have been controlled.
- Contact community groups near the Wainane Kai population to educate them about the conservation of this species.
- Survey geographical and historical range (Waianae Mountains) for unknown populations for a thorough current assessment of the status of populations.
- Study *Hesperomannia arbuscula* populations with regard to population size and structure, geographical distribution, flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, limiting factors, and threats.
- If populations from Oahu and Maui are published as distinct species, update the listed entity in 50 CFR 17.

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Table 1. Status of *Hesperomannia arbuscula* from listing through 5-year review.

Date	No. wild individuals	No. outplanted	Stability Criteria identified in Recovery Plan	Stability Criteria Completed?
1991 (listing)	~ 50	0	All threats managed in all 3 populations	Unknown
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
1998 (recovery plan)	~ 90	0	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	No
2003 (critical habitat)	Oahu: 90-92 Maui: 37	0	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	No
2008 (5-year review)	Oahu: 13 Maui: 3	0	All threats managed	Partially
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	No

U.S. FISH AND WILDLIFE SERVICE
SIGNATURE PAGE for 5-YEAR REVIEW of *Hesperomannia arbuscula*

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

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Date 9/7/09