

5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Hesperomannia arborescens* (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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Marilet A. Zablan, Pacific Islands Fish and Wildlife Office, Recovery Program Leader and acting Assistant Field Supervisor for Endangered Species

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 final critical habitat designation for *Hesperomannia arborescens* and other species from the island of Oahu, as well as a review of current, available information (USFWS 2003). 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 designations for a complete review of the *Hesperomannia arborescens* status (including biology and habitat), threats, and management efforts (USFWS 2003a, b, c). 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. arborescens*.

Hesperomannia arborescens was formerly known from locations on three islands: Kaiholena and Kukui on Lanai, Koolau Mountains on Oahu, and Pelekunu Trail on Molokai. At the time of Federal listing, the species was extant in 18 locations, totaling fewer than 70 individuals on the islands of Oahu, Molokai and Maui and considered extirpated from Lanai (USFWS 1994). In 2003, *H. arborescens* was known from at least 22 occurrences totaling 185 individuals (USFWS 2003d). Molokai had a single known occurrence with only three individuals (USFWS 2003b), Maui had four known occurrences with a total of six individuals (USFWS 2003a), and on Oahu, the species was known from 17 occurrences with 178 extant individuals (Maakua (22 individuals); Kaluanui-Maakua Ridge (2); Kaipapau (6); Kaluanui (2); Halawa (3); Kapakahi Gulch (1); Niu-Waimanalo summit Ridge (1); Poamoho trail (2); lower Peahinaia trail (15); lower north Kaukonahua Gulch (1); upper north Kaukonahua Gulch (4); upper Kawaiiloa trail (1) ; lower Kawaiiloa trail (2) ; Kawainui (42); Laie-Waimea Ridge (15); north Kaukonahua Gulch (13); and south Kaukonahua Gulch (46)) (USFWS 2003d).

A single population of three individuals of *Hesperomannia arbuscula* in Iao Valley, West Maui, has, in the past, been separated from the individuals of the taxon found in the Waianae Mountains of Oahu either by species, subspecies, or variety (Carlquist 1957; Degener 1938; St. John 1978, 1983). Genetic analysis showed that the Iao Valley population currently placed within *H. arbuscula* actually belong genetically to *H. arborescens*, and should be included within this taxon (Ching Harbin 2003). While Ching Harbin proposed that *H. arbuscula*, *H. arborescens* subsp. *arborescens*, and *H. arbuscula* subsp. *arbuscula* be treated as synonyms of *H. arborescens*, this has not been formally published to date. Similarly, populations of *H. arborescens* found in the Koolau Mountains of Oahu were proposed to be returned to *Hesperomannia swezeyi* based on genetic analysis, but this has also not been formally published or accepted (Ching Harbin 2003; S. Ching, U.S. Army, pers. comm. 2008). In 2007, more than 21 populations of the taxon were noted, totaling 187 individuals (USFWS 2008). On Maui, 5 populations totaling 95 mature individuals are known to occur in Honokohau (30 individuals), Waihee (60), Kapilau Ridge (1), Lanilili, Kahakuloa Section of West Maui Natural Area Reserve (1), and 3 individuals in an Iao Valley population taxonomically regarded as *H. arbuscula*, but genetically most similar to Maui Nui *H. arborescens* (see genetics discussion below) (Plant Extinction Prevention Program 2007; H. Oppenheimer, Maui Nui Coordination, Plant Extinction Prevention Program, pers. comm. 2008). On Molokai, between Wailau and Pelekunu, 30 individuals are currently known (Plant Extinction Prevention Program 2007). On Oahu, populations currently known as *H. arborescens* are actually two different species: *H. swezeyi* is known from four populations totaling 179 mature and 127 immature individuals and 151 seedlings in the Koolau Mountains; and *H. oahuensis* is known from one individual in the Waianae Mountains (U.S. Army 2008).

Populations of *Hesperomannia arborescens*, only on Maui as recognized by the latest genetics, tend to be locally dense (Ching Harbin 2003), and seedlings have been noted

only at Honokohau and Wailau on Maui (Plant Extinction Prevention Program 2007). Little is known about the biology and life history of *Hesperomannia arborescens*. Pollen viability from one sample of *H. arborescens* was estimated at 98 percent, but fruiting heads are not frequently observed and embryo viability has not been determined (Ching Harbin 2003), but is assumed to be low. Since there are seedlings some years and not others, there is likely a decline in the pollinator for the taxon (H. Oppenheimer, pers. comm. 2008).

Populations of *Hesperomannia arborescens* from West Maui and the population from Molokai have been found to be very similar to each other and also genetically distinct from the Oahu populations of the species. Morphological and genetic data indicate that any taxonomic ties to the two species found on Oahu are tenuous. Most of the genetic diversity of Maui and Molokai *H. arborescens* is contained among populations and each population has been shown to be genetically distinct, but more similar to each other than to populations and species on Oahu. Data indicate that there is likely both inbreeding and genetic drift occurring in the Maui and Molokai *H. arborescens*. However, the populations still contain a good deal of genetic variation (54.7 percent), and genetic drift has likely had a greater effect than inbreeding (Ching Harbin 2003).

With a recent genetic analysis, the distribution of *H. arborescens* has increased on Maui to include the Iao Valley, Maui population, but does not include the Oahu populations, limiting the historical range of the species to Maui and Molokai. It is suggested (Ching Harbin 2003), therefore, that the taxon *Hesperomannia arborescens* be inclusive only of the Maui and Molokai populations for conservation purposes. This reduces the historical range of the species and the current population number to six extant populations with a total of 121 mature individuals and few observed seedlings on West Maui and Molokai (Plant Extinction Prevention Program 2007).

Loss of habitat and degradation of remaining habitat by feral ungulates (pigs (*Sus scrofa*) and goats (*Capra hircus*)) remain the largest threats to the taxon (Factors A and D), but the extent differs at each locality. Introduced invasive plant species compete for light, space and nutrients including *Clidemia hirta* (Koster's curse), *Ageratina adenophora* (Maui pamakani), *Tibouchina herbacea* (glorybush), and *Buddleia asiatica* (dog tail). Few threats are noted for the Iao Valley population (Wood 2005; Plant Extinction Prevention Program 2007). On Maui, the other populations were previously heavily impacted by feral pigs that consume fruits and other plant parts, or indirectly due to their rooting behavior which further degrades the habitat (USFWS 2003b, d). The recent strategic fencing and hunting activities of the Maui Land and Pineapple Co. and West Maui Mountains Watershed Partnership have decreased pig numbers to near zero in the area (H. Oppenheimer, pers. comm., 2008). The consumption of plant parts by rats (*Rattus* spp.) and pigs threatens the individuals directly (Factor C), and through reduced vigor and fruit set (Factor E) (USFWS 2008). The Iao Valley population has been noted to be at high risk of fire due to human activities and natural causes (Factor E) (USFWS 2003b). Threats to the Oahu populations, now potentially separate species, include pigs and goats (Factors A and D), invasive introduced plant species (Factor E), fire (Factor E), rats (Factor C), effects of military activities (Factor E), and low seed set (Factor E) (U.S.

Army 2008; USFWS 2008).

To safeguard existing genetic material, propagation for genetic storage and reintroduction is occurring at the National Tropical Botanical Garden and the Center for Conservation Research and Training Seed Storage Facility. Long-term storage comprises 202 seeds at the National Tropical Botanical Garden (2008), but the viability of this seed is unknown, as it has not been tested since being placed in storage. Also, it is unclear from which populations this genetic material has been collected, so it may represent Oahu material that is potentially no longer part of this species.

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 arborescens* 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* (at other than the plant's natural location, such as a nursery or arboretum) 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 (see Table 1), for while three populations contain 25 or more mature individuals, the species is not consistently producing viable seeds, and most of the threats are not being managed. Therefore, *Hesperomannia arborescens* meets the definition of endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:

- Continue collection of genetic material for storage, controlled propagation and future population augmentation.
- Construct enclosure fences to protect individuals from the activities of feral pigs, and eradicate introduced invasive plant species within the enclosures.
- Study the use of hand-pollination techniques to produce viable seeds and augment genetic diversity among populations.
- Determine and implement propagation techniques for this species.
- Determine and implement adequate methods for rat control.
- Enhance current natural populations to increase numbers of individuals.

- Establish new populations within historical range or suitable habitat where threats have been controlled.
- Survey the geographical and historical range of *Hesperomannia arborescens* for additional populations and a thorough current assessment of the status of known populations. Surveys should be mostly conducted, but not limited to West Maui Mountains and also in the wet forests of the North coastal cliffs of Molokai.
- Study *Hesperomannia arborescens* 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.
- Clarify taxonomic entity of extant individuals from Oahu, Molokai, and Maui.
- Once taxonomy has been officially published for *Hesperomannia* species in Hawaii, update 50 CFR 17 to reflect official taxonomy.

References:

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Personal Communications

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

Date	No. wild individuals	No. outplanted	Stability Criteria identified in Recovery Plan	Stability Criteria Completed?
1994 (listing)	< 70	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 25 mature individuals each	No
1996 (recovery plan)	< 100	0	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 25 mature individuals each	Unknown
1998 (recovery plan)	< 100	0	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 25 mature individuals each	Unknown
2003 (critical habitat)	185	unknown	All threats managed in all 3 populations	Unknown
			Complete genetic storage	Unknown
			3 populations with 25 mature individuals each	Unknown
2008 (5-year review)	> 597		All threats managed	Partially
			Complete genetic storage	Partially
			3 populations with 25 mature individuals each	Yes*

*Numbers are met, but most mature individuals are not producing viable seed consistently, and therefore are not really reproductive, especially for true *H. arborescens*.

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

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

Field Supervisor, Pacific Islands Fish and Wildlife Office



Patrick Leonard

Date 4/7/09