

5-YEAR REVIEW

Short Form Summary

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

Current Classification: Endangered

Federal Register Notice announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2008. Endangered and threatened wildlife and plants; initiation of 5-year status reviews of 70 species in Idaho, Montana, Oregon, Washington, and the Pacific Islands. Federal Register 73(83):23264-23266.

Lead Region/Field Office:

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

Name of Reviewer(s):

Marie Bruegmann, Pacific Islands Fish and Wildlife Office, Plant Recovery Coordinator
Marilet A. Zablan, Pacific Islands Fish and Wildlife Office, Assistant Field Supervisor for Endangered Species
Jeff Newman, Pacific Islands Fish and Wildlife Office, Acting Deputy Field Supervisor

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 April 29, 2008. The review was based on the proposed rule and final critical habitat designation for *Hesperomannia lydgatei* and other species from the island of Kauai (USFWS 2003), as well as a review of current, available information. The National Tropical Botanical Garden provided an initial draft of portions of the review and recommendations for conservation actions needed prior to the next five-year review. The evaluation of Tamara Sherrill, biological consultant, was reviewed by the Plant Recovery Coordinator. The document was then reviewed by the Assistant Field Supervisor for Endangered Species and Acting Deputy Field Supervisor 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 lydgatei* published in the Federal Register on February 27, 2003 (USFWS 2003) 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. lydgatei*.

At the time of listing in 1991, four populations of *Hesperomannia lydgatei*, all found along or near the Wahiawa Stream, consisted of an estimated 154 to 192 individuals (USFWS 1991). *Hesperomannia lydgatei* is currently restricted to a single large population of less than 100 individuals located in the Wahiawa/ Kanaele Bog Drainage Basin in southern Kauai at 660 to 774 meters (2,165 to 2,540 feet) elevation (Perlman 2008). Before the Wahiawa population was severely reduced by Hurricane Iniki, it was estimated to contain approximately 280 individuals (Lorence and Flynn 1991; USFWS 1994). Approximately 75 individuals were estimated to remain near Mt. Kahili, on stream banks below the ridge between Kahili and Kapalaoa, following Hurricane Iniki (National Tropical Botanical Garden 2008). Several smaller subpopulations are scattered along various stream tributaries within the larger population. Fewer than 100 individuals were seen in September 2000 when field collections were made for genetic study (Ching Harbin 2003). Previous collections were also made from Waioli below Namolokama in 1991 and 1992 (Lorence and Flynn 1993; Wood 2008a) and in the upper Limahuli Valley, in the back of the west gulch near Hanakapiai in 1996 and 1998 (Perlman 2008).

Recent information about *Hesperomannia lydgatei* biology and life history suggests that the species has high pollen viability, but low germination rates (Ching Harbin 2003). Most of the fruit are aborted, and few have embryos (Tangalin 2008).

A study of the genetic composition of endemic Hawaiian genus *Hesperomannia* was undertaken in 2000 (Ching Harbin 2003). For the Kauai portion of the research, collections were made from a total of 61 individuals of *H. lydgatei* from six subpopulations in Wahiawa in 2001. Subpopulations were numbered for the purposes of the study, "1" being most upstream to "6" being the farthest downstream. The study found that the genus *Hesperomannia* has high genetic polymorphism (variation) compared to other Hawaiian plant species for which genetic studies have been done using the same method to distinguish differences between genomes (RAPD, random amplification of polymorphic DNA). The three Hawaiian *Hesperomannia* species other than *H. lydgatei* also have a higher level of polymorphic loci than other rare Hawaiian species that have been studied. *Hesperomannia lydgatei* was an exception, having the lowest genetic variation compared to the other *Hesperomannia* species though similar to other rare Hawaiian species such as *Haplostachys haplostachya*. Average variation at the subpopulation level was similar to that of other *Hesperomannia* species, but the total species variation within all the subpopulations combined was the lowest in the genus. This species also had the highest genetic similarity among subpopulations within the genus. Despite some degree of genetic similarity of individuals from different subpopulations, each subpopulation is genetically distinct. These subpopulations show patterns of genetic similarity based on geographic proximity. Other analyses show a similar trend of subpopulation distinction with considerable overlap (Ching Harbin 2003).

Low genetic variation and high similarities throughout the larger population indicates some degree of inbreeding. As the number of individuals was reduced by two-thirds in Hurricane Iniki, it is possible to attribute the current low degree of genetic variation to

having only a few closely related parents. The six smaller subpopulations sampled had a fair amount of genetic variation within each subpopulation, and showed some genetic subdivision based on subpopulation and geographic associations, but the division between subpopulations is not large when compared to other species. Overall, research suggests there is some inbreeding and genetic drift (random genetic changes not related to natural selection) taking place, and some reduction in fitness (genetic adaptability) compared to the other species in the genus. All ages of growth were observed in the field, which indicates reproduction is still occurring. While seed viability was low, reflecting a lack of pollination, estimated pollen viability was high (Ching Harbin 2003).

There have been no changes in taxonomic classification or nomenclature for this species.

Hesperomannia lydgatei grows in Wahiawa in *Metrosideros polymorpha* (ohia) wet forest with *Adenophorus* spp. (no common name), *Antidesma platyphyllum* (hame), *Bidens forbesii* (kookoolau), *Bobea brevipes* (akahea lau lii), *Boehmeria grandis* (akolea), *Broussaisia arguta* (kanawao), *Cheirodendron* sp. (olapa), *Cibotium* spp. (hapuu), *Cyanea fissa*, *C. spathulata*, *C. sylvestris* (haha), *Cyrtandra longifolia* (haiwale), *Dicranopteris linearis* (uluhe), *Diplopterygium pinnatum* (uluhe lau nui), *Dubautia* spp. (naenaena), *Elaphoglossum* spp. (ekaha), *Ilex anomala* (kawau), *Kadua affinis* (manono), *Labordia lydgatei* (kamakahala), *Machaerina angustifolia* (uki), *Melicope feddei* (alani), *Myrsine lessertiana* (kolea lau nui), *Peperomia* spp. (ala ala wai nui), *Perrottetia sandwicensis* (olomea), *Pipturus* sp. (mamake), *Platydesma rostrata* (pilo kea lau lii), *Pritchardia flynnii* (loulou), *Psychotria mariniana* (kopiko), *Sadleria* sp. (amau), *Scaevola mollis*, *S. gaudichaudiana* (naupaka), *Syzygium sandwicense* (ohia ha), *Tetraplasandra oahuensis* (ohe mauka), and *Wikstroemia* sp. (akia) (National Tropical Botanical Garden 2008; Perlman 2008; Tangalin 2008).

Invasive introduced plant species are competing with native vegetation in much of the area (Factor E). These include *Erigeron karvinskianus* (daisy fleabane), *Psidium cattleianum* (strawberry guava), *Rubus rosifolius* (thimbleberry), *Melastoma septemnerium* (melastoma), and *Clidemia hirta* (Koster's curse) (National Tropical Botanical Garden 2008). *Psidium cattleianum* (strawberry guava) may be having some of the worst effects on *Hesperomannia* through competition for light and resources. Hurricanes have already taken a toll on this species (Factor E), as Hurricane Iniki damaged both the Waioli and Wahiawa populations, and while the Wahiawa population seemed to bounce back, the Waioli population did not (USFWS 1994). Landslides are commonly observed in the Wahiawa area (Factor E) (Tangalin 2008). Pigs (*Sus scrofa*), which favor wet stream sides where this species occurs, dig up the ground and open it to invasive introduced plant species (Factors A and E) (Perlman 2008).

Seeds of *Hesperomannia lydgatei* are usually destroyed by insects, with larvae visible in the seed (Factor B) (Tangalin 2008; USFWS 1994). Leaves often have black fungus spots (Factor B) (National Tropical Botanical Garden 2008; Tangalin 2008). Rats (*Rattus* spp.) are observed in the area (Perlman 2008; USFWS 1994), but it is not known if they eat *H. lydgatei*. Lack of observed pollinators and non-viable seed are factors which probably contribute to its decline (Factor E) (USFWS 1994).

Climate change may also pose a threat to *Hesperomannia lydgatei* (Factors A and E). However, current climate change models do not allow us to predict specifically what those effects, and their extent, would be for this species.

A fence has been constructed around the Wahiawa Bog by The Nature Conservancy, under a management agreement with the landowner. This will not provide any direct protection for the existing *Hesperomannia lydgatei* population. The Nature Conservancy will be working with USFWS and the National Tropical Botanical Garden to implement recovery actions within the enclosure, including the possible reintroduction of endangered species in the recovery plan for the Wahiawa Plant Cluster, including *H. lydgatei* (Tangalin 2008; USFWS 1994; Wood 2008b).

In addition to all of the other threats, species like *Hesperomannia lydgatei* that are endemic to small portions of a single island are inherently 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, flooding, and disease outbreaks (Factor E). The effects of these processes on this single-island endemic are exacerbated by anthropogenic threats, such as habitat loss for human development or predation by introduced species (Factor E) (USFWS 1994).

Stabilizing, downlisting, and delisting objectives are provided in the recovery plan for the Wahiawa plant cluster (USFWS 1994). To be considered stable, existing populations must be freed from competition with invasive introduced plant species, protected from feral pigs and seed predators, and be represented in an *ex situ* (at other than the plant's natural location, such as a nursery or arboretum) collection.

The interim stabilization goals for this species have not been met (see Table 1), as the fence that has been constructed around Wahiawa Bog does not protect the known population of this species from feral pigs. In addition, the area is not being managed for invasive introduced plant species and no effort has been made to control insects that continue to damage seeds of this species. Therefore, *Hesperomannia lydgatei* meets the definition of endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:

- Protect the current population from pigs and invasive introduced plant species.
- Collect seeds from all subpopulations for genetic storage and reintroduction; plants may need pollination assistance to produce viable seed.
- Test seeds, when collected, for viability.
- Survey historical range of the species to determine the current status of the species.

- Research seed predation and protection methods.
- Determine if fungal disease is a major threat and determine control methods, if necessary.
- Remove pigs from the existing fenced area and surrounding areas.
- Propagate for reintroduction and augmentation, particularly within the existing fenced enclosure.
- Work with Hawaii Division of Forestry and Wildlife, The Nature Conservancy, and the landowner to continue implementation of ecosystem-level restoration and management to benefit this species.

References:

- Ching Harbin, S.N. 2003. Measures of fitness and genetic variation in the endangered Hawaiian genus *Hesperomannia*. Department of Botany, University of Hawaii at Manoa, Honolulu, Hawaii. 201 pages.
- Lorence, D.H. and T. Flynn. 1991. Botanical survey of the Wahiawa Drainage, Kauai. Final report submitted to the State of Hawaii, Department of Land and Natural Resources, Division of Forestry and Wildlife. National Tropical Botanical Garden, Kalaheo, Hawaii. Unpublished.
- Lorence, D.H. and T. Flynn. 1993. Botanical survey of the upper Waioli Valley, Kauai. Final report submitted to the State of Hawaii, Department of Land and Natural Resources, Division of Forestry and Wildlife. National Tropical Botanical Garden, Kalaheo, Hawaii. Unpublished.
- National Tropical Botanical Garden. 2008. Living collections database. National Tropical Botanical Garden, Kalaheo, Hawaii. Unpublished.
- Perlman, S. 2008. *Hesperomannia lydgatei*. National Tropical Botanical Garden, Kalaheo, Hawaii. 2 pages. Unpublished.
- Tangalin, N. 2008. *Hesperomannia lydgatei* reports. National Tropical Botanical Garden, Kalaheo, Hawaii. 2 pages. Unpublished.
- [USFWS] U.S. Fish and Wildlife Service. 1991. Determination of endangered status for five plants from the Wahiawa drainage basin; final rule. Federal Register 56(183):47695-47700.
- [USFWS] U.S. Fish and Wildlife Service. 1994. Recovery plan for the Wahiawa plant cluster: *Cyanea undulata*, *Dubautia pauciflora*, *Hesperomannia lydgatei*, *Labordia lydgatei*, and *Viola helenae*. 51 pages + appendices.

[USFWS] U.S. Fish and Wildlife Service. 2003. Endangered and threatened wildlife and plants; final designation or nondesignation of critical habitat for 95 plant species from the islands of Kauai and Niihau, Hawaii; final rule. Federal Register 68(39):9116-9479.

Wood, K.R. 2008a. *Hesperomannia lydgatei*. National Tropical Botanical Garden, Kalaheo, Hawaii. One page. Unpublished.

Wood, K.R. 2008b. Kanaele Bog, island of Kauai. The Nature Conservancy, Available online at <http://www.nature.org/wherework/northamerica/states/hawaii/preserves/art20437.html>. Accessed 8 November 2008.

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

Date	No. wild indivs.	No. outplanted	Stability Criteria identified in Recovery Plan	Stability Criteria Completed?
1991 (listing)	154-192	0	Competition from alien plant species managed in existing populations	No
			Protection of existing populations from feral pigs and seed predators	No
			Complete genetic storage	No
1994 (recovery plan)	281	0	Competition from alien plant species managed in existing populations	No
			Protection of existing populations from feral pigs and seed predators	No
			Complete genetic storage	No
2003 (critical habitat)	304	0	Competition from alien plant species managed in existing populations	No
			Protection of existing populations from feral pigs and seed predators	No
			Complete genetic storage	No
2009 (5-year review)	> 100	0	Competition from alien plant species managed in existing populations	No
			Protection of existing populations from feral pigs and seed predators	No
			Complete genetic storage	No

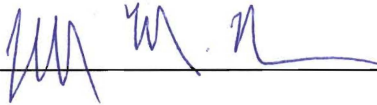
U.S. FISH AND WILDLIFE SERVICE
SIGNATURE PAGE for 5-YEAR REVIEW of *Hesperomannia lydgatei*
(no common name)

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

POB **Field Supervisor, Pacific Islands Fish and Wildlife Office**



Date AUG 27 2010