

5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Schiedea membranacea* (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 final critical habitat designation for *Schiedea membranacea* 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 Samuel Aruch, 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 *Schiedea membranacea* 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 *S. membranacea*.

When listed in 1996, six populations of *Schiedea membranacea* were known with as many as 250 or more individuals. Those populations, located on the western side of the island of Kauai, were at Mahanaloa-Kuia, Paaiki, Kalalau, Kuia-Nualolo Stream, Wainiha, and Waialae Valleys (USFWS 1996).

More recent observations by field botanists from the National Tropical Botanical Garden on Kauai indicate lower numbers of individuals in fewer locations. In 2008, four individuals were observed at Kalalau, just west of Puu o Kila in the drainage (Wood 2008). Seven individuals were seen in 2000 in the Kuia drainage, below the confluence of the north and south fork (Wood 2008). About 30 individuals were seen in 1998 in the back of Wainiha Valley below Hinalele Falls (Wood 2008). In 1999, three individuals were observed in Awaawapuhi in the Na Pali Forest Reserve (Hawaii Biodiversity and Mapping Program 2008). About 50 individuals were seen in Mahanaloa Valley in 1999 (Perlman 2008). In 2004, *Schiedea membranacea* was observed on the west walls of Mahanaloa Valley just before the junction of the confluence with Kuia. It was observed there again in February and May 2008, with about 35 individuals in flower and fruit (Tangalin 2008). The total number of individuals for this species in these 5 populations is estimated at less than 90 individuals.

Schiedea membranacea appears to be in slow decline. Both the number of locations and the number of individual plants are fewer than seen in the early 1990s (Perlman 2008; Wood 2008). In some cases it may not have been observed because the species goes dormant for part of the year (Tangalin 2008; Wagner 2005). It reproduces by outcrossing, but pollinators have not been observed. *Schiedea membranacea* has been determined to be strongly outcrossing, with a high level of inbreeding depression (Culley *et al.* 1999). For this reason, the lack of observed pollinators is a serious concern.

In spring 2008, Dr. Molly Nepokroeff of the University of South Dakota and her students studied this species at Mahanaloa. They counted the entire population, collected DNA samples, seeds, and various measurements. They found that several individuals sampled from *Schiedea helleri*, *S. membranacea*, and *S. kauaiensis* share chloroplast markers and genomes. Although some of these species grow near each other, no obvious morphological hybrids have been reported, so this potentially represents a form of cryptic interspecific hybridization. Because preliminary findings are based on a small number of individuals, additional sampling will allow testing to determine how genealogy may have diverged from the species' lineages, and to infer whether potential hybridization events were ancient or more recent. Additionally, since all of the species are listed as federally endangered or threatened, they will be assessing measures of genetic diversity for these populations as a measure of genetic health. Population-level sampling will also allow them to assess the degree of gene flow between populations of the same species, and interspecific gene flow between species. This data will allow them to assess the potential for morphologically cryptic lineages (Willyard 2008).

Schiedea membranacea occurs in a wide variety of habitat types including diverse mesic forest, *Acacia koa* (koa) - *Metrosideros polymorpha* (ohia) mesic forest, *M. polymorpha* wet - mesic cliffs, *M. polymorpha* lowland wet forest and *M. polymorpha* montane wet forest (Perlman 2008).

At several places on Kalalau Rim, *Schiedea membranacea* is found in steep drainages and on cliffs from 914 to 1,158 meters (3,000 to 3,800 feet) elevation on *Metrosideros polymorpha* wet mesic cliffs and in *M. polymorpha* montane wet forests with *Artemisia* sp. (ahinahina), *Boehmeria grandis* (akolea), *Carex wahuensis* (no common name [NCN]), *Cheirodendron* spp. (olapa), *Cibotium* sp. (hapuu), *Claoxylon sandwicense* (laukea), *Coprosma kauaense* (koi), *Diplazium sandwichianum* (hoio), *Dodonaea viscosa* (aalii), *Dubautia laevigata* (naenae), *Elaeocarpus bifidus* (kalia), *Eurya sandwicensis* (anini), *Kadua acuminata* (au), *Labordia* sp. (kamakahala), *Lepidium serra* (anaunau), *Melicope anisata* (mokihana), *M. pallida*, *M. puberula* (alani), *Myrsine lessertiana* (kolea lau nui), *M. linearifolia* (kolea), *Nothocestrum longifolium* (aiea), *Nototrichium* sp. (kului), *Perrottetia sandwicensis* (olomea), *Phyllostegia electra* (no common name), *Pipturus* spp. (mamake), *Pleomele aurea* (hala pepe), *Ranunculus mauiensis* (makou), *Remya montgomeryi* (NCN), *Sadleria cyatheoides* (amau), *Scaevola procera* (naupaka kuahiwi), *Touchardia latifolia* (olona), and *Zanthoxylum dipetalum* (kawau) (Perlman 2008; S. Perlman, National Tropical Botanical Garden, pers. comm. 2008; Wood 2008).

In Kuia, *Schiedea membranacea* is located on steep basalt walls in shade half of the day. The elevations at which it has been seen there vary from 524 to 804 meters (1,720 to 2,640 feet). At Nualolo Stream in Kuia, the elevations where this species has been seen vary from 950 to 1,073 meters (3,117 to 3,520 feet). The habitat is *Metrosideros polymorpha* – *Acacia koa* montane mesic forest with patches of diverse mesic forest with associated native species including *Alphitonia ponderosa* (kauila), *Alyxia stellata* (maile), *Bohea brevipes* (ahakea lau lii), *Diospyros sandwicensis* (lama), *Dodonaea viscosa*, *Doodia kunthiana* (okupukupu), *Euphorbia haeleleana* (NCN), *Hibiscus waimeae* subsp. *waimeae* (kokio keo keo), *Isodendrion laurifolium* (aupaka), *Kokia kauaiensis* (kokio), *Leptecophylla tameiameiae* (pukiawe), *Lysimachia kalalauensis* (NCN), *Melicope anisata*, *Melicope ovata* (alani), *M. barbiger* (uahiapele), *Myrsine lanaiensis* (kolea), *Pisonia* sp. (papala), *Pittosporum* sp. (hoawa), *Pleomele aurea*, *Pouteria sandwicensis* (alaa), *Psychotria greenwelliae* (kopiko), *Remya kauaiensis* (NCN), *Streblus pendulinus* (aiai), *Tetraplasandra kauaiensis* (ohe ohe), *Wikstroemia furcata* (akia), and *Zanthoxylum dipetalum* (Perlman 2008; Wood 2008). The Paaiki population is found in similar habitat (Perlman 2008; S. Perlman, pers. comm. 2008).

In Awaawapuhi, *Schiedea membranacea* was seen at 945 meters (3,100 feet) elevation in *Metrosideros polymorpha* – *Acacia koa* montane mesic forest on steep northern slopes with *Kadua affinis* (manono), *Melicope anisata*, *M. barbiger*, *M. pallida*, *Poa mannii* (NCN), and *Pouteria sandwicensis* (Hawaii Biodiversity and Mapping Program 2008).

In Mahanaloa, *Schiedea membranacea* occurs at 573 meters (1,880 feet) elevation with *Hillebrandia sandwicensis* (aka aka awa), *Charpentiera elliptica* (papala), and *Morinda trimera* (noni kuahiwi) in the immediate area. It is well shaded with a canopy of

Aleurites moluccana (kukui) and native species including *Hibiscus waimeae* subsp. *waimeae* (kokio keo keo) (Tangalin 2008).

In Wainiha, this species is found at approximately 664 meters (2,180 feet) elevation, the habitat is *Metrosideros polymorpha* mixed lowland wet forest with *Antidesma platyphyllum* var. *hillebrandii* (hame), *Boehmeria grandis*, *Chamaesyce remyi* var. *kauaiensis* (akoko), *Cheirodendron* spp., *Cibotium* sp., *Coprosma waimeae* (olena), *Cyanea recta* (haha), *Dubautia knudsenii* (naenae), *Kadua affinis*, *K. tryblium* (NCN), *Lipochaeta connata* var. *acris* (nehe), *Machaerina mariscoides* (ahaniu), *Perrottetia sandwicensis*, *Pipturus* sp., *Psychotria mariniana*, *P. hexandra* (kopiko), *Sadleria* sp., *Syzygium sandwicensis* (ohia ha), and *Touchardia latifolia* (Perlman 2008; Perlman, pers. comm. 2008; Wood 2008).

At Waialae and Makaha, *Schiedea membranacea* was found at 950 to 1,000 meters (3,117 to 3,281 feet) elevation in *Metrosideros polymorpha* – *Acacia koa* mixed mesic forest with *Alphitonia ponderosa*, *Alyxia stellata*, *Antidesma platyphyllum* var. *hillebrandii*, *Charpentiera* sp., *Cyperus pennatifolius*, *Dianella sandwichensis* (uki uki), *Diospyros* spp., *Dodonaea viscosa*, *Leptecophylla tameiameia*, *Melicope anisata*, *Panicum nephelophilum* (konakona), *Poa sandwicensis* (NCN), and diverse endemic ferns (Perlman 2008; Wood 2008).

Threats to this species throughout its range include habitat degradation and herbivory by feral goats (*Capra hircus*) and pigs (*Sus scrofa*) (Factors A and D) and competition with invasive introduced plants including *Bryophyllum pinnatum* (airplant), *Lonicera japonica* (Japanese honeysuckle), *Lantana camara* (lantana), *Rubus argutus* (blackberry), *Erigeron karvinskianus* (daisy fleabane), *Passiflora tarminiana* (banana poka), and *Hedychium gardnerianum* (kahili ginger) (Factor E) (Perlman 2008).

Various species of introduced snails have been observed feeding on flowers and developing seed capsules, and introduced garlic snails (*Oxychilus alliarius*) are common near the individuals. It seems very likely that they are responsible for the lack of seedlings. In the greenhouse this and other *Schiedea* species are attractive to slugs and snails (USFWS 1998).

Climate change may also pose a threat to *Schiedea membranacea* (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.

Conservation measures that have been taken include propagation of *Schiedea membranacea* in the nursery at the National Tropical Botanical Garden in Lawai, outplantings at the garden's Limahuli Garden, and in the native plant section of the McBryde Garden of the National Tropical Botanical Garden. It has been propagated from both cuttings and seed (National Tropical Botanical Garden 2008), and is currently being grown at the Hawaii Department of Land and Natural Resources, Hawaii Department of Forestry and Wildlife's mid-elevation nursery on Kauai (2008). The National Botanical Garden (2009) has 5,271 seeds in storage. The University of

Hawaii's Harold L. Lyon Arboretum Micropropagation Laboratory (2009) has 3 individual propagules. The U.S. Army (2009) has six propagules at its Oahu facility. Between 1999 and 2004, the Hawaii Department of Land and Natural Resources planted 53 individuals of *Schiedea membranacea* at Kalalau Rim Exclosure for genetic storage. They were all collected material from either Kuia or Mahanaloa Valley. In February 2000, four individuals survived at Kalalau Rim. They are all about 0.3 meters (one foot) tall, with moderate vigor but none had been observed flowering or fruiting. This habitat is probably marginal for them, and future focus will be on reintroducing within Kuia Natural Area Reserve exclosures (M. Wysong, Hawaii Department of Land and Natural Resources, pers. comm. 2008).

Stabilizing, downlisting, and delisting objectives are provided in the recovery plan for plants from the island of Kauai (USFWS 1998), based on whether the species is an annual, a short-lived perennial (fewer than 10 years), or a long-lived perennial. *Schiedea membranacea* is a short-lived perennial, and to be considered stable, 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 Kauai. Each of these populations must be naturally reproducing and increasing in number, with a minimum of 50 mature individuals per population.

The interim stabilization goals for this species have not been met (see Table 1), as only one population has 50 individuals and these may not all be mature, and not all threats are being managed. Therefore, *Schiedea membranacea* meets the definition of endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:

- Continue collecting seeds from all individuals for genetic storage and reintroduction.
- Construct exclosures around existing populations to protect from negative impacts from feral ungulates.
- Propagate material for augmentation of existing populations and reintroductions, as suitable protected sites become available.
- Conduct surveys, particularly in areas where *Schiedea membranacea* has not been observed since the 1990s, which include Paaiki, Nualolo, Koaie, Makaha, Waialae Ridge, and Awaawapuhi.
- Research the presence of a seed bank.
- Research the cause of low recruitment in the natural populations.
- Determine the species and abundance of pollinators.

- Work with Hawaii Division of Forestry and Wildlife, especially in Kuia and Mahanaloa, and Hawaii State Parks to initiate planning and contribute to implementation of ecosystem-level restoration and management to benefit this species.

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Table 1. Status of *Schiedea membranacea* from listing through 5-year review.

Date	No. wild indivs.	No. outplanted	Stability Criteria identified in Recovery Plan	Stability Criteria Completed?
1996 (listing)	200-250+	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
1998 (recovery plan)	200-250	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
2003 (critical habitat)	344-348	53	All threats managed in all 3 populations	No
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	No
2009 (5-year review)	90		All threats managed	No
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	No

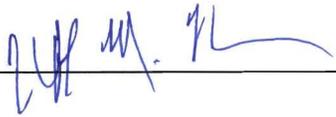
U.S. FISH AND WILDLIFE SERVICE
SIGNATURE PAGE for 5-YEAR REVIEW of *Schiedea membranacea*
(no common name)

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

⁶⁰² Field Supervisor, Pacific Islands Fish and Wildlife Office



Date AUG 27 2010