Schiedea nuttallii
(No common name)

5-Year Review
Summary and Evaluation

U.S. Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office
Honolulu, Hawaii

5-YEAR REVIEW

Species reviewed: *Schiedea nuttallii* (No common name)

TABLE OF CONTENTS

5-YEAR REVIEW
Schiedea nuttallii/ No common name

1.0 GENERAL INFORMATION

1.1 Reviewers

Lead Regional Office:
Region 1, Endangered Species Program, Division of Recovery, Jesse D'Elia, (503) 231-2071

Lead Field Office:
Pacific Islands Fish and Wildlife Office, Gina Shultz, Deputy Field Supervisor, (808) 792-9400

Cooperating Field Office(s):
N/A

Cooperating Regional Office(s):
N/A

1.2 Methodology used to complete the 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 Bernice P. Bishop Museum provided most of the updated information on the current status of *Schiedea nuttallii* and provided recommendations for conservation actions needed prior to the next five-year review. The evaluation of the status of the species was prepared by the 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, and Deputy Field Supervisor, before submission to the Field Supervisor for approval.

1.3 Background:

1.3.1 Federal Register (FR) Notice citation announcing initiation of this review:

USFWS. 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.

1.3.2 Listing history

Original Listing
FR notice: USFWS. 1996. Endangered and threatened wildlife and plants; determination of endangered or threatened status for fourteen plant taxa from the Hawaiian Islands; final rule. Federal Register 61(198):53108-53124.
Date listed: October 10, 1996
Entity listed: Species
Classification: Endangered

Revised Listing, if applicable
FR notice: N/A
Date listed: N/A
Entity listed: N/A
Classification: N/A

1.3.3 Associated rulemakings:

USFWS. 2003a. Endangered and threatened wildlife and plants; final designation or nondesignation of critical habitat for 95 plant species from the islands of Kauai and Niihau, HI; final rule. Federal Register 68(39):9116-9479.

USFWS. 2003b. Endangered and threatened wildlife and plants; final designations and nondesignations of critical habitat for 42 plant species from the island of Molokai, Hawaii; final rule. Federal Register 68(52):12982-13141.

USFWS. 2003c. Endangered and threatened wildlife and plants; designation of critical habitat for 60 plant species from the Islands of Maui and Kahoolawe, HI; final rule. Federal Register 68(93):25934-26165.

USFWS. 2003d. Endangered and threatened wildlife and plants; final designation or nondesignation of critical habitat for 101 plant species from the island of Oahu, HI: final rule. Federal Register 68(116):35949-35998.

Critical habitat was designated for *Schiedea nuttallii* in one unit totaling 282 hectares (698 acres) on Kauai, two units totaling 265 hectares (653 acres) on Molokai and three units totaling 709 hectares (1,753 acres) on Oahu. This designation includes habitat on State, and private lands (USFWS 2003a, b, d). Critical habitat was not designated on Maui as the species likely no longer occurs there and we were unable to identify physical and biological characteristics for its conservation (USFWS 2003c).

1.3.4 Review History:

Species status review [FY 2008 Recovery Data Call (September 2008)]: Declining

Recovery achieved:
1 (0-25%) (FY 2008 Recovery Data Call)

1.3.5 Species' Recovery Priority Number at start of this 5-year review:
5

1.3.6 Current Recovery Plan or Outline
Name of plan or outline: Recovery plan for the Multi-Island plants. U.S. Fish and Wildlife Service, Portland, Oregon. 206 pages, plus appendices.
Date issued: June 10, 1999.
Dates of previous revisions, if applicable: N/A

2.0 REVIEW ANALYSIS

2.1 Application of the 1996 Distinct Population Segment (DPS) policy

2.1.1 Is the species under review a vertebrate?
_____ ***Yes***
__X__ ***No***

2.1.2 Is the species under review listed as a DPS?
____ ***Yes***
__X_ ***No***

2.1.3 Was the DPS listed prior to 1996?
____ ***Yes***
____ ***No***

2.1.3.1 Prior to this 5-year review, was the DPS classification reviewed to ensure it meets the 1996 policy standards?
____ ***Yes***
____ ***No***

2.1.3.2 Does the DPS listing meet the discreteness and significance elements of the 1996 DPS policy?
____ ***Yes***
____ ***No***

2.1.4 Is there relevant new information for this species regarding the application of the DPS policy?
____ ***Yes***
__X_ ***No***

2.2 Recovery Criteria

2.2.1 Does the species have a final, approved recovery plan containing objective, measurable criteria?

__X_ ***Yes***
____ ***No***

2.2.2 Adequacy of recovery criteria.

2.2.2.1 Do the recovery criteria reflect the best available and most up-to date information on the biology of the species and its habitat?

__X_ ***Yes***
____ ***No***

2.2.2.2 Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria?

__X_ ***Yes***
____ ***No***

2.2.3 List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information:

A synthesis of the threats (Factors A, C, D, and E) affecting this species is presented in section 2.4. Factor B (overutilization for commercial, recreational, scientific, or educational purposes) is not known to be a threat to this species.

Stabilizing, downlisting, and delisting objectives are provided in the recovery plan for the Multi-Island plants (USFWS 1999), based on whether the species is an annual, a short-lived perennial (fewer than 10 years), or a long-lived perennial. *Schiedea nuttallii* 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, weeding, etc.) and be represented in an *ex situ* (off-site) collection. In addition, a minimum of three populations should be documented on islands where they now occur or occurred historically. Each of these populations must be naturally reproducing and increasing in number, with a minimum of 25 mature individuals per population.

This recovery objective has not been met.

For downlisting, a total of five to seven populations of *Schiedea nuttallii* should be documented on islands where they now occur or occurred historically. Each of these populations must be naturally reproducing, stable or increasing in number, and secure from threats, with a minimum of 100 mature individuals per population. Each population should persist at this level for a minimum of five consecutive years before downlisting is considered.

This recovery objective has not been met.

For delisting, a total of eight to ten populations of *Schiedea nuttallii* should be documented on islands where they now occur or occurred historically. Each of these populations must be naturally reproducing, stable or increasing in number, and secure from threats, with 100 mature individuals per population for short-lived perennials. Each population should persist at this level for a minimum of five consecutive years before delisting is considered.

This recovery objective has not been met.

2.3 Updated Information and Current Species Status

In addition to the status summary table below, information on the species' status and threats was included in the final critical habitat rule referenced above in section 1.3.3 ("Associated Rulemakings") and in section 2.4 ("Synthesis") below, which also includes any new information about the status and threats of the species.

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

Date	**No. wild individuals**	**No. outplanted**	**Stability Criteria identified in Recovery Plan**	**Stability Criteria Completed?**
1996 (listing)	< 75	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 25 mature individuals each	No
1998 (recovery plan)	40-100	0	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 25 mature individuals each	Partially
2003 (critical habitat)	81-121	unknown	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 25 mature individuals each	Partially
2008 (5-year review)	42-52*	211	All threats managed	Partially
			Complete genetic storage	Partially
			3 populations with 25 mature individuals each	Partially

*Including 16 to 26 individuals from the 2 Kauai species

2.3.1 Biology and Habitat [see note in section 2.3]

2.3.1.1 New information on the species' biology and life history:

2.3.1.2 Abundance, population trends (e.g. increasing, decreasing, stable), demographic features (e.g., age structure, sex ratio, family size, birth rate, age at mortality, mortality rate, etc.), or demographic trends:

2.3.1.3 Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.):

2.3.1.4 Taxonomic classification or changes in nomenclature:

2.3.1.5 Spatial distribution, trends in spatial distribution (e.g. increasingly fragmented, increased numbers of corridors, etc.), or historic range (e.g. corrections to the historical range, change in distribution of the species' within its historic range, etc.):

2.3.1.6 Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem):

2.3.1.7 Other:

2.3.2 Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms) [see note in section 2.3]

2.3.2.1 Present or threatened destruction, modification or curtailment of its habitat or range:

2.3.2.2 Overutilization for commercial, recreational, scientific, or educational purposes:

2.3.2.3 Disease or predation:

2.3.2.4 Inadequacy of existing regulatory mechanisms:

2.3.2.5 Other natural or manmade factors affecting its continued existence:

2.4 Synthesis

At the time of Federal listing as endangered, 25 individuals of *Schiedea nuttallii* were known from a single population on the island of Oahu and 10 to 50 individuals in a single population on the island of Kauai, the latter of which are now recognized as a

separate species (see taxonomy discussion below) (USFWS 1996). The discovery of more individuals within the Kahanahaiki population and the discovery of two additional populations in Pahole Natural Area Reserve on Oahu increased the number of known individuals to about 50 to 80 (USFWS 1999). As of 2007, *S. nuttallii* consisted of only one population occurring from Kahanahaiki to Pahole totaling 26 wild individuals (19 mature individuals, four immature individuals, and three seedlings) and it was augmented with 42 mature and four immature individuals. An additional population of seven individuals was outplanted in a fenced exclosure in Makaha (U.S. Army 2007). During 2007 and 2008, the U.S. Army (2008) reintroduced 154 individuals in Kahanahaiki and Pahole. The last known individual from the Kapuna-Keawapilau Ridge population died in 2007, as did two of the three *ex situ* stocks representing this population (U.S. Army 2007). Limited recruitment has been observed at both naturally occurring and established populations, and the vigor of outplanted individuals ranges from healthy to poor, while survivorship ranges from 50 to 75 percent (USFWS 2007). No regeneration has been noted at the augmented sites (U.S. Army 2007).

It is estimated that nearly one-half of the critical habitat is located in forest habitat comprised of 50 to 75 percent native plant cover (USFWS 2007). Historical populations on Molokai and West Maui are not believed to be extant, and individuals within the population at Ekahanui Gulch, Oahu, have not been observed since 1999 (USFWS 1999, 2007; Wagner *et al*. 2005). The populations that were listed under the distribution of this species on Kauai are now recognized as separate taxa (*S. perlmanii* and *S. kauaiaensis*) (see taxonomy discussion below).

Schiedea nutttallii is an outcrossing species that requires pollinators, probably insects, for fruit production (USFWS 2003e; Wagner *et al*. 2005). Flowers and fruits are abundant in the wet season and less so throughout the year. Other demographic information for *S. nuttallii* in the wild is unknown (USFWS 2007).

Schiedea nuttallii has been successfully propagated by tissue culture from seeds and cuttings (USFWS 2003e, 2007). The germination rate of fresh seed is about 50 percent, and the propagation success rate from cuttings is 10 to 50 percent. Seeds can be stored at -18 degrees Celsius and 20 percent humidity with little or no decrease in viability based on chemical tests, but germination trials have not been conducted. Seeds are best collected when capsules are turning tan and drying, but before dehiscence (USFWS 2003e). Many times only one seed remains in a dry capsule, limiting collection. Immature, white seeds are present when capsules are still green and somewhat fleshy.

Schiedea nuttallii is characterized by low isozyme variability (low heterozygosity and percentage of polymorphic loci) and is vulnerable to inbreeding effects due to small population size (Weller *et al*. 1996; Wagner *et al*. 2005). Reductions in population size could result in expression of inbreeding depression among progeny, including reduced reproductive vigor, and potentially deleterious consequences for the long-term persistence of this species.

The taxon *Schiedea nuttallii* was recircumscribed by Wagner *et al*. (2005). Wagner *et al*. (1999) included in *S. nuttallii* specimens now assigned to *S. perlmannii* as well as the types of *S. nuttallii* var. *pauciflora* and var. *lihuensis*. As such, the Kauai populations of *S. nuttallii* are now recognized as belonging to the taxa *S. perlmanii* (Mt. Haupu population) and *S. kauaiensis* (Limahuli population).

Schiedea nuttallii formerly had one of the widest geographical ranges in the genus, but now is restricted to a few populations in the northern Waianae Mountains (Wagner *et al*. 2005). The historical distribution of the species with the redescription of the species is now the Koolau and Waianae ranges on Oahu, Molokai, and West Maui. The species is currently restricted to the northern Waianae Mountains, with plants in the southern Waianae Mountains not being seen since the late 1970s (USFWS 2007).

Schiedea perlmanii was described as a new species based on material from Mt. Haupu and Lihue on Kauai (formally considered synonyms of *S. nuttallii* as var. *pauciflora* and var. *lihuensis*). *Schiedea perlmanii* differs from *S. nuttallii* and *S. kauaensis* by having pendent flowers and a vining growing habit (Wagner *et al*. 2005). One population is currently known from Mt. Haupu containing 10 to 20 individuals as of 2005 (Wood 2005; Perlman 2006; USFWS 2008). Plants from Lihue have not been seen since 1911 (Wagner *et al*. 2005). The major threats to *S. perlmanii* are habitat degradation by feral pigs (*Sus scrofa*), goats (*Capra hircus*), and possibly mule deer (*Odocoileus hemionus*) (Factors A and D); competition with introduced invasive plant species (Factor E), predation by black twig borer (*Xylosandrus compactus*), as well as various slug and snail species (Factor C), and random environmental stochastic events such as landslides and hurricanes (Factor E) (USFWS 2003a). Plants are in controlled propagation and seeds in genetic storage at the National Tropical Botanical Garden (2008). The University of California at Irvine (2008) also has plants for research purposes.

Schiedea kauaensis was previously described as a new species from Wahina-Manoa Ridge on Kauai by Harold St. John (1988). St. John (1988) also describes *S. wichmanii* as a separate species from the Limahuli Valley. In the most recent treatment, Wagner *et al*. (2005) recognized *S. wichmanii* as a synonym of *S. kauaensis*, which they considered a new species. *Schiedea kauaensis* differs from *S. nuttallii* by having fewer flowers, open, sparsely to moderately inflorescence, larger flowers and leaves (Wagner *et al*. 2005). This species is currently known from about three individuals in Limahuli Valley and three in Mahanauloa (S. Perlman, Research Botanist, National Tropical Botanical Garden, pers. comm. 2008). The population reported for Kalalau is no longer extant (K. Wood, Research Botanist, National Tropical Botanical Garden, pers. comm. 2008). The major threats to *S. kauaensis* are habitat degradation by feral pigs, goats, and possibly mule deer (Factors A and D); competition with introduced invasive plant species (Factor E), predation by black twig borer as well as various slug and snail species (Factor C), and random environmental stochastic events such as landslides, hurricanes (Factor E) (USFWS 2003a). The plants occurring at Mahanaloa are currently fenced. The National

Tropical Botanical Garden (2006, 2007, 2008) outplanted about 20 plants in Limahuli.

Extant populations of *Schiedea nuttallii* on Oahu continue to be threatened by habitat degradation by feral ungulates (pigs and goats) (Factor A and D), predation of new recruits by introduced invertebrates (slugs and snails) and black twig borer (Factor C), natural disasters such as landslides and erosion (Factor E), military activities (Factor E), fire (Factor E), reduced reproductive vigor due to small number individuals and populations (Factor E), and competition with introduced invasive alien species (Factor E). Invasive introduced plants threatening *S. nuttallii* include *Andropogon virginicus* (broomsedge bluestem), *Clidemia hirta* (Koster's curse), *Grevillea robusta* (silk oak), *Melinis minutiflora* (molasses grass), *Paspalum conjugatum* (hilograss), and *Psidium cattleianum* (strawberryguava) (USFWS 1996, 1999, 2003d, e, 2007). Predation by mice (*Mus musculus*), mostly in summer (Factor C), and drought (Factor E) were recently considered to be a significant threat to the species. Inappropriate collection for scientific or horticultural purposes, or increased visitation may also seriously impact the species due to the low population and individual number (Factor B) (U.S. Army 2007).

The populations at Kahanahaiki to Pahole and the extirpated Kapuna-Keawapilau Ridge are represented in *ex situ* collections. There are 26 plants in the Army's nursery, one individual in micropropagation and 16 seeds in storage from the Kahanahaiki to Pahole population (USFWS 2007; U.S. Army 2007). Other genetic materials in storage include 1,370 seeds in from 21 accessions at the Center for Conservation, Research and Training Seed Storage Laboratory (2007), approximately 8,300 seeds at the National Tropical Botanical Garden (2008), 62 plants in storage at the Pahole Mid-Elevation Nursery (2008), and 24 explants from the two populations housed at the Harold L. Lyon Arboretum Micropropagation Laboratory (2007). Wild and outplanted individuals located in the Army's Kahanahaiki and Pahole management units are protected from the activities of ungulates by fences, but the Upper Kapuna management unit is not currently fenced. The reintroduced population in Makaha is currently fenced (U.S. Army 2007). All but one wild site in the Pahole area contains good-quality habitat within fenced exclosures, are augmented with outplanted individuals, and are partially controlled to reduce cover of invasive introduced plant species (USFWS 2003e, 2007; U.S. Army 2007).

The stabilization and recovery goals for this species have not been met as only 26 wild plants remain of what is now considered *Schiedea nuttallii*, reintroduced individuals have not yet reproduced, and not all threats are been managed (see Table 1). Therefore, *Schiedea nuttallii* meets the definition of endangered as it remains in danger of extinction throughout its range.

3.0 RESULTS

3.3 Recommended Classification:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
____ *Extinction*
____ *Recovery*
____ *Original data for classification in error*
__X__ No change is needed

3.2 New Recovery Priority Number: N/A

Brief Rationale:

3.3 Listing and Reclassification Priority Number: N/A

Reclassification (from Threatened to Endangered) Priority Number: ____
Reclassification (from Endangered to Threatened) Priority Number: ____
Delisting (regardless of current classification) Priority Number: ____

Brief Rationale:

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

- Continue collection of genetic resources for storage, future propagation and reintroducing into protected suitable habitat within historical range.
- Construct large-scale exclosure fences to protect individuals from the activities of feral ungulates, and eradicate invasive introduced plant species within the exclosures.
- Initiate planning and contribute to implementation of ecosystem-level restoration and management to benefit this species.
- Enhance current natural populations with appropriate genetic individuals.
- Survey geographical and historical range for a thorough current assessment of species.
- Assess genetic variability within extant populations and between species.
- Study *Schiedea nuttallii* 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.

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Wood, Ken. Research Biologist, National Tropical Botanical Garden. Communication to Bernice P. Bishop Museum on June 2008.

Signature Page
U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of *Schiedea nuttallii* (No common name)

Current Classification: _____E_____

Recommendation resulting from the 5-Year Review:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
__X__ No change needed

Appropriate Listing/Reclassification Priority Number, if applicable:_____

Review Conducted By:
Christian Torres-Santana, Student Trainee Biologist
Marie Bruegmann, Plant Recovery Coordinator
Marilet A. Zablan, Recovery Program Leader and acting Assistant Field Supervisor for Endangered Species
Gina Shultz, Deputy Field Supervisor

Approved _____ Date 21 July 2009
Acting Field Supervisor, Pacific Islands Fish and Wildlife Office