

5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Schiedea verticillata* (No common name)

Current Classification: Endangered

Federal Register Notice announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2015. Endangered and threatened wildlife and plants; initiation of 5-year status reviews of 133 species in Hawaii, Oregon, Idaho, and Washington. Federal Register 80(30): 8100–8103.

Lead Region/Field Office:

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

Name of Reviewer(s):

Cheryl Phillipson, Biologist, PIFWO

Lauren Weisenberger, Plant Recovery Coordinator, PIFWO

Gregory Koob, Conservation & Restoration Team Manager, PIFWO

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 in January 2016. The review was based on a review of current, available information since the last 5-year review for *Schiedea verticillata* (USFWS 2009). The evaluation by Cheryl Phillipson, Biologist, PIFWO, was reviewed by Lauren Weisenberger, Plant Recovery Coordinator, and Gregory Koob, Conservation and Restoration Team Manager.

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).

Review Analysis:

Please refer to the previous 5-year review for *Schiedea verticillata* published in the Federal Register on July 21, 2009 (USFWS 2009, available at https://ecos.fws.gov/docs/five_year_review/doc2434.pdf) for a complete review of the species' status, threats, and management efforts. 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. verticillata*.

This short-lived perennial fleshy herb in the Caryophyllaceae family is endangered and found on Nihoa. The current status and trends for *Schiedea verticillata* are provided in the tables below.

New Status Information:

In addition to those populations cited in the previous 5-year review, new observations include the following:

- At the time of the last 5-year review in 2009 there were eight populations totaling more than 1,000 individuals from Dog's Head to Derby's Beach, at Devil's Slide, Needle Rock, Miller's Peak, Albatross Plateau, Middle Valley, Tanager Peak, and Tunnel Cave on the island of Nihoa. Currently, there are there are estimated to be 1,000 individuals at the same locations (Plentovich *et al.* 2015).

New Threats:

- Climate change loss or degradation of habitat—Fortini *et al.* (2013) conducted a landscape-based assessment of climate change vulnerability for native plants of Hawaii using high resolution climate change projections. Climate change vulnerability is defined as the relative inability of a species to display the possible responses necessary for persistence under climate change. This assessment was not conducted specifically for *Schiedea verticillata*. However, it was concluded that the genus *Schiedea* (with a vulnerability score of 0.512; on a scale of 0 being not vulnerable to 1 being extremely vulnerable to climate change) is the genus most vulnerable to climate change. Therefore, additional management actions are needed to conserve this taxon into the future.

New Management Actions:

- NTBG has two collections of seeds from 2006 from the Devil's Slide and Middle Valley populations in storage (NTBG 2017). Lyon Arboretum has two founders maintained via micropropagation (Lyon Arboretum 2017). The University of California at Irvine has 10 plants in their greenhouse representing nine founders (UCI 2017).
- Botanists collected ovaries and stigmas from three populations to determine possible pollinators for *Schiedea verticillata*. Researchers at the University of California at Irvine prepared this material for analysis using a scanning electron microscope and detected moth scales and pollen on stigmas from all samples analyzed (Sakai and Weller 2015, in appendix to Plentovich *et al.* 2015). This study provided evidence in support of moth pollination of *S. verticillata*. In addition, genetic analysis shows that *S. verticillata* maintains a high level of genetic diversity despite being a single-island endemic (S. Weller pers. comm. in Plentovich *et al.* 2015).

Synthesis:

Currently, there are at approximately 1,000 individuals of *Schiedea verticillata* in eight locations on the island of Nihoa. A landscape-based assessment of climate change vulnerability for native plants of Hawaii using high resolution climate change projections by Fortini *et al.* (2013) suggests that species in the genus *Schiedea* are most vulnerable to the effects of climate change than any other genus. Seeds and plants are in storage.

Stabilizing (interim), downlisting, and delisting objectives were provided in the Recovery Plan for Three Plant Species from Nihoa Island (USFWS 1998), and have been updated according to the draft revised recovery objective guidelines developed by the Hawaii and Pacific Plants Recovery Coordinating Committee (HPPRCC 2011). The HPPRCC identifies an additional initial objective, the Preventing Extinction Stage, in addition to the Interim Stabilization, Delisting, and Downlisting objectives. Furthermore, life history traits such as breeding system, population size fluctuation or decline, and reproduction type (sexual or vegetative), have been included in the determination of goals for the number of populations and reproducing individuals

for each stage. The goals for each stage remain grouped by life span defined as annual, short-lived perennial (fewer than 10 years), or long-lived perennial.

Schiedea verticillata is a short-lived perennial fleshy herb and is apparently outcrossing, with perfect flowers (Weller *et al.* 2005). To reach preventing extinction objectives, the taxon must be managed to control threats (*e.g.*, fenced) and have 50 individuals (or the total number of individuals if fewer than 50 exist) from each of three populations represented in an *ex situ* (at other than the plant's natural location, such as a nursery or seed bank) collection. In addition, a minimum of three populations should be documented on Kauai where they now occur or occurred historically and each of these populations must be naturally reproducing (*i.e.* viable seeds, seedlings), with a minimum of 50 mature individuals per population.

The Preventing Extinction goals for the number of populations and reproducing individuals per population have been met. However, all threats are not being managed and genetic storage is incomplete (Table 2). As these objectives are also included in the Interim Stabilization Stage, in addition to replacement regeneration, this species will currently be evaluated at the Interim Stabilization Stage (Table 1). Therefore, *Schiedea verticillata* meets the definition of endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:

No new threats and no other significant new information regarding the species' biological status have been reported since the last 5-year review in 2009. Therefore, the following recommendations for future actions are reiterated for the 5-year review for 2017.

- Invasive plant monitoring and control—
 - Continue to prevent invasion of any introduced species to Nihoa.
 - Control invasive introduced plant species in all existing populations and periodically monitor to ensure invasive species are not establishing nearby.
- Predator and herbivore monitoring and control—Determine if control of the vagrant grasshopper is needed, and if so, develop an efficient and effective control method.
- Captive propagation for genetic storage and reintroduction—Continue seed and cuttings collection for *ex situ* genetic storage.
- Reintroduction and translocation—
 - Begin reintroduction efforts to increase underrepresented individuals into suitable habitat being managed for known threats to this species.
 - Assess feasibility of outplanting *Schiedea verticillata* on Lehua Island State Bird Sanctuary, Necker Island National Wildlife Refuge (NWR), Kilauea Point NWR, and Midway Atoll NWR, which are the closest islands to Nihoa and are managed for conservation.
- Human disturbance—Continue to restrict access to Nihoa Island.
- Population biology research—Study *Schiedea verticillata* populations to determine viable population size and structure, geographical distribution, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, limiting factors, and threats.

Table 1. Status and trends of *Schiedea verticillata* from listing through current 5-year review.

Date	No. wild individuals	No. outplanted	Downlisting Criteria identified in Recovery Plan	Downlisting Criteria Completed?
1996 (listing)	170–190	0	Five colonies with a minimum of 300 mature individuals per population for a minimum of five consecutive years	No
			Successful propagation and outplanting <i>ex situ</i>	No
			Remote monitoring system	No
1998 (recovery plan)	359	0	Five colonies with a minimum of 300 mature individuals per population for a minimum of five consecutive years	No
			Successful propagation and outplanting <i>ex situ</i>	Partially
			Remote monitoring system	No
2003 (critical habitat)	No new information	0	Five colonies with a minimum of 300 mature individuals per population for a minimum of five consecutive years	No
			Successful propagation and outplanting <i>ex situ</i>	Partially
			Remote monitoring system	No

2009 (5-year review)	1,042	0	Five colonies with a minimum of 300 mature individuals per population for a minimum of five consecutive years	No
			Successful propagation and outplanting <i>ex situ</i>	Partially
			Remote monitoring system	No
Date	No. wild individuals	No. outplanted	Interim Stabilization Criteria identified by HPPRCC	Interim Stabilization Criteria Completed?
2016 (5-year review)	1,000	0	All threats managed in all three populations	No
			Complete adequate genetic storage	Partially
			Replacement regeneration (seedlings growing into mature plants) at all three populations	Partially
			Three populations with 300 mature individuals each	Partially

Table 2. Threats to *Schiedea verticillata* and conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Established ecosystem altering invasive plant species degradation of habitat	A	Ongoing	Partial, some nonnative plant control
Landslides and flooding destruction or degradation of habitat	A	Ongoing	None
Hurricane destruction or degradation of habitat	A	Potential	None
Climate change loss or degradation of habitat	A	Ongoing	None
Rodent predation or	C	Potential	Partial, controlled access to

herbivory			island
Invertebrate predation or herbivory	C	Ongoing	None
Stochastic events—Hurricane mortality and reduced viability	E	Potential	None
Human disturbance	E	Ongoing	Partial, controlled access to island

References:

See previous 5-year review in 2009 for a full list of references. Only references for new information are provided below.

Fortini, L., J. Price, J. Jacobi, A. Vorsino, J. Burgett, K. Brinck, F. Amidon, S. Miller, S. Gon II, G. Koob, and E. Paxton. 2013. A landscape-based assessment of climate change vulnerability for all native Hawaiian plants. Technical report HCSU-044, Hawaii Cooperative Studies Unit, University of Hawaii at Hilo, Hawaii. 134 pp.

[HPPRCC] Hawaii and Pacific Plants Recovery Coordinating Committee. 2011. Revised recovery objective guidelines. 12 pp.

Lyon Arboretum. 2017. Micropropagation and Seed Conservation Laboratories controlled propagation database report.

[NTBG] 2017. NTBG controlled propagation database report.

Plentovich, S., R. Rounds, M. Bruegmann, V. Caraway, C. Javar-Salas, T. Kroessig, J. Higashino, D. Sischo, J. Sprague, and S. Conant. 2015. Nihoa Island trip report, 1-11 June, 2015. 56 pp.

[UCI] University of California Irvine. 2017. Department of Ecology and Evolutionary Biology controlled propagation report.

[USFWS] U.S. Fish and Wildlife Service. 2009. *Schiedea verticillata* 5-year review summary and evaluation. https://ecos.fws.gov/docs/five_year_review/doc2434.pdf.

[USFWS] 2015. Endangered and threatened wildlife and plants; initiation of 5-year status reviews of 133 species in Hawaii, Oregon, Idaho, and Washington. 80 FR 8100, February 13, 2015.

U.S. FISH AND WILDLIFE SERVICE
SIGNATURE PAGE for 5-YEAR REVIEW of *Schiedea verticillata*
(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

For Field Supervisor, Pacific Islands Fish and Wildlife Office
