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. 2019. Endangered and threatened wildlife and plants; initiation of 5-year status reviews for 91 species in Oregon, Washington, Hawaii, and American Samoa. Federal Register 84(112): 27152–27154, June 11, 2019.

Lead Region/Field Office:

Interior Region 12/Pacific Islands Fish and Wildlife Office (PIFWO), Honolulu, Hawai‘i

Name of Reviewer:

Daniel Adamski, Biologist, PIFWO
Lauren Weisenberger, Plant Recovery Coordinator, PIFWO
Megan Laut, 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 (Service) beginning in October 2020. The review was based on a review of current, available information since the last 5-year review for *Schiedea verticillata* (USFWS 2017). The evaluation by Daniel Adamski, Biologist, was reviewed by Lauren Weisenberger, Plant Recovery Coordinator, and Megan Laut, 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 reviews for *Schiedea verticillata* published in the Federal Register on July 21, 2009 and September 18, 2017 (available at *https://ecos.fws.gov/docs/tess/species_nonpublish/1371.pdf* and *https://ecos.fws.gov/docs/tess/species_nonpublish/2512.pdf*) for a complete review of the species' status, threats, management efforts, and references cited. We are not aware of any significant new information regarding the species' biological status since listing to warrant a change in the Federal listing status of *S. verticillata*.

This short-lived perennial herb in the *Caryophyllaceae* (pink) family is endangered and endemic to Nihoa. The status and trends for *Schiedea verticillata* are provided in the tables below.

New Status Information:

- At the time of the last 5-year review in 2017 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. Recent monitoring conducted by the U.S. Fish and Wildlife Service (USFWS) was conducted at all the above listed sites with the exception of Dog's Head (Rounds et al., 2021) . Due to high plant density, and steep, rocky terrain, access to plants to obtain accurate counts was difficult without the risk of damaging the populations. Therefore, population estimates were made. Approximately 65 individuals (including 60 mature) were observed at Middle Plateau Cliffs, and hundreds of individuals were estimated at both Pinnacle Peak and Devil's Slide. The majority of plants were reproductive with buds, flowers, immature fruits, and mature fruits. Currently there are still estimated to be at least 1,000 individuals on the island of Nihoa (Rounds et al., 2021).
- In 2003, 1 critical habitat unit in 1 ecosystems (coastal) was designated for *Schiedea verticillata* on the island of Nihoa (171 acres, 69 hectares) (68 FR 28054, May 22, 2003).

New Threats:

- Climate change loss or degradation of habitat—Climate change may pose a threat to this species. Fortini *et al.* (2013) conducted a landscape-based assessment of climate change vulnerability for native plants of Hawai‘i 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, such as locating key microsites that overlap with current and future climate envelopes for outplanting efforts.

New Management Actions: Surveys and inventories—

- Invasive plant monitoring and control— USFWS controlled weeds around all populations on Nihoa during recent monitoring (Rounds et al., 2021)
- Captive propagation for genetic storage and reintroduction—
    - National Tropical Botanic Garden (NTBG) reports 1,558 seeds in storage representing 3 founders, and 14 individual plants in propagation (NTBG 2020).
    - Lyon Arboretum reports 72 explants in micropropagation and the Lyon Seed Conservation Laboratory reports 13,036 seeds in storage from 4 founder plants, as well as an additional 1,656 seeds for research purposes (Lyon Arboretum 2020).

    - The University of California Irvine (UCI) reports 10 plants representing 9 founders in propagation, although only 4 plants are reported healthy, while the other 6 are infected with microbotryum fungus (UCI 2017).
    - Fruit with mature seeds were collected from 2 plants at Middle Plateau Cliffs, 10 plants at Pinnacle Peak, and 14 plants at Devil's Slide during plant monitoring in 2021 (Rounds et al., 2021).
- Population biology research—Flower and leaf collections, and pollinator observations of *Schiedea verticillata* were conducted on Nihoa to provide insight into an ongoing genomics study to investigate the evolution and past hybridization events of the genus *Schiedea*. Leaf samples for sequencing genomic data were collected at Middle Plateau Cliffs from 10 individuals and Devil's Slide from 20 individuals (Rounds et al., 2021).

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

Date	No. wild individuals	No. outplanted	Stability Criteria identified in Recovery Plan	Stability 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 *ex situ*	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 ex situ	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 ex situ	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 ex situ	Partially
			Remote monitoring system	No
2016 (5-year review)	1,000	0	All threats managed in all three populations	No
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	Partially
Date	**No. wild individuals**	**No. outplanted**	***Preventing Extinction Criteria identified by HPPRCC**	***Preventing Extinction Criteria Completed?**
2021 (5-year review)	ca 1,000	0	All threats managed in all 3 populations	No
			Complete genetic storage	Partially
			Natural reproduction at all 3 populations	Partially
			3 populations with 50 mature individuals each	Partially, yes at wild sites, 3 populations not identified within range

* The Preventing Extinction Stage was established in 2011. Prior to 2011, the Interim Stabilization Stage was the first stage towards recovery (now it is the second stage after Preventing Extinction).

Table 2. Threats to *Schiedea verticillata* and ongoing 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, including hurricanes	A	Ongoing	None
Rodent predation or herbivory	C	Potential	Partial, controlled access to island
Invertebrate predation or herbivory	C	Ongoing	None
Reduced viability due to low numbers	E	Ongoing	Partial, propagation and seed storage efforts are ongoing
Human disturbance	E	Ongoing	Partial, controlled access to island
Climate change degradation of habitat	E	Ongoing	None

Synthesis:
Currently there are an estimated 1,000 wild individuals of *Schiedea verticillata* on Nihoa. A landscape-based assessment of climate change vulnerability for native plants of Hawai‘i using high resolution climate change projections was made by Fortini *et al.* (2013) and their analysis showed 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. Individuals are provided protection by nonnative plant control. Seed collections and propagation are ongoing.

Stabilizing (interim), downlisting, and delisting objectives were provided in the Recovery Plan for Three Plant Species on Nihoa Island (USFWS 1998) and have been updated according to the draft revised recovery objective guidelines developed by the Hawai‘i 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 calculation 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 herb. To prevent extinction, which is the first milestone in recovering the species, 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 *ex situ* (secured off-site, such as a nursery or seed bank) collections that are well managed. In addition, a minimum of three populations should be documented on Nihoa 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, reproducing individuals per population.

The preventing extinction goals for this species have not been met. Although genetic storage is almost complete (Table 1), and there are 150 reproducing individuals, there are not 3 populations, there is a lack of monitoring to track population trends, and all threats are not being managed (Table 1, Table 2). Therefore, *Schiedea verticillata* meets the definition of Endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:
We are not aware of any new threats or significant new information regarding the species' biological status since the last 5-year review in 2017. Thus, the following recommendations for future actions are reiterated for the 5-year review for 2020.

- Surveys and inventories—
    - The historical range of *Schiedea verticillata* should be surveyed intensively.
    - Determine if historical populations are extirpated.
    - Determine sites that have the highest likelihood of maintaining reintroductions.
- Invasive plant monitoring and control—Continue control of established ecosystem-altering nonnative invasive plant species, and those that compete with *Schiedea verticillata*.
- Site and habitat protection—Develop and implement effective control measures to reduce the impact of collection and drought.
- Climate change adaptation strategy—Assess the modeled effects of climate change on this species and use to determine future landscape needed for the recovery of the species.
- Predator and herbivore monitoring and control—Determine and implement effective methods to control insect pests.
- Captive propagation for genetic storage and reintroduction—Continue collection and propagation efforts for maintenance of genetic stock and for reintroduction.
- Reintroduction and translocation—Reintroduce individuals into suitable habitat within historic range that is being managed for known threats to this species to build resiliency and redundancy to reduce impacts of habitat degradation.
- Population biology research—
    - Determine which species may act as pollinators and which may assist with fruit dispersal.

    - Conduct genetic studies to determine genetic variation within the population (and between populations) and plan an effective breeding program.
- Alliance and partnership development—Continue to work with partners and other land managers in planning and implementation of ecosystem-level restoration and management to benefit this species.

References:

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.

[HBMP] Hawaii Biodiversity and Mapping Program. 2010. Plant species GIS data and Access species database.

[HPPRCC] Hawai‘i and Pacific Plants Recovery Coordinating Committee. 2011. Revised recovery objective guidelines. 8 pp.

Lyon Arboretum. 2020. Report on controlled propagation of listed species, as designated under the U.S. Endangered Species Act. Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawaii.

[NTBG] National Tropical Botanic Garden. 2020. Report on controlled propagation of listed species, as designated under the U.S. Endangered Species Act. Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawaii.

Rounds, R., L. Weisenberger, K. Donmoyer, K. Hassett, D. Link, E. Sachs, and M. Saunter. 2021. Nihoa Island biological monitoring and management, May 2021. Unpublished report to the U.S. Fish and Wildlife Service. 41pp.

[UCI] University of California Irvine. 2017. Department of Ecology and Evolutionary Biology controlled propagation report. Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawaii.

[USFWS] 2003. Endangered and threatened wildlife and plants; Designation of Critical Habitat for Five Plant Species from the Northwestern Hawaiian Islands, Hawaii; final rule. Department of the Interior, 81 FR 28054, May 22, 2003.

[USFWS] 2009. *Schiedea verticillata* 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI. *https://ecos.fws.gov/docs/tess/species_nonpublish/1371.pdf*.

[USFWS] 2017. *Schiedea verticillata* 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI. *https://ecos.fws.gov/docs/tess/species_nonpublish/2512.pdf.*

[USFWS] 2019. Endangered and threatened wildlife and plants; initiation of 5-year status reviews for 91 species in Oregon, Washington, Hawaii, and American Samoa. Federal Register 84(112): 27152–27154, June 11, 2019.

U.S. FISH AND WILDLIFE SERVICE
SIGNATURE PAGE for 5-YEAR REVIEW of *Schiedea verticillata* (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
_X____ No Change in listing status

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

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