5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Schiedea adamantis* (Diamond Head schiedea)

Current Classification: Endangered

Federal Register Notice announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2017. Endangered and threatened wildlife and plants; initiation of 5-year status reviews for 138 species in Hawaii, Oregon, Washington, and California. Federal Register 82(75): 18665–18668, April 20, 2017.

Lead Region/Field Office:

Region 1/Pacific Islands Fish and Wildlife Office (PIFWO), Honolulu, Hawai‘i

Name of Reviewer:

Cheryl Phillipson, 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 2018. The review was based on a review of current, available information since the last 5-year review for *Schiedea adamantis* (USFWS 2013). The evaluation completed by Cheryl Phillipson, 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 adamantis* published in the Federal Register on January 18, 2008 and August 19, 2013 (available at *https://ecos.fws.gov/docs/five_year_review/doc1802.pdf* and *https://ecos.fws.gov/docs/five_year_review/doc4235.pdf*) for a complete review of the species' status, threats, and management efforts. 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. adamantis*.

This short-lived perennial shrub in the Caryophyllaceae (carnation) family is endangered and endemic to O‘ahu. The current status and trends for *Schiedea adamantis* are provided in the tables below.

New Status Information:

- Currently there are 17 wild individuals of *Schiedea adamantis* in two populations (Lēʻahi and Kuluʻī) in the Koʻolau mountains of Oʻahu (Plant Extinction Prevention Program 2019). The Kuluʻī population was discovered in 2017, until which the species was only known from Lēʻahi (Diamond Head).

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 Hawaiʻi 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. The assessment was not conducted specifically for *Schiedea adamantis*; however, at the genus level, *Schiedea* has one of the highest vulnerability scores. The analysis was conducted for 26 other species of *Schiedea*, 17 of which had vulnerability scores greater than 0.5. Considering that *S. adamantis* is endemic to two small areas with a range of less than 10 km^2, its population numbers are very small (two populations of fewer than 20 individuals), and threats such as drought and human disturbance are increasing, it is likely that climate change could affect its ability to persist. Therefore, additional management actions may be needed to conserve this taxon into the future, such as ensuring that adequate viable genetic storage is maintained, identifying suitable microsites where climate change effects are anticipated to occur more slowly, and considering suitable habitat in areas outside of its known range.
- In 2016, a wildfire on Lēʻahi burned 2 acres (0.8 hectares) and destroyed 45 of the 60 reintroduced plants and the irrigation system (PEPP 2016; Beimler *in* Hawaii News Now 2016, in litt.).

New Management Actions:

- Captive propagation for genetic storage and reintroduction—
  - Lyon Arboretum Micropropagation Laboratory reports propagation of more than 2,500 explants with currently 218 explants maintained, representing two founders from Lēʻahi (Lyon Arboretum 2018). The Lyon Seed Conservation Laboratory reports approximately 260,000 seeds in storage representing controlled crosses from wild and outplanted individuals from approximately 25 Lēʻahi founders as well as seeds from three Kuluʻī founders (Lyon Arboretum 2018).
  - Waimea Arboretum reports 34 seeds in storage (Waimea Arboreum 2018).
  - Pahole Rare Plant Facility (PRPF) reports 30 plants in refugia representing both populations (PRPF 2018).
- Reintroduction—In 2014 and 2015, the Division of Forestry and Wildlife (DOFAW) and PEPP reintroduced 100 individuals of *Schiedea adamantis* at Lēʻahi (PEPP 2014, 2015). In 2016, 45 individuals were burned in a wildfire, along with the irrigation system. In 2017, the irrigation system was repaired and 200 more plants were reintroduced (PEPP 2017). In 2019, 232 plants were planted into Kuluʻī, representing founders from both populations (PEPP 2019).

Synthesis:
Currently there are fewer than 20 wild individuals of *Schiedea adamantis* in the Koʻolau mountains of Oʻahu. *Schiedea adamantis* is susceptible to drought and may be vulnerable to the effects of climate change. Wildfires are a severe threat to wild and reintroduced plants. Collection, propagation, and reintroductions are ongoing.

Stabilizing (interim), downlisting, and delisting objectives were provided in the Recovery Plan for the Oʻahu Plants (USFWS 1998), and have been updated according to the draft revised recovery objective guidelines developed by the Hawaiʻi 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 adamantis is a short-lived perennial shrub. To prevent extinction, which is the first step 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. In addition, a minimum of three populations should be documented on Oʻahu where they now occur or occurred historically and each of these populations must be naturally reproducing (*i.e.,* viable seeds, seedlings, saplings) and increasing in number, with a minimum of 50 mature, reproducing individuals per population.

The preventing extinction goals for this species have not been met. Genetic representation is incomplete and there are no populations of 50 mature individuals (excluding the outplanting that was established in 2019). In addition, not all threats are managed (Table 1, Table 2). Therefore, *S. adamantis* 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 except for increased numbers of wildfires and drought associated with climate change. There is no significant new information regarding the species' biological status since the last 5-year review in 2013. Thus, the following recommendations for future actions are reiterated for the 5-year review for 2019.

- Invasive plant monitoring and control—Control established ecosystem-altering nonnative invasive plant species, and those that compete with *Schiedea adamantis* at all wild and reintroduced populations.

- Fire protection—Continue to implement a fire management plan and coordinate control efforts.
- 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.
- Captive propagation for genetic storage and reintroduction—Continue seed collection from tagged individuals, recording the maternal source for *ex situ* propagation.
- Reintroduction—
    - Continue to establish new populations and augment existing populations, keeping close track of maternal source used for *ex situ* propagation.
    - Consider additional reintroduction sites outside of historic range.
    - Monitor irrigation system closely and assess needs during extreme drought.
- Population biology research—
    - Continue to conduct genetic studies to assess the genetic variability and the viability of remaining populations.
    - Continue to investigate the causes of reproductive failure and implement techniques to improve natural recruitment.
- Population viability monitoring—Continue studies of *Schiedea adamantis* with regard to population size and structure, geographical distribution, flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, limiting factors, and threats.
- Alliance and partnership development—Continue to work with the Division of Forestry and Wildlife and other land managers to contribute to implementation of ecosystem-level restoration and management to benefit this species.

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

Date	No. wild individuals	No. outplanted	Stabilization ** Criteria identified in Recovery Plan	Stabilization ** Criteria Completed?
1984 (listing)	~78	0	All threats managed in all three populations	No
			Complete genetic storage	No
			Three populations with 50 mature individuals each	No
1994 (recovery plan)	244	0	All threats managed in all three populations	No
			Complete genetic storage	No
			Three populations with 50 mature individuals each	No, only one population
2008 (5-year review)	6	~80	All threats managed in all three populations	No
			Complete genetic storage	No
			Three populations with 50 mature individuals each	No
2013 (5-year review)	13	15	All threats managed in all three populations	No
			Complete genetic storage	No
			Three populations with 50 mature individuals each	No

Date	No. wild individuals	No. outplanted	*Preventing Extinction Criteria identified by HPPRCC	*Preventing Extinction Criteria Completed?
2019 (5-year review)	<20	300	All threats managed in all three populations	Partially
			Complete genetic storage	Partially
			Reproduction (*i.e.* viable seeds, seedlings) at all three populations	No
			Three populations with 50 mature individuals each	No

* 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 after Preventing Extinction).

** We changed the table to Stabilization Criteria to correct the 2013 5-year review that had used Downlisting Criteria in error.

Table 2. Threats to *Schiedea adamantis* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Degradation of habitat by established ecosystem-altering invasive plant species	A	Ongoing	Partial, some nonnative plant control
Climate change degradation or loss of habitat	A	Ongoing	None
Drought destruction and degradation of habitat	A	Ongoing	Partial, reintroductions on irrigation
Fire destruction and degradation of habitat	A	Ongoing	Partial, fire management plan in place
Competition with established invasive plant species	E	Ongoing	Partial, one managed area
Human disturbance–Hikers	E	Ongoing	None
Low numbers	E	Ongoing	Partial, seed collection, propagation, and reintroduction; research on inbreeding depression

References:

See previous 5-year reviews for a full list of references (USFWS 2008, 2013). 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.

Hawaii News Now. 2016, in litt. Report by P. Beimler, Diamond Head Brush Fire Burns 2 Acres, 5 APR 2016.

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

Lyon Arboretum. 2018. 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.

[PRPF] Pahole Rare Plant Facility. 2018. 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.

[PEPP] Plant Extinction Prevention Program. 2014. PEPP annual report fiscal year 2014 (July 1, 2013-June 30, 2014). 185 pp.

[PEPP] 2015. PEPP annual report fiscal year 2015 (July 1, 2014-June 30, 2015). 179 pp.

[PEPP] 2016. Plant Extinction Prevention Program FY 2016 Annual Report (Oct 1, 2015-Sep 30, 2016), US FWS CFDA Program #15.657; Endangered Species Conservation-Recovery Implementation Funds, Coop Agreement F14AC00174, December 24, 2016, UH Manoa, PCSU, PEPP. 237 pp.

[PEPP] 2017. Plant Extinction Prevention Program FY 2017 annual report (Oct 1, 2016-Sep 30, 2017), US FWS CFDA program #15.657; Endangered species conservation-recovery implementation funds, Cooperative Agreement F14AC00174, December 12, 2017, UH Manoa, PCSU, PEPP. 235 pp.

[PEPP] 2019. Plant Extinction Prevention Program, annual recovery subpermit FWSPIFWO-26 report (January 1st, 2018–December 31st 2018), as designated under the U.S. Endangered Species Act. Unpublished report submitted to U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawaii. 569 pp.

[USFWS] 2013. *Schiedea adamantis* 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI. *https://ecos.fws.gov/docs/five_year_review/doc4235.pdf.*

[USFWS] 2017. Endangered and threatened wildlife and plants; initiation of 5-year status reviews for 138 species in Hawaii, Oregon, Washington, and California. Federal Register 82(75): 18665–18668, April 20, 2017.

Waimea Arboretum. 2018. 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.

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SIGNATURE PAGE for 5-YEAR REVIEW of *Schiedea adamantis* (Diamond Head schiedea)

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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