5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Schenkia sebaeoides* (ʻāwiwi)

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, Hawaiʻi

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 *Schenkia sebaeoides* (USFWS 2013). 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 *Schenkia sebaeoides* published in the Federal Register on August 27, 2010 and August 19, 2013 (available at *https://ecos.fws.gov/docs/tess/species_nonpublish/1600.pdf* and *https://ecos.fws.gov/docs/tess/species_nonpublish/2060.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. sebaeoides*.

This short-lived determinate annual herb in the *Gentianaceae* (gentian) family is endangered and endemic to Kauaʻi, Oʻahu, Molokaʻi, Lānaʻi, and Maui. The status and trends for *Schenkia sebaeoides* are provided in the tables below.

New taxonomic information:

- In 2012, USFWS proposed revising the taxonomic status for this species, recongizing the reinstatement of the genus *Schenkia* (Mansion 2004), when it revised critical habitat on Maui Nui, with no change in range or distribution (USFWS 2012). In 2016, the proposed genus change was finalized, and the species was listed as *Schenkia sebaeoides* (USFWS 2016).

New Status Information:

- On Kauaʻi, *Schenkia sebaeoides* was reported from one population at Māhāʻulepū, totaling 4 mature and 30 immature individuals (Heintzman 2021, pers. comm.). On Oʻahu, 24 mature and 6 immature plants were reported at an existing population on near Koko Crater, as well as an estimated 1,000-2,000 individuals from surrounding habitat (PEPP 2020). On Maui, 45 individuals were observed in 2015 (PEPP 2020).

- In 2003, 1 critical habitat units in 1 ecosystems (coastal) was designated for *Schenkia sebaeoides* on Kauaʻi (385 acres [ac], 156 hectares [ha]) (68 FR 9116, February 27, 2003). In 2012, 15 critical habitat units in 1 ecosystem (coastal) were designated for *S. sebaeoides* on Oʻahu (1332 ac, 539 ha) (77 FR 57648, September 18, 2012). In 2016, 3 critical habitat units in 1 ecosystem (coastal) was designated for *S. sebaeoides* on Maui (349 ac, 142 ha), and 7 critical habitat units in 1 ecosystem (coastal) were designated on Molokaʻi (3,851 ac, 1,557 ha) (81 FR 17790, March 30, 2016).

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 by Fortini *et al.* (2013) concluded that *Schenkia sebaeoides* is vulnerable to the impacts of climate change, with a vulnerability score of 0.487 (on a scale of 0 being not vulnerable to 1 being extremely vulnerable to climate change). Therefore, additional management actions may be 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— PEPP continues to monitor individuals of *Schenkia sebaeoides* in existing populations on Kauaʻi and Oʻahu (PEPP 2021).
- Captive propagation for genetic storage and reintroduction—

- The Lyon Seed Conservation Laboratory reports 422,371 seeds in storage from 95 wild plants from Kaua‘i, O‘ahu, and Maui and an additional 1,170 seeds for research purposes (Lyon 2020).
- National Tropical Botanical Garden (NTBG) reports approximately 1,000 seeds from 2 wild plants from Kaua‘i (NTBG 2020).
- Maui Nui Botanical Garden (MNBG) reports 3,750 seeds from 7 founders (MNBG 2020).

- Reintroduction—There are currently no outplantings of *Schenkia sebaeoides.*

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

Date	No. wild individuals	No. outplanted	Stability Criteria identified in Recovery Plan	Stability Criteria Completed?
1991 (listing)	>1,000	0	All threats managed in all 5-7 populations	No
			Complete genetic storage	No
			5-7 populations with 500 mature individuals each	No
1999 (recovery plan)	>580-2,250	0	All threats managed in all 5-7 populations	No
			Complete genetic storage	No
			5-7 populations with 500 mature individuals each	No
2003 (critical habitat)	212-1000’s	0	All threats managed in all 5-7 populations	No
			Complete genetic storage	No
			5-7 populations with 500 mature individuals each	No
2010 (5-year review)	6,000	0	All threats managed in all 5-7 populations	No
			Complete genetic storage	Partially
			5-7 populations with 500 mature individuals each	No

2013 (5-year review)	Unknown	0	All threats managed in all 5-7 populations	Partially
			Complete genetic storage	Partially
			5-7 populations with 500 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 100 observed (>2,000 estimated)	0	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			Natural reproduction at all 3 populations	Yes, persisting populations of an annual species
			3 populations with 300 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 stage after Preventing Extinction).

Table 2. Threats to *Schenkia sebaeoides* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulate degradation of habitat	A	Ongoing	Partially
Established ecosystem altering invasive plant species degradation of habitat	A	Ongoing	Partially
Drought destruction and degradation of habitat	A	Ongoing	None
Fire destruction or degradation of habitat	A	Ongoing	None
Damage caused by off-road vehicles (O‘ahu, Moloka‘i)	A	Ongoing	Partially
Ungulate predation or herbivory	C	Ongoing	Partially

Trampling by humans on or near trails (Oʻahu, Kauaʻi)	E	Ongoing	None
Reduced viability due to low numbers	E	Ongoing	Partial, seed storage efforts are ongoing
Climate change degradation or loss of habitat, including hurricanes	E	Ongoing	None

Synthesis:
Currently there were over 100 individuals observed over the last five years of *Schenkia sebaeoides* on Kauaʻi, Oʻahu, Molokaʻi, Lānaʻi, and Maui, but thousands have been estimated. It is difficult to assess populations due to limited observations, dependency on rainfall, and annual life span. A landscape-based assessment of climate change vulnerability for native plants of Hawaiʻi using high resolution climate change projections was made by Fortini *et al.* (2013, p. 94) and their analysis showed that *S. sebaeoides* is vulnerable to the effects of climate change. Individuals are provided protection by fencing and nonnative plant control. Seed collections, propagation, and outplanting are ongoing.

Stabilizing (interim), downlisting, and delisting objectives were provided in the Recovery Plan for the Multi-Island Plants (USFWS 1999) 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.

Schenkia sebaeoides is an annual herb prone to fluctuations in population size. 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 Kauaʻi, Oʻahu, Molokaʻi, Lānaʻi, and Maui 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 300 mature, reproducing individuals per population.

The preventing extinction goals for this species have not been met. Although there are some seeds in genetic storage (Table 1), there are no single populations totaling at least 300 reproducing individuals, and all threats are not being managed (Table 1, Table 2). Therefore, *Schenkia sebaeoides* 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 2013. Thus, the following recommendations for future actions are reiterated for the 5-year review for 2020.

- Surveys and inventories—
    - The historical range of *Schenkia sebaeoides* should be surveyed intensively.
    - Determine if historical populations are extirpated.
    - Determine sites that have the highest likelihood of maintaining reintroductions.
- Ungulate monitoring and control—Continue to maintain fenced exclosures to protect individuals from the negative impacts of browsing by ungulates.
- Invasive plant monitoring and control—Continue control of established ecosystem-altering nonnative invasive plant species, and those that compete with *Schenkia sebaeoides*.
- Site and habitat protection—Develop and implement effective control measures to reduce the impact of drought.
- Fire monitoring and control—Continue to develop and implement fire prevention management plans.
- 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 the impacts of drought and fire.
- 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:

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[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.

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[MNBG] Maui Nui Botanical 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, Hawai‘i.

[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, Hawai‘i.

[PEPP] Plant Extinction Prevention Program. 2020. Annual report for plant extinction prevention program fiscal year 2020 (July 1, 2019-June 30, 2020). Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawai‘i.

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[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.

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SIGNATURE PAGE for 5-YEAR REVIEW of *Schenkia sebaeoides* (awiwi)

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 Reclassify from Endangered to Threatened status
_____ No Change in listing status

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

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