

5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Schiedea nuttallii* (no common name)

Current Classification: Endangered

Federal Register Notice announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2010. Endangered and threatened wildlife and plants; initiation of 5-year status reviews of 58 species in Washington, Oregon, California, and Hawaii. Federal Register 75(226):71726-71729.

Lead Region/Field Office:

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

Name of Reviewer(s):

Michelle Clark, Partners Biologist, PIFWO

Daniel Clark, Oahu, Kauai, Northwest Hawaiian and American Samoa Islands Team
Manager, PIFWO

Marie Brueggemann, Plant Recovery Coordinator, PIFWO

Recovery Program Leader, PIFWO

Kristi Young, Programmatic Deputy Field Supervisor, PIFWO

Methodology used to complete this 5-year review:

This review was conducted by staff of the Pacific Islands Fish and Wildlife Office of the U.S. Fish and Wildlife Service (USFWS), beginning on January 31, 2012. The review was based on a review of current, available information since the last five-year review for *Schiedea nuttallii* (USFWS 2009). The National Tropical Botanical Garden provided an initial draft of portions of the five-year review and recommendations for conservation actions needed prior to the next five-year review. The document was reviewed by the Partners Biologist, Islands Team Manager, and Plant Recovery Coordinator, followed by the Recovery Program Lead. It was subsequently reviewed and approved by the Programmatic Deputy Field Supervisor.

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 nuttallii* published on July 21, 2009 (available at http://ecos.fws.gov/docs/five_year_review/doc2435.pdf for a complete review of the species status, threats, and management efforts. No new significant information regarding the species biological status has come to light since listing to warrant a change in the Federal listing status of *S. nuttallii*.

This short-lived shrub is endangered and occurs on Oahu and Kauai. The current status and trends for *Schiedea nuttallii* are provided in the tables below.

New taxonomic information:

- As discussed in the previous five-year review, the Kauai populations of *S. nuttallii* are now recognized as belonging to the taxa *S. perlmanii* (Mt. Haupu and Moloaa populations) and *S. kauaiensis* (Limahuli population) (Wagner *et al.* 2005).
- Pubescence which is a characteristic of *Schiedea kauaiensis*, is apparently also present in some individuals of *S. perlmanii*, and could indicate some interspecific hybridization (NTBG 2011a).
- *Schiedea kauaiensis* was reviewed by the Service as a separate listed entity in 2008 (USFWS 2008), and thus will not be covered in this review. *S. perlmanii* was included in the last review of *S. nuttallii* (USFWS 2009), and has not yet been formally recognized as a listed entity, so will thus be included in this review.

New status information:

Schiedea nuttallii:

- As of the end of 2012, the *Schiedea nuttallii* population at Kahanahaiki to Pahole contained 211 mature and six immature individuals and 19 seedling individuals. Of these 11 individuals were wild, the rest (195 individuals) were reintroductions (Oahu Army Natural Resources Program [OANRP] 2012c).
- Kapuna-Keawapilau Ridge contained no remaining individuals, and Makaha contained 30 mature reintroduced individuals (OANRP 2012c).

Schiedea perlmanii:

- Eight mature individuals were noted in the Haupu population in 2010 (National Tropical Botanical Garden [NTBG] 2010).
- In the Moloaa Forest Reserve, in the upper reaches of Papaa Valley below Kawalumakua Peak, a new population was discovered in 2011 (NTBG 2011a, 2012). Two clumps of *Schiedea perlmanii* were observed in the area where a new *Hibiscus clayi* population was also discovered. The larger clump, with eight to 20 individuals (N. Tangalin, NTBG, pers. comm. 2013; NTBG 2011b) has its inflorescence and peduncle covered in short thick hairs. These individuals, while initially identified as *S. perlmanii*, may actually be *S. kauaiensis* (N. Tangalin, pers. comm. 2013). Pubescence was variable (NBTG 2011b). The second smaller clump in the *Hibiscus clayi* area contained an estimated three to eight individuals also exhibiting hairs on the peduncles, but less so than the first clump (N. Tangalin, pers. comm. 2013). Along the ridge, NTBG staff found a single individual and a clump of about ten individuals about 30 feet away (NTBG 2011a). Here the inflorescences are nearly glabrous with only a few reduced and sparse scale-like hairs (N. Tangalin, pers. comm. 2013).
- Plants from Lihue have not been seen since 1911 (Wagner *et al.* 2005).

New threats:

- Climate change – Climate change may pose a threat to this species. However, current climate change analyses in the Pacific Islands lack sufficient spatial resolution to make predictions on impacts to this species. The Pacific Islands Climate Change Cooperative (PICCC) funded climate modeling that will help

resolve these spatial limitations. High spatial resolution climate outputs are expected in 2013.

New management actions:

- Ungulate exclosures - In 2011 all populations of *Schiedea nuttallii* were protected from feral ungulates by fences (U.S. Army Garrison 2011).
- Threats research - invertebrate control –slugs:
 - Research by Joe (2006) indicated that invasive slugs negatively impacted the regeneration of *Schiedea* species on Oahu, likely including *S. nuttallii*.
 - In 2009, monitoring of slug activity in anticipation of the approval of the control agent Sluggo, a slug and snail bait, began in the field for two *Schiedea nuttallii* sites on U.S. Army lands (U.S. Army Garrison 2010).
- Captive propagation for genetic storage and reintroduction for *Schiedea nuttallii*:
 - OANRP (2012b) had 489 plants in their nursery.
 - OANRP (2012a) had full genetic storage as seed from 46 individuals from the Kahanahaiki to Pahole population .
 - In 2010, 54 plants from 12 wild individuals were growing at the Pahole Rare Plant Facility (2010).
 - Sixty plants from two populations (Kahanahaiki and Pahole) were in micropropagation at the Harold L. Lyon Arboretum (2012).
 - Plants from Kapuna-Keawapilua population were in propagation in the research greenhouses at the University of California, Irvine. Since the wild population has since been extirpated, pollination was done and resulting seed returned to the OANRP for reintroduction (S. Weller, University of California, Irvine, pers. comm. 2012).
- Reintroduction / translocation
 - A complete plan for augmentation and reintroduction was completed for *Schiedea nuttallii* by OANRP in 2011 (U. S. Army Garrison 2011).
 - OANRP has reintroduced 225 individuals of *Schiedea nuttallii* in the Kahanahaiki to Pahole and the Makaha population areas (OANRP 2012c).

Synthesis:

Stabilizing, downlisting, and delisting objectives are provided in the recovery plan for plants from the island of Oahu (USFWS 1998), 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 stable, the taxon must be managed to control threats (*e.g.*, fenced) and be represented in an *ex situ* (at other than the plant's natural location, such as a nursery or arboretum) collection. In addition, a minimum of three populations should be documented on the island of Oahu and Kauai. Each of these populations must be naturally reproducing and increasing in number, with a minimum of 50 mature individuals per population.

The stabilization goals for *Schiedea nuttallii* as listed have not been met, as one population of 50 or more mature individuals exists on Oahu (Tables 1 and 2) and all threats are not being sufficiently managed throughout the populations (Tables 3 and 4).

Therefore *Schiedea nuttallii* meets the definition of endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:

- Captive propagation for genetic storage and reintroduction - Collect cuttings or seed from tagged individuals, keeping close track of the maternal source for use in *ex situ* propagation. Invertebrate control research - Investigate slug and black twig borer herbivory and appropriate control methods.
- Ungulate exclosures - Fence remaining populations to protect them from the impacts of feral ungulates. Ecosystem-altering invasive plant species control - Remove competing invasive introduced plant species within fenced areas and maintain those areas free of invasive introduced plants.
- Predator / herbivore control – Implement effective control methods for rodents.
- Population biology research
 - Implement genetic studies to assess the viability of remaining populations.
 - Investigate the causes of reproductive failure and techniques to improve natural recruitment.
- Surveys / inventories – Survey geographical and historical ranges of both species for a thorough current assessment of the species status.
- Fire protection – Develop and implement fire management plans for all wild and reintroduced populations.
- Alliance and partnership development - Initiate planning and contribute to implementation of ecosystem level restoration and management to benefit this taxon.
- Threats research – Assess the modeled effects of climate change on this species, and use to determine future landscape needed for the recovery of the species.
- Federal Register updates - Revise the listed entities to reflect the currently recognized taxonomy.

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

Date	No. wild individuals	No. outplanted	Stabilization Criteria identified in Recovery Plan	Stabilization Criteria Completed?
1996 (listing)	~75	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
1998 (recovery plan)	40-100	8	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 50 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 50 mature individuals each	Partially
2009 (5-yr review)	26	211	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	Partially
2013 (5-yr review)	11	225	All threats managed in all 3 populations	Partially (see Table 2)
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	Partially, 1 population

Table 2. Status of *Schiedea perlmanii* from listing through current 5-year review.

Date	No. wild individuals	No. outplanted	Stabilization Criteria identified in Recovery Plan	Stabilization Criteria Completed?
1996 (listing)	Unknown, listed as <i>S. nuttalli</i>	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50mature individuals each	No
1998 (recovery plan)	Unknown	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50mature individuals each	No
2003 (critical habitat)	Unknown	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
2009 (5-yr review)	10-20	0	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 50mature individuals each	No
2013 (5-yr review)	30-47	0	All threats managed in all 3 populations	Partially (see Table 2)
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No

Table 3. Threats to *Schiedea nuttallii* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulates – Degradation of habitat and herbivory by pigs and goats	A, C, D	Ongoing	Partially: Kahanahaiki and Pahole fenced, also Makaha but not Upper Kapuna
Established ecosystem-altering invasive plant species	A, E	Ongoing	Partially:
Black twig borer predation	C	Ongoing	None
Slugs and snails herbivory	C	Ongoing	Partially: Localized slug control at Kahanahaiki PU and Upper Kapuna
Fire	E	Ongoing	None
Landslides and erosion	A, E	Ongoing	None
Military activities	E	Ongoing	Partially
Drought	A, E	Ongoing	None
Mice (<i>Mus musculus</i>) herbivory	E		None
Reduced reproductive vigor due low numbers of individuals	E	Ongoing	Partially: Captive propagation and genetic storage
Climate change	A, E	Increasing	None

Table 4. Threats to *Schiedea perlmanii* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulates – Degradation of habitat and herbivory by feral pigs, goats and possibly deer	A, C, D	Ongoing	None
Established ecosystem-altering invasive plant species	A, E	Ongoing	None
Predation by black twig borer (<i>Xylosandrus compactus</i>),	C	Ongoing	None
Slug and snail herbivory	C	Ongoing	None
Landslides, hurricanes	A, E	Ongoing	None
Fire	A, E	Ongoing	None
Low numbers	E	Ongoing	None
Climate change	A, E	Increasing	None

References:

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

- Harold L. Lyon Arboretum. 2012. Micropropagation and seed storage databases. University of Hawaii at Manoa, Honolulu, Hawaii. Unpublished.
- Joe, Stephanie M. 2006. Impact of alien slugs on native plant seedlings in a diverse mesic forest, Oahu, Hawaii, and a study of slug food plant preferences; Thesis submitted to the Graduate Division of the University of Hawaii in partial fulfillment of the requirements for the Degree of Master of Science in Botanical Sciences. 95 pages. Available online at <http://scholarspace.manoa.hawaii.edu/handle/10125/14955>. Accessed December 30, 2011.
- [NTBG] National Tropical Botanical Garden. 2010. Living collections database, provenance report 100490. National Tropical Botanical Garden, Kalaheao, Hawaii. Unpublished.
- [NTBG] National Tropical Botanical Garden. 2011a. Living collections database, provenance reports 110555 and 110568. National Tropical Botanical Garden, Kalaheao, Hawaii. Unpublished.
- [NTBG] National Tropical Botanical Garden. 2011b. Herbarium database, K.R. Wood 14719. National Tropical Botanical Garden, Kalaheao, Hawaii. Unpublished.
- [NTBG] National Tropical Botanical Garden. 2012. Living collections database, provenance report 120581. National Tropical Botanical Garden, Kalaheao, Hawaii. Unpublished.
- [OANRP] Oahu Army Natural Resources Program. 2012a. Genetic storage summary, *Schiedea nuttallii*. 1 page. Unpublished.
- [OANRP] Oahu Army Natural Resources Program. 2012b. Army nursery summary – *Schiedea nuttallii*. 1 page. Unpublished.
- [OANRP] Oahu Army Natural Resources Program. 2012c. Makua implementation plan - population unit status- population unit status; *Schiedea nuttallii*. 1 page. Unpublished.
- U.S. Army Garrison. 2010. 2010 status report for the Makua and Oahu implementation plans. U.S. Army Garrison, Hawaii and Pacific Cooperative Park Studies Unit. Schofield Barracks, Hawaii. 588 pages. Available online at http://manoa.hawaii.edu/hpicesu/DPW/2010_YER/2010_YER_Edited.pdf.

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[USFWS] U.S. Fish and Wildlife Service. 1998. Recovery plan for the Oahu plants. U.S. Fish and Wildlife Service, Portland, Oregon. 207 pages, plus appendices.

[USFWS] U.S. Fish and Wildlife Service. 2008. *Schiedea kauaiensis* (no common name) 5-year review summary and evaluation. U.S. Fish and Wildlife Service, Honolulu, Hawaii. 6 pages. Available online at http://ecos.fws.gov/docs/five_year_review/doc1805.pdf.

[USFWS] U.S. Fish and Wildlife Service. 2009. *Schiedea nuttallii* (no common name) 5-year review summary and evaluation. U.S. Fish and Wildlife Service, Honolulu, Hawaii. 15 pages. Available online at http://ecos.fws.gov/docs/five_year_review/doc2435.pdf.

Wagner, W.L., S.G. Weller, A. Sakai. 2005. Monograph of *Schiedea* (Caryophyllaceae-Alsinoideae). Systematic Botany Monographs 72:1-169.

Personal communications:

Tangalin, Natalia. 2013. Field Botanist, National Tropical Botanical Garden. E-mail to Margaret Clark, National Tropical Botanical Garden, dated January 4, 2013. Subject: *Schiedea*.

Weller, Stephen G. 2012. Professor, Ecology and Evolutionary Biology, School of Biological Sciences, University of California, Irvine. E-mail to Margaret Clark, National Tropical Botanical Garden, dated November 13, 2012. Subject: *Schiedea kealiae*, etc..

U.S. FISH AND WILDLIFE SERVICE

SIGNATURE PAGE for 5-YEAR REVIEW of *Schiedea nuttallii* (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

Appropriate Listing/Reclassification Priority Number, if applicable: _____

acting deputy
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Maire M Buegman

Date *2013-08-13*