# 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. 2018. Endangered and threatened wildlife and plants; initiation of 5-year status reviews for 156 species in Oregon, Washington, Hawaii, Palau, Guam, and the Northern Mariana Islands. Federal Register 88(83): 20088–20092, May 7, 2018.

**Lead Region/Field Office:**

Interior Region 12/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 2019. The review was based on a review of current, available information since the last 5-year review for *Schiedea nuttallii* (USFWS 2013). The evaluation 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 nuttallii* published in the Federal Register on July 21, 2009 and August 13, 2013 (available at *https://ecos.fws.gov/docs/five_year_review/doc2453.pdf* and *https://ecos.fws.gov/docs/five_year_review/doc4238.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. nuttallii*.

This short-lived perennial subshrub in the Caryophyllaceae (carnation) family is endangered and known from the islands of O‘ahu, Moloka‘i (not extant), and west Maui (not extant). As discussed in the previous five-year review, the Kaua‘i populations of *Schiedea nuttallii* are now recognized as the taxa *S. perlmanii* (at Mt. Hā‘upu and Moloa‘a) and *S. kauaiensis* (Limahuli) (Wagner *et al.* 2005). We include discussion of

the status of *S. perlmanii* in this review until the taxonomic change is published in the Federal Register.

New Status Information:
*Schiedea nuttallii*:

- In 2011, there was one individual at Mākua Military Reservation and 10 individuals at Pahole (Plant Extinction Prevention Program (PEPP) 2019). In 2016, there were three subpopulations totaling 25 mature individuals (Keir *et al.* 2016). Currently, there are 9 mature and one immature wild individuals at Kahanahāiki to Pahole (U.S. Army 2019; PEPP 2019).
- Plants have been observed flowering in March and April at Pahole, Oʻahu (National Tropical Botanical Garden (NTBG) 2019a).
- In 2012, critical habitat was designated for *S. nuttallii* on Oʻahu in seven units in the lowland mesic ecosystem (3,169 hectares, 7,829 acres) (77 FR 57648, September 18, 2012).

*Schiedea perlmanii*:

- In 2011, there were 19 wild individuals of *Schiedea perlmanii* at Mt. Hāʻupu and ʻAliomanu on Kauaʻi (PEPP 2011). Currently, there are two populations total fewer than 60 individuals (Clark 2020). Plants have been observed flowering in March at Mt. Hāʻupu and in July at Moloaʻa, Kauaʻi (NTBG 2019a).

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 *Schiedea nuttallii* is highly vulnerable to the impacts of climate change, with a vulnerability score of 0.833 (on a scale of 0 being not vulnerable to 1 being extremely vulnerable to climate change). Therefore, additional management actions are likely needed to conserve this taxon into the future, such as locating key microsites that overlap with current and future climate envelopes for outplanting efforts. The assessment for *Schiedea perlmanii* concluded that the taxon is extremely vulnerable to the impacts of climate change, with a vulnerability score of 0.92. In addition, *S. perlmanii* has no overlap between current and future climate envelopes, and is unlikely to tolerate expected changes in climate at its current location on Kauaʻi. Therefore, additional management actions are needed to conserve this *S. perlmanii* into the future, such as moving the species to suitable microrefugia, or to newly available climate compatible areas.

New Management Actions:

- Surveys and inventories—PEPP monitors *S. perlmanii* on Kauaʻi (PEPP 2011, 2012, 2015). The Army Natural Resources Program-Oʻahu (ANRP) monitors wild and reintroduced populations of *S. nuttallii* on Oʻahu (ANRP 2019).
- Ungulate monitoring and control—The ANRP reports that all wild and reintroduction sites are fenced and ungulates are controlled (ANRP 2019).
- Invasive plant monitoring and control—The ANRP reports weeds are controlled at all population units for *S. nuttallii* (ANRP 2019).
- Rat control—The ANRP controls rats at Keʻawapilau (upper Kapuna) and at the Mākaha populations of *S. nuttallii* to improve viability (ANRP 2019). There is nearly 100 percent control of rats at the Kahanahāiki to Pahole population (ANRP 2019).
- Slug control—The ANRP treats two *S. nuttallii* reintroduction sites (Kahanahāiki to Pahole and Kapuna to Keʻawapilau) for slugs (ANRP 2019).
- Captive propagation for genetic storage and reintroduction—
    - Lyon Arboretum Micropropagation Laboratory reports 93 explants in storage of *Schiedea nuttallii* representing populations from Mākua Military Reservation and Pahole on Oʻahu (Lyon Arboretum 2019).There are 79 explants in storage representing four individuals of *S. perlmanii* from Hulēʻia on Kauaʻi.
    - Lyon Arboretum Seed Conservation Laboratory report 69 seeds from one founder of *S. perlmanii* from Pāpaʻa (Lyon Arboretum 2019).
    - The ANRP reports propagation of 277 *S. nuttallii* representing 40 individuals from four populations (U.S. Army 2019).
    - The Kōkeʻe Rare Plant Facility (KRPF) reports propagation of six plants representing two individuals of *S. perlmanii* at Anahola (ʻAliomanu) on Kauaʻi (KRPF 2019).
    - The NTBG reports storage of four seeds collected from *S. perlmanii* plants at Mt. Hāʻupu in 2005; however, the viability of these seeds is unknown (NTBG 2019b). Between 2013 and 2014, NTBG collected cuttings from at least four individuals of *S. perlmanii* in their living collections and wild plants at Anahola (ʻAliomanu) and Mt. Hāʻupu for propagation in the greenhouse (NTBG 2013, 2014).
    - PEPP reports collection and propagation of cuttings from *S. perlmanii* at Mt. Hāʻupu, Kauaʻi (PEPP 2011, 2012).
- Reintroduction and translocation—
    - The ANRP reports reintroduction and current survival of 73 mature, 58 immature, and 53 seedlings of *Schiedea nuttallii* at Kahanahāiki to Pahole; 75 mature, 89 immature, and 45 seedlings of *S. nuttallii* at Kapuna to Keʻawapilau, and 121 mature and six immature individuals of *S. nuttallii* at Mākaha (ANRP 2019). Goals for seed storage are complete for plants at Kapuna-Keʻawapilau and are nearly complete (78 percent) for plants at Kahanahāiki to Pahole (ANRP 2019).
    - The ANRP testing strategic planting of other native plants at reintroduction sites for *S. nuttallii*, to improve habitat with native understory (ANRP 2019). The ANRP also tested reintroduction into areas with varying

nonnative plant control and light conditions; plantings survived better in the native shrub areas (ANRP 2019).

- PEPP and the ANRP reintroduced 19 individuals into a fenced area at Wai‘anae Kai (PEPP 2019).

**Table 1. Status and trends 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) | 25 | 0 | All threats managed in all 3 populations | No |
| | | | Complete genetic storage | No |
| | | | 3 populations with 50 mature individuals each | No |
| 1999 (recovery plan) | 50–80 | 0 | All threats managed in all 3 populations | No |
| | | | Complete genetic storage | No |
| | | | 3 populations with 50 mature individuals each | No |
| 2003 (critical habitat) | 49 | 0 | All threats managed in all 3 populations | No |
| | | | Complete genetic storage | No |
| | | | 3 populations with 50 mature individuals each | No |
| 2009 (5-year review) | 26 | 203 | All threats managed in all 3 populations | Partially |
| | | | Complete genetic storage | Partially |
| | | | 3 populations with 50 mature individuals each | Partially, no regeneration |

| | | | | |
|---|---|---|---|---|
| 2012 (critical habitat, O‘ahu) | 41–54 | 225 | All threats managed in all 3 populations | Partially |
| | | | Complete genetic storage | Yes |
| | | | 3 populations with 50 mature individuals each | Partially, no regeneration |
| 2013 (5-year review) | 11 | 225 | All threats managed in all 3 populations | Partially |
| | | | Complete genetic storage | Yes |
| | | | 3 populations with 50 mature individuals each | Partially, no regeneration |
| **Date** | **No. wild individuals** | **No. outplanted** | ***Preventing Extinction Criteria identified by HPPRCC** | ***Preventing Extinction Criteria Completed?** |
| 2020 (5-year review) | 9 mature, 1 immature | 254 (out of 435 outplanted) | All threats managed in all 3 populations | Partially, all wild and reintroduced populations fenced |
| | | | Complete genetic storage | Yes |
| | | | Reproduction (i.e. viable seeds, seedlings) at all 3 populations | Yes |
| | | | 3 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 stage after Preventing Extinction).

**Table 2. Status and trends 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) | 10–50 | 0 | All threats managed in all 3 populations | No |
| | | | Complete genetic storage | No |
| | | | 3 populations with 50 mature individuals each | No |
| 1999 (recovery plan) | 10–50 | 0 | All threats managed in all 3 populations | No |
| | | | Complete genetic storage | No |
| | | | 3 populations with 50 mature individuals each | No |
| 2003 (critical habitat) | 10–50 | 0 | All threats managed in all 3 populations | No |
| | | | Complete genetic storage | Partially |
| | | | 3 populations with 50 mature individuals each | No |
| 2009 (5-year review) | 10–20 | 0 | All threats managed in all 3 populations | No |
| | | | Complete genetic storage | Partially |
| | | | 3 populations with 50 mature individuals each | No |
| 2013 (5-year review) | 30–47 | 0 | All threats managed in all 3 populations | No |
| | | | Complete genetic storage | Partially |

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|---|---|---|---|---|
| | | | 3 populations with 50 mature individuals each | |
| **Date** | **No. wild individuals** | **No. outplanted** | ***Preventing Extinction Criteria identified by HPPRCC** | ***Preventing Extinction Criteria Completed?** |
| 2020 (5-year review) | <60 | 0 | All threats managed in all 3 populations | No |
| | | | Complete genetic storage | Partially |
| | | | Reproduction (i.e. viable seeds, seedlings) at all 3 populations | Partially |
| | | | 3 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 stage after Preventing Extinction).

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

| Threat | Listing factor | Current Status | Conservation/ Management Efforts |
|---|---|---|---|
| Ungulate degradation of habitat | A | Ongoing | Partial, all populations fenced |
| Established ecosystem altering invasive plant species degradation of habitat | A | Ongoing | Partial, nonnative plant control at all populations |
| Destruction and degradation of habitat by landslides and erosion | A | Ongoing | None |
| Fire destruction and degradation of habitat | A | Ongoing | Partial, fire management plan and coordinated fire response |
| Climate change degradation or loss of habitat including drought | A | Ongoing | Partial, monitoring for drought stress |
| Ungulate predation or herbivory | C | Ongoing | Partial, all populations fenced |

| | | | |
|---|---|---|---|
| Rodent predation or herbivory | C | Ongoing | Partial, control ongoing at 3 populations |
| Invertebrate predation or herbivory | C | Ongoing | Partial, slug control ongoing at 2 populations |
| Military activities | E | Ongoing | Partial, management plan implementation |
| Lack of pollinators | E | Ongoing | Partial, research ongoing |
| Human disturbance from increased visitation | E | Potential | Partial, fencing as a deterrent |
| Reduced viability due to low numbers and inbreeding effects | E | Ongoing | Partial, research ongoing |

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

| Threat | Listing factor | Current Status | Conservation/ Management Efforts |
|---|---|---|---|
| Ungulate degradation of habitat | A | Ongoing | None |
| Established ecosystem altering invasive plant species degradation of habitat | A | Ongoing | None |
| Destruction and degradation of habitat by landslides and erosion | A | Ongoing | None |
| Climate change degradation or loss of habitat including hurricanes | A | Ongoing | None |
| Ungulate predation or herbivory | C | Ongoing | None |
| Invertebrate predation or herbivory | C | Ongoing | None |
| Reduced viability due to low numbers | E | Ongoing | None |

**Synthesis:**
Currently there are 9 mature and one immature individual of *Schiedea nuttallii* on O‘ahu. There are fewer than 60 individuals of *S. perlmanii* at two locations on Kaua‘i. 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 *S. nuttallii* is vulnerable to the effects of climate change and that *S. perlmanii* is extremely vulnerable and in addition, has no overlap between current and future climate envelopes. All populations of *S. nuttallii* are provided protection from feral ungulates by fencing. Nonnative plant control, and slug/snail control are also

conducted for *S. nuttallii*. Seed collection, propagation, and reintroduction are ongoing for *S. nuttallii*. Seed storage and propagation of cuttings are ongoing for *S. perlmanii*. Seed storage trials have been conducted for *S. nuttallii*, and the effects of inbreeding depression have also been studied for this species.

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 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 nuttallii* is a short-lived perennial subshrub. 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. In addition, a minimum of three populations should be documented on O‘ahu 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 complete for three populations (Table 1), there are no populations totaling at least 50 reproducing individuals, and all threats are not being managed (Table 1, Table 2). Therefore, *Schiedea nuttallii* 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 other 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—Continue to survey suitable habitat and historical ranges of both species for a thorough assessment of the species’ status.
- Ungulate monitoring and control—Fence remaining populations on Kaua‘i and continue to maintain fenced exclosures on O‘ahu to protect individuals from the negative impacts of browsing by ungulates.
- Invasive plant monitoring and control—Continue to control established ecosystem-altering nonnative invasive plant species, and those that compete with both species.

- Fire prevention and control—Continue to implement fire management plan and coordinate fire response efforts on Oʻahu.
- Climate change adaptation strategy—Assess the modeled effects of climate change on these species and use to determine future landscape needed for their recovery.
- Predator and herbivore monitoring and control—Continue to develop and implement effective control methods for rodents, and slugs and nonnative snails. Develop and implement effective control measures for the black twig borer.
- Captive propagation for genetic storage and reintroduction—Continue collection and propagation efforts for maintenance of genetic stock and for reintroduction.
- Reintroduction and translocation—Continue to reintroduce individuals into suitable habitat within historic range that is being managed for known threats to these species to build resiliency and redundancy to reduce impacts of loss of viability.
- Population biology research—
    - Continue to assess stored seed viability with germination trials.
    - Continue to investigate techniques to improve seed and seedling viability to improve natural recruitment.
- Alliance and partnership development—Continue to work with partners in planning and implementation of ecosystem-level restoration and management to benefit these species.
- Federal Register updates—Revise the listed entity to reflect the currently accepted taxonomy for *Schiedea perlmanii*.

**References:**


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**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
X No Change in listing status

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

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