5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Phyllostegia warshaueri* (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 *Phyllostegia warshaueri* (USFWS 2012). 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 review for *Phyllostegia warshaueri* published in the Federal Register on August 28, 2012 (available at *https://ecos.fws.gov/docs/five_year_review/doc4065.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 *P. warshaueri*.

This short-lived perennial scandent vine in the Lamiaceae (mint) family is endangered and found on the island of Hawai‘i. The current status and trends for *Phyllostegia warshaueri* are provided in the tables below.

New Status Information:

- There were three individuals of *Phyllostegia warshaueri* at Puʻu Pili (Kohala mountains) and a few individuals at the base of Puʻuwaʻawaʻa Cone at the time of the 5-year review in 2012. These individuals could not be relocated on recent surveys. The Plant Extinction Prevention Program (PEPP) reports two mature individuals at Waipunalei in 2014 and one wild individual discovered at ʻOʻōkala in 2017 (PEPP 2014, 2017).

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 *Phyllostegia warshaueri* is vulnerable to the impacts of climate change, with a vulnerability score of 0.328 (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 surveys for and monitors populations of *Phyllostegia warshaueri*. In 2013 and 2014, two individuals were monitored at Waipunalei (Laupāhoehoe Natural Area Reserve (NAR)). In 2017, a specimen from nearby ʻOʻōkala was taken for identification and was determined to be the only one of three founders still extant.
- Ungulate monitoring and control—
    - In 2014, a hog panel exclosure was constructed for plants along the streambank at Waipunalei (PEPP 2014). A new 10-ac unit was constructed at Laupāhoehoe NAR, with a second one planned for Laupāhoehoe Gulch (PEPP 2019).
- Established ecosystem altering invasive plant species control—The 2016 Laupāhoehoe Forest Management Plant (Final Environmental Assessment) management actions by Department of Land and Natural Resources-Division of Forestry and Wildlife (DLNR-DOFAW) include 30 person-days per year working on nonnative plant control with additional work provided by a summer youth group (DLNR-DOFAW 2016, p. 22).
- Captive propagation for genetic storage and reintroduction—
    - Cuttings were taken from plants at Laupāhoehoe NAR for propagation (PEPP 2013). In 2014, eight cuttings were taken from two founders at Waipunalei for propagation (PEPP 2014). Cuttings were taken from the newly discovered individual at ʻOʻōkala for propagation at the Volcano Rare Plant Facility (VRPF) (PEPP 2017).

    - From 2013 to 2019, the VRPF reported propagation of one plant representing one founder from Humuʻula/ʻOʻōkala; 11 plants representing four founders from Kohala (currently there are only six propagules representing two founders), with one plant in inventory. Fifteen plants are in inventory representing six founders from Laupāhoehoe (where only one individual is extant). Two plants are in inventory representing one founder from Puʻuwaʻawaʻa (VRPF 2013-2019).
- Reintroduction and translocation—
    - PEPP reported reintroduction of 96 plants at two locations in Laupāhoehoe, 36 individuals reintroduced to Waimanu Bog (Puʻu o Umi NAR), and 139 individuals reintroduced to Kawaihae Mauka (PEPP 2019).
    - VRPF reported reintroduction of 28 individuals to Laupāhoehoe and 14 individuals to Puʻuwaʻawaʻa (VRPF 2013-2019). These may also be included as part of the PEPP reintroduction reporting.

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

Date	No. wild individuals	No. outplanted	Stabilization Criteria identified in Recovery Plan	Stabilization Criteria Completed?
1996 (listing)	5–10	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
1998 (recovery plan)	5–10	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
2003 (critical habitat)	12+	Unknown	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No

2012 (5-year review)	3+	197	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	No
Date	**No. wild individuals**	**No. outplanted**	***Preventing Extinction Criteria identified by HPPRCC**	***Preventing Extinction Criteria Completed?**
2020 (5-year review)	3	Unknown (313 planted)	All threats managed in all 3 populations	Partially
			Complete genetic storage	Complete, 10 founders represented *ex situ*
			Reproduction (i.e. viable seeds, seedlings) at all 3 populations	Unknown
			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. Threats to *Phyllostegia warshaueri* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulate degradation of habitat	A, D	Ongoing	Partial, exclosures at Laupāhoehoe, Kohala, and Puʻuwaʻawaʻa
Established ecosystem altering invasive plant species degradation of habitat and competition	A, E	Ongoing	Partial, nonnative plant control at Laupāhoehoe
Agricultural and urban development–road clearing	A	Ongoing	None
Climate change degradation or loss of habitat	A	Ongoing	None

Low numbers	E	Ongoing	Partial, collection, propagation, and reintroduction
Hiking and trail maintenance	E	Ongoing	None

Synthesis:
Three wild individuals remain at two locations in and around Laupāhoehoe NAR. 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 *Phyllostegia warshaueri* is vulnerable to the effects of climate change. Seed and cuttings collections from wild and reintroduced individuals, propagation, and reintroduction are ongoing. Approximately 313 individuals were reintroduced; however, survival rates and recruitment are unknown. Reintroduced populations within Laupāhoehoe NAR, Pu‘u o Umi NAR, and Pu‘uwa‘awa‘a are provided protection from feral ungulates by fencing and ungulate control. Nonnative plants are controlled within exclosures at Laupāhoehoe NAR.

Stabilizing (interim), downlisting, and delisting objectives were provided in the Big Island II: Addendum to the Recovery Plan for Big Island Plants (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.

Phyllostegia warshaueri is a short-lived perennial scandent vine. 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 the island of Hawai‘i 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. There are only three wild individuals and no regeneration at reintroductions. Although genetic storage goals are complete (at least 10 founders represented) (Table 1), there are only two reintroduced populations totaling at least 50 individuals, and the survivorship and recruitment in these populations is unknown. In addition, all threats are not being managed (Table 1, Table 2).

Therefore, *Phyllostegia warshaueri* 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 2012. Thus, the following recommendations for future actions are reiterated for the 5-year review for 2020.

- Surveys and inventories—Continue to conduct thorough surveys of all historical and suitable habitat for new occurrences and to determine current status of known wild individuals.
- Ungulate monitoring and control—Continue to construct and maintain fenced exclosures to protect individuals from the negative impacts of habitat destruction and degradation, and browsing and trampling by ungulates.
- Invasive plant monitoring and control—Continue to control established ecosystem-altering nonnative invasive plant species, and those that compete with *Phyllostegia warshaueri* at all populations.
- 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 collection and propagation efforts for maintenance of genetic stock and for reintroduction.
    - Track maternal source of propagative materials for use in *ex situ* propagation.
- Reintroduction and translocation—Determine optimal sites and continue to reintroduce individuals into areas that are being managed for known threats.
- Population biology research—
    - Determine relative level of genetic diversity among remaining individuals.
    - Determine pollinators and seed dispersers of *P. warshaueri.*
- Human impact—Develop and implement measures to reduce the impact of road clearing and hiking and trail maintenance.
- Alliance and partnership development—Continue to work with the Hawai‘i Division of Forestry and Wildlife and other partners and land managers in planning and implementation of ecosystem-level restoration and management to benefit this species.

References:

[DLNR DOFAW] Department of Land and Natural Resources-Division of Forestry and Wildlife. 2016. Final environmental assessment and finding of no significant impact, Laupāhoehoe Forest Management Plan, June 2016. 99 pp. + appendices.

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.

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

[PEPP] Plant Extinction Prevention Program. 2013. Annual report fiscal year 2013 (July 1, 2012-June 30, 2013). 207 pp.

[PEPP] 2014. Annual report fiscal year 2014 (July 1, 2013-June 30, 2014). 185 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, Hawai‘i.

[USFWS] U.S. Fish and Wildlife Service. 1998. Big Island II: Addendum to the recovery plan for the Big Island plant cluster, 1998. Portland. 80 pp. + appendices.

[USFWS] 2012. *Phyllostegia warshaueri* 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI. *https://ecos.fws.gov/docs/five_year_review/doc4065.pdf.*

[USFWS] 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. 88 FR 20088, May 7, 2018.

[VRPF] Volcano Rare Plant Facility. 2013-2019. Summary of reports 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.

U.S. FISH AND WILDLIFE SERVICE
SIGNATURE PAGE for 5-YEAR REVIEW of *Phyllostegia warshaueri*
(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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