5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Phyllostegia racemosa* (kīponapona)

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:

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 2019. The review was based on a review of current, available information since the last 5-year review for *Phyllostegia racemosa* (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 racemosa* published in the Federal Register on August 8, 2012 (available at *https://ecos.fws.gov/docs/five_year_review/doc4067.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. racemosa*.

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 racemosa* are provided in the tables below.

New Status Information:

- No wild individuals of *Phyllostegia racemosa* were known at the time of the 5-year review in 2012. In 2014, an individual was found along a hiking trail passing through ʻĀinahou and Waiākea Upper on State land (PEPP 2015; VanDeMark 2020, in litt.). Collections of propagative materials were made; however, the wild plant has not been observed since that time.

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 racemosa* is vulnerable to the impacts of climate change, with a vulnerability score of 0.281 (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—Surveys were conducted in 2014-2016 by foot, vehicle, and helicopter (Kendall and Horiuchi 2018, pp. 10–11). The Hakalau Forest National Wildlife Refuge (FNWR) received funding to conduct surveys to search for additional plants on refuge lands (Kendall and Horiuchi 2018, pp. 10–11). Funding was received for development of a plant database (for locations and status) (Kendall and Horiuchi 2018, pp. 10–11).
- Ungulate monitoring and control—At Hakalau FNWR grant funds have been used for fence replacement, construction of exclosures, and ungulate control in the Maulua management unit (Kendall and Horiuchi 2018, pp. 10–11). An additional 10-ac exclosure was constructed by the Plant Extinction Prevention Program (PEPP) closer to the refuge's administration site for easier access to propagative materials (Kendall and Horiuchi 2018, pp. 10–11).
- Established ecosystem altering invasive plant species control—Herbicides are used to control nonnative grasses at Hakalau FNWR reintroduction sites (Kendall and Horiuchi 2018, p. 8).
- Captive propagation for genetic storage and reintroduction—
    - Hakalau FNWR reported receiving funds for construction of a greenhouse dedicated to rare plants and staff to propagate them (Kendall and Horiuchi 2018, pp. 10–11). In 2018, there were 78 plants in the greenhouse (Kendall and Horiuchi 2018, p. 9). Propagules have been sent to Volcano Rare Plant Facility (VRPF) as a back-up collection. In 2019, there were 15 plants in their nursery (Kendall and Horiuchi 2020, p. 12).
    - The Lyon Arboretum Micropropagation Laboratory reported 288 explants in storage representing one wild plant at ʻĀinahou (Lyon Arboretum

2019). The Lyon Seed Conservation Laboratory reported collection and storage of 28 seeds representing one wild plant at ʻĀinahou (Lyon Arboretum 2019).
    - The Volcano Rare Plant Facility (VRPF) reported propagation of 38 plants from Hakalau with 36 remaining in inventory, three plants from Keauhou with 17 in inventory, and six plants from Waiākea Upper with three in inventory (VRPF 2013-2019). Currently, they have 17 plants in their living collection from Hakalau, 1 from Keahou, and 3 from Upper Waiākea Forest Reserve (VRPF 2019).
- Reintroduction and translocation—
    - Since 1999, Hakalau FNWR has planted 1,639 *P. racemosa* (representing three founders), 144 of those in 2018, 136 in 2019 (Kendall and Horiuchi 2018, p. 9; Kendall and Horiuchi 2020, p. 12; PEPP 2019). Survival is unknown.
    - Plants were reintroduced in Hawai‘i Volcanoes National Park (HVNP), but none survived (National Park Service (NPS) 2015, p. 465).
    - In 2016, 21 plants representing two founders from Hakalau and one founder from Waiākea Upper were reintroduced to ʻĀinahou (PEPP 2019).
    - Three reintroduced populations were established at Kūlani: 48 individuals (representing one founder) at the north boundary, 34 at Puu Kīpū (representing two founders), and 9 (representing one founder) at Kūlani Bog (PEPP 2019).
    - Two reintroduced populations have been established at exclosures within Laupāhoehoe Natural Area Reserve (127 and 4 individuals, respectively) (PEPP 2019).
    - One reintroduced population was established at Maulua Nui (27 individuals representing three founders) (PEPP 2019).
    - VRPF reported propagation of 51 plants for reintroduction at Hakalau FNWR, 25 plants for reintroduction at Kūlani (Keauhou), 9 plants sourced from Waiākea Upper for reintroduction at Kūlani, and 12 plants sourced from Waiākea Upper for reintroduction at Kipāhoehoe (VRPF 2013-2019).
- Population biology research—Development of successful propagation methods is ongoing (Kendall and Horiuchi 2018, p. 11).

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

Date	No. wild individuals	No. outplanted	Stabilization Criteria identified in Recovery Plan	Stabilization Criteria Completed?
1996 (listing)	25–45	0	All threats managed in all 3 populations	No

			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
1998 (recovery plan)	35–45	0	All threats managed in all 3 populations	Partially
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
2003 (critical habitat)	10	95	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	No
2012 (5-year review)	0	943	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)	1, last observed 2014	>2,000 planted; current number unknown; low survival rate	All threats managed in all 3 populations	Partially
			Complete genetic storage	Yes

			Reproduction (i.e. viable seeds, seedlings) at all 3 populations	Partially, seedlings observed at one reintroduced population
			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 racemosa* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulate degradation of habitat	A	Ongoing	Partial, Hakalau FNWR and HVNP fenced and ungulates managed
Established ecosystem altering invasive plant species degradation of habitat	A, E	Ongoing	Partial, nonnative plant control at Hakalau Forest NWR and HVNP
Lava flows	A	Potential	Partial, some reintroduced populations in lower risk areas
Climate change degradation or loss of habitat	A	Ongoing	None
Predation and herbivory by ungulates	C	Ongoing	Partial, Hakalau FNWR and HVNP fenced and ungulates managed
Disease	C	Potential	None, diseases reported on other native *Phyllostegia*
Inadequate regulatory mechanisms—hunting	D	Ongoing	Partial, Hakalau FNWR and HVNP fenced and ungulates managed
Commercial timber harvest	E	Ongoing	None

Synthesis:
One wild individual was last observed in 2014. 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 racemosa* is vulnerable to the effects of climate change. Seed collection from

reintroduced individuals, propagation, and reintroduction are ongoing. More than 2,000 individuals were reintroduced; however, survival rates are very low and the current number surviving is unknown. Reintroduced populations within Hakalau FNWR and Hawai‘i Volcanoes National Park are provided protection from feral ungulates by fencing and ungulate control. Nonnative plants are controlled within exclosures.

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 racemosa 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 is only one wild plant remaining, and recruitment has only been documented at one reintroduction, with regeneration unknown (Table 1). Genetic storage goals have been met with at least 3 founders represented (greater than the total number of extant plants) (Table 1), but not all threats are being managed (Table 1, Table 2). Therefore, *Phyllostegia racemosa* 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.
- 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 racemosa* 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.
- Disease—Monitor populations for evidence of plant diseases and implement effective control methods if necessary.
- 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.
    - Develop horticultural protocols and pest management practices for rare plant nurseries.
- Reintroduction and translocation—Determine optimal sites and continue to reintroduce individuals into areas that are being managed for known threats.
- Population biology research—
    - Conduct molecular fingerprinting of *ex situ* stock.
    - Determine pollination and dispersal agents.
    - Determine if *P. racemosa* is a true epiphyte.
- Human impact—Develop and implement measures to reduce the impact of commercial logging.
- Alliance and partnership development—Continue to work with the Hawai‘i Division of Forestry and Wildlife, Hakalau FNWR and other partners and land managers in planning and implementation of ecosystem-level restoration and management to benefit this species.

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

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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