

Phyllostegia warshaueri
(No common name)

**5-Year Review
Summary and Evaluation**

**U.S. Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office
Honolulu, Hawaii**

5-YEAR REVIEW

Species reviewed: *Phyllostegia warshaueri* (No common name)

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5-YEAR REVIEW
***Phyllostegia warshaueri* (No common name)**

1.0 GENERAL INFORMATION

1.1 Reviewers

Lead Regional Office:

Region 1, Endangered Species Program, Division of Recovery, Jesse D'Elia,
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Lead Field Office:

Pacific Islands Fish and Wildlife Office, Loyal Mehrhoff, Field Supervisor, (808)
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Cooperating Field Office(s):

N/A

Cooperating Regional Office(s):

N/A

1.2 Methodology used to complete the 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 April 8, 2010. The review was based on the designation of critical habitat for *Phyllostegia warshaueri* and the Big Island II: Addendum to the recovery plan for the Big Island plant cluster (USFWS 2003, 1998), as well as a review of current, available information. The Bernice Pauahi Bishop Museum provided an initial draft of portions of the review and recommendations for conservation actions needed prior to the next five-year review. The evaluation of Samuel Aruch, biological consultant, was reviewed by a recovery biologist and the Plant Recovery Coordinator. The document was then reviewed by the Recovery Program Leader and the Assistant Field Supervisor for Endangered Species before submission to the Field Supervisor for approval.

1.3 Background:

1.3.1 Federal Register (FR) Notice citation announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2010. Endangered and threatened wildlife and plants; 5-year review status of 69 species in Idaho, Washington, Hawaii, Guam, and the Commonwealth of the Northern Mariana Islands. Federal Register 75(67):17947-17950.

1.3.2 Listing history

Original Listing

FR notice: USFWS. 1996. Endangered and threatened wildlife and plants; determination of endangered status for thirteen plants from the island of Hawaii, State of Hawaii; final rule. Federal Register 61(198):53137-53153.

Date listed: October 10, 1996

Entity listed: Species

Classification: Endangered

Revised Listing, if applicable

FR notice: N/A

Date listed: N/A

Entity listed: N/A

Classification: N/A

1.3.3 Associated rulemakings:

USFWS. 2003. Endangered and threatened wildlife and plants; final designation and nondesignation of critical habitat for 46 plant species from the island of Hawaii, Hawaii; final rule. Federal Register 68(127):39624-39761.

Critical habitat was designated for *Phyllostegia warshaueri* in two units totaling 3,648 hectares (9,013 acres) on Hawaii Island. These designations include habitat on State and private lands (USFWS 2003).

1.3.4 Review History:

Species status review [FY 2011 Recovery Data Call (August 2011)]:

Stable

Recovery achieved:

1 (0-25%) (FY 2007 Recovery Data Call)

1.3.5 Species' Recovery Priority Number at start of this 5-year review:

2

1.3.6 Current Recovery Plan or Outline

Name of plan or outline: USFWS. 1998. Big Island II: Addendum to the recovery plan for the Big Island plant cluster. U.S. Fish and Wildlife Service, Portland, Oregon. 80 pages + appendices. Available online at <http://www.fws.gov/pacificislands/recoveryplans.html>.

Date issued: May 11, 1998

Dates of previous revisions, if applicable: N/A

2.0 REVIEW ANALYSIS

2.1 Application of the 1996 Distinct Population Segment (DPS) policy

2.1.1 Is the species under review a vertebrate?

Yes
 No

2.1.2 Is the species under review listed as a DPS?

Yes
 No

2.1.3 Was the DPS listed prior to 1996?

Yes
 No

2.1.3.1 Prior to this 5-year review, was the DPS classification reviewed to ensure it meets the 1996 policy standards?

Yes
 No

2.1.3.2 Does the DPS listing meet the discreteness and significance elements of the 1996 DPS policy?

Yes
 No

2.1.4 Is there relevant new information for this species regarding the application of the DPS policy?

Yes
 No

2.2 Recovery Criteria

2.2.1 Does the species have a final, approved recovery plan containing objective, measurable criteria?

Yes
 No

2.2.2 Adequacy of recovery criteria.

2.2.2.1 Do the recovery criteria reflect the best available and most up-to date information on the biology of the species and its habitat?

Yes
 No

2.2.2.2 Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria?

Yes
 No

2.2.3 List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information:

A synthesis of the threats (Listing Factors A, B, C, D, and E) affecting this species is presented in Section 2.3.2 and Table 2.

Stabilizing, downlisting, and delisting objectives are provided in the Big Island II: Addendum to the recovery plan for the Big Island plant cluster (USFWS 1998), based on whether the species is an annual, a short-lived perennial (fewer than 10 years), or a long-lived perennial. *Phyllostegia warshaueri* is a short-lived perennial, and to be considered stable, which is the first step in recovering the species, the taxon must be managed to control threats (*e.g.*, fenced) and be represented in an *ex situ* collection. In addition, a minimum of three populations should be documented on the Big Island (Hawaii Island). For the species to be considered stable, each of these populations must be naturally reproducing and increasing in number, with a minimum of 50 mature individuals per population.

This recovery objective has not been met.

For downlisting, a total of five to seven populations of *Phyllostegia warshaueri* should be documented on the island of Hawaii. Each of these populations must be naturally reproducing, stable or increasing in number, and secure from threats, with a minimum of 300 mature individuals per population. Each population should persist at this level for a minimum of five consecutive years before downlisting is considered.

This recovery objective has not been met.

For delisting, a total of eight to ten populations of *Phyllostegia warshaueri* should be documented on the island of Hawaii. Each of these populations must be naturally reproducing, stable or increasing in number, and secure from threats, with 300 mature individuals per population. Each population should persist at this level for a minimum of five consecutive years before delisting is considered.

This recovery objective has not been met.

2.3 Updated Information and Current Species Status

2.3.1 Biology and Habitat

2.3.1.1 New information on the species' biology and life history:

Phyllostegia warshaueri is a short-lived perennial species (USFWS 1998). Its growth habit is decumbent to scandent (climbing or clambering) (Wagner *et al.* 1999).

2.3.1.2 Abundance, population trends (e.g. increasing, decreasing, stable), demographic features (e.g., age structure, sex ratio, family size, birth rate, age at mortality, mortality rate, etc.), or demographic trends:

Historically, *Phyllostegia warshaueri* is known from the northern slopes of Mauna Kea (Laupahoehoe) and from the Kohala Mountains (Wagner *et al.* 1999).

After the time of listing, *Phyllostegia warshaueri* was known from 5 to 10 individuals comprising two populations in the Kohala Mountains near the Hamakua Ditch Trail (USFWS 1996).

Marie Bruegmann (Pacific Islands Fish and Wildlife Office, pers. comm. 1998) observed approximately five individuals in Laupahoehoe Natural Area Reserve at approximately 915 meters (3,000 feet) elevation and reported then that only 12 individuals were known. At approximately the same time, USFWS (1998) reported four populations containing a total of 5 to 10 individuals in the same regions – from Laupahoehoe; from the Waipunalei boundary and within Laupahoehoe Natural Area Reserve; at the Ookala Trail; and near the Hamakua Ditch Trail in the Kohala Mountains. Wagner (1999) reported 3 to 10 individuals from Laupahoehoe near Kilau Stream.

At the time when critical habitat was designated in 2003, there were 7 locations on State and privately-owned lands; 3 populations with 12 individuals in Laupahoehoe Natural Area Reserve near the Waipunalei boundary; 2 populations in the Hilo Forest Reserve with an unknown number of individuals; and a single population containing 2 individuals in the Kohala Forest Reserve at the Ookala Trail and near the Hamakua Ditch Trail; and a single population on private land just outside the Kohala Forest Reserve in Waipio Valley near Kaiwainui Stream (USFWS 2002). Fourteen individuals were located in critical habitat units (USFWS 2003).

In July of 2007, surveys for *Phyllostegia warshaueri* occurred at Kohala (Muliwai Gap and Bog Camp areas), although no individuals were observed. The survey in May 2008 of several sites along the Ditch Trail at

Kohala also revealed no wild individuals (Plant Extinction Prevention Program 2008).

The Plant Extinction Prevention Program (2010) reported three individuals at Puu Pili. Giffin (2009) also mentioned observing *P. warshaueri* growing at the base of the crater at Puuwaawaa, but no further information was provided.

2.3.1.3 Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.):

Lindqvist *et al.* (2003) included *Phyllostegia warshaueri* in a study of Hawaiian mints of the genera *Phyllostegia* and *Stenogyne*. Using DNA sequences from the 5S transcribed spacer region of nuclear ribosomal DNA, the authors found a large but poorly resolved clade that included species of *Phyllostegia* intermixed with members of *Stenogyne*. These genera may in time be merged with *Stachys* if further data corroborate initial studies (Lindqvist and Albert 2002; Lindqvist *et al.* 2003).

2.3.1.4 Taxonomic classification or changes in nomenclature:

A member of the mint family (Lamiaceae), the species was first described at the varietal level as *Phyllostegia ambigua* A. Gray var. *longipes* Hillebr. (Hillebrand 1888). Sherff (1934, 1935) maintained this taxon at the varietal level but transferred it to *P. brevidens* A. Gray var. *longipes* (Hillebr.) Sherff. St. John (1987) raised this taxon in rank to the species level, which has been followed subsequently (Wagner *et al.* 1999; Wagner 1999).

Still little is known about the life history of *Phyllostegia warshaueri*. Its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors remain unknown (USFWS 2002).

2.3.1.5 Spatial distribution, trends in spatial distribution (e.g. increasingly fragmented, increased numbers of corridors, etc.), or historic range (e.g. corrections to the historical range, change in distribution of the species' within its historic range, etc.):

No new information.

2.3.1.6 Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem):

Phyllostegia warshaueri is typically found on old volcanic substrates between 730 and 1,150 meters (2,395 to 3,773 feet) elevation (USFWS 1998). It occurs in *Metrosideros polymorpha* (ohia) and *Cibotium* spp. (hapuu) forests in montane and lowland wet forests, where *Acacia koa* (koa) or *Cheirodendron trigynum* (olapa) may co-dominate (USFWS 1998, 2002). Associated native plant taxa include *Sadleria pallida* (amau), *Antidesma platyphyllum* (hame), *Psychotria hawaiiensis* (kopiko), *Pipturus albidus* (mamaki), *Clermontia parviflora* (oha wai), *Broussaisia arguta* (kanawao), *Dubautia plantaginea* (naenae), *Machaerina angustifolia* (uki), *Cyanea pilosa* (haha), and other species of *Cyanea* (USFWS 1998, 2002).

2.3.1.7 Other:

No new information.

2.3.2 Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)

2.3.2.1 Present or threatened destruction, modification or curtailment of its habitat or range:

Threats:

- Ungulate degradation of habitat (Bruegmann pers. comm. 1998; Plant Extinction Prevention Program 2008, 2010; USFWS 1998)
 - Feral pigs (*Sus scrofa*)
 - Cattle (*Bos taurus*)
- Established ecosystem-altering invasive plant species degradation of habitat (Bruegmann pers. comm. 1998; Plant Extinction Prevention Program 2008,2010; USFWS 1998)
 - *Clidemia hirta* (Koster's curse)
 - *Cyathea cooperi* (Australian tree fern)
 - *Hedychium gardnerianum* (kahili ginger)
 - *Psidium cattleianum* (strawberry guava)
- Agricultural and urban development – Ditch improvements and maintenance (USFWS 1996, 1998; Hawaii Department of Land and Natural Resources 2005)

Current conservation efforts:

- Ungulate exclosure:

- In May 2009, a fenced enclosure approximately 69 by 23 meters (225 by 75 feet) was built by the Big Island Plant Extinction Prevention program coordinator and Natural Area Reserve System staff to protect several rare species within the Laupahoehoe Natural Area Reserve and Forest Reserve, including *Phyllostegia warshaueri* (Plant Extinction Prevention Program 2009). This enclosure will be used as a reintroduction site for other rare plant species.
- In 1999, an existing fence at the Kohala Bogs within Puu O Umi Natural Area Reserve was ‘winged’ to enlarge the size of the fenced enclosure by the Hawaii Island Plant Extinction Prevention Program coordinator and staff from the Natural Area Reserve System. The enlarged area will be used as a reintroduction site for several rare species including *Phyllostegia warshaueri* (Plant Extinction Prevention Program 2009).

2.3.2.2 Overutilization for commercial, recreational, scientific, or educational purposes:

None reported.

2.3.2.3 Disease or predation:

None reported.

2.3.2.4 Inadequacy of existing regulatory mechanisms:

Threats:

- Lack of adequate hunting regulation in areas with ungulates – The lack of adequate ungulate control and the existence of established hunting programs in areas where *Phyllostegia warshaueri* occurs continue to threaten this species.

2.3.2.5 Other natural or manmade factors affecting its continued existence:

Threats:

- Low numbers (USFWS 1996, 1998; Hawaii Department of Land and Natural Resources 2005).
- Established invasive plant species competition (Brueggemann pers. comm. 1998; Plant Extinction Prevention Program 2008; USFWS 1998)

- *Angiopteris evecta* (mule's-foot fern)
- *Juncus planifolius* (rush)
- *Melastoma septemnerium* (no common name)
- *Setaria palmifolia* (palmgrass)
- *Tibouchina herbacea* (glorybush)
- Hiking and trail maintenance (USFWS 1996, 1998; Hawaii Department of Land and Natural Resources 2005)
- 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) has currently funded climate modeling that will help resolve these spatial limitations. We anticipate high spatial resolution climate outputs by 2013.

Current conservation efforts:

- Surveys / inventories:
 - In July 2007, a survey was conducted for *P. warshaueri* in Kohala (Muliwai Gap and Bog Camp areas), although no individuals were seen (Plant Extinction Prevention Program 2008).
 - In May 2008, a survey of several sites along the Ditch Trail at Kohala also revealed no wild individuals (Plant Extinction Prevention Program 2008).
- Captive propagation for genetic storage and reintroduction:
 - The Volcano Rare Plant Facility (2011) reported 30 individuals in captive propagation between 2010 and 2011.
 - In April 1998, cuttings of *Phyllostegia warshaueri* were taken from Laupahoehoe Natural Area Reserve by Rick Warshauer of the U.S. Geological Service Biological Resources Division from the population of about five individuals surveyed by Bruegmann (pers. comm. 1998) and colleagues. The cuttings were sent to the Volcano Rare Plant Facility (Bruegmann pers. comm. 1998).
- Reintroduction / translocation implementation – The Volcano Rare Plant Facility (2011) reported 197 individuals were reintroduced between 2010 and 2011 at Kohala (155 individuals), Laupahoehoe Natural Area Reserve (28 individuals), and Puuwaawaa (14 individuals).

- Population viability monitoring – In February and April 2010, the status and phenology of individuals of *Phyllostegia warshaueri* at Puu Pili were monitored (Plant Extinction Prevention Program 2010).

2.4 Synthesis

The interim stabilization goals for this species have not been met. As there are only three wild individuals known, there is no population containing more than 50 mature individuals (Table 1). In addition, all threats are not being managed (Table 2). Therefore, *Phyllostegia warshaueri* meets the definition of endangered as it remains in danger of extinction throughout its range.

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

Date	No. wild individuals	No. outplanted	Stabilization Criteria identified in Recovery Plan	Stabilization Criteria Completed?
1996 (listing)	3-10	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
1998 (recovery plan)	5-12	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
2003 (critical habitat)	>14	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 (see Table 2)
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	No

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	Partially: Ungulate exclosures at Laupahoehoe Natural Area Reserve and Kohala Bogs
Established ecosystem-altering invasive plant species degradation of habitat	A	Ongoing	No
Agricultural and Urban development – Road clearing	A	Ongoing	No
Established invasive plant species competition	E	Ongoing	No
Low numbers	E	Ongoing	Partially: Captive propagation for genetic storage and reintroduction, reintroduction / translocation implementation, and monitoring
Hiking and trail maintenance	E	Ongoing	No
Climate change	A, E	Increasing	No

3.0 RESULTS

3.1 Recommended Classification:

Downlist to Threatened

Uplist to Endangered

Delist

Extinction

Recovery

Original data for classification in error

No change is needed

3.2 New Recovery Priority Number:

Brief Rationale:

3.3 Listing and Reclassification Priority Number:

Reclassification (from Threatened to Endangered) Priority Number: _____
Reclassification (from Endangered to Threatened) Priority Number: _____
Delisting (regardless of current classification) Priority Number: _____

Brief Rationale:

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

- Captive propagation for genetic storage and reintroduction:
 - Continue to collect seeds from all existing populations and send to at least two or three different venues for propagation and genetic storage.
 - Collect cuttings or seed from tagged individuals, keeping close track of the maternal source for use in *ex situ* propagation.
- Reintroduction / translocation site identification – Reintroduction attempts should be made in the Kohala Mountains and Laupahoehoe Natural Area Reserve within sites that are free from ungulates (fenced) and introduced invasive plant species.
- Reintroduction / translocation implementation – Continue to reintroduce the species back into its known historical range.
- Genetic research – Conduct genetic fingerprinting research to determine the relative level of genetic diversity among remaining individuals.
- Ecosystem-altering invasive plant species control – Control invasive introduced plant species around all populations.
- Ungulate exclosures – Continue to construct ungulate-proof fenced exclosures around all known populations in the Kohala Mountains and Laupahoehoe area.
- Ungulate control – Protect all populations against disturbances from feral ungulates.
- Surveys / inventories – Re-survey the known historical range of the species for surviving populations and potentially undiscovered populations.
- Site / area / habitat protection – Develop and implement effective measures to reduce the impact of road clearing and hiking and trail maintenance.
- Population biology research – Carry out field studies to determine what agents pollinate the flowers and disperse the seeds of this species and other aspects of its life history cycle.
- Threat monitoring and control – Monitor the health of existing populations and determine if any insects or plant diseases might be affecting the survival of individuals. If threats are found, implement effective control methods.
- Alliance and partnership development – Work with the Hawaii Division of Forestry and Wildlife and other land managers to continue implementation of ecosystem-level restoration and management to benefit this species.

- 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.

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U.S. FISH AND WILDLIFE SERVICE
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
 No Change in listing status

Appropriate Listing/Reclassification Priority Number, if applicable: _____

Review Conducted By:

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Marie Bruegmann, Plant Recovery Coordinator
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for
Jess Newton

Date 8/28/2012