

Phyllostegia velutina
(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 velutina* (No common name)

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

1.0 GENERAL INFORMATION

1.1 Reviewers

Lead Regional Office:

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Lead Field Office:

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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 velutina* 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. 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 or threatened status for thirteen plant species 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 velutina* in two units totaling 3,646 hectares (9,009 acres) on State lands on Hawaii Island (USFWS 2003).

1.3.4 Review History:

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

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 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 ten years), or a long-lived perennial. *Phyllostegia velutina* is a short-lived perennial, and to be considered stabilized, 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* (off-site) 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 velutina* 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 velutina* 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:

Baskin and colleagues (no date) report that *Phyllostegia velutina* exhibits “physiological dormancy,” wherein the seed has inadequate push power or growth potential to overcome the mechanical constraints of the seed coat (and other tissues, if present) that surround it.

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:

At the time of its listing (USFWS 1996), approximately 30 to 55 individuals were known from three populations on State lands, including the wildlife sanctuary at Puuwaawaa, Honuaula Forest Reserve, and Kulani /Keauhou Correctional Facility and adjacent privately owned land (USFWS 1996).

When the Recovery Plan was released there were five populations consisting of 63 to 116 individuals (USFWS 1998). These populations were located at the Honuaula Forest Reserve, near the Waiea tract in South Kona, in Puuwaawaa, and near the Kulani Correctional Facility (USFWS 1998). In 2002, there were five known populations consisting of approximately 100 individuals (USFWS 2002).

In 2003, there were a total of eight populations of *Phyllostegia velutina*, with an unknown number of individuals located in the Kau Forest Reserve and seven individuals within the Kaahakini watershed near the Kulani summit and on adjacent Kamehameha Schools land (USFWS 2003). When critical habitat was designated (USFWS 2003), the eight populations cited for Hakalau Forest National Wildlife Refuge represented a change in how populations were listed, and reflected an increase from what previously had been cited as five “locations.” As of 2010, only a single *P. velutina* individual was known from Hakalau Forest National Wildlife Refuge; it lies in a natural gulch that provided some protection, and was first observed in 1991 (Jeffrey and Horiuchi 2008; USFWS 2010).

According to Nick Agorastos (Hawaii Department of Land and Natural Resources, pers. comm. 2011), the populations of *Phyllostegia velutina* in Puuwaawaa Bird Sanctuary, Kulani and Kau Forest Reserve sections of Puu Makaala probably still exist, although he was unable to confirm with

certainty the situation at Kau Forest Reserve. Surveys completed in 2002 to 2005 indicated that *P. velutina* may only occur within the Puuwaawaa Forest Bird Sanctuary in an area that is fenced, although feral pigs (*Sus scrofa*) are still being removed within the fence (Edith Nonner, Hawaii Department of Land and Natural Resources, pers. comm. 2011). Botanical crews have observed 45 individuals within 15 populations in Puuwaawaa Forest Bird Sanctuary.

Currently, *Phyllostegia velutina* is known from populations in three areas (Puuwaawaa, Honuaula Forest Reserve, and Kulani /Keauhou area) with estimates of more than 116 individuals (USFWS 1998; Giffin 2009; N. Agorastos, pers. comm. 2011). Another population was reported from the general area of Waiea Tract on State-owned land in South Kona, but the exact location and current status of this population are unknown (USFWS 1998).

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

Phyllostegia velutina was included in a molecular study (using the 5S-NTS region of nuclear ribosomal DNA) that studied the origin of the endemic Hawaiian mints (Lindqvist and Albert 2002). The study concluded that Hawaiian mints are evolutionarily (cladistically) nested within the North American genus *Stachys* L. If further studies corroborate these results then members of *Phyllostegia* may be transferred into the genus *Stachys* at a later time. Lindqvist *et al.* (2003) further demonstrated that members of the genus *Stenogyne* are phylogenetically mixed with members of *Phyllostegia* in a clade of Hawaiian mints, which likely originated from polyploid North American ancestors.

2.3.1.4 Taxonomic classification or changes in nomenclature:

Phyllostegia velutina (Sherff) H. St. John is an endangered member of the mint family (Lamiaceae). The type specimen was collected in 1840 on Mauna Kea as part of the U.S. Exploration Expedition. This species, which has no consistently used vernacular name, was first described by Sherff (1934) at the varietal level as *P. macrophylla* (Gaudich.) Benth. var. *velutina*. The Hawaiian species of *Phyllostegia* were revised by Sherff (1935). In 1987, Harold St. John raised the taxonomic rank to the species, which was followed by Wagner (1999) and colleagues (Wagner *et al.* 1999).

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):

Historically, *Phyllostegia velutina* was reported on the southern slopes of Hualalai and the eastern, western, and southern slopes of Mauna Loa (Wagner 1999; USFWS 2010). The species is found in montane mesic and dry forests to montane wet forests with annual rainfall that varies from 12 to over 100 inches (300 to over 2,000 millimeters). At Puuwaawaa the species occurs in the upper mesic zone (Giffin 2009). Associated native species at Puuwaawaa includes *Vicia menziesii* (Hawaiian vetch) and *Cyanea stictophylla* (haha). In the *Metrosideros polymorpha* (ohia) – and *Acacia koa* (koa) dominated montane mesic and montane wet forests, *Phyllostegia velutina* occurs with *Cheirodendron trigynum* (olapa), *Dryopteris wallichiana* (laukahi), *Myrsine lessertiana* (kolea), *Coprosma* spp. (pilo), *Vaccinium calycinum* (ohelo), *Rubus hawaiensis* (akala), *Pipturus albidus* (mamaki), *Ilex anomala* (kawau), and *Cibotium* spp. (hapuu) (USFWS 1996, 1998, 2002, 2010).

2.3.1.7 Other:

Land snails have been reported on leaves of *Phyllostegia velutina*, although the species were not indicated (Giffin 2009). A heteropteran species of the genus *Sarona* (mirid leaf bugs) and an undetermined species of leafhopper (*Nesophyrne* sp.) have been observed on *P. velutina* (Giffin 2009).

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 (USFWS 2010)
 - Cattle (*Bos taurus*)
 - Feral pigs (*Sus scrofa*)
 - Sheep (*Ovis aries*)
- Established ecosystem-altering invasive plant species degradation of habitat (USFWS 1996, 1998)
 - *Pennisetum clandestinum* (kikuyu grass)

- *Pennisetum setaceum* (fountain grass)
- *Rubus ellipticus* (yellow Himalayan raspberry)
- Lava flow degradation of habitat – Fire and habitat changes due to volcanic activity (USFWS 1996, 1998)
- Timber management – Logging (USFWS 2010)
- Agricultural and urban development – Road clearing (USFWS 2010)

Current conservation efforts:

- Ungulate exclosure:
 - Fences were constructed at various times to protect *Phyllostegia velutina* from ungulates at Puuwaawaa, Middle Honohina unit, Shipman unit, Upper Maulua unit, Upper Honohina unit, Middle Papaikou unit, and Pua Akala unit (USFWS 1998, 2002).
 - Fences were constructed on land managed cooperatively by the Three Mountain Alliance (formerly known as Olaa-Kilauea Partnership) (USFWS 1998, 2002).
 - Individuals located within Puuwaawaa Forest Bird Sanctuary are fenced (E. Nonner, Hawaii Department of Land and Natural Resources, pers. comm. 2011).
- Ungulate control – Feral pigs are being removed within fenced exclosures at Puuwaawaa Forest Bird Sanctuary (E. Nonner, Hawaii Department of Land and Natural Resources, pers. comm. 2011).

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 vellutina* occurs continue to threaten this species.

2.3.2.5 Other natural or manmade factors affecting its continued existence:

Threats:

- Established invasive plant species competition (USFWS 1996, 1998)
 - *Paspalum urvillei* (Vasey's grass)
- Human disturbance:
 - Prison expansion (USFWS 1996, 2010)
 - Hiking, trail maintenance, road work, ranching, and logging (USFWS 1996)
- 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:

- Captive propagation for genetic storage and reintroduction:
 - In 1998, the National Tropical Botanical Garden had 251 seeds of *Phyllostegia velutina* in storage and 2 individuals in cultivation in a greenhouse or nursery (USFWS 1998).
 - The Volcano Rare Plant Facility had 282 individuals in cultivation. In 2007, three new accessions were received of *P. velutina* from Puuwaawaa Plant Sanctuary (Plant Extinction Prevention Program 2007).
 - The Volcano Rare Plant Facility reported 55 individuals in captive propagation from 2010 to 2011 (Volcano Rare Plant facility 2011).
- Reintroduction / translocation implementation:
 - Since 1991, a total of 121 individuals of *Phyllostegia velutina* have been reintroduced into Hakalau Forest National Wildlife Refuge (Jeffrey and Horiuchi 2008). The numbers of individuals reintroduced by year were: 1999 (27 individuals); 2000 (2); 2001 (33); 2002 (20); 2003 to 2005 (none); 2006 (9); and 2007 (30) (Jeffrey and Horiuchi 2008). By 2003, only 52 percent (43 of 82) of the

individuals reintroduced into Hakalau had survived (Jeffrey and Horiuchi 2008).

- USFWS (2010) reported that 112 individuals of *P. velutina* were reintroduced at Hakalau Forest Unit from 1999 to 2007 (USFWS 2010). This figure is not in agreement with Jeffrey and Horiuchi (2008), who reported 121 specimens were reintroduced from 1997 to 2007 (see above). The most recent information (USFWS 2010) indicated the species is still in cultivation at Hakalau Forest National Wildlife Refuge, and 60 individuals were reintroduced into Upper Maulua Tract in 2010.
- In 2007, 35 individuals of *P. velutina* were reintroduced to Puuwaawaa Plant Sanctuary (Plant Extinction Prevention Program 2007).
- The Volcano Rare Plant Facility reported 163 individuals reintroduced from 2010 to 2011 (Volcano Rare Plant facility 2011).

2.4 Synthesis

The interim stabilization goals for this species have not been met. *Phyllostegia velutina* is known from three areas (Puuwaawaa, Honuaula Forest Reserve, and Kulani/Keauhou area) with estimates of more than 116 individuals. However, none of these populations contain more than 50 mature individuals (Table 1), and all threats are not being managed (Table 2). Therefore, *Phyllostegia velutina* meets the definition of endangered as it remains in danger of extinction throughout its range.

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

Date	No. wild individuals	No. outplanted	Stabilization Criteria identified in Recovery Plan	Stabilization Criteria Completed?
1996 (listing)	30-55	0	All threats managed in all 3 populations	Partially
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
1998 (recovery plan)	63-116	27 (planted in 1999)	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	No
2003 (critical habitat)	~100	0	All threats managed in all 3 populations	Partially
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
2012 (5-year review)	116	~223	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 velutina* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulates – Degradation of habitat	A, D	Ongoing	Partially: Ungulate exclosures at Puuwaawaa, units at Hakalau Forest, and Kulani/Keauhou areas; ungulate control at Puuwaawaa
Established ecosystem-altering invasive plant species degradation of habitat	A	Ongoing	No
Lava flow degradation of habitat	A	Ongoing	No
Timber management – Logging	A	Ongoing	No
Agricultural and urban development – Road clearing	A	Ongoing	No
Established invasive plant species competition	E	Ongoing	No
Human disturbance	E	Ongoing	No
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 implementation – Continue to reintroduce the species back into its known historical range.
- Reintroduction / translocation site identification – While surveying for new populations or reintroduced populations, determine which sites are least invaded by invasive introduced plant species and which appear to have the highest likelihood of maintaining new reintroductions.
- Ungulate exclosures – Continue to construct fenced exclosures around all populations. Reinforce existing fencing, if there is evidence that it is being breached.
- Ungulate control – Protect all populations against disturbances from feral ungulates.
- Ecosystem-altering invasive plant species control – Control invasive introduced plant species around all populations.
- Surveys / inventories – Survey the historical range of the species for additional populations.
- Site / area / habitat protection – Develop and implement effective measures to reduce the impact of timber management (logging), road clearing, human disturbance, and hiking and trail maintenance.
- Threat monitoring and control – Continue to survey known populations for evidence of plant disease and insect predation. If threats are found, implement effective control methods.
- Population biology research – Carry out field studies to determine what agents pollinate the flowers and disperse the seeds of this species.
- Alliance and partnership development – Work with the Hawaii Division of Forestry and Wildlife, Hakalau Forest National Wildlife Refuge, 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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Personal Communications:

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Nonner, Edith. 2011. Habitat Conservation Planner, Hawaii Department of Land and Natural Resources, Division of Forestry and Wildlife, Hilo, Hawaii. E-mail to Neil Snow, Bishop Museum, dated January 27, 2011. Subject: *Phyllostegia velutina*.

Signature Page
U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of *Phyllostegia velutina* (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:

Chelsie Javar, Fish and Wildlife Biologist
Marie Bruegmann, Plant Recovery Coordinator
Jess Newton, Endangered Species Recovery Program Leader
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Date 8/28/2012