Phyllostegia mollis
(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 mollis* (No common name)

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5-YEAR REVIEW
Phyllostegia mollis/ No common name

1.0 GENERAL INFORMATION

1.1 Reviewers

Lead Regional Office:
Region 1, Endangered Species Program, Division of Recovery, Jesse D'Elia, (503) 231-2071

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 (PIFWO) of the U.S. Fish and Wildlife Service (USFWS) beginning on March 8, 2007. The Bernice P. Bishop Museum provided most of the updated information on the current status of *Phyllostegia mollis* and also provided recommendations for conservation actions needed prior to the next five-year review. The document was then reviewed by the Recovery Program Leader and acting Assistant Field Supervisor for Endangered Species, and Deputy Field Supervisor, 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. 2007. Endangered and threatened wildlife and plants; initiation of 5-year reviews of 71 species in Oregon, Hawaii, Commonwealth of the Northern Mariana Islands, and Territory of Guam. Federal Register 72(45):10547-10550.

1.3.2 Listing history

Original Listing
FR notice: USFWS. 1991. Endangered and threatened wildlife and plants; determination of endangered status for 26 plants from the Waianae Mountains, island of Oahu, Hawaii; final rule. Federal Register 56(209):55770-55786
Date listed: October 29, 1991
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. 2003a. Endangered and threatened wildlife and plants; designation of critical habitat for 60 plant species from the Islands of Maui and Kahoolawe, HI; final rule. Federal Register 68(93):25934-26165.

USFWS. 2003b. Endangered and threatened wildlife and plants; final designation or nondesignation of critical habitat for 101 plant species from the island of Oahu, HI: final rule. Federal Register 68(116):35949-35998.

Critical habitat was designated for *Phyllostegia mollis* in two units totaling 237 hectares (586 acres) on Oahu and one unit totaling 128 hectares (316 acres) on Maui. This designation includes habitat on State and private lands (USFWS 2003a, b).

1.3.4 Review History:

Species status review [FY 2008 Recovery Data Call (September 2008)]: Declining

Recovery achieved:
1 (0-25%) (FY 2008 Recovery Data Call)

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

5

1.3.6 Current Recovery Plan or Outline

Name of plan or outline: Recovery Plan for the Oahu plants. U.S. Fish and Wildlife Service, Portland, Oregon. 207 pages, plus appendices.
Date issued: August 10, 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***
__X__***No***

2.1.2 Is the species under review listed as a DPS?

____ ***Yes***
__X_ ***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***
__X_ ***No***

2.2 Recovery Criteria

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

__X_ ***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?

__X_ ***Yes***
____ ***No***

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

__X_ ***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 (Factors A, C, D, and E) affecting this species is presented in section 2.4. Factor B (overutilization for commercial, recreational, scientific, or educational purposes) is not known to be a threat to this species.

Stabilizing, downlisting, and delisting objectives are provided in the recovery plan for the Oahu plants (USFWS 1998), based on whether the species is an annual, a short-lived perennial (fewer than 10 years), or a long-lived perennial. *Phyllostegia mollis* is a short-lived perennial, and to be considered stable, the taxon must be managed to control threats (*e.g.*, fenced, weeding, etc.) and be represented in an *ex situ* (off-site) collection. In addition, a minimum of three populations should be documented on Oahu and if possible, at least one other island where they now occur or occurred historically. 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 been partially met.

For downlisting, a total of five to seven populations of *Phyllostegia mollis* should be documented on Oahu and if possible, at least one other island where they now occur or occurred historically. 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 mollis* should be documented on Oahu and if possible, at least one other island where they now occur or occurred historically. Each of these populations must be naturally reproducing, stable or increasing in number, and secure from threats, with 300 mature individuals per population for short-lived perennials. 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

In addition to the status summary table below, information on the species' status and threats was included in the final critical habitat rule referenced above in

section 1.3.3 (“Associated Rulemakings”) and in section 2.4 (“Synthesis”) below, which also includes any new information about the status and threats of the species.

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

Date	**No. wild individuals**	**No. outplanted**	**Stabilization Criteria identified in Recovery Plan**	**Stabilization Criteria Completed?**
1991 (listing)	< 50	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
1995 (recovery plan)	120 - 140	0	All threats managed in all 3 populations Complete genetic storage	No Partially
			3 populations with 50 mature individuals each	Partially
1998 (recovery plan)	120 - 140	0	All threats managed in all 3 populations	No
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	Partially
2003 (critical habitat [a, b])	85 - 105	unknown	All threats managed in all 3 populations	No
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	Partially
2008 (5-year review)	< 2; unknown on Maui	67	All threats managed	Partially
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	Partially

2.3.1 Biology and Habitat [see note in section 2.3]

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

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:

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

2.3.1.4 Taxonomic classification or changes in nomenclature:

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.):

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

2.3.1.7 Other:

2.3.2 Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms) [see note in section 2.3]

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

2.3.2.2 Overutilization for commercial, recreational, scientific, or educational purposes:
No new information.

2.3.2.3 Disease or predation:

2.3.2.4 Inadequacy of existing regulatory mechanisms:
No new information.

2.3.2.5 Other natural or manmade factors affecting its continued existence:

2.4 Synthesis

At the time of Federal listing of *Phyllostegia mollis*, two Oahu populations in the Waianae Mountains, and single population in East Maui were known, totaling fewer than 50 individuals (USFWS 1991). By 1998, five populations of the taxon were known, totaling 120 to 140 individuals (USFWS 1998). In 2003, 98 to 118 individuals were known in eight occurrences on Oahu: South Mohiakea Gulch (five individuals), Mohiakea Gulch (50 to 70), north Palawai (one), central Kaluaa (one), Huliwai Gulch (two), Waieli (seven), Pualii Gulch (16) and Ekahanui (16) (U.S. Army 2006; USFWS 2003a, b, c). By 2006, the Mohiakea population consisted of one immature individual and two seedlings, and only a single mature individual remained at Waieli (U.S. Army 2006; USFWS 2007). No individuals were recorded at Huliwai or Ekahanui. The Pualii Gulch population was considered to be a hybrid between *P. mollis* and *P. parviflora* var. *lydgatei*, but no extant individuals were found in the area (U.S. Army 2006). In 2007, only two populations were extant in the Waianae Mountains of Oahu, consisting of only two individuals: one recently discovered immature individual at central Kaluaa and one mature individual at Waieli, and the populations were continuing to decline (U.S. Army 2007). The *Phyllostegia mollis* population was resurrected as *P. pilosa* (see taxonomic discussion below), and currently in known from two populations totally an unknown number of individuals (Plant Extinction Prevention Program 2008).

Reintroduction efforts at Kaulaa started in 2002, when 26 plants were outplanted inside the exclosure fence. Unfortunately, all 26 plants have since died. In 2006, an additional 16 plants were outplanted and 14 died quickly; plants were thought to have declined due to effects of powdery mildew and/or a virus caused by a sudden increase in rainfall. Currently, 36 immature and 15 mature individuals have been reintroduced with an overall survivorship of 76 percent (U.S Army 2007). Weed control is ongoing at this population. In Ekahunui, stock from the Ekahanui and Huliwai populations were used for reintroductions in the past. Thirteen plants were outplanted in 2006 and they were still known extant in 2007 (U.S. Army 2007). Weed control is ongoing at this population.

Historically, *Phyllostegia mollis* was known from the central and southern Waianae Mountains from Mt. Kaala to Honouliuli, and from the Koolau Mountains, Oahu; Molokai; and Maui. With the recent taxonomic review of *Phyllostegia* (Wagner 1999), *P. pilosa* was resurrected from synonymy from *P. mollis*. As a result, the historic distribution of the species has been restricted to Oahu, and the spatial distribution of the species has declined to only two localities within the Waianae Mountains (Kaluaa Gulch, Schofield Barracks Military Reservation, and Honouliuli Preserve).

Branches of *P. mollis* have the ability to root when they touch the ground, with the rooted stems forming separate plants. As such, vegetative reproduction may currently be the primary method of reproduction as extant individuals form dense clusters, and few seedlings are observed (U.S. Army 2006). The species is easily propagated from

seed and cuttings, and germination is high (U.S. Army 2006, 2007). Little else is known about the life history or biology of the species.

There may have been hybridization between *Phyllostegia mollis* and *P. parviflora* var. *lygatei*, and genetic stock from the area is not being mixed with *P. mollis* stock (U.S. Army 2006; USFWS 2008). Analysis of the 5S-NTS gene region of Hawaiian mints showed that an Oahu collection of *P. mollis* was sister to *P. haliakalae*, but was otherwise unresolved from other species (Lindqvist *et al*. 2003). *P. mollis* var. *micrantha* was synonymized with *Phyllostegia haliakalae*, historically known from Lanai, East Maui and Molokai (Wagner 1999). This taxon has not been collected in more than 70 years and is likely extinct.

Phyllostegia mollis as treated by Wagner *et al*. (1999) consisted of specimens from Oahu, Molokai, and Maui. Maui and Molokai specimens were later determined to belong to a second species, *Phyllostegia pilosa* (Wagner 1999). *Phyllostegia pilosa* differs from *P. mollis* in having a greater number of flowers per vertillaster (a flowering stalk resembling a whorl but arising from the axils of opposite bracts, on the stem of mints), closer spacing of vertillasters, shorter pedicels (inflorescence stalks), smaller flowers, smaller leaves, and shorter petioles (individual flower stalks) (Wagner 1999). *Phyllostegia pilosa* remains at two sites and consists of about nine individuals at The Nature Conservancy's Waikamoi preserve and Kahikinui on Maui (Plant Extinction Prevention Program 2007). Plants from Waikamoi were propagated at Haleakala National Park and three individuals were reintroduced in Waikamoi by The Nature Conservancy staff (Heleakala National Park 2006, 2007); however, their survival seems low (Plant Extinction Prevention Program 2007).

Habitat degradation and predation by feral pigs (*Sus scrofa*) and goats (*Capra hircus*) (Factor A, C and D), and competition with introduced invasive plant species (Factor E) continue to be the primary threats to the remaining extant individuals of *Phyllostegia mollis* and *P. pilosa* (USFWS 1991, 1998, 2003a, b, c, 2008; U.S. Army 2006, 2007). Introduce invasive plants threatening these taxa include *Schinus terebinthifolius* (Christmas berry) and *Toona ciliata* (Australian red cedar), *Ageratina adenophora* (Maui pamakani), *Blechnum appendiculatum* (hammock fern), *Christella parasitica* (Christella), *Clidemia hirta* (Koster's course), *Heliocarpus papayanensis* (white moho), *Kalanchoe pinnana* (airplant), *Passiflora suberosa*, (corkystem passionflower), *Psidium cattleianum* (strawberry guava), and *Rubus rosifolius* (thimbleberry) (USFWS 1991, 1998, 2003a, b, c, 2008; U.S. Army 2006, 2007). Arthropod damage has been observed on the stems of *Phyllostegia mollis* (Factor C) (U.S. Army 2006) and leopard slugs' (*Limax maximus*) predation is presumed to be severe for *P. pilosa* (Factor C) (Plant Extinction Prevention Program 2007). The small number of extant populations remains as a threat as the species is more vulnerable to extinction and/or reduced reproductive vigor (USFWS 1991, 1998, 2003a, b, c, 2008; U.S. Army 2006, 2007).

In addition to all of the other threats, species like *Phyllostegia mollis* that are endemic to small portions of islands are inherently more vulnerable to extinction than

widespread species because of the higher risks posed to a few populations and individuals by random demographic fluctuations and localized catastrophes such as hurricanes, landslides, drought, fires, flooding and disease outbreaks (Factor E). When considered on their own, the natural processes associated with being a single island endemic do not affect *P. mollis* to such a degree that it is threatened or endangered with extinction in the foreseeable future, but these natural processes can exacerbate the threat from anthropogenic factors, such as habitat loss for human development or predation by introduced species (USFWS 1998).

To safeguard existing genetic material, propagation for genetic storage and reintroduction is occurring at the University of Hawaii's Lyon Arboretum Micropropagation Laboratory, Center for Conservation Research and Training Seed Storage Laboratory, The Nature Conservancy of Hawaii, Waimea Botanic Garden, U.S. Army, and Haleakala National Park. Stored genetic resources of *Phyllostegia mollis* consist of 1,641 seeds in 12 lots (Center for Conservation Research and Training Seed Storage Facilities 2007); 172 plants in 19 micropropagation accessions (Harold L. Lyon Arboretum Micropropagation Laboratory 2007); 11 individuals in cultivation from the Ekahanui population (The Nature Conservancy 2006); one single plant in storage at Waimea Arboretum (Waimea Botanic Garden 2007). The U.S. Army has five individuals represented in seedbank, 11 individuals in micropropagation, and 13 plants are housed within the Army's nursery. With exceptions of the Mohiakea population, nearly all populations known from Oahu are represented in *ex situ* (U.S. Army 2007). Stored genetic resources for *P. pilosa* consist of nine plants from Waikamoi preserve (Haleakala National Park 2007).

Reintroductions within exclosure fences and threats suppression is critical to the survival of the species, and the Army has plans to reintroduce appropriate genetic material into three sites, Kaluaa, Ekahanui, and Pualii (U.S. Army 2006, 2007). However, outplanting success has been shown to be low as individuals may be affected by leopard slugs (Plant Extinction Prevention Program 2007), powdery mildew and/or viruses (U.S. Army 2007). Introduced invasive plant species control is ongoing at the two remaining populations as well as at the outplanted populations on Oahu. New exclosure fences in Pualii were completed in 2006, and the U.S. Army expects to reintroduce hybrids of *Pyllostegia mollis* and *P. parviflora* var. *lydgatei* at this location. To increase the reintroduction sites, the Army also planned to finish the exclosure fence at Ekahanui (U.S. Army 2007).

The stabilization goals for this species have not been met, as only 11 wild individuals remain and not all threats are being managed (see Table 1). Therefore, *Phyllostegia mollis* meets the definition of endangered as it remains in danger of extinction throughout its range.

3.0 RESULTS

3.3 Recommended Classification:

____ Downlist to Threatened

____ Uplist to Endangered
____ Delist
____ *Extinction*
____ *Recovery*
____ *Original data for classification in error*
__X__ No change is needed

3.2 New Recovery Priority Number: N/A

Brief Rationale:

3.3 Listing and Reclassification Priority Number: N/A

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

- Continue collection of fruit and plant material to increase the *ex situ* stocks of the species is critical for the survival and future management of the species.

- Construct exclosure fences to protect individuals from the activities of feral ungulates, and eradicate invasive introduced plant species within the exclosures.

- Continue to augment current natural populations with appropriate genetic individuals.

- Establish *ex situ* populations within protected habitats.

- Determine the impacts of and control methods for powdery mildew and/or viruses negatively impacting the species.

- Survey geographical and historical range for a thorough current assessment of the species.

- Assess genetic variability within extant populations, especially the potential impact of hybrids with other *Phyllostegia* species.

- Study *Phyllostegia mollis* populations with regard to population size and structure, geographical distribution, flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, limiting factors, and threats.

- Update the listed entity in 50 CFR 17 to match the currently recognized taxonomy.

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of *Phyllostegia mollis* (No common name)

Current Classification: E

Recommendation resulting from the 5-Year Review:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
__X__ No change needed

Appropriate Listing/Reclassification Priority Number, if applicable:_____

Review Conducted By:
Christian Torres-Santana, Fish and Wildlife Biologist
Marie Bruegmann, Plant Recovery Coordinator
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Approved _____ Date 21 July 2009
Acting Field Supervisor, Pacific Islands Fish and Wildlife Office