Phyllostegia racemosa
(Kiponapona)

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 racemosa* (Kiponapona)

TABLE OF CONTENTS

5-YEAR REVIEW
Phyllostegia racemosa (Kiponapona)

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:
Pacific Islands Fish and Wildlife Office, Loyal Mehrhoff, Field Supervisor, (808) 792-9400

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 racemosa* and the Big Island plant cluster recovery plan (USFWS 2003, 1996), 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 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 racemosa* in three units totaling 2,888 hectares (7,134 acres) on Hawaii Island. These designations include habitat on State and Federal lands (USFWS 2003).

1.3.4 Review History:

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

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***
__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 (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 10 years), or a long-lived perennial. *Phyllostegia racemosa* 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 racemosa* 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 racemosa* 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:

Some reports (e.g., USFWS 1998) have indicated that the species grows epiphytically, but it seems more likely that the word epiphytic was used in the sense of being "scandent" (climbing or clambering). The species is a host to a delphacid planthopper (*Nesosydne phyllostegiae*) (Giffard 1918; Giffin 2009). Wagner *et al*. (1999) indicated hybridization between members of *Phyllostegia* and *Stenogyne*, but did not report specifically on hybrids formed with *P. racemosa*.

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:

Available information suggests that the species has always been relatively rare. In 1996, when the species was federally listed as endangered (USFWS 1996) there were four known populations, with a total of 25 to 45 individuals located on State and private lands in the Kulani- Keauhou area, and on Federal lands at Hakalau Forest National Wildlife Refuge and Hawaii Volcanoes National Park (USFWS 1998). By 1998, only three populations comprising a total of 35 to 45 individuals were known (USFWS 1998).

A single individual was discovered in the Mauna Loa Special Ecological Reserve in 1987 at about 1,800 meters (5,900 feet) within Kipuka Maunaiu in a grove of *Acacia koa*, with a ground cover of invasive introduced grass species *Ehrharta stipoides* (meadow ricegrass) (Belfield and Pratt 2002). This individual persisted through at least 1993 but had disappeared by 1997 (Belfield and Pratt 2002), possibly due to grazing by mouflon sheep (*Ovis gmelini musimon*). The site within Kipuka Maunaiu was significant in that it was 8.00 kilometers (4.97 miles) farther

west than other known sites, and from a vegetation type that is drier (Belfield and Pratt 2002). Efforts to relocate this individual at the Mauna Loa Special Ecological Reserve in 1998 and 2002 were unsuccessful (Belfield and Pratt 2002).

A specimen in the herbarium at Hawaii Volcanoes National Park initially believed to be *Phyllostegia racemosa* was later determined to be *P. parviflora* var. *glabriuscula* (Hawaii Volcanoes National Park 2004).

When critical habitat was proposed there were seven known populations with a total of 10 individuals located on private and State lands in the Kulani-Keauhou area, on Federal lands in the Hakalau Unit of the Hakalau Forest National Wildlife Refuge and in Hawaii Volcanoes National Park (USFWS 2002). When final critical habitat was designated there were six known populations within the same locations identified in 2002 (USFWS 2003).

Jeffrey and Horiuchi (2008) later reported *Phyllostegia racemosa* as having only 35 individuals scattered in 4 populations at Hakalau Unit of Hakalau Forest National Wildlife Refuge. However, all individuals of the species were destroyed between 1994 and 2003 in Hakalau Forest National Wildlife Refuge by a combination of rooting feral pigs (*Sus scrofa*), grazing domestic cattle (*Bos taurus*), and competition from introduced invasive grass species (Jeffrey and Horiuchi 2008). As of 2008, there were no wild individuals of *P. racemosa* known at the refuge (Jeffrey and Horiuchi 2008).

In 2007, the Plant Extinction Prevention Program reported that the wild population located at Puu Kipu of the Kulani-Keauhou area died; reason for the cause of death was not provided (USFWS 2009). The Plant Extinction Prevention Program (2009, 2010) surveyed for *Phyllostegia racemosa* at Hakalau Forest National Wildlife Refuge but found no individuals of this species, and concluded that the species is extinct in the wild (Plant Extinction Prevention Program 2009, 2010).

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

Lindqvist and Albert (2002) used three molecular markers that showed four species of *Phyllostegia* to be deeply nested within

Stachys. However, these authors were unable to suggest a better classification due to the large size of *Stachys* and other uncertainties about relationships. A follow-up study (Lindqvist *et al*. 2003) showed species of *Phyllostegia* to intermix in a clade with members of *Stenogyne*, with low levels of DNA sequence divergence overall among Hawaiian mints. What this means nomenclaturally is that *Phyllostegia racemosa* may be transferred into the genus *Stenogyne* at a later date, if further molecular data suggest either that 1) *Phyllostegia* is polyphyletic, or 2) if *Stenogyne* is shown to be paraphyletic with respect to *Phyllostegia*. Evidence of hybridization also suggests that the two genera may warrant combining (Wagner 1999).

2.3.1.4 Taxonomic classification or changes in nomenclature:

Phyllostegia racemosa, a member of the mint family (Lamiaceae), was described from Hawaii Island by Bentham in 1830 (although the publication date says 1829), based on a specimen collected by James McRae on Mauna Kea. It is most easily distinguished from others in the genus by its scandent (clambering) growth habit, leaf shape, sessile flower clusters, and rounded calyx lobes (Wagner *et al*. 1999). The genus *Phyllostegia* was revised by Sherff (1935), who described *P. racemosa* var. *bryanii*. This variety was subsequently reduced to synonymy under *P. mannii* (Wagner *et al*. 1999; Wagner 1999). Wagner (1999) also reduced *Phyllostegia rhuakos* H. St. John to synonymy under *P. racemosa*.

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 racemosa is endemic to the Island of Hawaii. It occurs in mesic to wet forests between 700 to 1,935 meters (approximately 2,300 to 6,350 feet) elevation, on the windward slopes of Mauna Kea and Mauna Loa (Wagner *et al*. 1999; USFWS 1996; USFWS 2003). The species also was found historically at several sites between Mauna Kea and Mauna Loa

(USFWS 1996). Based on information contained on specimens housed at Bishop Museum (2010), *P. racemosa* typically grows in forests dominated by *Metrosideros polymorpha* (ohia) and *Acacia koa* (koa). The species had been observed at Puuwaawaa previously but has not been seen there in recent years (Giffin 2009).

The soil types for which *Phyllostegia racemosa* has been recorded include typic hydrandepts on Kilauea Crater and Mauna Loa, and lithic tropofolists in the Upper Waiakea Forest Reserve (Hawaii Biodiversity and Mapping Program 2010).

On Mauna Loa, where the species was not known until 1987 (Belfield and Pratt 2002), associated species at Kipuka Maunaiu include *Acacia koa*, invasive introduced grass *Ehrharta stipoides*, and common native species including *Myoporum sandwicense* (naio) (Belfield and Pratt 2002). Other reported taxa known to grow in association with the species includes *Vaccinium calycinum* (ohelo), *Rubus hawaiensis* (akala), *Dryopteris wallichiana* (laukahi), species of the fern genus *Cibotium* (hapuu), and *Astelia menziesii* (painiu) (Hawaii Department of Land and Natural Resources 2005; USFWS 1996, 1998).

The habitat at Hakalau Forest National Wildlife Refuge was reported as "degraded" (Plant Extinction Prevention Program 2007) and infested with invasive introduced grass species *Pennisetum clandestinum* (kikuyu grass)

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 (Hawaii Department of Land and Natural Resources 2005; USFWS 1996, 1998 Jeffrey and Horiuchi 2008; Belfield and Pratt 2002)
    - Feral pigs (*Sus scrofa*)

    - Cattle (*Bos taurus*)
    - Mouflon sheep (*Ovis gmelini musimon*)
- Established ecosystem-altering invasive plant species degradation of habitat (Hawaii Department of Land and Natural Resources 2005; USFWS 1996, 1998)
    - *Ehrharta stipoides* (meadow ricegrass)
    - *Grevillea robusta* (silk oak)
    - *Psidium cattleianum* (strawberry guava)
    - *Passiflora ligularis* (sweet granadilla)
    - *Passiflora tarminiana* (banana poka)
    - *Pennisetum clandestinum* (kikuyu grass)
- Timber management – Logging (Hawaii Department of Land and Natural Resources 2005; USFWS 1996, 1998)
- Lava flow degradation of habitat (Hawaii Department of Land and Natural Resources 2005; USFWS 1996, 1998)

Current conservation efforts:

- Ungulate control – Reintroductions at Hakalau Forest National Wildlife Refuge occurred in areas where ungulates were reduced to nearly zero (Jeffrey and Horiuchi 2008).
- Established ecosystem-altering invasive plant species control – Kipuka Aiea receives management in the form of invasive introduced plant species control (L. Pratt, U.S. Geological Service, Hawaii, Botanist, pers. comm. 2011).

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

None reported.

2.3.2.3 Disease or predation:

Threats:

- Ungulate predation or herbivory
    - Cattle (Jeffrey and Horiuchi 2008)
    - Mouflon sheep (Belfield and Pratt 2002)

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 racemosa* occurs outside of Hawaii Volcanoes National Park continue to threaten this species.

2.3.2.5 Other natural or manmade factors affecting its continued existence:

Threats:

- Established invasive plant species competition (Hawaii Department of Land and Natural Resources 2005; USFWS 1996, 1998).
    - *Anthoxanthum odoratum* (sweet vernal grass)
    - *Paspalum vaseyi* (vasey grass)
- 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:
    - At the end of 2007 the greenhouse at Hakalau Forest National Wildlife Refuge had 550 individuals of *Phyllostegia racemosa*, of various sizes, derived from cuttings of greenhouse individuals.
    - As of 2007, 550 individuals of *Phyllostegia racemosa* were growing at the Volcano Rare Plant Propagation Facility (Jeffrey and Horiuchi 2008).

- The Volcano Rare Plant Facility reported 46 individuals in captive propagation between 2010 and 2011 (Volcano Rare Plant Facility 2011).
- The Center for Conservation Research and Training Seed Storage Facility (2009) has 348 seeds of *Phyllostegia racemosa* in storage.
- Harold L. Lyon Arboretum Micropropagation Laboratory (2009) had a single individual in storage.

- Reintroduction / translocation implementation:
  - In June of 2001, a total of 385 cuttings were reintroduced at Puu Kipu Unit at the Kulani Correctional Facility (Rubenstein 2007). In 2003, 95 seedlings were reintroduced at the same site (R. Robichaux, Hawaii Silversword Foundation, pers. comm. 2003). Approximately equal numbers of cuttings were generated from each of two maternal lines, since no additional founders were available. As of 2007 the survivorship was 6.6 percent (24 out of 359 individuals), and flowering, fruiting, and seedling establishment were all observed (Rubenstein 2007). An additional 138 new accessions of *Phyllostegia racemosa* were received by Plant Extinction Prevention Program staff for reintroduction during fiscal year 2007 (Plant Extinction Prevention Program 2007).
  - Approximately 1,044 individuals have been reintroduced at the Hakalau Forest Unit, from cuttings or seedlings (Jeffrey and Horiuchi 2008). Of this total, 774 were reintroduced in 2007, but none ultimately survived (Jeffrey and Horiuchi 2008).
  - The Hawaii Volcanoes National Park (2004) reported that all 26 individuals reintroduced in 2002 in Kilauea Forest Reserve at a site near the Mauna Loa Strip Road in the Mauna Loa Special Ecological Area had died by 2003. It is not clear if these individuals were associated with those reintroduced by the Hawaiian Silversword Foundation.

- A second reintroduction of 69 individuals in 2004 in “Kipuka Aiea” of Hawaii Volcanoes National Park was initially successful, showing no mortality at the time of the report (Hawaii Volcanoes National Park 2004); however in 2011, it was reported that this reintroduction failed with no individuals surviving (L. Pratt, pers. comm. 2011). Kipuka Aiea is a name that the Park uses for a very small kipuka northwest of Kipuka Ki on the boundary of the Park and Keauhou Ranch (L. Pratt, pers. comm. 2011). It is a remnant mesic forest similar in vegetation to Kipuka Ki and is named for a natural population of *Nothocestrum longifolium* that occurs there (L. Pratt, pers. comm. 2011).
- Between 2001 and 2004, the Hawaiian Silversword Foundation reintroduced 348 cuttings of *Phyllostegia racemosa* in Kilauea Forest and Keauhou (Anonymous 2004). Approximately equal numbers of individuals were obtained from each of the two maternal lines from which the cuttings were taken. The last census taken by this group revealed an annual survivorship rate of 48 percent. It was noted that many individuals had flowered prior to dying, individuals did not appear to be long-lived, and no seedling recruitment had occurred (Anonymous 2004).
- As of 2010, a total of 878 individuals of *Phyllostegia racemosa* had been reintroduced into Hakalau Forest National Wildlife Refuge (USFWS 2010).
- The Volcano Rare Plant Facility reported that a total of 65 individuals were reintroduced between 2010 and 2011 with 17 individuals reintroduced within the Hakalau area and 48 individuals reintroduced at Kulani (Volcano Rare Plant Facility 2011).

- Reintroduction / translocation site identification – Potential reintroduction sites for *Phyllostegia racemosa* are numerous in the upper unit of Hawaii Volcanoes National Park, but sites in Kipuka Kulalio located near the Mauna Loa Road will permit a greater degree of

post-planting care than the more remote sites (Belfield and Pratt 2002).

- Alliance and partnership development – The Three Mountain Alliance consists of 451,750 hectares (1,116,300 acres) and includes lands owned or controlled by 9 partners including: the Hawaii Department of Public Safety (Kulani Correctional Facility), the Hawaii Department of Land and Natural Resources, the National Park Service, and privately owned lands. Originally formed as the Olaa- Kileaua partnership in 1994, in 2007 additional partners and areas were included to jointly develop a natural resources management plan that includes, but was not limited to, feral animal and invasive introduced plant control measures, collaborative research projects, and habitat protection and restoration. A group of landowners and managers of these project lands as well as representatives from the USFWS, U.S. Geological Service Biological Resources Division, and the U.S. Forest Service developed a management plan (Hawaii Association of Watershed Partnerships 2011). The Three Mountain Alliance management plan was finalized in 2007 and the group implements actions stated in the plan across Mauna Loa, Kilauea, and Hualalai (Three Mountain Alliance 2007).
- Reintroduction / translocation population management and monitoring – Reintroductions of *Phyllostegia racemosa* reportedly responded well where herbicides had been applied to control invasive introduced grass species (Jeffrey and Horiuchi 2008).

2.4 Synthesis

The interim stabilization goals for this species have not been met as there are no known naturally occurring individuals in the wild. Outplanting from captive propagation facilities is ongoing but survivorship is low and there is only one outplanted population of 24 mature individuals that in naturally reproducing (Table 1). Not all threats are being managed (Table 2). Therefore, *Phyllostegia racemosa* meets the definition of endangered as it remains in danger of extinction throughout its range.

Table 1. Status of *Phyllostegia racemosa* from listing through 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 (see Table 2)
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	No

Table 2. Threats to *Phyllostegia racemosa* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulates – Degradation of habitat and herbivory	A, C, D	Ongoing	Partially: Ungulates controlled at Hakalau Forest
Timber management – Logging	A	Ongoing	No
Lava flow degradation of habitat	A	Ongoing	No
Established ecosystem-altering invasive plant species	A	Ongoing	Partially: Invasive plant species controlled at Kipuka Aiea
Established invasive plant species competition	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*
__X__ 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

- Surveys / inventories – Survey the historical range of the species for surviving populations.
- Captive propagation for genetic storage and reintroduction:
    - Continue to collect seeds and/or cuttings and send to at least two or three different venues for propagation and storage.
    - Collect cuttings or seed from tagged individuals, keeping close track of the maternal source for use in *ex situ* propagation.
- Reintroduction / translocation protocol development – Develop proper horticultural protocols and pest management practices for rare plant nurseries.
- 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, identify sites that are least invaded by invasive introduced plant species and that appear to have the highest likelihood of maintaining new reintroductions.
- Ungulate exclosures – Construct fenced exclosures that are sturdy enough to exclude cattle and feral pigs around all populations.
- Ungulate control – Continue to protect all populations against disturbances from feral ungulates.
- Ecosystem-altering invasive plant species control – Control invasive introduced plant species around all populations.
- Genetic research – Conduct molecular fingerprinting of *ex situ* stocks.
- Site / area / habitat protection – Develop and implement effective measures to reduce the impact of logging.
- Population biology research:
    - Carry out field studies to determine what agents pollinate the flowers and disperse the seeds.
    - Determine if the species ever grows as a true epiphyte, wherein the apex of the root crown is situated on a tree or other object above ground level.
- Threat monitoring and control – Monitor all populations for evidence of insect damage and plant diseases. If threats are found implement effective control methods.
- Alliance and partnership development – Continue to work with Hawaii Division of Forestry and Wildlife, Hakalau Forest National Wildlife Refuge, and other land managers to initiate planning and contribute to 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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Signature Page
U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of *Phyllostegia racemosa* (Kiponapona)

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

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
Kristi Young, Assistant Field Supervisor for Endangered Species

Field Supervisor, Pacific Islands Fish and Wildlife Office

for

Jess Newton

Date 8/28/2012