

Vicia menziesii
(Hawaiian Vetch)

**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: *Vicia menziesii* (Hawaiian Vetch)

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5-YEAR REVIEW
***Vicia menziesii* (Hawaiian Vetch)**

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)
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 recovery plan for *Vicia menziesii* (USFWS 1984), 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. 1978. Determination that various plant taxa are endangered or threatened species; final rule. Federal Register 43(81):17910-17916.

Date listed: May 27, 1978

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:

No critical habitat has been designated for *Vicia menziesii* (USFWS 1984).

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:

2C

1.3.6 Current Recovery Plan or Outline

Name of plan or outline: USFWS. 1984. *Vicia menziesii* recovery plan. U.S. Fish and Wildlife Service, Portland, Oregon. 54 pages. Available online at <http://www.fws.gov/pacificislands/recoveryplans.html>.

Date issued: May 18, 1984

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

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.

Interim recovery objectives are provided in the recovery plan for *Vicia menziesii* (USFWS 1984). However, recovery objectives were not defined in the recovery plan due to insufficient data. The interim recovery objectives for *V. menziesii* are to identify, secure, and maintain all existing populations and not allow the populations to decline further.

These objectives have 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:

Vicia menziesii has an extensive system of branching. It is a climber and typically can grow well into the sub-canopy of the forest (Hawaii Department of Land and Natural Resources 2005). At the Puu Waawaa site, this species has been observed to sprawl over ferns and flowered from April to August (Ralph *et al.* 1980; Giffin 2009). Mature pods have formed by July and may last into October or beyond (Ralph *et al.* 1980). Of the individuals studied by Ralph *et al.* (1980), 23 percent of the flowers set fruit.

Ralph *et al.* (1980) discussed many aspects of the life history of *Vicia menziesii*. The species can flower prolifically but does not flower until 2 or 3 years old (Ralph *et al.* 1980). The large flowers are reddish, which turn rose-purple on maturation, are atypical for the genus, and its seed size evidently is the largest in the genus (Lassetter and Gunn 1979). Ralph *et al.* (1980) provided a detailed analysis of flowering, breaking it up into 13 arbitrary (in their words) stages. The honeycreepers iiwi (*Vestiaria coccinea*) and amakihi (*Loxops virens*) have been observed feeding at *Vicia menziesii*, and given their downcurved bills, may pollinate the species (Lassetter and Gunn 1979; Ralph *et al.* 1980). Ralph *et al.* (1980) speculated that birds use the flowers as a source of nectar or be gleaning insects attracted to the flowers.

To determine whether *Vicia menziesii* was self-compatible, Dave Hopper (University of Hawaii at Manoa, pers. comm., 2001) hand pollinated a total of 10 flowers across 3 different individuals, all of which were

labeled, at the Hualalai site. Hopper reported that most (approximately 60 percent) papilionaceous legumes that were studied are self-compatible to some degree. Therefore, given the low number of individuals and populations, Hopper (pers. comm., 2001) concluded that production of seed was unlikely in the absence of hand pollination.

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:

Vicia menziesii was the first plant species in Hawaii to be officially listed as endangered (USFWS 1978; Warshauer and Jacobi 1982). The population size of *V. menziesii* has fluctuated substantially. The thorough summary by Warshauer and Jacobi (1982) now is somewhat outdated, but in 1974 its population at a single site was estimated at 150 to 300 individuals, covering an estimated area of 200 hectares (494 acres), and most of which were seedlings (Warshauer and Jacobi 1982). Ralph *et al.* (1980) indicated a population size of about 85 individuals in 1980.

When the recovery plan was issued in 1984, there were an estimated 1,500 to 2,000 individuals within upper Keauhou Ranch (USFWS 1984).

The small population at Puu Waawaa, which was discovered by C. Kepler of the USFWS in 1985, was estimated to cover an area of approximately 46 square meters (500 square feet) (Giffin 2009). The location of this population was never marked and subsequent attempts to relocate the colony were unsuccessful for many years (Giffin 2009). However, on April 1, 1993, Hawaii Division of Forestry and Wildlife staff rediscovered the same *V. menziesii* colony in the Halepiula mauka Waimea paddock at 1,600 meters (5,250 feet) elevation (Giffin 2009). The Puu Waawaa colony was found in a forest opening and covered an area of approximately 348 square meters (3,750 square feet), and individuals were observed growing over species of ferns (Giffin 2009). The Hawaii Island Plant Extinction Prevention Program reported only a single individual of *V. menziesii* remaining in the Puu Waawaa colony that was last observed in 2004; the current status of this individual is unknown (Plant Extinction Prevention Program 2007b).

In 2001, a total of three to five individuals of *Vicia menziesii* were observed in an enclosure at Hualalai by Dave Hopper, a researcher at the University of Hawaii at Manoa (pers. comm. 2001). Only a single individual was in flower, and others had reported that fruits had not been observed on these individuals in the few years prior to that time (D. Hopper pers. comm. 2001).

Vicia menziesii occurs in two populations at Keauhou-Kilauea and on the northern flank of Hualalai volcano at Puu Waawaa (Giffin 2009). The number of mature individuals reported for *Vicia menziesii* varied in 2007. The Plant Extinction Prevention Program (2007a) reported only 18 individuals of *V. menziesii*. In contrast, another report prepared by the Plant Extinction Prevention Program (2007b) reported the number of mature individuals as: 20 individuals from Keauhou/Kilauea; a single individual from Puu Waawaa; 25 individuals from Kapapala Forest Reserve next to Kau Forest Reserve; 3 individuals from Piha; no individuals at Puu Kipu or Kau Forest Reserve (Plant Extinction Prevention Program 2007b). In 2008, the Plant Extinction Prevention Program (2008) reported a single individual at Olaa Kilauea Management Area.

In 2009, a total of 37 individuals in 6 populations were reported for *Vicia menziesii* (Plant Extinction Prevention Program 2009). At that time the Plant Extinction Prevention Program (2009) reported problems with access issues for populations, and difficulties in propagation, which may be in part due to aspects of the reproductive biology, such as low levels of self-compatibility.

In 2010, the population census remained the same as recorded in 2009 with a total of 37 individuals located within 6 populations (Plant Extinction Prevention Program 2010).

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

The genus *Vicia* is in the legume family (Fabaceae or Leguminosae) and comprises some 160 species, occurring mostly in the north temperate zones (Mabberley 2008). Lassetter and Gunn (1979) studied the cytology and other aspects of *V. menziesii* and a few putatively related species. They found a base chromosome number of $n=7$ for *V. menziesii*. The authors also speculated, based on their overall analyses, that *V. menziesii* might be closely related to *V. gigantea* of North America (coastal, from northern California to the panhandle of Alaska) and *V. nigricans* (in the Andes of Chile [mostly] and Argentina) (Lassetter and Gunn 1979).

2.3.1.4 Taxonomic classification or changes in nomenclature:

Vicia menziesii is a short-lived perennial species that is endemic to the Island of Hawaii. This Hawaii endemic was first described by Smith as *V. grandiflora* (Wagner *et al.* 1999). However, that name had been used previously, so it was described with its current name by Sprengel in 1826

(Warshauer and Jacobi 1982). The first specimen was collected in 1794 during an ascent of Mauna Loa by Archibald Menzies, the surgeon and botanist on Captain George Vancouver's ship. The species has been collected on Mauna Loa and Mauna Kea volcanoes, but during the past 150 years it had been known only from the northeastern slope of Mauna Kea (Warshauer and Jacobi 1982). Until its rediscovery in 1974, the species had been considered extinct, having not been seen since 1915 (Lassetter and Gunn 1979; Warshauer and Jacobi 1982).

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):

The species occurs in wet to mesic forests of *Metrosideros polymorpha* (ohia)-*Acacia koa* (koa) in the Keauhou-Kilauea area, and in the upper montane zone in decadent (*i.e.*, declining naturally) *Acacia koa*-*Myrsine* forests with a prominent fern understory at Puu Waawaa (Wagner *et al.* 1999; Giffin 2009). The elevation range for this species is 1,570 to 1,720 meters (5,150 to 5,640 feet). At Puu Waawaa, native plant species associated with *Vicia menziesii* include *Metrosideros polymorpha*, *Acacia koa*, and species of fern such as *Diplazium* sp. (pohole), *Cibotium* sp. (hapuu), and *Pseudophegopteris keraudreniana* (waimakanui) (Giffin 2009).

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 (Warshauer and Jacobi 1982; Hawaii Department of Land and Natural Resources 2005)
 - Cattle (*Bos taurus*)

- Goats (*Capra hircus*)
- Feral pigs (*Sus scrofa*) were noted as a threat to the native forest outside of a fenced enclosure at the Hualalai site, which at the time contained three to five individuals of *V. menziesii* (D. Hopper, pers. comm. 2001).
- Sheep (*Ovis aries*)
- Established ecosystem-altering invasive plant species degradation of habitat (Warshauer and Jacobi 1982; Hawaii Department of Land and Natural Resources 2005)
 - *Passiflora tarminiana* (banana poka)
 - *Rubus argutus* (Florida prickly blackberry)
- Timber management degradation of habitat – Logging was listed as an earlier threat to the survival of *Vicia menziesii*, but this activity has decreased (Warshauer and Jacobi 1982).

Current conservation efforts:

- Ungulate exclosure – At Puu Kipu in Kilauea Forest, individuals of *Vicia menziesii* were reintroduced into a fenced area free of ungulates (Anonymous 2004; Rubenstein 2007).

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

None reported.

2.3.2.3 Disease or predation:

Threats:

- Rodent predation or herbivory – Rats (*Rattus* spp.) (Warshauer and Jacobi 1982; Hawaii Department of Land and Natural Resources 2005)
- Invertebrate predation or herbivory – Caterpillars (Anonymous 2004; Rubenstein 2007)

Current conservation efforts:

- Predator / herbivore control – Reintroduced individuals were treated with insecticide to prevent damage by caterpillars at Puu Kipu in Kilauea Forest (Rubenstein 2007).

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 *Vicia menziesii* 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:

- Low numbers (Warshauer and Jacobi 1982; Hawaii Department of Land and Natural Resources 2005; Plant Extinction Prevention Program 2007b, 2008, 2009, 2010)
- 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 2003, about 100 seedlings were grown for reintroduction in the Puu Kipu unit, which were derived from 10 maternal lines (R. Robichaux, Hawaiian Silversword Foundation, pers. comm. 2003).
 - In November of 2007, a single pod and two cuttings were collected from the Olaa Kilauea Partnership management area (now known as the Three Mountain Alliance) (Plant Extinction Prevention Program 2008).
 - The Volcano Rare Plant Facility (2011) reported 36 individuals of *Vicia menziesii* in genetic storage and 68 individuals in controlled propagation. In previous years, the Volcano Rare Plant Facility (2010, 2009, 2008, 2007, 2006) totals were: 2010, 36 individuals in genetic storage and 137 individuals in controlled propagation; 2009, 36 individuals in genetic storage and 140 individuals in controlled propagation; 2008, 49 individuals in genetic storage and 9 individuals in controlled propagation; 2007, 50 individuals in genetic storage and 62 individuals in controlled propagation; 2006, 50 individuals in genetic storage, 62 individuals in controlled propagation.
- Reintroduction / translocation implementation:

- In June 2001, a total of 385 cuttings were reintroduced at Puu Kipu Unit at the Kulani Correctional Facility (Rubenstein 2007).
- In 2004, a total of 69 cuttings, collected from 12 maternal lines, were reintroduced at Puu Kipu in Kilauea Forest (Anonymous 2004; Rubenstein 2007). Unfortunately, nearly all of the reintroduced individuals in the Puu Kipu unit perished from heavy browsing by caterpillars (Anonymous 2004; Rubenstein 2007).
- In January 2006, an additional 27 individuals of *V. menziesii* were reintroduced at Puu Kipu, but despite treatment with insecticide to prevent damage by caterpillars, the survival rate was only 4.1 percent (4 out of 96 individuals overall between 2004 and 2006 reintroductions) (Rubenstein 2007).

2.4 Synthesis

The interim recovery objectives for *Vicia menziesii* are to identify, secure, and maintain all existing populations and not allow the populations to decline further. The interim stabilization goals for this species have not been met, as existing populations are continuing to decline (Table 1) despite efforts to control threats (Table 2). In addition, not all threats are being managed at all known populations. Therefore, *Vicia menziesii* meets the definition of endangered as it remains in danger of extinction throughout its range.

Table 1. Status of *Vicia menziesii* from listing through 5-year review.

Date	No. wild individuals	No. outplanted	Stabilization Criteria identified in Recovery Plan	Stabilization Criteria Completed?
1978 (listing)	1974: 150-300 1980: 85	0	All threats managed in all populations	No
			Complete genetic storage	No
			Prevent populations from declining further	No
1984 (recovery plan)	1,500-2,000	0	All threats managed in all populations	No
			Complete genetic storage	No
			Prevent populations from declining further	No
2012 (5-year review)	37	Unknown	All threats managed in all populations	Partially (see Table 2)
			Complete genetic storage	Partially
			Prevent populations from declining further	No

Table 2. Threats to *Vicia menziesii* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulates – Degradation of habitat, lack of adequate hunting regulations	A, D	Ongoing	Partially: Ungulate fenced exclosure at Puu Kipu in Kilauea Forest
Established ecosystem-altering invasive plant species	A	Ongoing	No
Timber management – Logging	A	Decreased	No
Rodent predation or herbivory – Rats	C	Ongoing	No
Invertebrate predation or herbivory – Caterpillars	C	Ongoing	Partially: Caterpillars controlled at Puu Kipu in Kilauea Forest
Low numbers	E	Ongoing	Partially: Captive propagation for genetic storage and reintroduction, reintroduction / translocation implementation, and monitoring
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 at Kilauea Forest, Keauhou Ranch, and Puu Waawaa 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.
- Ungulate exclosures:
 - Continue to construct fenced exclosure around existing and reintroduced populations to provide protection from feral ungulates.
 - Monitor fenced exclosures for evidence of breaching by feral ungulates.
- 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 individuals or populations, and to determine the current status of the species.
- Genetic research – Carry out molecular studies to assess overall genetic variation among existing populations and individuals.
- Site / area / habitat protection – Develop and implement effective measures to reduce the impact of timber management (logging).
- Predator / herbivore control – Control rodents around existing populations.
- Invertebrate control research – Research the effects of invertebrates and caterpillars around existing and reintroduced populations. If research demonstrates there is an immediate threat, determine and implement effective control measures.
- Alliance and partnership development – Work with Hawaii Division of Forestry and Wildlife, Three Mountain Alliance Partnership, and other landowners to initiate planning and contribute to implementation of ecosystem-level restoration and management to benefit this species.

- Revise recovery criteria – Update and define recovery objectives in a revised recovery plan for *Vicia menziesii* based on current, available scientific information.
- Threat monitoring and control – Monitor populations for evidence of disease or other pests.
- 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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Fish and Wildlife Office, dated 1 May 2001. Subject: Hand pollinations of *Vicia menziesii* in enclosure at Hualalai Forest Reserve.

Robichaux, Rob. 2003. President, Hawaiian Silversword Foundation, Tucson, Arizona. E-mail to Marie Bruegmann, U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, dated 23 June 2003. Subject: Update (regarding reintroduction efforts on the Big Island involving four plant species, including *Vicia menziesii*).

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of *Vicia menziesii* (Hawaiian Vetch)

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
Assistant Field Supervisor for Endangered Species

Field Supervisor, Pacific Islands Fish and Wildlife Office

for

 Jess Newton

Date 8/28/2012