

## **5-YEAR REVIEW**

### Short Form Summary

**Species Reviewed:** *Bonamia menziesii* (no common name)

**Current Classification:** Endangered

#### **Federal Register Notice announcing initiation of this review:**

[USFWS] U.S. Fish and Wildlife Service. 2008. Endangered and threatened wildlife and plants; initiation of 5-year status reviews of 70 species in Idaho, Montana, Oregon, Washington, and the Pacific Islands. Federal Register 73(83):23264-23266.

#### **Lead Region/Field Office:**

Region 1/Pacific Islands Fish and Wildlife Office, Honolulu, Hawaii

#### **Name of Reviewer(s):**

Marie Bruegmann, Pacific Islands Fish and Wildlife Office, Plant Recovery Coordinator  
Marilet A. Zablan, Pacific Islands Fish and Wildlife Office, Assistant Field Supervisor for Endangered Species  
Jeff Newman, Pacific Islands Fish and Wildlife Office, Acting Deputy Field Supervisor

#### **Methodology used to complete this 5-year 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 29, 2008. The review was based on proposed and final critical habitat designations for *Bonamia menziesii* and other species from the islands of Lanai, Hawaii, Kauai, and Niihau, Molokai, Maui, and Kahoolawe, and Oahu (USFWS 2002, 2003a-e), as well as a review of current, available information. The National Tropical Botanical Garden 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 Tamara Sherrill, biological consultant, was reviewed by the Plant Recovery Coordinator. The document was then reviewed by the Assistant Field Supervisor for Endangered Species and Acting Deputy Field Supervisor before submission to the Field Supervisor for approval.

#### **Background:**

For information regarding the species listing history and other facts, please refer to the Fish and Wildlife Service's Environmental Conservation On-line System (ECOS) database for threatened and endangered species ([http://ecos.fws.gov/tess\\_public](http://ecos.fws.gov/tess_public)).

#### **Application of the 1996 Distinct Population Segment (DPS) Policy:**

This Policy does not apply to plants.

#### **Review Analysis:**

Please refer to the proposed and final rule for critical habitat designation for *Bonamia menziesii* published in the Federal Register on May 28, 2002; January 9, February 27, March 18, May 14, and June 17, 2003, respectively (USFWS 2002, 2003a-e) for a complete review of the species' status (including biology and habitat), threats, and

management efforts. No new threats and no significant new information regarding the species biological status have come to light since listing to warrant a change in the Federal listing status of *B. menziesii*.

This large perennial vine of the morning glory family (Convolvulaceae) is found on most of the main Hawaiian Islands. At the time of listing, *Bonamia menziesii* was known from 28 populations containing approximately 200 individuals on five islands: Kauai, Oahu, Lanai, Maui, and Hawaii (USFWS 1994). In 1999 when the recovery plan was written, *B. menziesii* was known from 31 to 44 populations on the same islands. The total number of individuals statewide was estimated to be in the thousands. Most populations were on Kauai, with several thousand individuals estimated. On Oahu, less than 150 individuals were estimated, and on Lanai approximately 12 individuals were known. On Maui, between 10 and 15 individuals were known, and on the island of Hawaii just one individual (USFWS 1999).

In 1999, population sizes varied from 1 to 100 or more individuals. On Kauai, at least 10 populations were known: Kalalau, Waioli Valley, North Shore, around Limahuli, Na Pali Coast from Hanakapiai to Milolii, Kawaiula Valley, Hipalau Valley, Paaiki Valley, Mount Kahili, and Wahiawa. On Oahu, *Bonamia menziesii* was known from both the Waianae and the Koolau Mountains. In the Waianae Mountains between Kuaokala and Nanakuli, 7 to 8 populations totaling 25 to 50 individuals were known, including in the Lualualei Naval Reservation and the U.S. Army's Makua Military Reservation. In the southeastern part of the Koolau Mountains, there were 7 populations totaling 75 to 100 individuals. On Lanai, *B. menziesii* was known from three scattered locations: approximately six individuals at Kaa, two individuals on Puhielelu Ridge, and four individuals at Paomai. On Maui, a single individual was known from private land on the western slopes of West Maui, and 3 to 5 populations of 9 to 14 individuals were known on East Maui. On the island of Hawaii, a single population of at least one individual was located at Kaupulehu (USFWS 1999).

By 2003, the total number of individuals was estimated to be less than 166 in 37 populations statewide. Kauai had 36 individuals in nine populations; Oahu had less than 100 individuals in 18 populations; Lanai had 14 individuals in three populations; Maui had eight individuals in six populations, and Hawaii island had six to eight individuals in one population (USFWS 2002, 2003a-e). In general, the numbers of extant populations and individuals appear to have declined significantly since 1999, although thorough surveys have not been completed recently. Currently, a total of 138 to 141 *Bonamia menziesii* individuals in at least 31 populations statewide have been observed since 1999 on Kauai, Oahu, Lanai, Maui, and Hawaii islands.

On Kauai, approximately 52 individuals in 7 populations have been observed since 1999, with observations in two additional locations made before that year. An individual plant was seen at a location not previously recorded on Haupu Mountain, at 466 meters (1,530 feet), in February 2007 (National Tropical Botanical Garden 2009a). Observations have not been recorded for all known populations in the last 15 to 20 years, but among those which have been noted, numbers seem to have declined. In Kalalau Valley, one scandent

vine was last observed in 2002 growing ten meters (33 feet) tall in a *Nestegis sandwicensis* (olopua) tree. It had a vigorous main stem of 12 centimeters (five inches) diameter (Hawaii Biodiversity and Mapping Program 2009; National Tropical Botanical Garden 2009a). In Koaie Canyon, a single individual was observed in 2001 climbing 7 meters (23 feet) into a *Hibiscus* sp. (kokio) tree and spreading 25 meters (82 feet) along flats near a stream. An estimated 25 other individuals were also seen that year (Hawaii Biodiversity and Mapping Program 2009; National Tropical Botanical Garden 2009a). Five individuals were observed in Awaawapuhi in 1999 at 853 meters (2,800 feet) elevation (Hawaii Biodiversity and Mapping Program 2009; USFWS 2008) and in Lumahai three individuals were seen in 2001 (National Tropical Botanical Garden 2009b). In the Limahuli Valley an estimated 15 individuals were observed in 1999 (National Tropical Botanical Garden 2009a), while 50 to 100 had been estimated in 1996. Other observations of *B. menziesii* were made in Makaha Valley in 1996 at 695 meters (2,280 feet) elevation, in Kuia in 2001, in Waioli in 1993 (National Tropical Botanical Garden 2009b), and one individual in Kawaiula Valley in 2000 at 753 meters (2,470 feet) elevation (Hawaii Biodiversity and Mapping Program 2009). Thus, current numbers of populations and individuals do not begin to approach the estimates of 1999.

On Oahu, approximately 15 populations now total fewer than 65 individuals, located in both the Waianae and Koolau Mountains. U.S. Army surveys from 2005 estimated 10 individuals each at Kaluakauila, Nanakuli, and Kuaokala; five individuals each at Alaiheihe, Keawaula, and Kapuna; two individuals at Lualualei south of Kolekole Pass and one individual each at Makua, Keaau, Waianae Kai, Kaumokunui, and Kaumoku iki; totaling approximately 52 individuals (U. S. Army Environmental Program 2008; USFWS 2007). At Hawaii Loa Ridge a single individual seen in 2005 by Joel Lau was almost dead. A plant at Lualualei southwest of Pohakea Pass that was fenced in 1997 appears to have died by 2002 (U.S. Army Environmental Program 2008; Hawaii Biodiversity and Mapping Program 2009). Ten individuals were estimated at Kaawa Gulch in the Mt. Kaala Natural Area Reserve in 2003, and an undetermined number of individuals at Kuaokala were found by Joel Lau in 2001, and only two individuals were known at Alaiheihe in 2000 (Hawaii Biodiversity and Mapping Program 2009).

On Lanai, *Bonamia menziesii* is known from three scattered populations that contain at least one individual each. In 2001, two individuals were seen at Kanepuu Preserve at 500 meters (1,600 feet) elevation (National Tropical Botanical Garden 2009a) but only one individual remained in 2008 (H. Oppenheimer, Plant Extinction Prevention Program, pers. comm. 2008). One plant was observed in 2001 at Puhielelu at 506 meters (1,660 feet) elevation (National Tropical Botanical Garden 2009a). Two individuals were located in the Nature Conservancy's Kanepuu Preserve Ahakea Unit but earlier this year one died (H. Oppenheimer, pers. comm. 2008).

On Maui, there are currently 15 to 18 individuals in 5 to 6 populations, with 2 individuals in West Maui, and the remainder in East Maui. One population of two individuals is known from Kapuanakea Preserve, on the Honokowai Ditch Trail, on the slopes of West Maui, at 457 to 500 meters (1,500 to 1,600 feet) elevation (Hawaii Biodiversity and Mapping Program 2009; H. Oppenheimer, pers. comm. 2008). Forbes once collected this

species in Olowalu, but it has not been relocated there during survey work in 2006 and 2008, although the habitat remains in good condition (H. Oppenheimer, pers. comm. 2008). East Maui populations include Puu o Kali with two wild individuals and several outplanted individuals; Kanaio Natural Area Reserve contains three or four wild individuals all some distance from one another; and Lualailua on Department of Hawaiian Homelands land in two or three locales, most with a single individual each. One of these locations, called “*Bonamia* gulch,” was visited by Art Medeiros in 2005 or 2006, and he observed seven to eight large individuals (A. Medeiros, U.S. Geological Survey, pers. comm. 2008). Ken Wood of the National Tropical Botanical Garden had observed four individuals in the Kanaio Natural Area Reserve in 1999 (National Tropical Botanical Garden 2009a).

On the island of Hawaii, one very old individual and two immature individuals are found in the dry forest of Kaupulehu Preserve in North Kona (W. Brawner, Kaupulehu Preserve, pers. comm. 2008; USFWS 2008).

Recruitment of *Bonamia menziesii* has been observed in the Kaluakauila fenced enclosure on Oahu where in 2005, five new individuals were observed (USFWS 2007) and in the fenced Kaupulehu Preserve on the island of Hawaii (W. Brawner, pers. comm. 2008). Elsewhere recruitment has not been seen, and observed individuals are usually mature or senescent (Hawaii Biodiversity and Mapping Program 2008; National Tropical Botanical Garden 2009).

On Oahu, the habitat for *Bonamia menziesii* includes steep slopes or level ground in dry or mesic forest in open or closed canopy and sometimes in wet forest at elevations between 81 and 658 meters (266 and 2,158 feet) containing one or more of the following associated native plant species: *Acacia koa* (koa), *Alectryon macrococcus* (mahoe), *Alyxia stellata* (maile), *Carex meyenii* (no common name [NCN]), *C. wahuensis* (NCN), *Dianella sandwicensis* (uki uki), *Diospyros hillebrandii* (lama), *D. sandwicensis* (lama), *Dodonaea viscosa* (aalii), *Erythrina sandwicensis* (wili wili), *Kadua affinis* (manono), *Leptecophylla tameiameia* (pukiawe), *Melicope* sp. (alani), *Metrosideros polymorpha* (ohia), *Myoporum sandwicensis* (naio), *Nestegis sandwicensis* (olopua), *Pisonia sandwicensis* (papala), *Pittosporum* sp. (hoawa), *Pleomele* sp. (hala pepe), *Pouteria sandwicensis* (alaa), *Psydrax odorata* (alahee), *Rauvolfia sandwicensis* (hao), *Reynoldsia sandwicensis* (ohe makai), *Sapindus oahuensis* (lonomea), *Sicyos* sp. (anunu), *Sida fallax* (ilima), and *Waltheria indica* (uhaloa) (U.S. Army Environmental Program 2008; USFWS 2007).

On Kauai, in the Kalalau Valley below Pihea, *Bonamia menziesii* grows in mesic forest dominated by the native species *Diospyros sandwicensis*, *Antidesma platyphylla* (hame), *Bohea elatior* (ahakea lau nui), *Carex meyenii*, *Diospyros hillebrandii*, *Diplazium sandwichianum* (hoio), *Doodia kunthiana* (okupukupu), *Freycinetia arborea* (ie ie), *Melicope feddei* (alani), *Myrsine lanaiensis* (kolea), *Nephrolepis exaltata* (nianiau), *Pisonia sandwicensis* (papala kepau), *Pleomele aurea*, *Pritchardia minor* (loulu), *Psychotria mariniana* (kopiko), *Psydrax odorata*, *Pteralyxia kauaiensis* (kaulu),

*Rauvolfia sandwicensis*, *Santalum freycinetianum* var. *pyrularium* (iliahi), and *Syzygium sandwicensis* (ohia ha) (National Tropical Botanical Garden 2009a, b).

In Koaie Canyon on Kauai, the habitat is *Diospyros sandwicensis* – *Metrosideros polymorpha* mixed mesic forest with associated native species including *Acacia koaia* (koaia), *Alectryon macrococcus* var. *macrococcus*, *Alyxia stellata*, *Antidesma platyphyllum* var. *hillebrandii*, *Bidens sandwicensis* subsp. *sandwicensis* (kookoolau), *Bohea brevipes* (ahakea lau lii), *B. timonioides* (ahakea), *Carex meyenii*, *C. wahuensis*, *Diospyros sandwicensis*, *Dodonaea viscosa*, *Doodia kunthiana*, *Elaeocarpus bifidus* (kalia), *Eragrostis variabilis* (kawelu), *Flueggea neowawraea* (mehamehame), *Hibiscus waimeae* subsp. *waimeae* (kokio keokeo), *Kadua affinis*, *Psydrax odorata*, *Melicope feddei*, *M. pallida* (alani), *Microlepis strigosa* (palapalai), *Myrsine lanaiensis*, *Nestegis sandwicensis*, *Sphenomeris chinensis* (palaa), *Perrottetia sandwicensis* (olomea), *Pleomele aurea*, *Polypodium pellucidum* (ae lau nui), *Pouteria sandwicensis*, *Pritchardia minor*, *Psilotum nudum* (moa), *Psychotria greenwelliae* (kopiko), *Pteralyxia kauaiensis*, *Pteridium aquilinum* var. *decompositum* (kilau), *Pteris irregularis* (mana), *Rauvolfia sandwicensis*, *Santalum freycinetianum*, *Sophora chrysophylla* (mamane), and *Tetraplasandra kavaiensis* (ohe ohe) (National Tropical Botanical Garden 2009a, b).

In Kuia on Kauai, the habitat is mixed mesic forest with native species *Alyxia stellata*, *Carex wahuensis*, *Diospyros* sp., *Dodonaea viscosa*, *Euphorbia haeleleana* (NCN), *Isodendron laurifolium* (aupaka), *Kokia kauaiensis* (kokio), *Leptecophylla tameiameiae*, *Metrosideros polymorpha*, *Pisonia sandwicensis*, and *Pouteria sandwicensis* (National Tropical Botanical Garden 2009b).

In Lumahai on Kauai, on the eastern ridge just above falls, *Bonamia menziesii* grows in *Metrosideros polymorpha* lowland wet forest with native species *Antidesma platyphyllum* var. *hillebrandii*, *Cheirodendron* spp., *Dubautia knudsenii* (naenaena), *Ilex anomala* (kawau), *Kadua affinis*, *Melicope* spp., *Psychotria hexandra* (kopiko), *P. mariniana*, *P. wawrae* (kopiko), *Syzygium sandwicensis*, and *Tetraplasandra kavaiensis* (National Tropical Botanical Garden 2009b).

In Limahuli on Kauai, the habitat is *Diospyros sandwicensis* - *Metrosideros polymorpha* forest with associated native species including *Antidesma platyphyllum* var. *hillebrandii*, *Bidens* spp., *Bohea* spp., *Boehmeria grandis* (akolea), *Cibotium* spp. (hapuu), *Coprosma* spp. (pilo), *Ilex anomala*, *Kadua acuminata* (au), *Nestegis sandwicensis*, *Pipturus ablidus* (mamake), *Pisonia* spp., *Pleomele aurea*, *Psychotria* spp., *Psydrax odorata*, *Santalum* spp., *Touchardia latifolia* (olona), and *Wikstroemia* sp. (akia) (National Tropical Botanical Garden 2009a).

In Waioli on Kauai, the habitat is *Metrosideros polymorpha* - *Diplopterygium pinnatum* (uluhe lau nui) lowland wet forest with the native species *Cyanea* sp. (haha), *Cyrtandra kealiae* subsp. *kealiae* (haiwale), *C. pickeringii* (haiwale), *Isodendron longifolium* (aupaka), *Lindsaea repens* (laukahi), *Psychotria* spp., and *Scaevola* sp. (National Tropical Botanical Garden 2009b).

On Makaha Ridge on Kauai, associated species include introduced *Aleurites moluccana* (kukui) and native *Acacia koa*, *Diospyros sandwicensis*, *Metrosideros polymorpha*, and *Myrsine* spp. (National Tropical Botanical Garden 2009b).

In Kawaiula Valley on Kauai, *Bonamia menziesii* grows in *Acacia koa* – *Metrosideros polymorpha* mesic forest with native species *Diospyros sandwicensis*, *Diplazium sandwichianum*, *Dodonaea viscosa*, *Euphorbia haelealeana* (NCN), *Freycinetia arborea*, *Isodendron* spp., *Kadua affinis*, *K. knudsenii* (NCN), and *Pleomele aurea* (National Tropical Botanical Garden 2009b).

On Lanai, in the Kanepuu Preserve, *Bonamia menziesii* grows in *Nestegis sandwicensis* – *Diospyros sandwicensis* dry forest with native species *Gardenia brighamii* (nanu) and *Psydrax odorata* (National Tropical Botanical Garden 2009a), and on Puhielelu Ridge in *Diospyros sandwicensis* – *Metrosideros polymorpha* forest with *Dodonaea viscosa*, *Erythrina sandwicensis*, *Nestegis sandwicensis*, *Pouteria sandwicensis*, *Psydrax odorata*, and *Rauvolfia sandwicensis* (National Tropical Botanical Garden 2009a).

In the Kanaio Natural Area Reserve on Maui, *Bonamia menziesii* grows in open dry forest with native species *Alphitonia ponderosa* (kauila), *Dodonaea viscosa*, *Nestegis sandwicensis*, *Osteomeles anthyllidifolia* (ulei), *Pleomele auwahiensis* (hala pepe), *Santalum ellipticum* (iliahi), and *Xylosma hawaiiensis* (maua) (National Tropical Botanical Garden 2009a). In Puu o Kali, there is remnant *Erythrina sandwicensis* dry forest where *Bonamia menziesii* grows with native species *Acacia koa*, *Achyranthes splendens* (NCN), *Argemone glauca* (pua kala), *Canavalia pubescens* (awikiwiki), *Capparis sandwichiana* (maiapilo), *Chamaesyce* sp. (akoko), *Dodonaea viscosa*, *Ipomoea cairica* (ai ai), *Lipochaeta rockii* (nehe), *Nototrichium sandwicensis* (kulei), *Reynoldsia sandwicensis*, *Sida fallax*, and *Senna gaudichaudii* (kolomona) (National Tropical Botanical Garden 2009b). The species' habitat in West Maui is mesic *Diospyros sandwicensis* forest with a mixture of introduced plant species including *Aleurites moluccana*, *Blechnum appendiculatum* (NCN), *Cordyline fruticosa* (ti), *Hedychium* sp. (ginger), *Psidium guajava* (common guava), *Syzygium cumini* (Java plum), and *Schinus terebinthifolius* (Hawaii Biodiversity and Mapping Program 2008).

On the island of Hawaii at Kaupulehu, the dry forest has associated native species including *Colubrina oppositifolia* (anapanapa), *Diospyros sandwicensis* (lama), *Kokia drynarioides* (kokio), *Myrsine lanaiense* (kolea), *Santalum paniculatum* var. *paniculatum* (iliahi), *Sophora chrysophylla* (mamane), and *Xylosma hawaiiense* (maua) (Lorence *et al.* 2000).

Military activities (Factor E) are a possible threat to populations on the Lualualei Naval Reservation and a demonstrated threat on the U.S. Army's Makua Military Reservation (USFWS 1999). Twenty percent of the known individuals of *Bonamia menziesii* and 65 percent of critical habitat on Oahu occur within Kaluakauila in Makua, in xeric invasive introduced grassland habitat, and thus stand a significant risk of being destroyed by military training related wildfires (Factor E) (USFWS 2007). The critical habitat for *B.*

*menziesii* was impacted during a 2003 prescribed burn, and the Army is restoring the habitat in this area as a result (U.S. Army Environmental Program 2008; USFWS 2007).

Invasive introduced plant species (Factor E) also contribute to degradation of *Bonamia menziesii* habitat on Oahu. They include *Adiantum hispidulum* (maidenhair fern), *Grevillea robusta* (silk oak), *Lantana camara* (lantana), *Leucaena leucocephala* (haole koa), *Melinis minutiflora* (molasses grass), *Panicum maximum* (guinea grass), *Pennisetum setaceum* (fountain grass), *Psidium guajava*, *Toona ciliata* (Australian red cedar), *Rivina humilis* (pokeweed), *Salvia coccinea* (sage), *Schinus terebinthifolius*, and *Sida rhombifolia* (NCN) (U.S. Army Environmental Program 2008).

Threats on Lanai include habitat degradation by axis deer (*Axis axis*) (Factor A), mouflon sheep (*Ovis musimon*) (Factor A), and invasive introduced plant species *Schinus terebinthifolius*, *Lantana camara*, and *Pluchea* sp. (marsh fleabane) (Factor E) (National Tropical Botanical Garden 2009a).

On Kauai in Koaie, the threats to this species are habitat degradation by feral goats (*Capra hircus*) and pigs (*Sus scrofa*) (Factor A), and competition from invasive introduced plant species such as *Adiantum hispidulum*, *Aleurites moluccana*, *Commelina diffusa* (dayflower), *Cordyline fruticosa*, *Gastroidium ventricosum* (nitgrass), and *Grevillea robusta* (Factor E) (National Tropical Botanical Garden 2009a). In Limahuli, invasive introduced plant threats (Factor E) include *Syzygium sandwicense* (ohia ha), *Blechnum pyramidatum* (NCN), *Clidemia hirta* (Koster's curse), *Lantana camara*, *Psidium guajava*, *Schefflera actinophylla* (octopus tree), *Schinus terebinthifolius* (Christmas berry), and *Schizachyrium condensatum* (beardgrass), (National Tropical Botanical Garden 2009a). On Makaha Ridge, threats are *Lantana camara* and *Psidium cattleianum* (strawberry guava) (Factor E) (National Tropical Botanical Garden 2009b).

Threats to the populations on Maui are fire (Factor E), and competition from invasive introduced plants species such as *Abutilon grandifolium* (hairy abutilon), *Bidens pilosa* (Spanish needle), *Bocconia frutescens* (NCN), *Cenchrus ciliaris* (buffelgrass), *Lantana camara*, *Pennisetum clandestinum* (Kikuyu grass), and *Prosopis pallida* (mesquite) (Factor E) (National Tropical Botanical Garden 2009a).

The worst threats on the island of Hawaii at Kaupulehu are fire (Factor E) and competition from invasive introduced plant species *Pennisetum setaceum* (fountain grass) (Factor E) (Lorence *et al.* 2000).

Cattle (*Bos taurus*), goats, and sheep apparently browse *Bonamia* plants if they can reach them (Factor C). On Oahu, after cattle were removed, plants of *Bonamia menziesii* at Lualualei grew well over other native vegetation (USFWS 1999). On Lanai, deer (*Axis axis*) are known to feed on this species (Factor C), especially at Kanepuu. An alien beetle (*Physomerus grossipes*) (Factor C), which has become established on Oahu, is a potentially significant threat to *Bonamia menziesii* (USFWS 1999), as are an unidentified species of ant (Factor C) (Board of Water Supply 2004) and an unidentified species of

hard-bodied scale insect (Factor C) (M. DeMotta, National Tropical Botanical Garden, pers. comm. 2008).

Climate change may also pose a threat to *Bonamia menziesii* (Factors A and E). However, current climate change models do not allow us to predict specifically what those effects, and their extent, would be for this species.

The Nature Conservancy has a program for fenced areas in their Kanepuu Preserve on Lanai, and Kamehameha Schools and the National Tropical Botanical Garden have replaced a fence at the Kaupulehu Preserve established by the Territorial Forestry Service almost fifty years ago (Lorence *et al.* 2000). On Oahu, in Lualualei Naval Reservation, *Bonamia menziesii* and one population of *Flueggea neowawraea* were fenced, and there has been an on-going weed removal program (USFWS 2007). On Kauai, the Hawaii Division of Forestry and Wildlife constructed a five foot hog and barbed wire fenced enclosure around an area of approximately 60 by 90 feet protecting *B. menziesii* within the Kekaha Game Management Area at Kahelunui Valley. This is an expansion of an existing enclosure that is protecting *Marattia douglasii* (pala) (State of Hawaii Department of Land and Natural Resources 2008).

The Hawaii Division of Forestry and Wildlife on Maui reintroduced six individuals in the Kanaio Natural Area Reserve (State of Hawaii Department of Land and Natural Resources 2008). Reintroductions have occurred at Puu o Kali on Maui since 2003, but numbers are unknown (Starr and Starr 2009; State of Hawaii Department of Land and Natural Resources 2008). On Hawaii island, the Hawaii Division of Forestry and Wildlife reintroduced 33 *Bonamia menziesii* at Puu Waa Waa, propagated from one source plant collected at Kaupulehu in 2009 (Volcano Rare Plant Facility 2009). *Bonamia menziesii* is fairly well represented in Hawaiian botanical gardens and nurseries. On Maui it is growing at Fleming Arboretum, Maui Nui Botanical Garden, Puu Mahoe Arboretum (H. Oppenheimer, pers.comm. 2008), and Kahanu Garden (National Tropical Botanical Garden 2009a). On Oahu, the Waimea Valley Arboretum has 11 plants that were propagated from five wild individuals from Maui, Hawaii, and Oahu (Waimea Valley Arboretum 2009). Lyon Arboretum has ten seeds in long term storage collected in 2007 from Lanai (Center for Conservation Research and Training Seed Storage Facility 2008), and the species is growing in the Kalama garden at Kamehameha Schools (M. DeMotta, pers. comm. 2008). On Hawaii island, the Division of Forestry and Wildlife also has some plants from Maui in their nursery (Volcano Rare Plant Facility 2009). Attempts to collect and grow seed are being reinitiated at the National Tropical Botanical Garden on Kauai. At present only a small number of seeds were collected from Kanepuu and Puhielelu on Lanai and about 100 seeds from Puu o Kali on Maui are stored, and outplantings which were done in the mid 1990s have apparently died (M. DeMotta, pers. comm. 2008; National Tropical Botanical Garden 2009c,d). *Bonamia menziesii* has been successfully tissue cultured (cloned) at the Harold L. Lyon Arboretum on Oahu; the lab has one seedling propagated by this method from Wailupe Valley (Harold L. Lyon Arboretum 2009).



Stabilizing, downlisting, and delisting objectives are provided in the recovery plan for the multi-island plants (USFWS 1999), based on whether the species is an annual, a short-lived perennial (fewer than 10 years), or a long-lived perennial. *Bonamia menziesii* is a short-lived perennial, and to be considered stable, the taxon must be managed to control threats (e.g., fenced) and be represented in an *ex situ* (at other than the plant's natural location, such as a nursery or arboretum) collection. In addition, a minimum of three populations should be documented on an 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.

The interim stabilization goals for this species have not been met (see Table 1), as no population has been observed since 1999 to have more than 25 mature individuals; the majority of populations have only one individual. In addition, all threats are not being managed. Therefore, *Bonamia menziesii* meets the definition of endangered as it remains in danger of extinction throughout its range.

#### **Recommendations for Future Actions:**

- Continue collecting material for genetic storage and propagation for reintroduction.
- Fence remaining populations to protect them from the impacts of feral ungulates.
- Remove competing invasive introduced plant species within fenced areas.
- Develop and implement fire prevention plans for vulnerable populations.
- Implement genetic studies to assess viability of remaining populations.
- Investigate techniques to improve natural recruitment.
- Survey historical locations on Kauai.
- Work with Hawaii Division of Forestry and Wildlife and other landowners to initiate planning and contribute to implementation of ecosystem-level restoration and management to benefit this species.

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

<b>Date</b>	<b>No. wild indivs.</b>	<b>No. outplanted</b>	<b>Stability Criteria identified in Recovery Plan</b>	<b>Stability Criteria Completed?</b>
1994 (listing)	200	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
1999 (recovery plan)	thousands	0	All threats managed in all 3 populations	Partially
			Complete genetic storage	No
			3 populations with 50 mature individuals each	Yes
2003 (critical habitat)	>166	0	All threats managed in all 3 populations	Partially
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
2009 (5-year review)	138-141	6+	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	No

**U.S. FISH AND WILDLIFE SERVICE**

SIGNATURE PAGE for 5-YEAR REVIEW of *Bonamia menziesii* (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

 Field Supervisor, Pacific Islands Fish and Wildlife Office

  
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Date AUG 27 2010