

## **5-YEAR REVIEW**

### Short Form Summary

**Species Reviewed:** *Pteralyxia kauaiensis* (kaulu)

**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 the final critical habitat designation for *Pteralyxia kauaiensis* and other species from the island of Kauai (USFWS 2003), 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 Samuel Aruch, 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 final critical habitat designation for *Pteralyxia kauaiensis* published in the Federal Register on February 23, 2003 (USFWS 2003) 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 *P. kauaiensis*.

*Pteralyxia kauaiensis* was first known from the Wahiawa Mountains in the southern portion of Kauai. In 2003, when critical habitat was designated, it was known from 39 occurrences, with a total of 1,124 to 1,161 individuals, in scattered locations around Kauai, including Limahuli Valley, both left and right branches of Kalalau Valley, Pohakuao, Makaha Valley, Kuia Valley, Haeleele Valley, Koaie Canyon, Kawaiiki Valley, Hipalau, Haupu, Blue Hole, Poomau Valley, Kapalikea within the Lihue-Koloa Forest Reserve, Na Pali Coast State Park, Na Pali-Kona Forest Reserve, and Puu Ka Pele Forest Reserve (USFWS 2003). Fossil seeds from Makauwahi Cave, at Mahaulepu on Kauai's south shore, show that *P. kauaiensis* occurred in coastal forests before human arrival (Burney *et al.* 2001).

Since 2003 *Pteralyxia kauaiensis* has been observed at ten locations: Limahuli Valley, Mt. Kahili, Hanakapiai Valley, Mahanaloa Valley, Hipalau Valley, two locations in Kalalau Valley, Koaie, Kawaiiki, and Makaha. Fourteen other locations not observed in recent years include a third Kalalau location above Keanapuka Falls, with a single mature individual observed in from 1999 to 2000; Haeleele Valley in 2000; Poopooiki Valley, below the confluence of Mahanaloa and Kuia stream, on north facing forested slopes above basalt cliffs, with an estimated 300 individuals in 1996; two individuals at Blue Hole, in Wailua Drainage at 610 meters (2,000 feet) elevation in 1991; Poomau Canyon in Waimea Canyon with one individual at 463 meters (1,520 feet) in 1988; Pohakuao at 506 meters (1,660 feet) in 1992 with "scattered trees"; one individual on Kaluahaulu Ridge (Mohihi-Waialae Trail) in 1999 at 396 meters (1,300 feet); one individual in upper Kawaiiki at 966 meters (3,170 feet) in 1998; 10 trees on Haupu Mountain at 463 meters (1,520 feet) elevation in 1973; and other historical locations at Wahiawa; Waioli-Waipaa Ridge, Moloaa, behind Papaa; and Hoolulu Valley (Hawaii Biodiversity and Mapping Program 2008; National Tropical Botanical Garden 2008a, b).

From recent observations between 2005 and 2007, eight trees are known at Limahuli, in "Pritchardia Gulch," at an altitude 305 to 396 meters (1,000 to 1,300 feet). No other trees are known elsewhere in Limahuli (National Tropical Botanical Garden 2008b; Tangalin 2008). On Mt. Kahili, two mature individuals were seen in 2004 below the television relay tower at 564 meters (1,850 feet) elevation (National Tropical Botanical Garden 2008b). On Hanakapiai Valley's slopes below Pohakea at 183 meters (600 feet) elevation, nine individuals were counted in 2008, and an estimate was made that not more than 50 individuals remained in the area (National Tropical Botanical Garden 2008b; Tangalin 2008). In Mahanaloa, between 2005 and 2008, botanists from the National Tropical Botanical Garden observed about 30 mature individuals, as well as immature individuals and seedlings in Hawaii Division of Forestry and Wildlife *Pteralyxia* enclosure. Some mature individuals also grow outside the enclosure, and down slope of that valley at 533 to 567 meters (1,748 to 1,860 feet) (National Tropical Botanical Garden 2008b; Tangalin 2008). Hawaii Division of Forestry and Wildlife's records show a total of 27 mature individuals and 54 seedlings in the *Pteralyxia* enclosure in Mahanaloa Valley. They all were healthy to moderately healthy (M. Wysong, Hawaii Department of

Land and Natural Resources, pers. comm. 2008). There appears to be a total of 30 to 80 individuals in Mahanaloa. In Hipalau Valley, about 30 individuals were observed in 2004 at 616 to 914 meters (2,020 to 3,000 feet) elevation (Hawaii Biodiversity and Mapping Program 2008; National Tropical Botanical Garden 2008b). In the very back of Kalalau's lower valley, on forested slopes below and east of Pihea, about 100 mature individuals were observed in 2004 at 445 to 762 meters (1,460 to 2,500 feet) elevation. In Kalalau Valley's Huna region, a deep narrow box canyon below Kahuamaa Flat, 50 scattered mature individuals were seen in 2004 (Hawaii Biodiversity and Mapping Program 2008; National Tropical Botanical Garden 2008b). On a headwater streamlet of Waialae south of Kaluahaulu Ridge Trail, three mature individuals were noted in 2006 at 914 meters (3,000 feet) elevation (Hawaii Biodiversity and Mapping Program 2008; National Tropical Botanical Garden 2008b). In Waimea Canyon, on cliffs to the west of Kawaiiki, between Kawaiiki and Hipalau, facing Koaie stream from above, up to 300 or more mature individuals were observed several times in 2004 at elevations of 518 to 686 meters (1,700 to 2,250 feet) (Hawaii Biodiversity and Mapping Program 2008; National Tropical Botanical Garden 2008b). In Kawaiiki in drainages into Koaie Canyon, 20 mature individuals were observed in 2000 and visited again in 2007 (National Tropical Botanical Garden 2008a). About 50 mature individuals were seen in Makaha in 2004, scattered on the ridge and in gulches from 701 to 792 meters (2,300 to 2,600 feet) elevation (Hawaii Biodiversity and Mapping Program 2008). Estimates from observations since 2003 indicate that between 330 and 700 individual *Pteralyxia kauaiensis* trees remain in 10 populations.

*Pteralyxia kauaiensis* occurs in a range of elevations and habitat types around Kauai. Locations with diverse mixed mesic forest habitat include Mahanaloa, Kuia, Kalalau, Haeleele, and Makaha. Associated species in these areas include some of the following: *Acacia koa* (koa), *Alectryon macrococcus* (mahoe), *Aleurites moluccana* (candle nut), *Alphitonia ponderosa* (kauila), *Alyxia stellata* (maile), *Antidesma platyphyllum* (hame), *Bohea elatior* (ahakea lau nui), *Bonamia menziesii* (no common name [NCN]), *Carex meyenii* (NCN), *Carex wahuensis* (NCN), *Charpentiera elliptica* (papala), *Diellia pallida* (NCN), *Diplazium sandwichianum* (hoio), *Dodonaea viscosa* (aalii), *Doodia kunthiana* (okupukupu), *Elaeocarpus bifidus* (kalia), *Eugenia reinwardtiana* (nioi), *Euphorbia haeleleana* (NCN), *Flueggea neowawraea* (mehehame), *Freycinetia arborea* (ie ie), *Hibiscus waimeae* subsp. *waimeae* (kokio keokeo), *Isodendrion laurifolium* (aupaka), *Kadua affinis* (manono), *Kokia kauaiensis* (kokio), *Melicope barbigera* (uahiapele), *M. feddei* (alani), *Metrosideros polymorpha* var. *glaberrima* (ohia), *Myrsine lanaiensis* (kolea), *Nephrolepis exaltata* (kupukupu), *Nestegis sandwicensis* (olopua), *Nototrichium sandwicense* (kului), *Ochrosia kauaiensis* (holei), *Pisonia sandwicensis* (kalau), *Pittosporum kauaiensis* (hoawa), *Pleomele aurea* (halapepe), *Pouteria sandwicensis* (alaa), *Pritchardia minor* (loulou), *Psychotria greenwelliae* (kopiko), *P. hobyi* (kopiko), *P. mariniana* (kopiko), *Psydrax odorata* (alahee), *Rauvolfia sandwicensis* (hao), *Schiedea apokremnos* (NCN), *Streblus pendulinus* (aiiai), *Tetraplasandra kavaiensis* (ohe ohe), *Xylosma hawaiiense* (ae), and *Zanthoxylum dipetalum* (kawau) (National Tropical Botanical Garden 2008a, b; Perlman 2008; Tangalin 2008).

*Acacia koa* - *Metrosideros polymorpha* mesic wet forest is the habitat at Mt Kahili, and includes associated species *Gardenia remyi* (nanu), *Pisonia* sp., *Pritchardia flynnii*, *Pipturus* sp. (mamake), *Ilex anomala* (kawau), and *Hibiscus kokio* subsp. *kokio* (kokio ula) (National Tropical Botanical Garden 2008a; Perlman 2008; Tangalin 2008).

*Pteralyxia kauaiensis* occurs in Hipalau, Koaie, and Poomau off Waimea Canyon in *Metrosideros polymorpha* – *Diospyros sandwicensis* mesic dry forest where associated species include *Acacia koa*, *Acacia koaia* (koaia), *Alectryon macrococcus*, *Alphitonia ponderosa*, *Alyxia stellata*, *Antidesma platyphylla*, *Artemisia australis* (ahinahina), *Bobea brevipes* (ahakea lau lii), *Bobea timonioides* (ahakea), *Canavalia kauaiensis* (awikiwiki), *Chamaesyce celastroides* var. *hanapepensis* (akoko), *Claoxylon sandwicense* (laukea), *Cryptocarya mannii* (holio), *Diospyros* sp. (lama), *Dodonaea viscosa*, *Doryopteris decora* (NCN), *Erythrina sandwicensis* (wiliwili), *Flueggea neowawraea*, *Hibiscadelphus distans* (haukuahiwi), *Hibiscus waimeae*, *Kokia kauaiensis*, *Lipochaeta connata* var. *acris* (nehe), *Pouteria sandwicensis*, *Melicope anisata* (mokihana), *M. barbiger*, *M. feddei*, *Munroidendron racemosum* (NCN), *Myoporum sandwicensis* (naio), *Myrsine lanaiensis*, *Nototrichium sandwicensis*, *Nestegis sandwicensis*, *Pisonia sandwicensis*, *Pittosporum glabrum* (hoawa), *Plectranthus parviflorus* (ala ala wai nui wahine), *Pleomele aurea*, *Pouteria sandwicensis*, *Psychotria mariniana* (kopiko), *P. greenwelliae* (kopiko), *Psydrax odorata*, *Pteris hillebrandii* (NCN), *Rauvolfia sandwicensis*, *Santalum freycinetianum* (iliahi), *Schiedea spergulina* (NCN), *Spermolepis hawaiiensis* (NCN), *Streblus pendulinus*, *Tetraplasandra kavaiensis*, and *Xylosma hawaiiense* (Hawaii Biodiversity and Mapping Program 2008; National Tropical Botanical Garden 2008a, b; Perlman 2008).

Limahuli, Pohakuao, and Hanakapiai have areas of *Metrosideros polymorpha* – *Diospyros sandwicensis* mesic- wet forest which include some of the following associated native species: *Acacia koaia*, *Alyxia stellata*, *Bobea* sp., *Charpentiera elliptica*, *Cibotium* sp. (hapuu), *Cyrtandra confertiflora* (haiwale), *Diospyros hillebrandii* (lama), *D. sandwicensis* (lama), *Freycinetia arborea*, *Hibiscus kokio* subsp. *saintjohnianus* (kokio ula ula), *Ilex anomala*, *Kadua acuminata* (au), *Kokia kauaiensis*, *Munroidendron racemosum*, *Nephrolepis* sp., *Ochrosia kauaiensis*, *Pleomele aurea*, *Santalum freycinetianum* var. *pyrularium*, *Pandanus tectorius* (hala), *Pipturus* sp., *Pisonia* sp., *Pittosporum* sp., *Pleomele aurea*, *Pouteria* sp., *Psychotria mariniana*, *Psydrax odorata*, *Rauvolfia sandwicensis*, *Syzygium sandwicense* (ohia ha), *Touchardia latifolia* (olona), and *Wikstroemia oahuensis* var. *oahuensis* (akia) and Polynesian introduced tree species *Aleurites moluccana* (National Tropical Botanical Garden 2008a, b; Perlman 2008; Tangalin 2008).

Kawaiiki and Waialeale have *Acacia koa* – *Metrosideros polymorpha* montane mesic forest with *Alphitonia ponderosa*, *Chamaesyce atrococca* (akoko), *C. halemanui* (akoko), *Charpentiera elliptica*, *Claoxylon sandwicensis*, *Coprosma foliosa* (pilo), *Diospyros sandwicensis*, *Dodonaea viscosa*, *Exocarpos luteolus* (heau), *Isodendrion laurifolium*, *Kadua knudsenii* (NCN), *Leptecophylla tameiameiae* (pukiawe), *Lipochaeta fauriei* (nehe), *Peperomia macraeana* (ala ala wai nui), *Perrottetia sandwicensis* (olomea), *Pipturus* sp., *Pouteria sandwicensis*, *Schiedea stellarioides* (laulihilihi), and *Zanthoxylum*

*dipetalum* (Hawaii Biodiversity and Mapping Program 2008; National Tropical Botanical Garden 2008a, b).

Falling boulders (Factor E), goats (*Capra hircus*) (Factors A and D) and related erosion (Factor A) threaten *Pteralyxia kauaiensis*, particularly in steeper areas. The forest floor in Hanakapiai and elsewhere is at times highly disturbed with pig (*Sus scrofa*) and goat damage (Factors A and D) (Tangalin 2008). Invasive introduced plants including *Axonopus fissifolius* (narrow-leaved carpet grass), *Bryophyllum pinnatum* (airplant), *Clidemia hirta* (Koster's curse), *Erigeron karvinskianus* (daisy fleabane), *Grevillea robusta* (silk oak), *Lantana camara* (lantana), *Melia azedarach* (pride-of-India), *Pluchea* sp. (fleabane), *Psidium guajava* (common guava), *P. cattleianum* (strawberry guava), *Rubus rosifolius* (thimbleberry), and *Setaria parviflora* (yellow foxtail), are species which compete with *P. kauaiensis* and degrade habitat quality (Factor E) (National Tropical Botanical Garden 2008b; Perlman 2008; Tangalin 2008).

Larvae of an unknown invertebrate species have been observed eating seeds in Koaie Canyon (Factor C) (Hawaii Biodiversity and Mapping Program 2008). Climate change may also pose a threat to *Pteralyxia kauaiensis* (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.

Efforts to reintroduce *Pteralyxia kauaiensis* have had mixed results. Between 1998 and 2002 Hawaii Department of Land and Natural Resources staff outplanted 10 *P. kauaiensis* at 3 different locations: 8 individuals at Kalalau rim, 1 at the state base yard, and 1 at the Kokee Rare Plant Facility, but none survived. This is most likely due to the fact that none of these habitats were appropriate for the species. When fences are completed in Mahanaloa, the Hawaii Division of Forestry and Wildlife plans to reintroduce many more individuals there (M. Wysong, pers. comm. 2008). The National Tropical Botanical Garden has an uncounted number of seeds in storage, 37 propagated seedlings, 12 small trees in the Lawai Valley nursery, and 13 outplanted individuals for genetic storage between Limahuli, Lawai Kai, Allerton and McBryde Gardens (National Tropical Botanical Garden 2008c, 2009). One *P. kauaiensis* has been established for *inter-situ* storage at Makauwahi Cave Reserve. In Mahanaloa, there are many immature individuals and seedlings in the enclosure and none outside the fence, indicating that the exclusion of ungulates is beneficial to the species (Tangalin 2008).

Stabilizing, downlisting, and delisting objectives are provided in the recovery plan for plants from the island of Kauai (USFWS 1995), based on whether the species is an annual, a short-lived perennial (fewer than 10 years), or a long-lived perennial. *Pteralyxia kauaiensis* is a long-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 the island of Kauai. Each of these populations must be naturally reproducing and increasing in number, with a minimum of 25 mature individuals per population.

The interim stabilization goals for this species have not completely been met (see Table 1), while three populations have more than 25 mature individuals, all threats are not being managed and complete genetic storage has not occurred. Therefore, *Pteralyxia kauaiensis* meets the definition of endangered as it remains in danger of extinction throughout its range.

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

- Continue collecting seed from all populations for genetic storage and reintroduction.
- Propagate plants for reintroduction.
- Fence wild populations to exclude the negative impacts from ungulates.
- Control invasive introduced species around wild plants.
- Survey historical locations to the species' current status.
- Work with Hawaii Division of Forestry and Wildlife and Hawaii State Parks to initiate planning and contribute to implementation of ecosystem-level restoration and management to benefit this species.

#### **References:**

- Burney, D.A., H.F. James, L.P. Burney, S.L. Olson, W. Kikuchi, W.L. Wagner, M. Burney, D. McCloskey, D. Kikuchi, F.V. Grady, R. Gage, and R. Nishek. 2001. Fossil evidence for a diverse biota from Kauai and its transformation since human arrival. *Ecological Monographs* 71(4):615-641.
- Hawaii Biodiversity and Mapping Program. 2008. Program database. Hawaii Biodiversity and Mapping Program, Honolulu, Hawaii.
- National Tropical Botanical Garden. 2008a. Herbarium database. National Tropical Botanical Garden, Kalaheo, Hawaii.
- National Tropical Botanical Garden. 2008b. Living collections database. National Tropical Botanical Garden, Kalaheo, Hawaii. Unpublished.
- National Tropical Botanical Garden. 2008c. Plant out records from living collections database. National Tropical Botanical Garden, Kalaheo, Hawaii.
- National Tropical Botanical Garden. 2009. Report on controlled propagation of listed and candidate species, as designated under the U.S. Endangered Species Act. National Tropical Botanical Garden, Kalaheo, Hawaii. Unpublished.

Perlman, S. 2008. *Pteralyxia kauaiensis*. National Tropical Botanical Garden, Kalaheo, Hawaii. 5 pages. Unpublished.

Tangalin, N. 2008. *Pteralyxia kauaiensis*. National Tropical Botanical Garden, Kalaheo, Hawaii. 7 pages. Unpublished.

[USFWS] U.S. Fish and Wildlife Service. 1994. Endangered and threatened wildlife and plants; determination of endangered or threatened status for 24 plants from the island of Kauai, HI; final rule. Federal Register 59(38): 9304-9329.

[USFWS] U.S. Fish and Wildlife Service. 1995. Recovery plan for the Kauai plant cluster. U.S. Fish and Wildlife Service, Portland, Oregon. 270 pages.

[USFWS] U.S. Fish and Wildlife Service. 2003. Endangered and threatened wildlife and plants; final designation or nondesignation of critical habitat for 95 plant species from the islands of Kauai and Niihau, Hawaii; final rule. Federal Register 68(39):9116-9479.

### **Personal Communications**

Wysong, Michael. 2008. Kauai Natural Area Reserve Manager, Hawaii Department of Land and Natural Resources. E-mail to Margaret Clark, National Tropical Botanical Garden, dated December 24, 2008. Subject: *Pteralyxia kauaiensis*.

**Table 1. Status of *Pteralyxia kauaiensis* 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)	170-300	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 25 mature individuals each	Yes
1995 (recovery plan)	500-1000	Unknown	All threats managed in all 3 populations	No
			Complete genetic storage	Partially
			3 populations with 25 mature individuals each	Yes
2003 (critical habitat)	1,124-1,161	0	All threats managed in all 3 populations	No
			Complete genetic storage	Partially
			3 populations with 25 mature individuals each	Yes
2009 (5-year review)	330-700	0	All threats managed	No
			Complete genetic storage	Partially
			3 populations with 25 mature individuals each	Yes



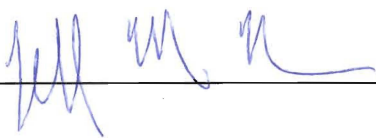
**U.S. FISH AND WILDLIFE SERVICE**  
SIGNATURE PAGE for 5-YEAR REVIEW of *Pteralyxia kauaiensis* (kaulu)

**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**

  
\_\_\_\_\_

Date   AUG 27 2010