5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Clermontia lindseyana* (oha wai)

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, 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 final critical habitat designations for *Clermontia lindseyana* and other species from the islands Maui and Kahoolawe, and Hawaii (USFWS 2003a, b) 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).

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 designations for *Clermontia lindseyana* published in the Federal Register on May 14, and July 2 of 2003 (USFWS 2003a, b) 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 *C. lindseyana*.

Clermontia lindseyana, a short-lived perennial member of the bellflower family (Campanulaceae), is a small, branched tree that grows from 2 to 6 meters (8.2 to 20 feet) tall. It is either terrestrial or epiphytic, on *Metrosideros polymorpha* (ohia), *Cibotium* sp. (hapuu), *Acacia koa* (koa) or mossy logs (Hawaii Biodiversity and Mapping Program 2009; Wood 2009). It is distinguished from other *Clermontia* species by having much larger leaves and flowers, petals similar to sepals, and spreading floral lobes. The leaves are hairy on the lower surface. It has been observed in fruit from June to October and in flower from February to August (Hawaii Biodiversity and Mapping Program 2009; USFWS 2003a).

Historically, *Clermontia lindseyana* was known from East Maui and the island of Hawaii. The two Maui populations are located in Waiopae and Wailaulau Gulches in the Kahikinui and Kula Forest Reserves on State and private lands, on the leeward slope of Haleakala Volcano, and in 2002 were estimated to total about 330 individuals at about 1,372 meters (4,500 feet) elevation (Hawaii Biodiversity and Mapping Program 2009; USFWS 2003a).

On the island of Hawaii, *Clermontia lindseyana* is known from South Hilo, North Hilo, Kau, and South Kona Districts. In the South Hilo District, in Hakalau National Wildlife Refuge, above Papaikou, near Pua Akala, three individuals were observed in 1994 in a gulch between 1,829 and 1,859 meters (6,000 and 6,100 feet) elevation (Wood 2009). Another six individuals were observed in 1994 at Puu Akala, near Hakalau (Perlman 2009). In 2009, 10 to 15 individuals are believed to remain in the Hakalau National Wildlife Refuge and Piha Forest Reserve (K. Bio, Plant Extinction Prevention Program, pers. comm. 2009).

In the Kau and South Hilo Districts, in 1991, 20 individuals were seen at Keauhou Ranch, 10 in the Kilauea Forest, and 7 in the Kulani Project (Hawaii Biodiversity and Mapping Program 2009). On the border of North Hilo and South Hilo Districts, at Kulani Correctional Facility, past the boy's school, on a bird survey transect, observations from 1991 to 1998 counted up to 12 individuals at elevations from 914 to 1,768 meters (3,000 to 5,800 feet) (National Tropical Botanical Garden 2008; Perlman 2009; Wood 2009). Nearby at Puu Kipu, in the Kilauea Forest, Steve Perlman of the National Tropical Botanical Garden and Kealii Bio of the Plant Extinction Prevention Program saw 18 individuals in 2007 (Perlman 2009). Currently, Olaa-Kilauea Management Area (Kilauea Forest and the boy's school) has between 40 and 50 wild individuals remaining (K. Bio, pers. comm. 2009).

In the Kau Forest Reserve, *Clermontia lindseyana* was documented at three sites. At Kahuku in the upper Kau Forest Reserve, 6 to 12 individuals remain. In the lower Kau Forest Reserve, 8 wild individuals remain (K. Bio, pers. comm. 2009). These occur in mesic to wet *Metrosideros polymorpha* forest in the eastern area along the Hawaii Volcanoes National Park boundary at 1,800 meters to 1,900 meters (5,905 to 6,234 feet)

elevation. The observed individuals were large and growing epiphytically on large-diameter *M. polymorpha* trees. One individual had seedlings which were also epiphytic (Benitez 2008). *Clermontia lindseyana* is a new endangered species record for the National Park. One hundred or more individuals were seen in South Kona, Olelomoana, near Kukuiopae in 2007 at 1,408 meters (4,620 feet) elevation (Perlman 2009), but the Hawaii island coordinator for the Plant Extinction Prevention program says there are only 30 to 40 wild individuals remaining there (K. Bio, pers. comm. 2009). *Clermontia lindseyana* had also been documented in the Kau Forest Reserve and Kapapala Forest Reserve in 1995 at 1,442 to 1,798 meters (4,730 to 5,900 feet) elevation (Hawaii Biodiversity and Mapping Program 2009).

In 2006 on East Maui, Hank Oppenheimer observed at least 30 plants in 6 distinct patches in eastern Waiopae Gulch, Kahikinui Forest Reserve at 1,493 meters (4,900 feet) elevation (H. Oppenheimer, Plant Extinction Prevention Program, pers. comm. 2010). These included saplings as small as 1 meter (3.3 feet) tall. Seeds were collected and sent to the seed storage lab at Lyon Arboretum.

Earlier observations have not been verified recently. Two populations on the island of Hawaii were noted in 1977: Laupahoehoe in North Hilo district, at 1,670 to 1,682 meters (5,480 to 5,520 feet) elevation and Makahanaloa north of Kapue Stream in the Hilo Forest Reserve, South Hilo District at 1,597 to 1,664 meters (5,240 to 5,460 feet) elevation (Hawaii Biodiversity and Mapping Program 2009). Two populations last seen in 1987 were two miles west of Puu Oo at 2,146 meters (7,040 feet) (North Hilo District) and at Waiea in South Kona District, Kona Forest Unit of the Hakalau National Wildlife Refuge, at 1,615 to 1,655 meters (5,300 to 5,430) feet. In 1993, Jack Jeffrey observed 1 individual in Piha Ahupuaa in North Hilo District, Hilo Forest Reserve at 1,646 to 1,664 meters (5,400 to 5,460 feet) elevation; 10 individuals on sidewalls and logs of a steep sided gulch in Papaikou, South Hilo, at 1,829 meters (6,000 feet); and in Maulua Nui, North Hilo, 1 individual at 1,597 meters (5,240 feet) and another individual at 1,652 meters (5,420 feet) (Hawaii Biodiversity and Mapping Program 2009).

Because many current observations are not available it is difficult to estimate the number of extant populations or individuals. However, it seems likely that there are at least four or more populations remaining on Hawaii and Maui, and between 400 and 500 individuals total.

A mapping project on the island of Hawaii revealed that *Clermontia lindseyana* grows in a circumscribed elevational band around the island, with occurrences forming a narrow circle around all but the Kohala portion of the island (Jacobi 2008).

On Maui, *Clermontia lindseyana* grows in *Acacia koa* mesic forest containing one or more of the following associated native plant species: *Coprosma* spp. (pilo), *Cyrtandra* spp. (haiwale), *Ilex anomala* (kawau), *Myrsine* spp. (kolea), or native fern species, at elevations between 1,142 and 1,870 meters (3,747 and 6,134 feet) (USFWS 2003a).

On the island of Hawaii the habitat is *Acacia koa – Metrosideros polymorpha* mesic forest with *Cheirodendron* sp. (olapa), *Cibotium* sp. (hapuu), *Clermontia clermontioides* subsp. *clermontioides* (oha wai), *Coprosma* spp., *Cyanea hamatiflora* subsp. *carlsonii* (haha), *Cyanea shipmanii* (haha), *Cyanea stictophylla* (haha), *Cyrtandra platyphylla* (ilihia), *Dryopteris wallichiana* (io nui), *Ilex anomala* (kawau), *Myrsine lessertiana* (kolea lau nui), *Rubus hawaiensis* (akala), and *Vaccinium* sp. (ohelo) (Perlman 2009). At Hakalau, the habitat is *Acacia koa – Metrosideros polymorpha* montane mesic-wet forest with *Astelia* sp. (painiu), *Clermontia* sp., *Cyanea* sp., and *Diplazium sp.* (hoio) (Wood 2009).

In South Kona Forest Reserve and the Olelomoana Forest Reserve the habitat is *Metrosideros polymorpha – Cibotium* sp. montane forest with *Acacia koa*, *Alyxia stellata* (maile), *Asplenium polyodon* (punana manu), *Astelia* sp., *Broussaisia arguta* (kanawao), *Coniogramme pilosa* (loulu), *Coprosma ochracea* (pilo), *C. pubens* (pilo), *Coprosma rhynchocarpa* (pilo), *Dicranopteris linearis* (uluhe), *Dryopteris wallichiana*, *Ilex anomala*, *Kadua affinis* (manono), *Melicope clusiifolia* (alani), *Melicope volcanica* (alani kuahiwi), *Myrsine* sp., *Peperomia hypoleuca* (ala ala wai nui), *Peperomia blanda* var. *floribunda* (ala ala wai nui), *Pipturus* sp. (mamake), *Pittosporum hosmeri* (hoawa), *Phytolacca sandwicensis* (popolo ku mai), *Pteris* sp. (mana), *Rubus hawaiensis*, *Rumex giganteus* (pawale), *Stenogyne calaminthoides* (no common name), and *Vandenboschia davallioides* (palai hihi). At the Kulani Correctional Facility, *Clermontia lindseyana* occurs in *Acacia koa – Metrosideros polymorpha* montane mesic forest with *Athyrium microphyllum* (akolea), *Carex* sp. (NCN), *Coprosma* spp., *Dryopteris wallichiana*, *Ilex anomala*, *Rubus hawaiensis*, *Myrsine* sp., and *Vaccinium* sp. (National Tropical Botanical Garden 2008; Wood 2009).

The threats to *Clermontia lindseyana* include trampling and grazing by cattle (*Bos taurus*), trampling and browsing by goats (*Capra hircus*), and trampling and rooting by pigs (*Sus scrofa*) (Factors A, C, and D) (Hawaii Biodiversity and Mapping Program 2009; National Tropical Botanical Garden 2008; Perlman 2009; USFWS 2003a, b).

Competition with the invasive introduced plant species *Pennisetum clandestinum* (Kikuyu grass) in Kulani, and *Ulex europaeus* (gorse) and *Juncus effusus* (Japanese mat rush) in Hakalau Forest Reserve are serious threats. Other introduced invasive plant species are *Rubus argutus* (prickly Florida blackberry), *Passiflora tarminiana* (banana poka), *Tibouchina herbacea* (glory bush), and *Ilex aquifolium* (English holly) (Factor E) (Maxfield 1998; Wood 2009).

Consumption of berries, flowers, bark, and vegetation by black rats (*Rattus rattus*) is a threat to *Clermontia lindseyana* (Factor C) (Hawaii Biodiversity and Mapping Program 2009; USFWS 2003a, b). Predation by unidentified species of slugs (Perlman 2009) is also noted (Factor C).

Another threat factor is the loss of pollinators and loss of transport vectors for seed, and limited outcrossing due to both the scarcity and distances in distribution (Factor E) (K. Bio, pers. comm. 2009).

Climate change may also pose a threat to *Clermontia lindseyana* (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.

Currently, the species is protected within ungulate-free exclosures only within Hakalau Forest, Kulani, and Kilauea Forest in the eastern section of the species' range. The areas of Kahuku where *Clermontia lindseyana* were observed had extensive damage from pig activity and either feral cattle or mouflon (*Ovis orientalis* and *O. musimon*) browsing; and no terrestrial individuals were observed. Protection of the Kahuku/Kau Forest population is important to the conservation of this species in the southernmost portion of its range (Benitez 2008).

On the island of Hawaii the Volcano Rare Plant Facility made 14 different collections from Puu Kipu, Kilauea Forest Reserve, and Kulani from ten individuals, and grew 105 individuals of *Clermontia lindseyana* from Puu Kipu for reintroduction by the Hawaii Department of Land and Natural Resources, Division of Forestry and Wildlife. These 105 individuals were planted in Puu Makaala and in the Kilauea Forest area in 2007 (K. Bio, pers. comm. 2009; P. Moriyasu, Volcano Rare Plant Facility, pers. comm. 2009). Their objective in 2008 was to complete a nine acre enclosure at Kukuiopae, in the South Kona Forest Reserve, to provide protected habitat for: *Clermontia lindseyana*, *Cyanea stictophylla* (haha), *Cyanea hamatiflora* ssp. *carlsonii* (haha), *Stenogyne macrantha* (NCN), and *Bidens campylotheca* ssp. *campylotheca* (kookoolau), but it was not completed as the feral cattle issue in South Kona Forest Reserve still needed to be resolved (Hawaii Department of Land and Natural Resources 2008). In Hakalau National Wildlife Refuge, 136 *C. lindseyana* seedlings were grown and reintroduced into pig-free areas (Maxfield 1998). Seeds were formerly collected from the South Kona Forest Reserve, Kulani Bogs, and Kilauea Forest for propagation there as well (Hawaii Department of Land and Natural Resources 2005; Olaa-Kilauea Partnership 2006).

In 2009, the Volcano Rare Plant Facility had plants representing 19 wild individuals from Puu Kipu, Kau, Piha, Olelomoana, and South Kona Forest Reserve in the nursery (Volcano Rare Plant Facility 2009). Two collections were made from two individual plants from Kukuiopae in 2008. Nine individuals were reintroduced to Kipahoehoe in 2003, and 7 in 2006 (Volcano Rare Plant Facility 2008). In 2009, 253 individuals were reintroduced into Puu Makaala Natural Area Reserve and 185 into Hawaii Volcanoes National Park. None of these reintroduced individuals have reached maturity yet (Volcano Rare Plant Facility 2009). Collections from four individuals were made at Olelomoana but none have been reintroduced yet. Recent collections have been made from newly discovered individuals in the Hilo Forest Reserve and the Kau Forest Reserve (P. Moriyasu, pers. comm. 2009).

Hawaii Volcanoes National Park has 125 plants in their nursery from Puu Kipu. Seventy-three individuals were reintroduced into two Kahuku enclosures (Hawaii Volcanoes National Park 2009). The National Tropical Botanical Garden has 650 seeds in storage from the Kulani Correctional Facility (National Tropical Botanical Garden 2009).

The Olaa-Kilauea Management Area in the Kilauea Forest and Puu Makaala Natural Area Reserve are the most stable habitat due to management efforts and therefore has the most stable population. There will be more individuals reintroduced there in the near future, representing 11 founders, from the Volcano Rare Plant Facility. Another 500 individuals will be reintroduced in the Manuka Natural Area Reserve and in Hawaii Volcanoes National Park in February 2009. These areas have good conservation management that provides suitable habitat for the Kilauea population of *Clermontia lindseyana* (K. Bio, pers. comm. 2009).

On Maui, the Leeward Haleakala Watershed Restoration Partnership has identified *Clermontia lindseyana* as one of a number of endangered species which need to be fenced against ungulates within its area of concern (Leeward Haleakala Watershed Restoration Partnership 2006).

Interim, downlisting, and delisting objectives are provided in the Recovery Plan for The Big Island plant cluster (USFWS 1996), based on whether the species is an annual, a short- lived perennial (fewer than ten years), or a long-lived perennial. *Clermontia lindseyana* is a long-lived perennial, and to be considered downlisted, 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 five to seven populations should be sustained for five years on islands where they now occur or occurred historically. For the species to be downlisted, each of these populations must be naturally reproducing and increasing in number, with a minimum of 300 mature individuals per population.

The downlisting goals for this species have not been met as no population has 300 mature individuals and not all threats have been managed (see Table 1). Therefore, *Clermontia lindseyana* meets the definition of endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:

- Protect all occurrences against trampling, browsing, and disturbances from feral ungulates.
- Develop and implement methods of rat control for all populations.
- Monitor for slug depredation, and develop and implement control methods as needed.
- Weed all exclosures to inhibit invasive alien competitor plant species.
- Survey formerly identified locations for current status of populations, especially on Maui.

- Work with Hawaii Division of Forestry and Wildlife and other land managers 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 *Clermontia lindseyana* from listing through 5-year review.

Date	No. wild indivs	No. outplanted	Downlisting Criteria identified in Recovery Plan	Downlisting Criteria Completed?
1994 (listing)	225-325	0	All threats managed in all 5-7 populations	No
			Complete genetic storage	No
			5-7 populations with 300 mature individuals each	No
1996 (recovery plan)	400-430	0	All threats managed in all 5-7 populations	No
			Complete genetic storage	No
			5-7 populations with 300 mature individuals each	No
2003 (critical habitat)	400-430	0	All threats managed in all 5-7 populations	No
			Complete genetic storage	No
			5-7 populations with 300 mature individuals each	No
2009 (5-year review)	400-500	0	All threats managed in all 5-7 populations	No
			Complete genetic storage	Partially
			5-7 populations with 300 mature individuals each	No

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SIGNATURE PAGE for 5-YEAR REVIEW of *Clermontia lindseyana* / (oha wai)

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

Field Supervisor, Pacific Islands Fish and Wildlife Office

for

Date AUG 2 7 2010