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. 2013. Endangered and threatened wildlife and plants; Initiation of 5-year status reviews of 44 species in Oregon, Hawaii, Guam, and the Northern Mariana Islands. Federal Register 78(24):8185-8187.

Lead Region/Field Office:

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

Name of Reviewer(s):

Chelsie Javar-Salas, Plant Biologist, PIFWO
Marie Bruegmann, Plant Recovery Coordinator, PIFWO
Kristi Young, Programmatic Deputy Field Supervisor, PIFWO

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 March 4, 2013. The review was based on a review of current, available information since the last 5-year review for *Cyanea shipmanii* (USFWS 2009). The evaluation by Chelsie Javar-Salas, Plant Biologist, was reviewed by the Plant Recovery Coordinator. It was subsequently reviewed and approved by the Programmatic Deputy Field Supervisor.

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 at: *http://ecos.fws.gov/tess_public*.

Review Analysis:

Please refer to the previous 5-year review for *Clermontia lindseyana* published on August 27, 2010 (available at: *http://ecos.fws.gov/docs/five_year_review/doc3333.pdf*) for a complete review of the species' status, threats, and management efforts. No significant new information regarding the species' biological status has come to light since listing to warrant a change in the Federal listing status of *C. lindseyana*.

This short-lived perennial is a member of the bellflower family (Campanulaceae) and is endangered (USFWS 2010). Historically, *Clermontia lindseyana* was known from East Maui and Hawaii Island (USFWS 1996) and currently, remains to be found on those islands. The status and trends for *C. lindseyana* are provided in the tables below.

New status information:

On Hawaii Island, *Clermontia lindseyana* is categorized as Rare on Island (ROI) and is monitored by the Plant Extinction Prevention Program (PEPP) (2009, 2010, 2011, 2012, 2014).

In 2009, there were four populations containing 75 wild individuals of *Clermontia lindseyana* (Plant Extinction Prevention Program [PEPP] 2010). As of 2009, the Olelomoana South Kona Forest Reserve population contained ten wild individuals of *Clermontia lindseyana* (PEPP 2009). There are 43 wild individuals at Hawaii Volcanoes National Park (2013) Kahuku Unit. Twenty-seven of the 43 wild individuals at Kahuku have seeds in storage. Within the Kahuku Unit, there are approximately 74 reintroduced individuals of *Clermontia lindseyana* (PEPP 2014).

In the South Hilo districts, thirteen mature individuals were observed at Hakalau Forest National Wildlife Refuge (NWR) (PEPP 2012). Six wild individuals are known from Piha Forest Reserve (PEPP 2009).

No status updates were provided for the populations at Kukuiopae Forest Reserve, Kilauea Forest and Kulani area, and Kau Forest Reserve on Hawaii Island.

On Maui, there is one known occurrence totaling approximately 30 individuals on east Maui at Wailaulau (USFWS 2012).

Overall, the numbers of individuals have decreased from the 400 to 500 individuals reported in the previous 5-year review, to approximately 124 wild individuals in 2015. This large decrease in the numbers of wild individuals is related to the lack of current information for four populations on Hawaii Island. Meanwhile, more than 2,000 individuals were reintroduced to Kipahoehoe Natural Area Reserve, Hawaii Volcanoes National Park and their Kahuku Unit, and Laupahoehoe Natural Area Reserve.

New management actions:

- Surveys / inventories
    - At Hakalau Forest NWR, a survey was conducted to search for potential reintroduction sites for *C. lindseyana* (PEPP 2009).
    - A survey was conducted for wild individuals at known locations in Hakalau Forest NWR (PEPP 2009). Seven of the 15 known individuals were observed and fruits were collected from two individuals (PEPP 2009).
    - At Kahuku CCC Exclosure, many new seedlings were found during a survey of the area following animal control and fence construction (PEPP 2014). Eight individuals were historically known from the area.
    - A survey was conducted at South Kona Forest Reserve for *C. lindseyana*; no new individuals were reportedly found (State of Hawaii Department of Land and Natural Resources [DLNR] 2014).
- Ungulate monitoring and control – In 2010, a 20-acre fenced exclosure (Kahuku CCC) was constructed with funds provided by the National Park Service Regional Program Block Grant at the Kahuku Unit (Hawaii Volcanoes National Park 2013a).
- Captive propagation for genetic storage and reintroduction

- In 2012, the Volcano Rare Plant Facility (2012) had four founders in their nursery representing founders from Kaʻu and Piha Forest Reserve. The Facility propagated 440 individuals for outplanting next year. Meanwhile, 51 individuals were propagated for reintroduction at Laupahoehoe (20) and Hawaii Volcanoes National Park (31) in 2012. In 2013, the Volcano Rare Plant Facility (2013) had two founders growing in their nursery from Piha Forest Reserve. The Facility propagated 159 individuals for reintroduction next year and 253 individuals were propagated for reintroduction at Hakalau Forest NWR in 2013. In 2014, the Facility had three plants growing in their nursery representing founders from Kau and Piha Forest Reserve (Volcano Rare Plant Facility 2014). The Facility propagated 10 individuals for reintroduction next year and 158 individuals were propagated for reintroduction at Hakalau Forest NWR in 2014.
- The Harold L. Lyon Arboretum Seed Conservation Laboratory (2014) has more than 50,000 seeds in storage representing founders from Maui and 500 seeds from Hawaii Island.
- The Hawaii Volcanoes National Park (2013b) has 2,000 plants of *C. lindseyana* growing in their nursery. In 2014, there were 1,226 plants growing in their nursery (Hawaii Volcanoes National Park 2014).
- The National Tropical Botanical Garden (2014) has 650 seeds in genetic storage from Hawaii Island.

- Reintroduction / translocation
  - In 2009, 419 individuals of *C. lindseyana* were reintroduced into a new site within the Kipahoehoe Natural Area Reserve (PEPP 2010; Volcano Rare Plant Facility 2010). In 2010, an additional 29 individuals were reintroduced at Kipahoehoe Natural Area Reserve (Volcano Rare Plant Facility 2011). The survivorship rates of these reintroduced individuals are unknown.
  - In 2009, 443 plants were propagated by the Volcano Rare Plant Facility and planted into two Kahuku exclosures (73 individuals) and at two sites on Mauna Loa strip (370 individuals) (Hawaii Volcanoes National Park 2010).
  - Two individuals were reintroduced at Laupahoehoe Natural Area Reserve and four individuals at Hawaii Volcanoes National Park (Volcano Rare Plant Facility 2011).
  - In 2012, 35 individuals were reintroduced at the Kahuku CCC exclosure (Hawaii Volcanoes National Park 2013b). In 2014, 1,165 individuals were reintroduced at Kahuku, Mauna Loa strip, and Kipuka Ki (Hawaii Volcanoes National Park 2014).
- Population viability monitoring and analysis
  - In 2008, the wild population at Olelomoana South Kona Forest Reserve was monitored and fruit was collected from 5 of the 10 wild individuals of *C. lindseyana* (PEPP 2009). The fruit was delivered to the Volcano Rare Plant Facility.
  - In 2011, 13 mature and 2 immature individuals of *C. lindseyana* were monitored at Hakalau Forest NWR (PEPP 2012).
  - The single wild individual at the Maulua Unit at Hakalau Forest NWR was also monitored in 2009 for reproductive status and health vigor conditions (PEPP 2009).

- The six wild individuals at Piha Forest Reserve were monitored (PEPP 2009).
- In 2008, the population of *C. lindseyana* in the Kau Forest Reserve was monitored and fruit was collected from one of the five known plants (PEPP 2009). The population was revisited in 2009 (PEPP 2010). Propagules of *C. lindseyana* was collected from the Kau Forest Reserve in 2013 (DLNR 2014).
- In 2008, the four known wild individuals at Nauhi Unit at Hakalau Forest NWF was monitored and fruit was collected from one individual (PEPP 2009).
- Three of the seven reintroduced individuals at Hakalau NWR Magnetic Hill were monitored (PEPP 2011).
- Natural regeneration of *C. lindseyana* from mature plants was observed within the newly constructed Kahuku CCC exclosure within weeks of fence construction (in 2010) and many seedlings have persisted into 2013, with some more than one meter in height (Hawaii Volcanoes National Park 2013).
- Thirteen months post-planting, survival rates was high with 73 percent of the 270 reintroduced individuals remained alive in the Boundary Kipukas (Hawaii Volcanoes National Park 2010). In contrast, the nearby Soapberry Bend site only recorded a 7.8 percent survival rate of the 100 individuals planted. The remaining individuals at Soapberry Bend were removed from the field and taken to the nursery at Hawaii Volcanoes National Park. In the Kahuku exclosures survival rate was 44 percent at 20 months and 40 percent by 31 months post planting of the 73 individuals (Hawaii Volcanoes National Park 2011). As of 2011, none of the plantings had produced flowers or fruit but growth was vigorous.
- Following one year since planting, 97 percent of the 35 plants reintroduced at the Kahuku CCC exclosure remained (Hawaii Volcanoes National Park 2013).

- Population biology research – Research on pollination ecology discovered that two honeycreeper species, iiwi (*Vestiaria coccinea*) and Hawaii amakihi (*Hemignathus virens*), were infrequent or occasional floral visitors to *C. lindseyana* at Hakalau Forest NWR (Pender 2013). However, whenever iiwi visited the flowers of *C. lindseyana* they did not function as pollinators but instead nectar robbed on average approximately 60 percent of the flowers they visited (Pender 2013). Hawaii amakihi also visited the flowers of *C. lindseyana*, but in almost all cases (91 percent) nectar robbed the flowers (Pender 2013).
- Climate change adaptation strategy – Fortini *et al.* (2013) conducted a landscape-based assessment of climate change vulnerability for native plants of Hawaii using high resolution climate change projections. Climate change vulnerability is defined as the relative inability of a species to display the possible responses necessary for persistence under climate change. The assessment by Fortini *et al.* (2013) concluded that *C. lindseyana* is minimally vulnerable to the impacts of climate change.
- Listing and critical habitat designation – A single unit of critical habitat was proposed on Maui in the montane mesic ecosystem for *C. lindseyana* (USFWS 2012). The final rule for critical habitat designations has not been published at the time of this review.

Synthesis:
Stabilizing, downlisting, and delisting objectives are provided in the recovery plan for Big Island plant cluster (USFWS 1996), based on whether the species is an annual, a

short-lived perennial (fewer than 10 years), or a long-lived perennial. *Clermontia lindseyana* 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 the island of Hawaii and, if possible, at least one other island where it now occurs or where it occurred historically. Each of these populations must be naturally reproducing and increasing in number, with a minimum of 50 mature individuals per population.

The downlisting goals for this species have not been met, as no population has more than 300 mature individuals (Table 1). However, additional information on the current status of the species from all of the populations is needed to better assess the downlisting goals for this species. Likewise, all of the threats are not being sufficiently managed throughout all of the populations (Table 2). Therefore, *Clermontia lindseyana* meets the definition of endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:

- Surveys / inventories – Survey geographical and historical range for a current assessment of the species' status.
- Captive propagation for genetic storage and reintroduction – Continue collection of genetic resources for storage, propagation, and reintroduction into protected suitable habitat within historical range.
- Ungulate monitoring and control – Maintain existing fences and fence remaining populations to protect them from the impacts of feral ungulates.
- Invasive plant monitoring and control – Eradicate invasive introduced plants within ungulate exclosures and maintain exclosures free of invasive plants.
- Predator / herbivore monitoring and control – Control slugs (unidentified species) and rodents within the vicinity of all known *C. lindseyana* populations.
- Population viability monitoring and analysis – Continue monitoring wild and reintroduced individuals.
- Alliance and partnership development – Initiate planning and contribute to implementation of ecosystem-level restoration and management to benefit this taxon.

Table 1. Status and trends of *Clermontia lindseyana* from listing through current 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-yr 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
2012 (critical habitat - proposed)	30 (Maui only)	n/a	All threats managed in all 5-7 populations	No
			Complete genetic storage	Partially
			5-7 populations with 300 mature individuals each	No
2015 (5-yr review)	~124	~2,093	All threats managed in all 5-7 populations	Partially
			Complete genetic storage	Partially
			5-7 populations with 300 mature individuals each	No

Table 2. Threats to *Clermontia lindseyana* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulates – degradation of habitat and herbivory	A, C, D, E	Ongoing	Partially, Hakalau NWR, Kahuku Unit, Kipahoehoe NAR unit, Kulani, Kilauea Forest are fenced
Invasive introduced plants	A, E	Ongoing	None
Rodent predation or herbivory – rats	C	Ongoing	None
Slug herbivory	C	Ongoing	None
Loss of mutualists	E	Ongoing	None
Climate change	A, E	Increasing	None

References:

See previous 5-year review for a full list of references (USFWS 2010). Only references for new information are provided below.

Fortini, L., J. Price, J. Jacobi, A. Vorsino, J. Burgett, K. Brinck, F. Amidon, S. Miller, S. Gon II, G. Koob, and E. Paxton. 2013. A landscape-based assessment of climate change vulnerability for all native Hawaiian plants. Technical report HCSU-044. Hawaii Cooperative Studies Unit, University of Hawaii at Hilo, Hawaii. 141 pages.

Harold L. Lyon Arboretum Seed Conservation Laboratory. 2014. Report on controlled propagation of listed and candidate species, as designated under the U.S. Endangered Species Act. Seed storage Microsoft Access database. University of Hawaii at Manoa, Honolulu, Hawaii. Unpublished.

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[DLNR] State of Hawaii Department of Land and Natural Resources. 2014. Department of Land and Natural Resources, Division of Forestry and Wildlife, Section 6 annual performance report for plant restoration and enhancement, threatened, endangered, candidate, and species of concern outplanting, Hawaii (endangered plant restoration and enhancement); interim report. July 1, 2013 – June 30, 2014. Unpublished.

[USFWS] U.S. Fish and Wildlife Service. 1996. Big Island plant cluster recovery plan. U.S. Fish and Wildlife Service, Portland, Oregon. 202 + pages.

[USFWS] U.S. Fish and Wildlife Service. 2010. 5-year review short form summary for *Clermontia lindseyana* (oha wai). Pacific Islands Fish and Wildlife Office, Honolulu, Hawaii. 10 pages.

[USFWS] U.S. Fish and Wildlife Service. 2012. Endangered and threatened wildlife and plants; listing 38 species on Molokai, Lanai, and Maui as endangered and designating critical habitat on Molokai, Lanai, Maui, and Kahoolawe for 135 species; proposed rule. Federal Register 77(112):34464-34775.

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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

Appropriate Listing/Reclassification Priority Number, if applicable:_____

for **Programmatic Deputy Field Supervisor, Pacific Islands Fish and Wildlife Office**

Maine M Bruegmann Date 2015-08-03